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report 1

water sector cooperation programme

Yemen Arab Republic
Kingdom of the Netherlands

main evaluation report

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WATER SECTOR COOPERATION PROGRAMME
YEMEN ARAB REPUBLIC - KINGDOM OF THE NETHERLANDS

Report 1

MAIN EVALUATION REPORT

The Hague, January 1985

From September 8-25, 1984 a joint evaluation mission of the Governments of the Yemen Arab Republic and the Kingdom of the Netherlands evaluated the water sector activities of the Yemeni-Dutch development cooperation programme with the aim to advise on future water sector activities together with an assessment of priorities. To this end the following activities were evaluated:

Water Resources
a. Water Resources Assessment Yemen Arab Republic
b. Tihama Water Resources and Water Use Study
c. Al Bayda Water Resources Study

Domestic Water Supply and Sanitation
a. Support Rural Water Supply Department
b. Water and Sewerage Dhamar/Ibb
c. Water Supply and Sanitation Component "Rada Integrated Rural Development"

Irrigation
a. Wadi Rima Supervision
b. Irrigation component "Rada Integrated Rural Development"
c. Irrigation component "Tihama Agricultural Extension"

The main findings, conclusions and recommendations of the mission are presented in a four-volume report:

Report 1: Main report water sector cooperation programme Yemen Arab Republic - Kingdom of the Netherlands

Report 2: Evaluation report Water Resources Assessment Yemen Arab Republic

Report 3: Evaluation report Support Rural Water Supply Department

Report 4: Review and recommendations Netherlands supported water sector activities in the Yemen Arab Republic

The rapporteurs have the pleasure to submit the draft reports for comments to the counterparts within the joint mission through the Central Planning Organization of the Yemen Arab Republic. After their reaction c.q. clearance these reports will officially be submitted to the Governments of the Yemen Arab Republic and the Kingdom of the Netherlands and through them to all projects concerned.

CONTENTS

Page

ABBREVATIONS

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

1. INTRODUCTION 1

2. DEVELOPMENT AND POLICY 3

2.1 Development Yemen Arab Republic 3

2.1.1. General objectives 3
2.1.2. Human resource development and education 3
2.1.3. Regional planning 3
2.1.4. Recent economic developments 3
2.1.5. Present economic situation 5
2.1.6. Domestic, world market and efficiency prices 6
2.1.7. Prospects for agricultural development 7

2.2. Netherlands Policy on Development Cooperation 9

2.2.1. General policy 9
2.2.2. Development programmes in partner countries 10
2.2.3. Water Sector policy 10

3. OVERVIEW OF ACTIVITIES AND PLANS IN THE WATER SECTOR IN THE YAR 12

3.1. General 12
3.2 Water Resources 13
3.3 Drinking Water and Sanitation 14
3.4 Irrigation 17
3.5 Integrated Rural Development 17

4. THE NETHERLANDS SUPPORTED WATER RELATED ACTIVITIES 19

4.1 Water Resources 19

4.1.1. Major findings 19
4.1.2. Significance 23
4.1.3. Efficiency 24
4.1.4. Effectiveness 24
4.1.5. Recommendations 25

4.2. Domestic Water Supply and Sanitation 28

4.2.1. Major findings 29
4.2.2. Significance 30
4.2.3. Efficiency 31
4.2.4. Effectiveness 33
4.2.5. Recommendations 33

4.3 Irrigation 34

4.3.1. Major findings 35
4.3.2. Significance 36
4.3.3. Efficiency 36
4.3.4. Effectiveness 37
4.3.5. Recommendations 38

Page

5. SECTOR ISSUES AND CONSIDERATIONS 39

5.1 Project Effectiveness and Sectoral Objectives 39
5.2 Sectoral Priorities 41
5.3 Implications for Water Use 43
5.4 Information to the Public 47

6. REFERENCES 48

ANNEXES

1. Terms of reference evaluation mission water sector
2. composition of the mission
3. List of organizations and people met

ABBREVIATIONS

AFESD	Arab Fund for Economic and Social Development
CPO	Central Planning Organization
CYDA	Confederation of Yemeni Development Associations
DGIS	Directorate General International Cooperation
DOH	Department of Hydrology
GDP	Gross Domestic Product
IDA	International Development Association
LDA	Local Development Association
NWSA	National Water and Sewerage Authority
RIRDP	Rada Integrated Rural Development Project
RWSD	Rural Water Supply Department
SRWSD	Support Rural Water Supply Department
TAE	Tihama Agricultural Extension
TDA	Tihama Development Authority
UNDP	United Nations Development Programme
UNCDF	United Nations Capital Development Programme
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization
WRAY	Water Resources Assessment Yemen Arab Republic
YAR	Yemen Arab Republic
YOMINCO	Yemen Oil and Mineral Corporation

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

1. Summary of Conclusions

1.1. Introduction

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This Main Report presents the mission's general views and comments on the Yemeni-Dutch water sector cooperation programme. After a brief introduction (chapter 1) a short description is given of the YAR's development policy and its influence on economic developments as well as of the Netherlands policy on development cooperation (chapter 2). Chapter 3 provides an overview of activities and plans in the water sector of the YAR, followed by a summary of the evaluations of the Netherlands supported project activities (chapter 4). Chapter 5 pays attention to important items in view of a further development of the water sector.

The mission's recommendations for further cooperation in the water sector are based on the conclusions of the main report in order to put the Yemeni-Netherlands cooperation for the next five years in a broader framework. Making recommendations for further projects is making choices based on priorities. However, these choices are influenced by many factors, unequal in weight and sometimes even contradictory. Therefore the choices made, may not always be easily derived from the contents of the reports.

In this summary of conclusions the mission will try to give her main considerations which have led to the choices made for the three fields of cooperation viz.
1. Water resources
2. Drinking water and sanitation
3. Irrigation

1.2. Water resources

In general the Netherlands policy on development cooperation does not give high priority to water resources studies. However, in the YAR there are some important reasons to cooperate in these type of projects as water in the YAR is extremely scarce. In important parts of the country groundwater extraction for irrigation purposes is increasing to such an extent that severe problems can be expected not only for irrigation but also for drinking water supply and industrial use of water. The knowledge of the geohydrological and climatological conditions to date is too limited to forecast the problems for the different parts of the country. Moreover, regional and national organizations are at present not fully capable to improve the knowledge in this field without foreign donor support. The political and administrative organization in this field is too weak to take the necessary legislative measures and to implement these measures. On the whole, many people are not sufficiently aware of the severity of the scarcity of water.

The cooperation on water resources development between the Department of Hydrology (DOH), the Tihama Development Authority (TDA) and the Rada Integrated Rural Development Project (RIRDP) on the one hand and the Netherlands on the other hand provides a good starting position to improve this situation in the coming years. Institution building and in particular support and advancement of the Supreme Water Council is of vital importance for a rational water exploitation. Moreover, the Netherlands contribution to water resources development is a substantial one due to lack of other foreign donors. The continuation of existing Yemeni-Netherlands water resources projects or the introduction of new projects will have to be determined by the distribution of work and a good cooperation between national and regional institutions.

1.3. Drinking water and sanitation

About eighty percent of the villages in the YAR are not yet provided with improved drinking water supplies. Various local, regional and national institutions are working in the field of rural drinking water supply, often with foreign donor assistance.

Where water is scarce problems exist with private and public hygiene. In case of new water supplies, especially with house connection new public health risks tend to develop caused by poor waste water disposal. Only in a few cases attention is paid to sanitation problems together with the implementation of water supply schemes.

Drinking water supply and sanitation are important components of integrated rural development. Activities in this sub-sector are closely related to primary health care and an increased productivety in on-farm and off-farm activities.

Direct participation of the people - men as well as women - is of utmost importance in the planning, site selection, implementation, operation and maintenance of rural water supply and sanitation systems. Such a participation has also to be reflected in a contribution in money and/or kind to the construction of the systems. The level of the contribution may depend on the financial capacity of the villages involved. The organization of the selection of villages, site selection, management and maintenance of the system has in general to be a regional one. In the future the organization at the national level - the Rural Water Supply Department - has to focus its activities more and more on the national planning, formulation of design standards, selection of bore sites and design facilities of drinking water systems. RWSD may construct systems in areas where no capable regional organizations exist.

1.4. Irrigation

The benefits of projects in the fields of water resources and drinking water supply and sanitation are often of an indirect nature. Therefore it is important also to include water sector projects with a direct impact on the increase in national income. In the YAR agriculture is one of the few sectors in which a substantial contribution to the growth of national income can be expected. Under existing climatological conditions irrigation is a prerequisite to such increased agricultural production. Presently an important part of food is imported. Increase of the national food production is therefore a government policy, although in general the production prices of agricultural products are higher than world market prices. Experience with the projects shows that a stimulation of improvements of the existing irrigation systems in direct consultation with the farmers and improvements at farm level through extension leads to better results than the construction of large scale irrigation systems leaving to the farmers the improvement of their on-farm developments. The relative scarcity of both water and labour has an important influence on the development of irrigation systems in the YAR. This development has to aim at improving the position of the smaller farmers and share croppers on one hand. On the other hand an introduction of irrigation systems and a more large scale approach by YAR investors leading to an increase in food production is also important, in particular in areas presently not cultivated intensively.

The above presented general analysis of the water sector in the YAR leads to the following recommendations of the mission for the Yemeni-Netherlands cooperation in the next five years.

2. Recommendations for further cooperation in the water sector

2.1. General

The water sector development cooperation between the YAR and the Netherlands which started in 1975 is generally successful. A further development of the water sector is of utmost importance for irrigation as well as for drinking water supply. Therefore, a continuation of the cooperation during the next five years is strongly recommended.

It is propesed that this cooperation will be continued in the three sub-sectors:
1. water resources development
2. drinking water supply and sanitation
3. irrigation

2.2. Water resources development

The mission is of the opinion that the Yemeni-Netherlands cooperation in water resources development should aim at:
- strengthening the legislation and coordination at national level through an improved functioning of the Supereme Water Council;
- increasing the knowledge of water resources through intensification of the water resources studies and coordination between regional and nation institutions executing these studies.

At the nation level the mission suggests that the Netherlands government continues to support the Department of Hydrology (DOH). Activities could concentrate on:
- collection, storage, analysis and publishing of all hydrological data of YAR;
- maintenance of the two measuring systems already installed in two areas. If possible the maintenance may also be handed over to capable regional institutions (like the Tihama Development Authority);
- establishment of a new study area, (Sana'a), including data collection and analysis.

At the regional level the mission recommends a continuation of the cooperation in water resources development with the regional institutions Tihama Development Authority (TDA) and Rada Integrated Rural Development Project (RIRDP).

In the Wadi Rima area it is suggested that the water resources study will be concentrated partly on the social-economic impact of the newly technically improved irrigation systems in order to improve the effectiveness of these systems and partly on the behavior of the unsaturated zone.

In the Al Bayda Province the collection of hydrological data will be intensified. Whereas the extension services for well-site selection will be continued.

It is suggested that up to 1990 Dfl. 21.2 million is made available from the Netherlands Development Cooperation Funds for water resources development. From this amount Dfl. 6.0

million has already been allocated and Dfl. 15.2 million are new allocations for the next five years. Table 1 shows the distribution of this money over the years and over the three projects already mentioned. The amount for water resources studies is based on the assumption that the total amount of the Netherlands bilateral aid for the YAR will remain the same and that the water, agricultural and health sectors are considered equally important.

2.3. Drinking water supply and sanitation

The mission is of the opinion that the Yemeni-Netherlands development cooperation in water supply and sanitation should aim at:

- institution building in the field of rural water supply and sanitation at the national and regional levels.
- Provision of water supply schemes to villages based on the following cirteria: need, poverty, workload and interests of women, and health.
- Sanitation and hygiene education.

Bisides this, the Netherlands has committed itself to cofinance the installation of a drinking water and sewerage system in Dhamar.

Cooperation at the national level is with the Rural Water Supply Department (RWSD) of the Ministry of Public Works. At present the RWSD is supported in two ways:

- support to the geohydrological planning of the exploitation of groundwater for drinking water supply;
- technical and financial assistance to the implementation of water supply schemes in villages in the Al Bayda and Dhamar Provinces and possible the Tihama.

The mission has a preference for the RWSD to develop in a institution on national level, that is responsible for the planning of the rural water supply over the whole country, that develops standards for this water supply and delivers specialized services. The responsibility for implementation constructions and managment of the rural water supply systems will be mainly the responsibility of decentralized institutions like TDA, RIRDP, etc.

In view of this preference the mission propose to strengthen the cooperation with RWSD as far as it focusses on these tasks in the future. Furthermore the cooperation in the implemetation of rural water supply schemes in the Al Bayda and Dhamar Provinces will be continued until the funds are exhausted. In principle only villages that are contributing to the cost of the construction will be provided with water supply systems under the Yemeni-Netherlands cooperation programme.

The implementation of drinking water supply schemes by the RIRDP in the Al Bayda Province will be intensified. At the same time attention will be paid to the sanitation problems through hygiene education activities and sanitation pilot projects.

It is suggested that up to 1990 Dfl. 53,1 million is made available from the Netherlands Development Cooperation Funds

for drinking water and sanitation until 1990. From this amount Dfl. 31.1 million has already been allocated and Dfl. 22.0 million are new allocations for the next 5 years. Table 1 shows the distribution of the money over the years and the projects.

2.4. Irrigation

Development of agriculture is a prerequisite for YAR to become more self supporting in food production. Under Yemeni climatological conditions irrigation is necessary to develop agricultural production.

In view of relative labour scarcity and high wages the development of the irrigation cannot be focussed on labour intensive methods. Due to scarcity of water, water saving methods are being favoured. These considerations lead to the introduction of modern water saving irrigation systems like drip irrigation or possible sprinkling irrigation by pivot systems, giving due attention to social impact.

The mission stresses the need to safeguard the supervision of the civel engineering works already completed in Wadi Rima. Therefore, the management of this supervision is to be included in the Yemeni-Netherlands development cooperation programme.

It is recommended that RIRDP will start with the introduction of the modern irrigation systems already mentioned on existing farms. For the introduction and operation of these systems expertise will be necessary.

In order to upgrade the irrigation systems already built in the Wadi Rima, it is proposed to develop a programme aimed at improving the use of available irrigation water on the farm level. For this research, extension and some additional structures will be necessary. Phase II of the water resources study of the Tihama plains will take care of some of the necessary research. The extension service of TDA is providing part of the required extension.

In addition the mission recommends the design and execution of the complete secundary and tertiary irrigation system for a part of the Wadi Rima area. The implementation of design and extension should be aimed at a highly efficient application of irrigation water and at familiarizing the farmers with the new irrigation systems.

A new study is recommended for the Wadi Rasyan. Based on the results of this study a decision is to be made on the type of irrigation, viz. sufac eor well irrigation. An irrigation system for the Wadi Rasyan area will be developed accordingly as part of an integrated development. It is recommeded that apart from the Netherlands also other donors will be involved in this activity.

It is suggested that up to 1990 Dfl. 23.4 million is made available from the Netherlands Development Cooperation Funds for irrigation, which are new allocations for the next five years. Table 1 shows the distribution of this money over the years and the projects.

The above mentioned recommendations are leading to an allocation of funds for the different projects. For most of the projects there is still a certain amount reserved which has been allocated already during the previous years. In the following table the mission's suggestion is given for the distribution of existing and new Netherlands funds during the nex six years. It is assumed that the new allocation of Netherlands funds for water sector development will remain the same of the years and amount to an average of Dfl. 10 million annually.

NETHERLANDS FUNDS; ALLOCATIONS AND DISBURSEMENTS PROPOSED BY THE WATER SECTOR EVALUATION MISSION

Projects	Remaining fun as per 1-1-1985	1985 N	1985 D	1986 N	1986 D	1987 N	1987 D	1988 N	1988 D	1989 N	1989 D	1990 N	1990 D
WRAY	-	(6.0)	2.0	-	2.0	-	2.0	(3.5)	1.5	-	1.0	-	1.0
Tihama Water Resources and Water Use Study	6.0	-	3.0	-	1.5	-	1.5	(4.5)	2.0	-	1.5	-	1.0
Al Bayda Water Resources Study	-	(0.6)	0.2	-	0.2	-	0.2	(0.6)	0.2	-	0.2	-	0.2
SRWSD	2.3	-	2.3	(12.0)[x]	4.0[x]	-	4.0[x]	-	4.0[x]	(10.0)[x]	5.0[x]	-	5.0[x]
Water Supply and Sanitation Component RIRDP	2.8	-	2.8										
Water & Sewerage Dhamar/Ibb	26.0	-	2.0	-	12.0	-	10.0	-	2.0	-	-	-	-
Wadi Rima Supervision	-	(0.6)	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1
Irrigation component RIRDP	-	(1.0)	0.3	-	0.3	-	0.3	(0.8)	0.3	-	0.3	-	0.3
Irrigation component TAE	-	(0.3)	0.1	-	0.1	-	0.1	-	-	-	-	-	-
Rasyan	-	(1.0)	0.1	-	0.9	(11.6)	2.9	-	2.9	-	2.9	-	2.9
Irrigation Rima	-	(1.0)	0.2	-	0.4	-	0.4	(6.0)	2.0	-	2.0	-	2.0
Total	-	(10.5)	13.1	(12.0)	21.5	(11.6)	21.5	(15.4)	15.0	(10.0)	13.0	-	12.5

N = New Allocations
D = Disbursements
x = Total proposed allocations and disbursements in rural water supply in the areas Al Bayda, Dhamar and possibly the Tihama

1. INTRODUCTION

The development cooperation between the Yemen Arab Republic (YAR) and the Kingdom of the Netherlands mainly concentrates on three sectors: viz. Agriculture, Health and Water.

The cooperation within the water sector includes a wide range of activities which started about 10 years ago. Presently the following projects in this sector are in execution, or have just been completed.

Water Resources

a. Water Resources Assessment Yemen Arab Republic
b. Tihama Water Resources and Water Use Study
c. Al Bayda Water Resources Study

Domestic Water Supply and Sanitation

a. Support Rural Water Supply Department
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Irrigation

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Whereas there was no doubt that these water sector activities form important elements in the social and economic development of the YAR less clarity existed as to which elements and strategies should be given priority in view of the future Yemeni-Dutch development cooperation programme. For this reason representatives of the Governments of the Yemen Arab Republic and the Kingdom of the Netherlands jointly evaluated the water sector cooperation programme in September 1984.

The main objective of this joint evaluation was to review the projects as listed above in order to submit recommendations on priorities for further Yemeni-Dutch development cooperation in water related activities. The recommendations were to aim at a comprehensive programme of water related activities in line with the Yemeni and Dutch development policy.

At the same time the evaluation included a study of the objectives and progress of the "Water Resources Assessment YAR" project and a comment on its effectiveness and efficiency in order to submit recommendations on possible follow-up activities after termination of phase I of the project. Also a study of the objectives and progress of the "Support Rural Water Supply Department" project and comments on its effectiveness and efficiency was included in order to submit recommendations on possible follow-up activities after termination of the present project period. The detailed terms of references for the mission are attached as annex 1.

The evaluations of the "Water Resources Assessment YAR" and "Support Rural Water Supply Department" projects are presented in Report 2 and 3 respectively, whereas the other before mentioned projects are reviewed in Report 4.

This Main Report presents the mission's general views and comments on the Yemeni-Dutch water sector cooperation programme. In chapter 2 a short description is given of the YAR's development policy and its influence on economic development as well as of the Netherlands policy on development cooperation. Chapter 3 provides an overview of activities and plans in the water sector of the YAR in order to put the development cooperation between the YAR and the Netherlands in a broader framework. The evaluations of the Netherlands supported project activities are summerized in chapter 4. Chapter 5 pays attention to important items in view of a further development of the water sector. Conclusions and recommendations for further cooperation in the water sector are presented in the front pages of this report.

The Netherland's members of the evaluation mission visited the YAR from September 8 until September 25, 1984. The composition of the mission is given in Annex 2.

From Yemeni side several representatives took part in the evaluation. Their names are given in the Reports 2, 3 and 4 and in annex 3 of this report.

During parts of the time, the mission was split up in groups to study the different projects. All the projects were visited. The hospitality felt during these visits and during the many discussions with the Ministries and Authorities is highly appreciated by the members of the mission. Also the active involvement of the Embassy of the Netherlands was of great importance for the work of the mission.

2. DEVELOPMENT AND POLICY

2.1. Development Yemen Arab Republic

2.1.1. General objectives

The economic and social development objectives and related strategies of the YAR are presented in the Second Five Year Plan 1982-1986 (CPO, 1981). The Plan underlines the need for a structural change in the economy in favor of productive sectors without diminishing the importance of other sectors. The aim is to strike a balance between increased production and the services related to social needs.

Amongst the general development objectives of the YAR the following are put forward in view of the present evaluation:

- increasing self-reliance by reducing the deficit in the balance of trade and reliance on foreign grants and loans;
- rapidly and extensively developing the agricultural sector and improving health and living conditions in rural areas;
- achieving a balanced and integrated regional development;
- expanding educational services, technical and vocational training;
- upgrading environmental conditions and controlling pollution.

2.1.2. Human resource development and education

The Plan puts a strong emphasis on expanding education, eradicating illiteracy and expanding technical and vocational training. One reason for this is to overcome the problem of a severe shortage of trained and experienced Yemeni staff.

Educational expenditures will expand from 437 million rials to 713 million rials between 1981 and 1986, an increase of 63% i.e. an average annual growth rate of 10.2%. Equal educational opportuntities are to be provided for men and women.

2.1.3. Regional planning

The Plan has, as one of its targets, the introduction of regional planning in order to exercise better control over the growing disparities in incomes and living standards between the inhabitants of the main cities and those of the other regions. The Plan aims at encouraging economic activity throughout the country in order to reduce the attraction of the main cities and to develop the other areas more equitably. Therefore the Plan will strive for increasing the share of investments to the regions outside the major cities and providing these areas with more public utilities and social services.

2.1.4. Recent economic developments

During the last decade, the YAR has witnessed turbulent economic developments. The effects of the oil boom during the mid 1970s in the Gulf States, especially in Saudi Arabia, caused a mass outflow of skilled and unskilled Yemeni labour in search of more remunerative jobs abroad. Remittances of Yemeni workers abroad strongly increased during the second half of the

1970s (in 1977/78 remittances reached an all-time high of 60% of the GDP), but stabilized at about 25% of GDP in the early 1980s. The immediate effect of the exceptional growth in remittances has been a surge in the level of private consumption and imports; many domestic activities, while expanding, have generally suffered from a shortage of manpower and have increasingly relied on foreign skills and workers.

A comparison of the situation before and after the effects of the oil boom in the Yemeni economy is shown in Table 1 for a selected number of macro-economic indicators. A dramatic increase in imports and investment and a further decline in the (negative) share of domestic savings as a result of increased government consumption has resulted in a considerable widening of the resource gap. Whereas increased capital formation and public consumption are indicative of intensified development efforts, the inability to mobilise sufficient savings and to restrain imports are reasons for great concern. Despite a high level of remittances, initially resulting in an improvement in the external position, the steadily increasing import requirements are responsible for a sharp deterioration of the balance of payments deficit during the early 1980s.

Table 1 Resources, uses, savings and external position of the Yemen Arab Republic, 1972/73 and 1981 (in percentages of GDP) (CPO, 1984)

Item	1972/73	1981
Resources:		
Gross domestic product (GDP)	100.0	100.0
Import (M)	30.2	73.4
Total resources	130.2	173.4
Uses:		
Private consumption (Cp)	96.7	98.6
Public consumption (Cg)	14.0	23.2
Gross capital formation (I)	16.8	43.0
Export (E)	2.7	8.6
Total uses	130.2	173.4
Savings and external position:		
Domestic savings (S = GDP-Cp-Cg)	-10.7	-21.8
Net factor income and private transfers from abroad (F)	26.6[a)]	27.0
National savings (Sn = S+F)	15.9[a)]	5.2
Resource gap (I-S = M-F)	27.5	64.8
Current account deficit balance of payments (D = M-E-F)	0.9	37.8
Financing of gross capital formation (S+F+D = I)	16.8	43.0

a) Includes capital transfers

During the first Five-Year Plan 1975/76 - 1980/81 GDP grew at a rate of almost 6% per year; excluding the public sector, however, the annual growth of private sector activities amounted to 4% only. The sectors manufacturing, construction, trade and commercial services expanded most rapidly; the agricultural sector grew at a mere 1% per year, implying a decrease in per capita availability of domestic agricultural output. Since the beginning of the 1980s, the growth of per-capita income has stagnated reflecting stabilized remittances, foreign exchange shortages and domestic supply bottlenecks.

2.1.5. Present economic situation

Among the factors characterising the present economic situation in the YAR, the following are of particular importance for the purpose of the present evaluation:

- For a considerable number of years, agricultural production has stagnated following the outflow of migrant workers to Saudi Arabia and the other Gulf States. Consequently, the relative importance of agriculture in GDP has decreased substantially in recent years from over 50% in the early 1970s to less than 30% at present. As a result, imports of food and other agricultural products increased substantially. In the early 1970s imports of agricultural products were approximately 25% of the value of domestic agricultural production; in the early 1980s the ratio of imports to domestic output has risen to 40-45%. Due to the tremendous increase in the import of capital goods, raw materials and durable consumer goods, the share of agricultural imports in the total import bill decreased from about one half a decade ago to less than one third at present. (N.B. qat production figures are excluded in all official statistics).

- The economy is heavily dependent on external resources: Remittances of Yemeni expatriates are substantial and mainly under control of their expatriate depositors, which limits the government to utilize them for public purposes. In view of the weak domestic production base, the country has to rely on importing most of its needs and the government on customs' duties and taxation for an important part of its revenues. The large and persistent balance of payments deficit requires ample external financial assistance. Scarcity of adequately trained manpower has led to extensive immigration of Arab and Asian skilled labour.

- High levels of inflation have pushed the general price level in the YAR well above international prices. Scarcity of labour during the 1970s has led to substantial increases in wages and salaries, and subsequently in commodity prices. In addition, excess liquidity resulting from emigrants' remittances has created excess demand for goods and services. Domestic supply responses have been weak in view of labour shortages, in particular skills, lack of necessary infrastructure, and inexperience in producing non-traditional goods in general.

- During the second half of the 1970s the Central Bank has accumulated large amounts of foreign exchange. Despite high levels of inflation, this would suggest that the Yemeni Rial was undervalued at the time and that its value would have appreciated if official intervention had been abolished (import tariffs were relatively low and mainly levied for fiscal reasons). Such an appreciation of the Rial before the end of the 1970s would certainly have accentuated the existing difference between relatively high domestic prices for Yemeni goods and services and reletively low prices for imported goods, including competing alternatives for domestically produced goods. The price structure is consistent with Yemen's specialisation in international trade: with the oil boom, Yemen's comparative advantage in exporting labour was considerably enhanced, human resources were consequently freed for employment abroad in more remunerative jobs, and cheaper imports progressively substituted for domestic production. Under the pressure of relative low-priced imports and domestic inflation agricultural and manufacturing production became increasingly uncompetitive at world market prices.

- In the early 1980s remittances from abroad stabilised but import demand continued to grow. Consequently, foreign exchange reserves dwindled, and in the autumn of 1983 a balance of payment crisis forced the government to take a number of corrective measures. New import controls were introduced, inflation was reduced to single-digit figures, and the Rial depreciated against the US dollar by approximately 20 percent. On balance, the extent to which domestic prices exceed world market prices will have been reduced for most tradeable goods as a result of these developments. If these policies are continued, Yemen's comparative advantage in international trade may eventually shift towards import substitution of those commodities for which domestic production costs become competitive with imports. Such a situation can, of course, only be achieved and sustained if production cost can be kept in line with international prices through badly needed increases in productivity and reasonable levels of renumeration.

2.1.6. Domestic, world market, and efficiency prices

Because of the predominant role of imports, the YAR has a relatively open economy which is to a large extent directed by the interaction of market forces. However, government intervention occurs in the case of the exchange rate, imports of a number of agricultural products are subject to quota systems and/or price regulations through tariffs (cotton, wheat, wheat flour, rice, sugar), luxurious foodstuffs such as fruits and vegetables and luxurious consumer goods face import restrictions or bans, and selected manufactured goods are subject to licenses and tariffs.

For many products the domestic market price (or financial price) is therefore much higher than the corresponding world market price including a mark-up for transshipment, internal transport and distribution. Among the reasons for this discrepancy are a possible overvaluation of the Rial (making

imports relatively cheap), bottlenecks in domestic supply, high cost production, inefficiencies in marketing, and a strong Yemeni preference for domestic goods. Such a preference premium, reflecting a willingness to pay more for home products than for imports, is especially strong in the case of perishables (wheat, chicken, eggs, meat, honey) and is reported to be in the range of 20 - 100% of the price of the imported alternative.

Market interventions and the presence of generally accepted development objectives make that in a number of instances financial prices do not accurately reflect the real scarcity of commodities and resources. It is therefore conceivable that further expansion of irrigated agriculture may seem financially attractive in terms of increased incomes for farmers, land owners, share croppers, etc. because of high domestic farmgate prices. At the same time the proposed expansion may be less attractive from an economic point of view of the society at large when prevailing financial prices overstate the real scarcity of cheaper imports. In such a case an economic analysis based on efficiency prices which reflect real scarcities will show whether the actual cost of the country's resources involved justifies the additional output when valued at efficiency prices. The latter are usually based on world market prices because the possibility of international trade often provides an alternative source of supply to domestic production, viz. imports, and an alternative outlet for the domestic market, viz. exports.

Taking into account the nature of the market interventions in the YAR as well as the prevailing consumer preference for domestic goods, most financial prices for agricultural goods (and other tradeables) are likely to overstate their real value in terms of efficiency prices. Because of the scarcity of skilled labour, its opportunity cost will in most cases equal the cost of attracting expatriates. In view of the low level of unemployment, local wage rates probably represent quite accurately the efficiency price of unskilled labour. The opportunity cost of capital in the YAR is difficult to estimate (economic rates of return of 12-15% have been mentioned) as investable funds are being made available at highly varying cost.

Although the information presented on the likely values of efficiency prices is scanty and provisional, the nature of the difference between financial and efficiency prices in the circumstances of the YAR is undoubtly such that differences between financial and economic benefits are by far more important than differences between financial and economic resource costs. Projects with high financial returns need therefore not necessarily be accpetable from an economic point of view, and care should be taken that such projects are critically assessed at the appraisal stage.

2.1.7. Prospects for agricultural development

If major investment activities in sectors producing tradeable goods and services are subjected to rigorous cost-benefit analysis (using efficiency prices and taking into account

external effects), the outcome would, among other things, highlight two interesting economic phenomena. First, investment opportunities in certain sectors would turn out to be systematically more attractive than those in other sectors. Such sectoral differences are common to all countries and reflect a country's compartive advantage in international trade as determined by its relative endowment of natural, human and financial resources.
Secondly, investment opportunities would also vary within sectors as a result of product and process differentiation, and of past over- or underinvestment. Hence, when assessing investment opportunities at a sectoral or subsectoral level, the approach should be selective (not all activities in a prima facie attractive sector are equally attractive) and flexible (not all activities in a prima facie less attractive sector can be discarded).

In terms of comparative advantages, the YAR can be characterised as a small primary exporter in the sense that not primary products, but a primary factor of production, labour, is exported to neighbouring countries. Foreign exchange earnings accrue in the form of remittances from abroad and are spent on imports of agricultural and manufactured products. For the future, however, further increases in export earnings from labour are highly unlikely, and other sectors will have to be developed to sustain further growth of the YAR economy.

Compared to most other developing countries in the early stages of development, the foreign exchange position of the YAR has, until recently, not been unfavourable. However, the remittances have acted as substitute for broad-based agricultural growth which, in many countries, has normally provided essential food crops for domestic consumption, raw materials for agro-processing industries, foreign exchange earnings from export crops, and has stimulated domestic demand for non-agricultural products in general and the development of off-farm activities in rural areas in particular. Consequently, agro-processing and other manufacturing activities in the YAR are mainly based on imported inputs of raw materials and capital goods and have no domestic linkages whatsoever. The only exception is the manufacture of non-metallic building materials based on domestic mineral resources.

Considering the position of the YAR with respect to the following resources and constraints:
- availability of agricultural land and presence of varying climatic conditions;
- limited endowment of natural resources, including water resources;
- high wage cost for all categories of labour and severe shortages of skilled labour and management;
- a small and geographically dispersed home market;
- weak infrastructure and high user costs;
- a fragmented capital market and limited fiscal resources;
- no apparent lack of private initiative;

the YAR's comparative advantage would appear to lie in:
- continued export of labour to neighbouring, high-wage countries;

- development of activities with a high domestic-resource content of relatively abundant natural resources; examples are:
  . development of broad-based agriculture for import substitution of food crops and raw materials for agro-processing,
  . selected agricultural development for exports,
  . selected import-substitution of manufactured goods, especially simple consumer goods and building materials,
  . resource-based manufacturing for exports (leather, soda ash).

Both the development of non-traditional agriculture and manufacturing are subject to relatively long gestation periods, during which skills and new knowledge will have to be acquired to become efficient producers, able to bring productions costs down to competitive levels. As far as agriculture is concerned, its development will therefore have to be accompanied by appropriate programmes of government-supported agricultural research, education and extension, geological surveys and hydrological research. The programmes are essential to ensure the creation of a proper environment necessary for long-term productive investment in agriculture and related activities such as irrigation.

Price incentives and a degree of protection against initial "enefficiency" in production will undoubtedly be necessary in the early stages of modern agricultural development. However, such a "learning period" should be limited to a decade or so, and a careful selection of projects should ensure that only those investment plans are carried out that are viable in the long run and do not require permanent protection against imports.

Of crucial importance in this respect will be the long-term price development of food crops on the world market. With increasing (decreasing) world market prices for food products relative to other commodities, the goal of long-term viable agricultural production in the YAR will be easier (more difficult) to achieve. As far as domestic developments are concerned, the maintenance of a realistic exchange rate and a gradual reduction of real wages will equally contribute to the conditions for succesful agricultural development.

2.2. Netherlands' Policy on Development Cooperation

2.2.1. General policy

Up till April 1984, the Netherlands Government pursued a "two pronged" development policy directed to:
- the economic, social and political independence of the developing countries;
- an alleviation of the living conditions of people presently living below the minimum subsistance level.

In April the "Nota Herijking Bilateraal Beleid" was presented, outlining the Netherlands policy on development cooperation for the coming years. As the primary aim of the present evaluation is to make recommendations on future Dutch supported activities

an appraisal will have to be made on the basis of the newly formulated policy.

The broad outlines of the Dutch policy for the future are:
- to fight poverty by strengthening productive powers in the society;
- to put emphasis on two main themes in two separate programmes: (1) rural development and (2) industrial development;
- to concentrate on long-term bilateral development cooperation with a limited number of countries (of which the YAR is one);
- to maximize the effectivity of the development cooperation efforts by improving procedures and performance.

2.2.2. Development programmes in partner countries

The rural development programme aims at a lasting improvement of the national food supply and of the living conditions of the rural population. This implies an integrated regional development approach. Priority will be given to projects covering the following sectors: water supply, primary health care and food production c.q food supply.

The industrial development programme aims at an increase of productive employment and the development of the productive capacity in order to strengthen the economic independence of the partner country.

The two main programmes will be indicative for Dutch aided activities in the partner country. The actual choice of regions, sectors and development activities will be based on the needs, priorities, development policy and financial possibilities of the partner country at the one hand, and the Dutch development potential in terms of expertise and material at the other hand.

In all country programmes special attention will be paid to:
- participation of the target population - women as well as men - in the preparation and implementation of the development activities;
- integration of women in the development process;
- strengthening of institutional and administrative structures;
- ecological aspects of the development activities and protection of the natural environment;
- improvment of donor coordination in development activities.

2.2.3. Water sector policy

Although no Netherlands water sector policy as such exists, contours show up of a domestic water supply sector. An adequate supply of safe water is given high priority as it is not only a basic need and consequently a fundamental human right, but also a benefit to public health and a preconditon for socio-economic development. Within this sector the policy focuses on:
- an adequate supply of safe water within a reasonable distance for the entire target population;

- participation of the target population - women as well as men - in the planning, implementation, operation and maintenance of the new facilities;
- appropriate technology in terms of water source, water purification, power requirements, level of service, choice of materials, finance, etc.;
- integration of water supply, sanitation and hygiene education as the anticipated health benefits from water alone cannot be expected;
- human resource development for the design, implementation, operation and maintenance of the facilities;
- continuity of the improved facilities. For this it will be necessary to strengthen institutional and administrative structures on local, district and national levels and to explore possibilities for appropriate tariff structures to cover operation and maintenance costs;
- water resources and water quality control to guarantee an ongoing adequate supply of safe water.

3. OVERVIEW OF ACTIVITIES AND PLANS IN THE WATER SECTOR IN THE YAR

3.1. General

Water sector activities in the YAR generally deal with:
- water resources;
- drinking water supply and sanitation;
- irrigation.

Government activities in these fields are to a great extend executed with the aid of foreign donor organisations. Activities of the private sector mainly concentrate on groundwater abstraction for irrigation.

Uncontrolled drilling for irrigation has resulted in considerable lowering of the groundwater table level in recent years, in some areas threatening the domestic water supplies.

At present the total abstraction of groundwater can roughly be estimated to be more then 600 million m^3 per year (see also chapter 4, table 11). The average cost of groundwater abstraction varies according to the depth of the groundwater table and the permeability of the aquifer. A rough average figure for the cost of groundwater abstraction in the YAR is 0.75 YR/m^3, with a total cost of 450 million YR on an annual base.

Groundwater abstraction is increasing rapidly. This can be illustrated by the increase in groundwater pumpage in Major Wadis in the Tihama coastal plain (Figure 1).

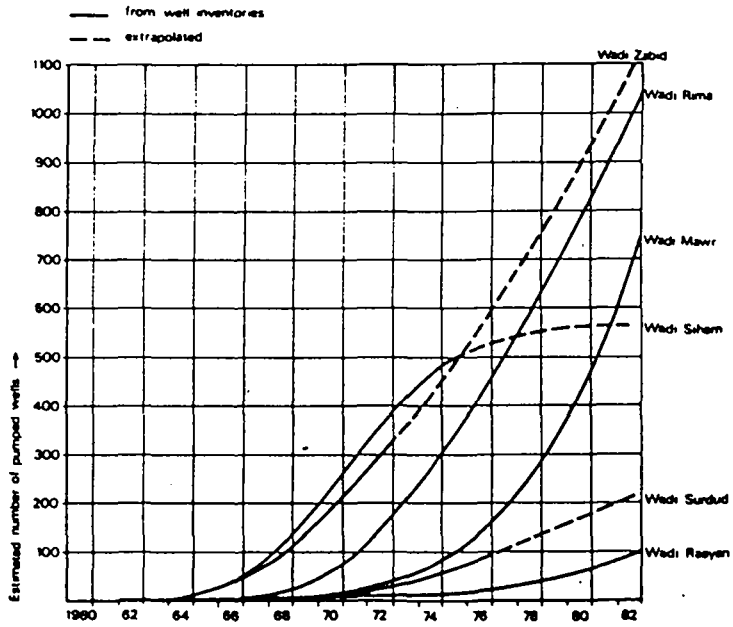


Fig. 1. Increase in groundwater pumpage in Major Wadis in the Tihama coastal plain 1960-1982 (DHV, 1983)

As water availability is one of the main bottlenecks hampering the development of the agricultural sector the Second Five Year Plan has allocated 20.5% of the total fixed capital investments in the public sector for water and irrigation projects (see table 2). Special attention is paid to:

- better water utilization by introducing modern methods of irrigation, such as drip and sprinkler systems;
- reducing run off to the sea by building small diversionary dams and conducting of water reserves;
- developing groundwater resources and regulating their use for the long run;
- building and maintaining distribution canals and preventing water pollution.

Table 2 Public investments in water related activities within the Second Five Year Plan (in thousand rials).

	Investments During Plan Years		
	Local	Foreign	Total
Irrigation and Water	112,000	383,200	495,200
Rural Development	411,384	358,812	770,196
Water Supply and Sanitation	382,384	710,144	1,092,528

For an optimal use of the available water the Second Five Year Plan aims at assessing surface and groundwater resources through intensive surveys and exploration to prepare a groundwater map that will help to formulate a general strategy for exploiting water resources for different purposes. In addition a Supreme Water Council has been established in 1982, one of its first tasks being the development of a water right and user code. Owing to the scarcity of water in the country first priority is given to drinking water.

The Water and Electricity sector is planned to achieve a 25% annual growth rate, the highest of all sectors. This is because the contribution to the Water and Electricity sector is very low at the present, only 89 million rials in the base year 1982. Fixed capital investments in the Water and Electricity Sector as listed in the Second Five Year Plan, amount to 2,340 million rials in total and 1,119,528 or 47.8% for water and sewerage. Foreign loans and grants will finance 79% of the fixed capital investments of this sector.

3.2. Water Resources

Several water resource studies are presently being executed in the YAR (see table 3).

Table 3 Ongoing water resources studies in the YAR

Activity	Estimated cost in thousand rials
Water Resources Assessment YAR	16,000
Yemeni Joint Project for Natural Resources	10,400
Tihama Water Resources Study	1,925
Water Resources Utilization Scheme of the Sana'a Basin	26,483

An overview of intended public investments in water resources studies within the second five year plan is given in table 4.

Table 4 Public investments in water resource studies within the second five year plan (in thousand rials)

Activity and project	Investments During Plan Years Local	Foreign	Total
Surveying water resources	4,000	12,000	16,000
Studying and developing Sana'a water basin	14,400	24,000	38,400
Total	18,400	36,000	54,400

Apart from these investments water resources components are also included in rural development projects and projects for urban and rural water supplies (mainly site selection).

3.3. Drinking water supply and sanitation

Urban water supplies presently in operation serve about 193,000 people or 49% of the 1981 population of the three largest cities, Sana'a, Hodeidah, and Taiz. Projects covered by the Second Five Year Plan would increase the total to about 595,000.

Virtually no piped sewerage existed in the urban areas in 1981. However, projects presently under construction (or entering the construction stage) will serve about 300,000 users. In addition about 150,000 people in the urban areas will have piped sewerage under construction by 1986 (see table 5).

Table 5 Investments in water supply and sewerage by activity and project (in thousand rials) (CPO, 1983)

Activity	Type	Investment During Five-Year Plan Local	Foreign	Total
I. Public Sector				
Sana'a water supply (Phase II)	ongoing	37,429	69,510	106,939
Sana'a sewerage (Phase I)	ongoing	86,365	160,394	246,759
Hodeidah water and sewerage	ongoing	49,591	92,099	141,690
Taiz water and sewerage	ongoing	87,768	162,998	250,766
Ibb and Dhamar water and sewerage	new	121,231	225,143	346,374
Subtotal		382,384	710,144	1,092,528
II. Private Sector		10,000	17,000	27,000
Total Investments		391,834	727,694	1,119,528

The Plan also strives to provide pure drinking water to all regions of the Republic as part of a long-term, gradual plan to be implemented according to a timetable specifically formulated for this purpose, with priority given to the neediest areas. In 1981, about 14% of the rural population or 800,000 people were served through village water supplies. During the present Second Five Year Plan it is proposed that rural water supply projects will benefit 2.2. million people, of whom 0.5 million will have a new service, 1.2 million a new well, and 0.5 million an improved service (WHO, 1981). A summary of the water supply and sewerage projects in the Second Five Year Plan is given in Table 7.

The Plan of the cooperative movement (LDAs) aims at financing and building 1,632 drinking water projects at a total cost of 163 rials before the end of 1986 (see table 6).

Table 6 Investmens of the Cooperative Associations Projects by Governorates (in thousand rials)

Project	Source of Financing												
	Self-Financed	Government Financed	Sana'a	Taiz	Hodeidah	Ibb	Dhamar	Hajjah	Saadah	Al-Beida	Al-Mahwit	Marib	Al-Jawf
Road paving	121.605	—	24.783	16.071	19.206	17.391	10.197	21.318	3.927	3.201	4.125	0.891	0.495
Road maintenance	80.838	—	16.506	10.746	12.858	11.634	6.798	14.154	2.466	2.136	2.790	0.570	0.180
Education	202.341	—	37.776	25.736	17.555	44.593	13.087	45.230	3.421	7.899	5.079	1.137	0.818
Drinking water	162.945	—	20.385	14.850	21.330	35.775	7.965	38.880	2.700	6.345	10.800	2.565	1.350
Health	121.936	—	36.080	11.457	11.070	30.753	9.748	12.175	3.317	2.713	3.517	0.603	0.503
Miscellaneous projects	121.792	—	24.684	16.058	19.468	17.422	10.117	21.350	4.017	3.193	4.155	0.868	0.460
Total	811.457	—	160.214	94.918	101.487	157.568	57.922	153.107	19.848	25.487	30.466	6.634	3.806

Source: Second Five Year Plan 1982-1986, 193-194

3.4. Irrigation

Ongoing projects in the field of irrigation are dealing with agricultural extension, improvement of spate irrigation systems and/or improvement of groundwater irrigation.

An overview of ongoing and planned irrigation projects is given in table 7.

Table 7 Public investments in irrigation projects (in thousand rials) (CPO, 1981)

Activity	Type	Investments During Plan Years		
		Local	Foreign	Total
Wadi Jawf development	ongoing	24,000	63,200	87,200
Small diversionary dams	ongoing	10,400	41,600	52,000
Maintaining terraces, dykes	ongoing	4,800	4,800	9,600
Meteorological station	ongoing	1,600	--	1,600
Study of groundwater and well drilling	ongoing	4,000	8,000	12,000
Supporting the Department of Irrigation and training surveyers	ongoing	2,880	3,200	6,080
Jannatain irrigation (Marib dam)	new	38,400	216,000	254,400
Developing Bana Valley	new	3,200	8,800	12,000
Adapting modern irrigation methods	new	1,600	1,600	3,200
Study of using sewerage water in irrigation	new	2,720	--	2,720
Total		93,600	347,200	440,800

3.5. Integrated Rural Development

Water related development activities are generally important components of integrated rural development projects and of regional organizations like the Tihama Development Authority (TDA). The total public investments in these fields are presented in Table 8.

Table 8 Public investments in rural development projects and the Tihama Development Authority (in thousand rials) (CPO, 1983)

Activity	Type	Investments during Five Year Plan Local	Foreign	Total
Rural development projects				
Rural development in Southern uplands	ongoing	91,920	40,650	132,570
Integrated rural development in Rada	ongoing	23,400	40,331	63,731
Integrated rural development in Baun	ongoing	14,908	1,577	16,485
Integrated rural development in Khaulan	new	14,369	8,382	22,751
Integrated rural development in Hajjah	new	14.637	11.102	25.739
Integrated rural development in Al Mahwit	new	14,344	6,140	20,484
Integrated rural development in Sa'adah	new	15,880	8,544	24,424
Integrated rural development in Anis	new	5,969	1,579	7,548
Total		195,427	118,305	313,732
Tihama Development Authority				
Zabid valley	ongoing	10,125	--	10,125
Rima valley	ongoing	63,150	66,707	129,857
Mour valley	ongoing	93,429	126,053	219,482
Agricultural extension	ongoing	24,975	12,829	37,804
Surdad farm	ongoing	9,298	13,947	23,245
Agricultural research in Surdad	ongoing	1,120	1,681	2,801
Siham valley	new	10,860	16,290	27,150
Study of nothern valleys	new	3,000	3,000	6,000
Total		215,957	240,507	456,464

4. THE NETHERLANDS SUPPORTED WATER RELATED ACTIVITIES

The Netherlands supported water related projects include activities in the fields of:
- Water Resources
- Drinking Water Supply and Sanitation
- Irrigation

This chapter provides a review of these activities.

4.1. Water Resources

The following three water resources studies are presently supported by the Netherlands Government:
- Water Resources Assessment Yemen Arab Republic.
  This project aims at (1) a nation wide collection, storage and evaluation of hydrological and hydrogeological data and (2) providing technical information and advises to the benefit of proper resources management.
- Tihama Water Resources and Water Use Study (Phase II).
  This activity concentrates on (1) a strengthening of TDA's Hydrological Section, (2) an assessment of available water resources in the Tihama area and (3) an assessment of the optimum distribution of water in areas where irrigation systems have been constructed.
- Al Bayda Water Resources Study of the Rada Integrated Rural Development Project (RIRDP). The overall objectives of this study are (1) to provide information on available water resources to assess present and future water use and (2) to prepare a first framework for future development of water resources and water management.

4.1.1. Major Issues

A. Changing water situation

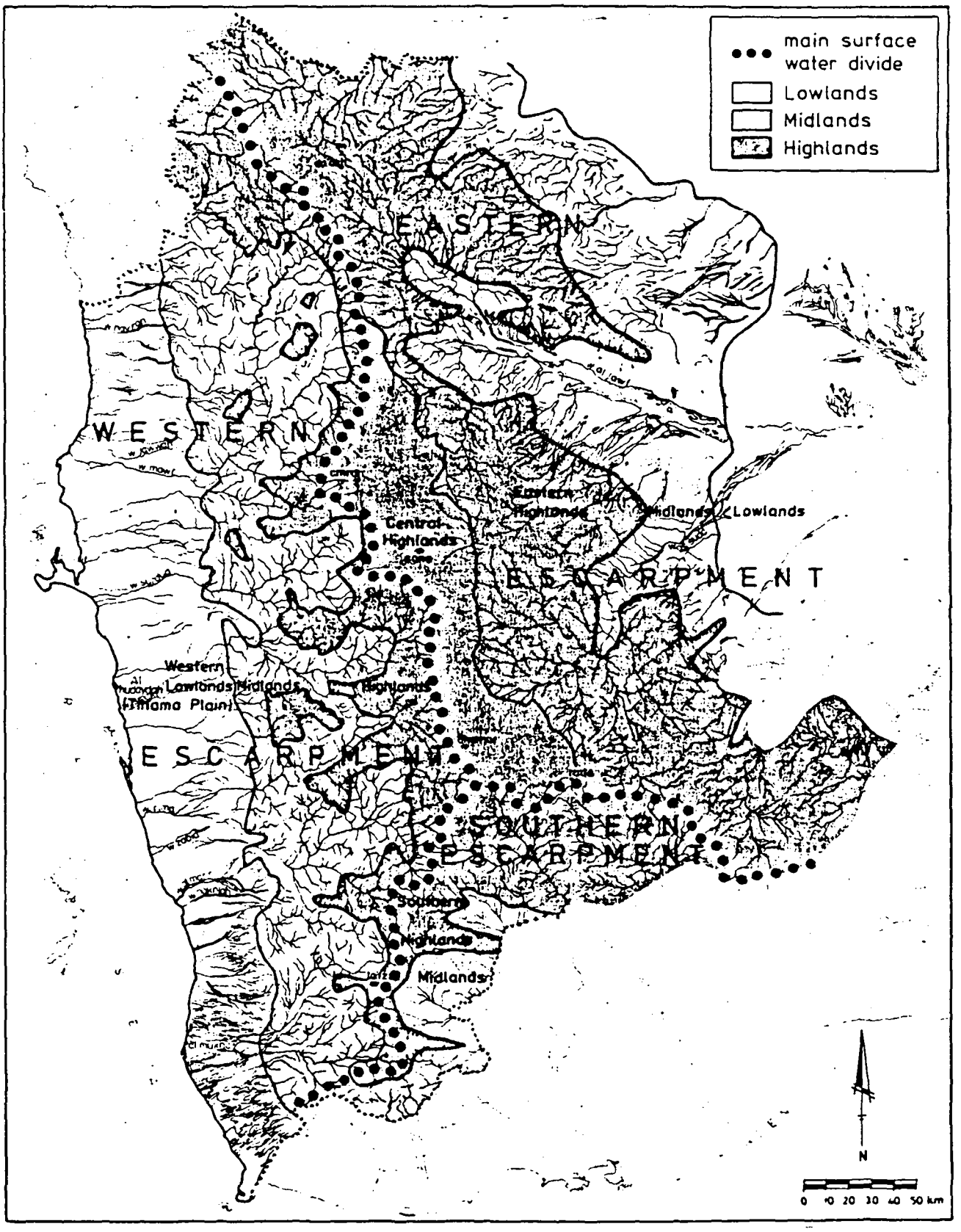
The only primary source of water in the YAR is rainfall. No rivers are entering the country nor does groundwater flow into the country.

The average annual rainfall in the YAR varies from less than 100 mm along the Red Sea and the eastern part of the country to a maximum of 1800 mm in the Ibb region. About 90% of the country receives less than 600 mm of rainfall annually.

Regarding to topography three zones can be distinguished: the Highlands, the Midlands and the Lowlands (see figure 2). In the Highlands and the Midlands the rains fall mainly on the mountain slopes, causing surface runoff. In the Lowlands where the terrain is more or less flat, surface runoff from rainfall is less important and more local.

Rain that falls on the mountain slopes is for the major part stored in local depressions, or artificially collected by farmers to grow crops on terraces. This part of the rainwater will finally evapo(transpi)rate. A minor part of the rainwater - 5 to 10% - is transported through the different wadis to the Lowlands or local plains in the Highlands and Midlands. Where the wadis enter the lowlands or the plains the farmers use the water as much as possible for spate irrigation.

Figure 2: Geographical units (WRAY-I, 1984)



The major part of the rain that directly falls on the Lowlands or the local plains in the Highlands or Midlands will only reach the upper 2 to 3 meters of the soil. This part of the rainwater will evaporate from the bare soil or evapotranspirate through crops and trees. Less then 10% of the rainfall contributes to the groundwater reservoirs.

The above-mentioned surplus rainwater and a part of the wadi discharges contribute to the recharge of the groundwater reservoirs. In principle two types of groundwater reservoirs can be distinguished, namely the Lowlands and the local basins in the Midlands and Highlands.

From these groundwater reservoirs there is a more or less small natural discharge. In the Tihama plain this discharge is towards the Red Sea and in the eastern Lowlands towards Saudi Arabia. In the local basins in the Midlands and Highlands there could be some superficial outflow. From old, where the groundwater level is not too deep (< 20 m), drinking water and/or irrigation water is taken from dug wells.

During centuries this system of recharge, storage in the groundwater reservoirs and discharge had been more or less in equilibrium.

From about 1960 in the Tihama plain and from an even later date in the other areas a tremendous change took place in the use of water resources due to the introduction of pumps and the drilling of deep wells, mainly for irrigation with groundwater. Recent data obtained through the Water Resources Assessment YAR (WRAY) project show that in the major part of the basins mining of groundwater occurs (see table 9).

The magnitude of the mining in relation to the available storage in the different reservoirs is such that in some of the reservoirs a significant reduction of the abstraction is already required to prevent their exhaustion within some decades. Especially the central wadis in the Tihama plain, the Saadah basin and the Sana'a basin are critical areas.

Table 9: Indication of groundwater recharge and abstraction in million m3/year in different basins. (WRAY-I, 1984)

basin	Recharge	Abstraction	Indication over exploitation*
Tihama plain			
Wadi Mawr	80	50	
Wadi Surdud	60	25	
Wadi Siham	18	70	50
Wadi Rima	30	100	70
Wadi Zabid	82	120	40
Wadi Rusyan	25	5	
Central Highlands**			
Sana'a	25 - 50	30 - 38	0 - 15
Dhamar	11	11	
Amran	18	18	
Rada	30	20	
Eastern Highlands, Midlands and Lowlands			
Saadah	20 - 60	76	15 - 50
Al Jawf		30	
Marib	83	29	

* This is a very rough figure indicating that mining occurs. A study is required to draw detailed conclusions.

** Although the figures for the Central Highlands give the impression that the recharge is greater than the abstraction it is known that locally within these basins already serious problems occurs resulting in wells falling dry .

B. The Supreme Water Council

In January 1982 a Supreme Water Council has been established. The council aims at coordinating the efforts of the Ministries and other relevant organizations concerned with drinking water supply, irrigation or power stations to making plans and policies to develop the water resources and advocating its proper use as follows:

- developing plans and policies and coordinating the necessary scientific research in the field of water;

- establishing laws and regulations to coordinate efforts and programme planning for water use within the framework of the adopted plans and policies and in accordance with the public interest;
- study and evaluation of reports, statistics and maps about water;
- following the implementation of policies, plans and programmes concerning research in the field of water and the means of developing water resources and organizing water use;
- study the reports prepared by the parties concerned and taking the correct dicisions;
- organizing participations in conferences about water inside and outside the country.

The Water Supreme Council is made up of the following representatives:
- Minister of Electricity, Water and Sewerage, Chairman
- Vice Minister of Electricity, Water and Sewerage, Vice Chairman
- Deputy Minister of Agriculture and Fisheries
- Deputy Minster of Public Works
- Deputy Minister of Religious Affairs
- Deputy Chairman of the Central Planning Organization
- Undersecretary of the Development Cooperation Union
- Director General of National Water and Sewerage Authority
- Director General of Yemen Oil and Mineral Cooperation
- Director General of the Rural Water Supply Department
- Director General of Civil Aviation and Meteorology
- Qualified and experienced members from each of the technical and financial departments appointed by the Minister for a five years' renewable term (the Council chooses the under-secretary out of its members).

In principle the Council meets once every two months. The meeting is considered to be official only if more than half of its members is present. Decisions can be taken by the majority of the members present. In case of a tie, the Minister can break up this deadlock.

From its start the Supreme Water Council is facing many problems which hamper a proper functioning.

4.1.2. Significance

The water situation in the YAR is very critical mainly because of a tremendous increase in groundwater irrigation during the last twenty years. At present in most of the aquifer systems mining of groundwater occurs (see table 9).

Given the need to protect the limited water resources in the YAR competent institutions like DOH and TDA are regarded to be essential for future water resources management. Expected benefits can be summarized as follows:
- organizations, able to execute (geo)hydrological studies and to give advice to solve regional or practical hydrological problems;
- clear information to Ministries, organizations and the public on possibilities for proper water use and the damage

that can be expected from wrong or over exploitation of water;
- sufficient technical background on a national scale to establish legislative rules with regard to proper use of water and protection of the water resources.

Within this context the significance of the ongoing water resources projects will be clear as the projects contribute to:
- institution building and training to strenghten the DOH and TDA to fullfil their tasks;
- the provision of information on water resources for present and future drinking water supply and irrigation purposes. Such information may reduce the number of unsuccessful drillings (and save costs) and minimize the risk of poorly prepared irrigation projects, or wrongly located well sites;
- signalizing unacceptable reductions in ground water resources and future water shortages;
- avoidance of potential capital losses caused by an unjustified development of agricultural land. Once such a capital loss materialises as a result of water shortage, employment will suddenly and severely be reduced;
- avoidance of intrusion of salt water in the aquifers of the Tihama region;
- provision of information required for the development of a water right and user code.

4.1.3. Efficiency

Although all studies are more or less suffering from delays and/or other problems, it is the missions impression that the projects are being executed in an efficient way.

As far as manpower requirements concerns, DOH may well have to employ approximately 100 staff members to carry out its functions properly in the future. This figure is in accordance with internationally accepted standards and tasks and certainly relevant in the circumstances of the YAR.

4.1.4. Effectiveness

As all three studies are still under way, only general comments can be made concerning their effectiveness. The mission likes to comment as follows:
- the WRAY project provides a very good insight in the water resources of the YAR, as well as in the critical situation caused by mining of groundwater resources. The same holds true for the Tihama study for the Tihama Coastal Plain. To maximize the effects of the obtained information, great attention should be paid to the distribution of this information both to the Ministries and Authorities and to the public;
- the mission has the impression that, although there is a promising attitude within the different authorities, still a lot of training and institution building will be required before they are able to perform all their tasks.

4.2.5. Recommendations

A. Water resources assessment YAR

Given the critical water situation in the YAR the mission is convinced that every effort should be made to an effective functioning of the Supreme Water Council.

An important contribution to the functioning of the Supreme Water Council will be a strong and well equiped technical secretariat. DOH may be the most suitable organization to play this role. On the one hand the main responsibilities of DOH are such that it will be increasingly in the position of assisting in an effective functioning of the Supreme Water Council. On the other hand, an important part of the tasks of DOH will have much more impact when the results are utilized by the Supreme Water Council. This is why the mission likes to stress that the relation between the Supreme Water Council and DOH will have to be clarifield and strengthened.

Realizing that there are many problems to solve before the Supreme Water Council and the technical secretariat will function according to expectation, perhaps an intermediate solution can be found in establishing a technical secretariat with representatives from the technical departments within the different Ministries that are represented in the Supreme Water Council. This intermediate technical secretariat may have the next tasks:

- to present and discuss reports prepared by the different members;
- to propose and discuss technical and legal measures to obtain an optimal water management;
- to coordinate different projects with common interests;
- to coordinate fieldwork like drilling of wells, monitoring of networks, etc.;
- to exchange relevant data;
- to standardize instruments, codifications etc.

It may be suggested that DOH will be the coordinator of such an intermediate technical secretariat. After several years of experience a decision can be made concerning a more permanent structure.

The mission recommends a phase II of the WRAY project for about three years and focusing on the following goals:

- to strenghthen DOH through training and institution building;
- to improve the hydrological data bank and assure that all relevant data will be stored in the bank and data retrievel will be an easy and accessible process;
- to supply information to Ministries, organizations and the public on proper use of water and protection of water resources;
- to establish sufficient technical background to make the Supreme Water Council able to fullfill its tasks.

Based on these goals the mission recommends the following activities:

- to continue monitoring in the Saadah and Wadi Surdud areas and to process and publish the data. Also to keep the equipment in these areas in good condition and to do some additional field work if required for a better understanding of the hydrological system;
- to improve the data bank;
- to improve the library;
- to execute a water resources study in the Sana'a basin which is the most critical basin in the YAR or in an area in which a lot of new developments are being expected in the near future (like the Marib area);
- to distribute information (e.g. by means of a monthly information sheet) on the hydrological conditions of the country, new publications, etc. among the Ministries, Authorities, organizations and the press;
- to execute specific studies or to give advice on request of clients, both private and governmental. These services are (partly) to be paid for by the clients. Within the project a budget should be fixed for this purpose to subsidise for example 50% of the costs.

For a proper functioning of DOH after termination of phase II, it is proposed that DOH's staff will grow during phase II from 25 to about 50 employees with annual costs of about YR 10 million.

B. Tihama Water Resources and Water Use Study (Phase II)

General

The mission is of the opinion that phase II of the Tihama study will only be benficial if the project aims at:

- training and institution building to strenghten TDA's capability to independently executing its hydrological research and water management tasks;
- a complete insight in the technical, economic and social aspects of water distribution and its effects in terms of increased yields.

Hydrology

The draft project document is proposing a lot of advanced hydrological equipment. Bearing in mind that training of counterpart staff is a primary goal, the instruments that will be installed or used should meet the following requirements:

- it should be possible to measure the hydrological conditions directly on the spot;
- as it is difficult to observe on the spot whether the proposed equipment is functioning, intensive testing has to be carried out also to ensure that TDA staff gets used to its sophisticated equipment;
- data processing, data storage and data retrievel should be organized in such a way that the Yemeni counterparts will be able to operate the whole process without any problems;
- an organization and (small) workshop has to be set up in such a way that the Yemeni counterparts can easily repair and maintain the hydrological and meteorological equipment.

In the hydrological system of the Tihama coastal plain the groundwater movement in the unsaturated zone plays a very important role. For an insight in this movement the important parameters have to be determined and the unsaturated groundwater flow has to be modelled for different soils and irrigation conditions. It is advised to do this for the Wadi Rima area. In the draft project document it is proposed to monitor both Wadi Rima and Wadi Zabid area. For the purpose of the Tihama study, this is not required. Monitoring the Wadi Rima area at relevant places from the dam down to the fields will provide full insight in one wadi system. This insight will probably cover the major part of the conditions that can be expected in the other wadis. It is understood that TDA attaches importance to including the Wadi Zabid in the monitoring activities in order to obtain also insight in the economic effects of the new works in this area.

Institutional aspects

It is recommended to pay more attention to institution building in Phase II of the Study as TDA should be able to execute its service in the fields of hydrology, hydrogeology, operation and maintenance of irrigation works and monitoring and evaluation of socio-economic development in a smooth and independent manner by the end of phase II. The mission is of the opinion that a mere monitoring of the institution building process by the consultant, followed by some recommendations in annual reports, may not be sufficient to guarantee a proper strengthening of TDA.

Therefore the mission recommends a more explicit advisory role for the consultant, in which the various experts of the project team act as advisers to the Yemeni and expatriate staff in the different sections of TDA and institution building takes place in an active way.

Socio-economic studies

In the draft project document it is proposed to carry out a series of socio-economic studies. However, in the opinion of the mission, not all aspects receive due attention. Consequent to the outcomes of the Water Resources Study, appropriate farming systems and related irrigation systems as well as on-farm irrigation techniques have to be developed. This requires a thorough study of possible cropping patterns, farm irrigation techniques and farm budgets.

On the other hand, the study of the impact of the new irrigation and farming techniques and related changes in legislative rules (i.e. a re-allocation of lands, share cropping agreements, distribution of water, etc.) on traditional socio-economic structures seems to be too well covered by a team of sociologists. Given the obvious need for more agronomic and (agro)economic inputs in phase II of the project, the mission recommends a re-examiniation of the manpower requirements.

Staffing

Based on the draft project document and the comments given, the mission likes to recommend that the proposed project manager will be responsible for the hydrological part of the study.

Given the importance of training, institution building and socio-economic aspects of the study, it is strongly recommended to nominate a project manager with extensive management experience in developing countries and an intimate knowledge of socio-economic aspects of rural development projects.

C. Al Bayda Water Resources STUDY (RIRDP)

The conclusion of the mission is that the first phase of the Al Bayda Water Resources Study can be considered as a good starting point for a next phase, in which the water resources studies have to be intensified and a monitoring network put into operation.

As such the mission:
- supports the use of computer equipment, electro-magnetic and geo-electric measurements for well siting;
- does not recommend the application of groundwater models as yet. Results of monitoring will enable first indications regarding riskful developments (salinity increase, excessive lowering of groundwater table). At a later stage, it may be necessary to carry out groundwater model studies; at the moment these models are considered inopportune, partly because of costs involved, partly as for some time to come, the data will be insufficient;
- recommends some trials with electronic rainfall recorders before applying them om a large scale. Contacts with DOH and their TNO advisers in this matter could prove to be useful with respect to this matter;
- recommends a combination of monitoring alternatives. A number of ten electronic water level recorders, to be installed at vital points, together with a great number of manual measurements, should offer a good start for monitoring activities. This combination of monitoring alternatives will require some backstopping from a senior expert;
- prefers Yemeni observers to Netherlands BSc graduates for the measuring of water levels, especially in view of the training aspect of this RIRDP activity.

4.2. Domestic Water Supply and Sanitation

In the field of water supply and sanitation the following projects are presently supported by the Netherlands Government:
- Support Rural Water Supply Department (SRWSD) with water supply schemes in the Dhamar and Rada areas;
- Rada Integrated Rural Development Project (RIRDP) with water supply projects and pilot sanitation schemes in the Al Bayda Province;
- Ibb and Dhamar Water Supply and Sewerage Project, a cofinanciers arrangement between YAR, the World Bank, the Netherlands and the Arab Fund.

These three activities have been evaluated by the mission. In addition the mission examined the conclusions and recommendations of the water supply and sanitation studies that have been carried out within the framework of the Rada Urban Development Project (For details see Report 4).

4.2.1. Major findings

Organisation

The National Water and Sewerage Authority (NWSA) within the Ministry of Power and Water Supply, is responsible for water and sewerage services in the urban centres of Sana'a, Taiz and Hodeidah. The existing water supply and sewerage systems of Ibb and Dhamar will be transferred to NWSA. Their are plans for water supply and sewerage networks in five secondary towns, probably under responsibility of NWSA. Rada town and Al Bayda town will be among them.

The development of rural water supplies is shared by the RWSD under the Ministry of Public Works and the LDA's with CYDA as the coordinating body. Water supply schemes that form part of integrated rural development projects are carried out by the agencies concerned (e.g. TDA and RIRDP) under the Ministry of Agriculture.

Rural sanitation is the responsibility of the Ministry of Municipalities and Housing, with the Ministry of Health having a secondary role.

Donor contributions

Most water supply and sanitation activities, urban as well as rural, are very much dependent on donor contributions.

Financial support for the construction of the urban systems is among others provided through IDA funds. The Ibb and Dhamar project is co-financed by IDA, AFESD, and the Governments of the Federal Republic of Germany and the Netherlands.

Donor assistance to rural water supply development is presently given by: Saudi Arabia, USAID (Transcentury), Japan (PCI), Unicef, UNCDF, Iraq, Netherlands, Germany, AFESD, and Oxfam (through CYDA).

Support to strengthen the Rural Water Supply Department has been and is being provided by UNDP/WHO, the Netherlands and Transcentury (USAID).

Present situation in towns and rural areas

The construction of water supply and sewerage systems in the three main cities are well under way c.q. completed. In other towns and regional centres like Rada the water and sanitation situation is far from adequate and in some cases even becoming a pressing problem. Problems exist with poor water quality, irregular supply, leakages in the distribution system, and poor disposal of waste water, human excreta and solid waste. Due to the concentration of people in a small area, the urban public health situation is deteriorating in a faster rate than in rural areas.

It is estimated that up till 1983 20% of the rural population has been provided with some kind of water supply system. In unserved villages water is collected by women and girls from wells and/or surface water. Donkeys are used to carry the water over long distances. Sometimes water trucks are used to buy water in other places and bring it to the houses. Where water

is scarce problems exist with private and public hygiene. In case of new water supplies, especially with house connections new public health risks tend to develop caused by poor waste water disposal.

In general, the sanitation situation in the rural areas is rather poor. A few donor organisations have recently started to gain some experience with small sanitation (pilot) schemes. There seems to be much scope for hygiene education to aid the improvement of private and public health (even without technical solutions) but up till now this has not been given serious consideration.

4.2.2. Significance

A reliable, convenient and increased supply of water ranks high on the list of priorities of the Yemeni population. Also, water supply development is an important development objective of the YAR government. At present, outside the three main cities, the water supply situation in urban areas is far from adequate. In the ural areas, where 90% of the population is living, it is estimated that about 80% of the villages are still unserved. Especially in the Highlands this implies a heavy and time consuming burden for women and children (girls).

In general, sanitation in rural areas is poor, given low priority by the people and does not feature as a development objective in Government programmes. Rural water supply projects often do not include activities to improve sanitary conditions, e.g. through waste water drainage, hygiene education, construction of safe latrines and a safe disposal of solid waste. In villages with a new water supply where waste water does not infiltrate adequately in the soil or does not evaporate within a reasonable time, stagnant pools pose new hazards to health. In urban areas, where the problem of safe disposal of liquid and solid waste is growing in a faster rate than in the rural areas, much more priority is given to improve the situation.

Whereas old and new (improved) water supply and sanitation situations differ in many aspects, both create often many health risks. The connection between the use of safe drinking water, sanitation and health is often not made and hampers full benefits of improved water supply and sanitation facilities. Although exact figures are generally lacking, there are clear indications that the incidence of water and sanitation related diseases is high, contributing to a high rate of infant morbidity and mortality.

At present, basic health services including preventive health care and hygiene education are - apart from a few exeptions - not yet developed. The main hindrance for starting training courses for (assistant) sanitarians is the difficulty in providing paid employment after completion of the course.

In view of the above, Netherlands development cooperation in the field of water supply and sanitation can be considered to be important:

- to assist the Government and the population in their efforts to improve the living conditions in rural areas and secondary towns (rural urban centres) through improved water supply and sanitation conditions;
- to alleviate the burden of women and children (girls) and to find proper ways for women participation in water supply and sanitation projects;
- to contribute to an improvement of sanitary conditions through research and pilot schemes;
- to contribute to the development and implementation of hygiene education programmes in order to maximize health benefits of new water supply and sanitation facilities;
- to support a coordination of efforts of agencies involved in water supply and sanitation and to promote an exchange of experiences that can lead to more successful programmes.

4.2.3. Efficiency

Some distinction should be made between the efficiency of local institutions in itself and the efficiency of Dutch projects in relation to these local institutions.

Rural Water Supply

Water supply schemes are constructed by the RWSD, Ministry of Agriculture, CYDA, LDA's and individual villages, sometimes each apart and sometimes together. No clear approach, fixing the amount of contribution of each party and valid for the whole country, exists. Non of the organisations apply cost recovery.

Coordination between donors and excuting agencies or firms and other local organisations is garanteed by the Deputy Director General of RWSD supported by WHO. Minor problems arise from the fact that donors have there own wishes and that local organisations in YAR are not very cooperative amongst each other.

Training programs for pipe fitters and pump attendants were organised by RWSD/WHO. After reduction of the Dutch financed WHO-team this activity has come to a stop.

New activities might be started with support of USAID. Doubts exist whether a centralised training programme might work or that district training centres could not do a more efficient job.

Technical designs and service level are basically standardised. Problems arise from donors who prefer own designs, and from villages who insist on a better service level (house connections).

Technically the designs of tanks of the SRWSD Project does not seem be the most appropriate.

Execution of the RWSD-project without contribution of the villages can decrease the emplementation time but reduces

community involvement with the schemes. Financial contribution by the villagers in the earthquake stricken Dhamar area is excluded by the government.

RWSD aims at a more decentralised organisation with offices in Dhamar and Hodeidah and Taiz. A higher efficiency of RWSD can be expected of this action.

A stronger position of RWSD is actually impossible due to lack of engineers. The salary structure of the Ministry of Public Works makes RWSD less attractive. The intention to change RWSD in a authority might improve this situation considerably.

To date the support role of the Dutch project to RWSD was not very effective. This was partly due to the above-mentioned organizational problems of RWSD and partly due to not very elaborate task descriptions of the Dutch support role.

The Ministry of Agriculture has no implementation capacity for the construction of water supply schemes and has no ambition in this direction. Integration of rural water supply in integrated projects seems to be more the wish of the Central Planning Organization and foreign donors than of the Ministry of Agriculture. Even when schemes are constructed in a rather efficient way in the long run this approach does not seem to be the most efficient one from a institutional point of view.

Rural sanitation

No activities exist from governmental side to improve sanitary conditions in villages. The Ministry of Municipalities is formaly responsible for this sector but is up till now only dealing with small towns. A few villages have taken actions on there own, like latrines near mosques, or simple sewer systems. In general knowledge on waste water treatment is completely lacking.

Health education is still a very little explored field in YAR. No general feeling exists that water supply, sanitation and health education should be linked together.

Funds for sanitation and health education are restricted to experiments.

Urban facilities

These facilities are treated with by NWSA and the Ministry of Municipalities. The approach seems adequate, but expensive, more low costs options are not applied. Due to elaborate governmental administrative procedures contractor prises are very high.

The administration of NWSA (billing system) is still not adequate. Return flow from tarifs stagnates.

Actual demand for facilities is much higher than the technical and financial capacity of NWSA.

Dutch involvement is reduced to cofinancing.

4.2.4. Effectiveness

Rural water supply and sanitation

The effectiveness of the national water supply programme seems to be low. No masterplan exists including all needs, programming of implementation and financial arrangements. Decisions are taken on a ad-hoc base. Villages with influence and money seem to have a better chance to obtain a water supply scheme than villages without, even when their needs are high. In villages that are provided with a scheme positive effect on the workload for the women and on the well-being of all may be expected especially when the village obtained a system with house connections.

A positive effect can be expected on the personal hygiene of the people. At the other hand an increased supply of water will create a waste-water problem with serious health risques. The lack of joint activities in the field of sanitation and health education reduces much the positive impact of water supply on health.

The SRWSD Project works within above mentioned framework up till now. The RIRDP project under the Ministry of Agriculture shows a some more effective approach: a first inventory of needs was made; for selection of villages criteria for participation are applied; a start with health education and sanitation will be made.

Maintenance of the schemes and especially of the pumps and motors, seems to be rather effective as people are used to pumping equipment for irrigation.

Urban facilities

In urban areas water supply and sewerage is combined which gives better chances for an important health improvement. However health education is a very difficult aspect to realise in YAR. No project in which the Netherlands are involved has been implemented as yet.

4.2.5. Recommendations

Assuming that the overall programme of cooperation between the YAR and the Netherlands maintains its present character, in the long run (c.q. after 1986) funds will probably be available for institutional support and the construction of about 20 water supply schemes per year.
It seems inefficient to maintain 2 complete teams (RIRDP and RWSD) to implement these schemes.

In the short term it is preferred to continue with the ongoing projects. Continuation of the RIRD-project will be at least one year after 1985 as this project goes reasonably well, integrating a number of desirable aspects as inventory of needs, participation and linkage of water supply to sanitation and hygiene education.
The RWSD-project should be continued to the end of 1986 on the condition of introducing some aspects like priority to needs and community involvement.

As village contribution to the construction of schemes is excluded by the government in the earthquake striken Dhamar area it is proposed that for the extension of the SRWSD Project a shift will take place to an area where needs and community involvement can be realized. The Tihama area seems to fulfil these requirements.

In the long run it seems desirable that the RWSD develops in a institution on national level that is responsible for the planning of the rual water supply over the whole country (and eventually sanitation also), that develops the criteria and standards for this supply and delivers specialized services as hydrogeological research, design facilities, quality control, centralized purchase of materials, etc. However, the responsibility for the selection of villages, as well as the site selection, implementation and management of the systems will be mainly the responsibility of decentralized institutions like TDA, RIRDP, etc.

An evaluation of the SRWSD-project should take place by the end of 1986. In case of a favourable development of RWSD the role of RIRDP could be reduced to financing and integration of the water supply schemes in the regional development plans, leaving technical matters to the RWSD.

To achieve to the development of RWSD it is advisable to insist on meetings of RWSD with donor organisations giving institutional support (USAID, WHO, UNICEF, Netherlands) to emphasize the need of restructuring and to arrive at a effective division of tasks between supporting agencies. The Netherlands role could be to continue to support the hydrogeological section including need and resources inventories, and training of personel. Further aspects for Netherlands assistance might be the development of rural sanitation and hygiene education.

As needs for water supply schemes are still enormous in the country it is recommended to strive after a low-cost implementation method on routine base to increase as much as possible the output for the limited funds available. The method should include very simple administative procedures, self-help, financial participation, appropriate technology, low overhead costs (local personnel, volunteers).
The possibility to supply most needed villages (walking distances to source of several kilometers) with only a borehole, pump, pumphouse and groundreservoir next to the pumpsite, should not be excluded.

4.3. Irrigation

In the irrigation sector, current activities supported by the Dutch Government concentrate on:

- Wadi Rima supervision, i.e. supervision of the construction of the Wadi Rima Irrigation Scheme during the April 1981 - September 1984 period;
- the irrigation components in the Rada Integrated Rural Development Project (RIRDP);
- the irrigation component of the Tihama Agricultural Extension.

All three activities have been evaluated by the mission (for details, see Report 4). In addition, the mission examined more closely the irrigation component of the proposed Tihama Water Resources and Water Use Study, especially its socio-economic implications.

4.3.1. Major findings

The mission came to the conclusion that irrigated agriculture in many regions of the YAR is entering a critical phase. In this respect, the following major findings can be presented:

- most of available surface water is currently being used for irrigation purposes. Although the applied irrigation systems are mainly still rather traditional, they have proven their efficiency over the times and, especially in the interior areas east of the Sa'adah - Sana'a - Taiz axis, there appears to be little scope for upgrading of present structures or erecting large-scale more sophisticated ones. In the Tihama Plain, however, an improvement in the use of surface water (i.e. spate floods) appears still to be feasible;
- the use of groundwater for irrigation increased considerable over the last decades, especially since the introduction of motor pumps in the late sixties and the rapid spread of deep boreholes since the seventies. At the moment, in most of the aquifer systems, mining of groundwater occurs.
  As the increasing pumping of groundwater exceeds the recharge of the aquifers, groundwater irrigation is rapidly deteriorating the dangerous water situation in the YAR;
- the responsible Yemeni authorities are realizing the dangers of an uncontrolled growth of groundwater irrigation. They would like to come to a tight control over and substantial decrease in groundwater mining. At the same time, they urge the Dutch Technical Assistance Units presently engaged in irrigation developments, to concentrate their efforts on a better use and extension of surface water irrigation.

As to the techniques and organization of irrigation at the farm level, the mission prefers to distinguish two main problem areas, viz. a high degree of water losses and spillage, and a malfunctioning of water distribution systems.

- water use at farm level is largely inefficient, especially in areas that are irrigated with groundwater. In general, farmers (i.e. borehole/pump owners) neglect the costs of energy - which indeed are still relatively low - of their pumps, hardly maintain irrigation canals, appear to be indifferent to unlevelled fields and so on. These observations all point in the direction of a rather low degree of awareness of Yemeni farmers about the scarcity of (ground)water. Therefore, it appears that there is quite some scope to increase water use at farm level;
- water distribution systems in improved spate irrigation areas (e.g. Wadi Rima, Wadi Zabid) are far from being optimal. Farmers are still used to apply their tradtional water distribution systems, based on customs, ancient water rights and ethnic differences. These tradtional systems often do not coincide with new distribution systems resulting from recently erected irrigation structures. Consequently, farmers tend to ignore the distribution

mechanisms of the new schemes which are considered unjust and unfair, and intervene with their own (illegal) dams, inlets and so on.

4.3.2. Significance

In view of the critical situation of irrigated agriculture in the YAR, a continued assistance of the Dutch government in the field of irrigation appears to be necessary. This assistance could be significant on three items:

- assistance to the Yemeni authorities in the current surface water/ groundwater debate. The YAR-government is inclined to decrease groundwater mining and to improve and extend surface water irrigation. In order to formulate adequate solutions to this dilemma, it has to face several problems, namely:
  . the absence of a strong, interdisciplinary and supra ministerial institution that will have full power to control groundwater mining and to implement necessary conservation measurements (cf. Supreme Water Council);
  . the need of a thorough knowledge of nation wide groundwater resources as well as of the current rate of abstraction and recharge of the various aquifers;
  . the need of a thorough assessment of present and possible future national surface water resources, of relevant water harvesting techniques and of cost/benefit analysises of new spate (= flood) irrigation structures;
- decrease of water losses at farm level, by improving present irrigation techniques (proper canal maintenance, levelling of the field, adequate crop irrigation, application of underground irrigation pipes, and so on) or the introduction of more optimal irrigation techniques (e.g. drip irrigation);
- improvement of water distribution systems, especially in spate irrigation areas. To this purpose, traditional water distribution systems and current water rights and landownership have to be examined closely. Proper water distribution systems, avoiding unjust and inefficient water use, can only be created with the full acceptance of the farmers.

4.3.3. Efficiency

At the moment, out of the tree irrigation related projects supported by the Netherlands, one is practically completed (Wadi Rima supervision), whereas another is facing an incorporation within the total framework of TDA (Tihama Agricultural Extension). As to the third project (irrigation component of RIRDP), assistance will be continued - preferably on a more intensive scale - as will be support to the irrigation part of the proposed Tihama Water Resources and Water Use study. The mission comments about the present and future efficiency of Dutch assistance to these irrigation projects in the YAR as follows:

- Structures
  Where large structures are involved (e.g. Wadi Rima, Wadi Zabid), the staffing of operation and maintenance is insufficient, resulting in a far from optimal water use and

sedimentation of canals and inlets. The structures themselves have been erected in good co-operation with the contractors and are functioning well;

- On-farm techniques
  In general, on-farm water use is still far from being efficient. In most fields, substantial water losses occur because of poor canal maintenance, inadequate levelling, overpumping and so on. Present techniques could be easily improved, although there also appears to be some scope for the introduction of new techniques, such as underground piping and drip irrigation. In this respect, the efforts and achievements of the Tihama Agricultural Extension Project are noteworthy;
- Water distribution
  Water distribution systems in the YAR are still based on traditional landownership and water rights, sometimes rooted in ethnic and social differences. These traditional systems do not always match with distribution systems resulting from recently erected, more advanced structures. In the opinion of the mission, farmers are not yet (fully) convinced that the new systems aim at a just, fair and efficient water distribution. Consequently, they obstruct regulating structures by dikes and so on. In such a situation, water use will be far from optimal and projected benefits will fall far behind estimates. A close examination of existing water rights and an adjustment of new water distribution systems to traditional ones - in order to obtain full acceptance of the water users - appears to be imperative;
- Extension
  Apart from the Tihama Agricultural Extension Project, extension services in irrigation systems and techniques are rather inadequate on the projects supported by the Dutch assistance, both in quality and numbers. Wheras most supervision and extension services concentrate on the operation and maintenance of structures and crop protection, proper on-farm water use is rather neglected. In order to prevent substantial water losses, extension services should concentrate more on the improvement of current irrigation techniques, the introduction of (tested) new techniques and the acceptance of new water distribution systems by the farmers. As most extension services are understaffed and lack adequate experience for these tasks, they have to be quantitatively and qualitatively supported.

4.3.4. Effectiveness

In view of the deteriorating situation in the provision of irrigation water in the YAR, the establishment of functional irrigation systems can be regarded essential for the future of Yemeni agriculture.

Despite the significance of the irrigation projects supported by the Dutch government, their present benefits cannot readily be compared with its costs in financial terms. The merits of the support which - in the opinion of the mission - will have to be continued on a more intensive scale, can only be fully measured in the decades to come, as most of the recommended measurements aim at a more efficient water use and water conservation, especially in the aquifers.

A crucial role in enhancing the effectiveness of the Dutch assistance will be played by the various extension services on the projects. At present, these services are understaffed and mainly not geared towards a special attention to irrigation related issues. More and more qualified personnel are essential to a full realization of the objectives of the projects, current as well as to be implemented.

The benefits of the present irrigation components of the various projects, as well as in the proposed Tihama Water Resources and Water Use Study, include the following:

- provision of more knowledge on irrigation systems in the YAR, in particular about the differences between and potentials of groundwater and surface water irrigation systems;
- more efficient water use at farm level, avoiding unnecessary losses and resulting in higher agricultural outputs per unity of water;
- avoiding mismanagement of irrigation systems by training qualified water operators;
- provision of information to improve and adjust water distribution systems, leading to a development of an updated and adequate water code.

4.3.5. Recommendations

As to the irrigation component of the water sector activities supported by the Dutch government, the missions recommends the following:

- to provide technical assistance to the Yemeni authorities in order to obtain a well-balanced comparison between the pros and cons of groundwater and surface water irrigation developments;
- to support institution building in Yemeni governmental bodies, involved in the development of irrigated agriculture. In this respect, special attention should be paid to the extension services on irrigation in the Tihama Plain after the completion of the merger between the Tihama Agrucultural Extension and the extension services of the Tihama Development Authority;
- to increase the quality and quantity of operating and maintenance staff in the improved spate irrigation systems of Wadi Rima, Wadi Zabid and Wadi Rasyan;
- to strengthen the various extension services, notably those of the TDA and RIRDP, in order to improve on-farm irrigation techniques, to test and to introduce more appropriate, new irrigation techniques, and to inform and guide farmers in new water distribution systems;
- to study current water rights and its socio-ecnonomic consequences, especially in the improved irrigation system in the Tihama Plain, in order to formulate guidelines for the development of an adequate water code;
- to study possibilities to increase the water users' participation in irrigation systems, financially as well as physically in operation maintenance and management/administration.

5. SECTOR ISSUES AND CONSIDERATIONS

5.1. Project Effectiveness and Sectoral Objectives [1)]

In assessing the effectiveness with which resources are used to build or establish and subsequently operate a project, four aspects will be distinguished: economic, financial, social and institutional.

To determine the economic value of a project, the net present value or the internal rate of return is generally used as a summary indicator of its overall merit in relation to its resource cost valued at efficiency prices. The estimation of benefits, however, varies with different types of projects. It is most straightforward where the project is intended to produce an output which is traded and whose economic value can therefore be observed. Irrigation schemes fall into this category because the economic value of improved yield levels (including shifts to high-value crops) can usually be established without great difficulties.

When the value of a project lies in saving costs or creating opportunities for new economic activity, as in transport, the estimation of benefits is less direct. The calculation of economic rates of return in public utilities such as water supply and sanitation projects is even more difficult because benefits are hard to quantify. An incremental financial rate of return is therefore normally calculated, using the increased revenues accruing from the project as a minimum measure of a project's benefits, although adjustments are sometimes made to incorporate the savings from existing systems which may accrue in the early years of project operation. In actual fact, consumers may value the service by more than they have to pay for it, particularly since there may be external benefits (health, convenience) which cannot be quantified. The incremental financial rate of return, therefore, provides more information about the adequacy of tariff levels in the longer term than about the economic value of the investment. Alternatively, water supply and sanitation projects are often assessed in terms of their cost-effectiveness in meeting physical and service objectives which lie within the financial capacity of the authorities or community installing the system.

Finally, there are projects for which benefits cannot readily be compared with costs; their merits must therefore be judged qualitatively in relation to the objectives set for them. Water resources assessment studies belong to this category; a brief indication of potential benefits in qualitative terms is given in section 4.1 of the evaluation report on WRAY.

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1) Part of this section is based on "Eighth Annual Review of Project Performance Audit Results", World Bank, Operations Evaluation Department, Report No. 4104, September 9, 1982.

A project's financial performance is usually linked to private profitability and financing goals. For revenue earning projects, private profitability shows the extent to which actual revenues exceed expenditures and therefore generates additional income. Financial goals relate to the question whether at any time sufficient funds will be available to finance the investment costs and to cover the operating costs. In the case of water and sanitation projects, the possibility to implement appropriate price and tariff policies determines to a large extent the success of cost recovery, and hence a project's long-term financial viability.

The social analysis of projects emphasises income and employment effects, the extent to which project beneficiaries are provided with new facilities and services, and the degree of success in reaching weaker sections of the society while maintaining project viability.

Institutional aspects at the project level are increasingly linked to wider sector objectives and incentives. Thus, price structures and levels, marketing arrangements, appropriate tax systems, manpower training, institution building and infrastructure investment can have a major impact on the viability of individual projects.

An interesting example of how wider sector objectives may affect decisions at the project level is presented by two sector objectives of agricultural development in the YAR, viz. the promotion of self-reliance in food products and the reduction of the foreign trade deficit in agrucultural products by reducing imports and increasing exports (see also section 2.1. on YAR development policy). Consistent with the import substitution element in both objectives is the present policy to maintain high domestic prices compared to world market prices and to restrict the import of competing agricultural products where necessary (import protection being more necessary the higher the degree of overvaluation of the Rial). The relatively high domestic price level is undoubtedly a strong incentive for farmers to increase production for a protected domestic market; without extensive subsidies, production for export seems hardly a realistic option as long as the divergence between domestic prices and cost levels and world market prices continues to exist.

Whereas the present price and tariff policy encourages the expansion of agricultural output in the short run, such a policy is bound to have several drawbacks in the long run if pursued in isolation of what happens in other sectors of the economy. First the cost of protecting the domestic market for agricultural goods is ultimately borne by the consumer who pays the difference between the domestic price and the world market alternative. When both sources of supply provide fungible goods, the consumer's willingness to pay for the price difference will invariably diminish. Secondly, protected markets tend to signal incorrect indications of future production possibilities relative to other, less protected sectors of the economy. Resources are drawn into the most protected markets and in many projects serious capital losses will occur if a reversal of price and tariff policies is

introduced or if the relation between domestic and international prices is otherwise affected, e.g. as a result of a further depreciation of the Rial. Moreover, investments that would be justified from an economic point of view are foregone in less protected markets because financial incentives are insufficient to compete for resources in protected markets.

To avoid misallocation of resources in the long run in an economy with differential protection, it is strongly recommended to conduct a careful cost-benefit analysis of new investment projects using efficiency prices which reflect the real scarcity of commodities and resources. Such an analysis will show which projects are viable irrespective of protective policies, and which activities do require protection to survive. The difference between the average output price that ensures financial viability under protection and the corresponding efficiency price can be considered the premium for being self-sufficient. In theory, the welfare loss to the country implied by the total value of this premimum should not exceed perceived welfare gain attached to self-sufficiency. In addition, the welfare gains associated with self-sufficiency should be weighted agaInst possible alternatives, e.g. the possibility of long-term contracts, strategic storage capability, etc.

5.2. Sectoral Priorities

Agricultural and rural development can be considered a cornerstone in the socio-economic development of the YAR during the next decade. In view of the scarcity of water, both as an input into agriculture (irrigation) and as an essential element of basic needs (drinking water, sewerage), high priority is accorded to the further development and rationalisation of these sectors by both the Yemeni and Netherlands government (see chapter 2 and 3). Given the limited knowledge of water resources in the YAR and the immanent danger of overexploitation in several areas, further hydrological research and water assessment studies are indispensible to obtain basic information on acceptable levels of ground- and surface water use.

Having established general priorities, it is not uncommon to require that preference be given to those activities that provide a lasting contribtuion to a country's productive capacity and, hence, ability to generate and sustain higher levels of income. To this effect, a distinction between "productive" and "non-productive" activities (or "economic" and "social" investment) is often made, and the necessity emphasized to strike a proper balance between the two types of activities. Unfortunately, this dichotomy is conceptually

confusing[1] and has no operational value in practice. Instead, production is sometimes differentiated into "directly" and "indirectly" productive activities, a distinction based on the nature of the benfits as explained in the previous section.

In the terminology of cost-benefit analysis, productive activities can simply be defined as those activities for which economic benefits exceed resource cost when both are valued at efficiency prices. New productive capacity will then be viable in the long run, and a surplus of benefits over costs indicates that factors of production can be paid higher incomes than before reflecting increased productivity. Provided benfits can be properly estimated, the activities in the subsectors irrigation, drinking water and sanitation, and water resources are, in principle, equally productive. In terms of priorities, an equitable treatment in terms of productive contribution is therefore recommended, be it that benefits are less direct in drinking water and sanitation and even more so in water resources.

Future sectoral priorities should also reflect the experience with projects in the three water subsectors thusfar. As far as large-scale irrigation is concerned, results appear disappointing (see sections 4.3. and 5.3). Financial and economic rates of return mentioned in the various feasibility studies are modest at best, but poor performance has seriously affected the profitability of the present large-scale irrigation schemes. Urgent action is recommended to improve this situation, and proposals for new investment should only be considered if the reasons behind the poor performance of the present schemes are known and measures to rectify the situation can be taken. Extension and improvements in on-farm irrigation practices have been quite succesful.

Experience with drinking water projects has been mixed.
Urban water supply is mostly financed through bank loans, sometimes in combination with cofinancing. Water rates seem to be difficult to implement.
A cause for great concern is the financing of rural water supply systems. Up till now, local contributions to investment costs have been low. Such a situation, implying a large transfer element in the financing of rural water sypply

1) the obvious distinction is between investment and consumption activities; "non-productive" investment should, of cource, always be avoided, and "productive" consumption often refers to positive external effects. The gradual evolution of the definition of "production" may also explain why the distinction mentioned above still exists; historically the meaning of "production" has evolved from primary production (fysiocrats), material production (classical and marxist economists), and market production, to activities for which payment is or could have been received. The latter definition forms the basis of the current system of National Accounts.

systems, carries great risks for the continued operation of the system. Unless the transfer element, which has thus far been financed by the donor, is fully underwritten by the Yemeni authorities as part of a (regional) income distribution policy, more attention should be paid to efforts to improve self-financing goals.

One may wonder whether and to what extent the present priorities will change if the recent oil findings in the YAR prove to be substantial in the sense that the YAR may become a net exporter of crude oil. Among the likely long-term effects of such a development can be mentioned:

- a marked shift in the YAR's comparative advantage towards the exploitation of oil reserves at the expense of agricultural and industrial development;
- easing of the foreign exchange situation and likely appreciation and subsequent overvaluation of the Rial;
- increased fiscal revenues for the central government and increased public spending, especially in the urban areas;
- substitution of foreign exchange earnings for official transfers and partly for remittances, increasing both power and independence of the central government;
- relative worsening of the situation in rural areas if increased public transfers do not sufficiently compensate for reduced remittances and adverse movement in the terms of trade.

In as far as concessional aid has a supplementary role, increased attention for rural development, easing of urban bottlenecks, skill formation, and institution building are the likely areas to receive increased attention. In terms of sectoral priorities in water-related activities, the following, minor shifts in relative priorities may be anticipated:

- water resources: central government priority of equal if not higher importance when ecnomic growth would accelerate causing increased demand for water;
- drinking water: improved financial position of the government should enable better financing arrangements; development of rural water supply is likely to require acceleration to keep pace with overall developments;
- irrigation: acceleration of broad-based agricultural development becomes less urgent (though not less important as a second line of defense to maintain sustained growth), so that large-scale irrigation programmes can be better phased and prepared over time; with increased appreciation of the Rial financial incentives to increase agricultural production will be eroded.

5.3. Implications for Water Use

Favourable prices for food crops and commercial crops and the availability of investible fund from remittances abroad in most of the rural areas of the YAR, have led to an ever increasing demand for one particular input, viz. pump irrigation water from boreholes and shallow wells. Although the flow of irrigation water is considered a scarce and valuable resource, in some areas competing with demand for drinking water and sanitation, the stock of groundwater is perceived by many as a free good, not subject to water rights and user codes.

Consequently, the cost of providing irrigation water to the farmer is considered to consist of the investment cost in well construction, pump house, pump, engine and ancillary equipment as well as the recurrent cost of fuel and maintenance. The possible depletion cost of "mining" groundwater (extraction exceeding recharge) is not taken into account.

High farmgate prices for irrigated crop production and a short-run private cost approach to pump irrigation has in several areas led to a situation where groundwater extraction exceeds the natural recharge. As a result, groundwater tables are already decreasing in certain areas at a rate of several meters per year, causing older and less deep wells to fall dry. The latter phenomenon implies a dual capital loss: either deeper wells have to be drilled and equiped, requiring new investment and higher recurrent cost, or past development of irrigated land is lost altogether.

A first attempt to analyse the economics of groundwater use for irrigated crop production was carried out for Al Bayda Province (RIRDP, 1984, Vols 1 and 2). For 8 types of crops net returns per ha (in financial terms based on crop budgets) and irrigation dosages per ha in m^3 (derived from agronomic surveys) were estimated; subsequently, returns were expressed per m^3 irrigation water. Next, the private cost of providing one m^3 of water by borehole or shallow well were calculated for various well depths and watertable depths (heads). Except for qat, the cost of the distribution system - usually simple hand-made earthen field channels and bunds - is not included. Comparison of cost and returns can then be made by means of simple graphs as shown in Figure 3 (RIRDP, 1984, Vol 1, p. 67). The cost and net return figures indicate that pumping from boreholes at all well depths and water depths considered is financially attractive for the production of commercial crops such as qat, potatoes, vegetables and fruits, and for maize. However, food crop production in general is much less attractive, and soon becomes marginal with boreholes of greater depth of well and water table. On the whole, shallow wells turned out to be more costly per m^3 than boreholes, especially at low annual discharges, and therefore less suitable for the production of food crops.

The cost and returns of pumped irrigation water as depicted in Figure 3 provides a suitable point of departure for analysing the effect of using effeciency prices instead of market prices and of efforts to promote higher efficiency in water use. In de economic circumstances of the YAR, the use of efficiency prices reflecting world market conditions will result in lowering the value of net returns of most crops. The cost of pump irrigation water as far as based on the cost of extraction and distribution only certainly underestimated the true scarcity of water as a productive input in agruculture. Ideally, the price of pump irrigation water should equal the value of its marginal product in the most attractive crop while maintaining long-term equilibrium between extraction and recharge of groundwater reservoirs. In practice, this would mean asking farmers what they would be willing to pay for an additional m^3 of water under a system of limited water supply to prevent exhaustion of groundwater. The highest price quoted would be an indication of

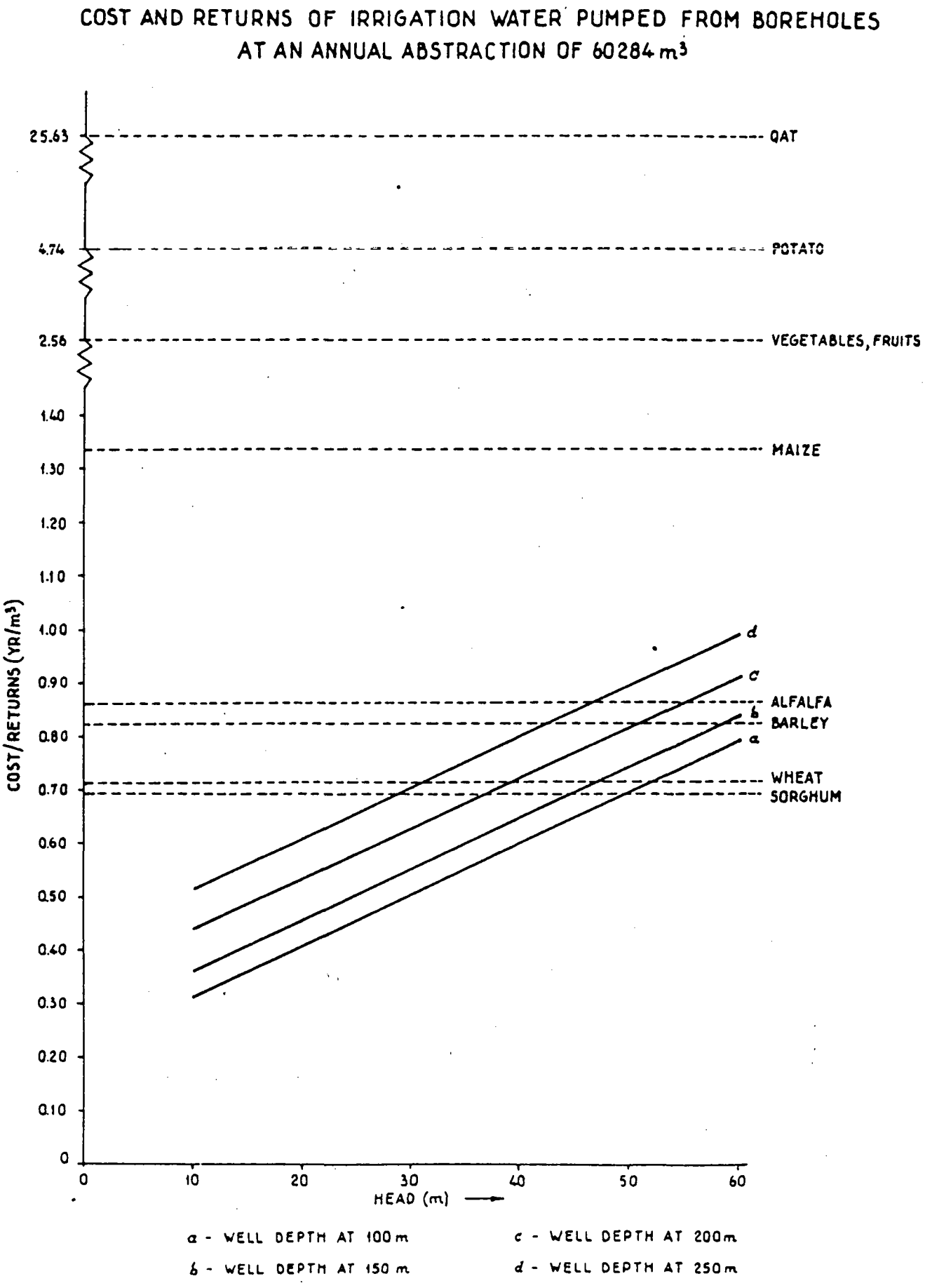
the true scarcity of water, and the difference between that price and the cost of extraction is the rent component in the efficiency price of water. The latter reflects the pure scarcity effect of a resource which can be put to productive use, but whose supply cannot be increased in the short-run without causing long-term damage to society. Implementation of this rent element can be realized by licening the number of wells, taxing the well owners, metering water extraction, and charging water users.

In terms of Figure 3, the overall effect of using efficiency prices would therefore be a downward shift of the return curves and an upward shift of the cost curves, rendering the production of food crops problematical in economic terms at higher, and probably also at present pumping depths. To restrict the future use of water, however, the introdution of water rights (cum taxation) and user codes (cum charges) is probably inescapable in the near future. In these circumstances, irrigated food production would need special protection indeed if it is to survive, let alone contribute to greater self-sufficiency with the present production methods and techniques.

The recent introduction of PVC pipes in the water distribution system shows, however, that substantial improvements in water effeciency are possible, even without increasing the price of water. Under the present price structure, water savings permit a horizontal expansion of the cultivated area where land development is relatively cheap, or increases in cropping intensity and shifts towards higher-value crops where land is in limited supply. Expansion of cultivated area (less irrigation dosages per ha) and increases in cropping intensity (higher net returns per ha) both result in an upward shift of the return curves because returns per m^3 irrigation water increase. Shifts towards higher-value crops simply mean an upward jump from the present return curve to a higher situated one.

In all cases, the relative distance between the return and cost curves increases, providing a strong incentive to farmers to introduce better water distribution systems and adjust their cropping patterns. With the present price incentives, it is therefore doubtful whether any absolute savings in water use will actually occur. Present water users can realise income gains by investing in more efficient water distribution systems and using all the water under their command for productive purposes. If anything, this will encourage additional demand for water, unless the price of complementary factors of production increases such that net returns become depressed. Any long-term conservation of water is likely to depend as much on savings through higher efficiency as on discouraging its use through an appropriate pricing system. Such a system means increasing the price of water (probably in combination with rationing) and reducing incentives to use water as an input in agriculture for water-intensive crops.

Figure 3


COST AND RETURNS OF IRRIGATION WATER PUMPED FROM BOREHOLES AT AN ANNUAL ABSTRACTION OF 60284 m³
COST/RETURNS (YR/m³)
25.63
4.74
2.56
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0
OAT
POTATO
VEGETABLES, FRUITS
MAIZE
ALFALFA
BARLEY
WHEAT
SORGHUM
d
c
b
a
0
10
20
30
40
50
60
HEAD (m)
a - WELL DEPTH AT 100 m
b - WELL DEPTH AT 150 m
c - WELL DEPTH AT 200 m
d - WELL DEPTH AT 250 m

5.4. Information to the Public

Groundwater depletion as a result of heavy overpumping for irrigation purposes takes serious dimensions in many aquifers in the YAR. In the Sana'a basin, for example, the domestic water supply is even risked in the immediate future, whereas in other regions salt water intrusion is also fastly becoming a major threat to drinking water systems.

Up till now, the Yemeni Government has been unable to control effectively groundwater extraction by individual farmers and well owners. An effective legislation in this matter appears to be imperative, but is has to be feared that such a legislation will lack adequate implementation, unless broad political support of the population can be assured. In this respect, the mission is of the opinion that the public will have to be made aware of the problem, as well as to be prepared for actions of the Government to contract the negative developments. As such, it is advised to organise nation wide, intensive information campaigns on the risks of uncontrolled water extraction.

Possible dissemination methods might be:
- television, a most widespread medium in the YAR;
- information campaigns through the extension services of the Ministry of Agriculture and/or the Primary Health Care Centres;
- information by local religious leaders (imans);
- basic information to schoolchildren.

A likewise information campaign could be prepared by a small team of Yemeni and Dutch experts on information dissemination in the Yemeni socio-cultural context. It is advised to study earlier experiences in such information campaigns in YAR, e.g. a sanitation/waste disposal programme in Taiz.

Tentatively, a budget of Dfl. 200,000 could be reserved for this badly needed information programme.

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WATER SECTOR EVALUATION YEMEN ARAB REPUBLIC

TERMS OF REFERENCE

Joint evaluation mission of the Government of the Yemen Arab Republic and the Government of the Netherlands, September 1984.

1. **Introduction:**
The Netherlands supported water sector activities in the Yemen Arab Republic presently concentrate on:

Water Resources
a. "Water Resources Assessment YAR"
b. "Tihama Water Resources and Water Use Study"
c. "Al Bayda Water Resources Study"

Domestic Water Supply and Sanitation
a. "Support Rural Water Supply Department"
b. "Water and Sewerage Dhamar/Ibb"
c. "Water Supply and Sanitation Component "Rada Integrated Rural Development"

Irrigation
a."Wadi Rima Supervision"
b. Irrigation component "Rada Integrated Rural Development"
c. Irrigation component "Tihama Agricultural Extenstion"

Whereas there is no doubt that these water sector activities form important elements in the social and economic development of the Yemen Arab Republic less clarity exists as to which elements and strategies should be given priority in view of the future Yemen-Dutch co-operation programme.

2. **Objectives of the evaluation**
The objectives of this joint evaluation are:
A. to review the projects as listed above in order to submit recommendations on priorities for furter Yemeni-Dutch development co-operation in water related activities.
The recommendations should include a description of the type of projects, counterpart organizations, manpower requirements, target population, local cost component, financing and cost consequences in the long run. The recommendations should aim at a comprehensive programme on water related activities in line with the Yemeni and Dutch development policy.

B. to study objectives and progress of the "Water Resources Assessment" project and comment on its effectiveness and efficiency in order to submit recommendations on possible follow up activities after termination of the present project period.

C. to study objectives and progress of the "Support Rural Water Supply Department" project and comment on its effectiveness and efficiency in order to submit recommendations on possible follow up activities after termination of the present project period.

Given the recognition that the role and position of women have been very much neglected in development processes and projects, the mission should pay special attention to the integration of women in the project activities and to the interests of women in relation to project objectives, results and recommendations.

The recommendations will be presented to the Government of the Yemen Arab Republic, the Government of the Netherlands and the various projects involved.

3. Sectoral evaluation of Netherlands supported water related activities.

3.1. The sectoral evaluation as formulated under 2A should deal with the following aspects:
- Examine to what extend the YAR policy is reflected in the actual programme of development projects
- Review of the significance of the individual projects in relation to
  + problem perception
  + project objectives
  + target population
  + plans and priorities of the Yemen Arab Republic
  + Netherlands policy on development co-operation;
- Review of the effectiveness and efficiency of the project activities;
- Comparative assessment of the development impact of the individual projects in terms of significance, efficiency and effectivity;
- Identification of possible follow-up activities;
- Recommendations on priorities for future Yemen-Dutch development co-operation in water related activities with a clear indication of type of projects, counterpart organizations, manpower requirements, target population, local cost financing and cost consequences in the long run.
- Possible adjustments for ongoing activities.

3.2 Special points to be examined are:

A. General
- Manpower requirements, human recource development, trainingsprogrammes;
- Strengthening of institutional and administrative structures versus implementation capacity;
- Integration of women in the development process: participation of women in project activities; effects of project activities on the position of women;
- Identification and co-ordination of donor activities in water rescources management, water supply and sanitation and irrigation;
- Planning for continuity after ending the project;
- Support for individual projects by a sector policy and appropriate institutions;
- Question whether demand surveys were carried out for the various services.

B. Water Resources
- Policy aspects:
  . Role and functioning of the Supreme Water Council and action taken to a more rational exploitation of water resources;
  . the contribution of the central hydrological department to improvement of water resources management; information transmission to "users"; relation to Supreme Water Council.

- Organizational aspects:
  . Co-ordination of different water resources projects, expertise and data both within Yemen-Netherlands co-operation programme (WRAY, Tihama Water Resources Study, Al Bayda Water Resources Study) as well as between water projects in general;
  . The need to integrate water resouces studies with water development projects (e.g. RIRDP).

- Technical aspects:
  . Reliability and usefulness of the collected data;
  . Appropriate technology for data bank development (use of models, automation);
  . Institution building versus technical studies.

- Economic aspects:
  . Assessment of costs involved with the start and functioning of a hydrological department in relation to expected benefits, comparison to international standards.
  . Feasibility of an economic cost-benefit analysis of the DOH activities and/or water resources studies in general.
  . Possibilities to charge for supply of hydro(geo)logical information.

C. Domestic Water Supply and Sanitation

- Policy aspects:
  . Conformity of projects to National Sector policy.
  . Integration of water supply, sanitation and hygiene education.
  . Criteria for the selection of villages which will be served first.
  . Public versus private water supply and sanitation facilities;
  . Rural versus urban water supply and sanitation projects;
  . Co-financing versus bilateral aid.

- Organizational aspects:
  . Appropriate counterpart organizations for the development and implementation of village water supply and sanitation (RWSD; LDAs/CYDA).
  . Co-operation and co-ordination of agencies and organizations involved in water supply and sanitation (MPW; RWSD; LDAs/CYDA; MOA; MOH; MOMH; MPWS; DOH; donor organizations).
  . A "single track" approach versus an integrated rural development approach in water supply and sanitation projects.
  . Attention for water recources management.
  . Organization of operation and maintenance for water supply and sanitation facilities.

- Technical aspects:
  . Need for water resources studies in the planning phase.
  . Physical implementation and appropriate technology.
  . Level of service and choice of technology compared to need, health aspects, manpower requirements, cost-effectiveness, maintenance aspects.
  . Functioning of the facilities.
  . Maintenance capability.
  . Water quantity and water quality control.
  . Water reuse and utilization of sewerage effluent.
  . Standards applied both technical (engineering) as well as with regard water demand.

- Social aspects:
  . Need for water supply and sanitation facilities.
  . Contribution of water supply and sanitation projects to an improvement of the living conditions of the rural poor; who benefits.
  . Participation of the local population in project planning and implementation.
  . Participation in operation and maintenance.
  . Accessability of the facilities; equal distribution of water and sanitation facilities.
  . Use of the facilities.
  . Productive use of water (cattle, garden, small scale industries).
  . Constraints for work in sanitation.

- Health aspects:
  . Health risks and health benefits of water supply and sanitation facilities.
  . Involvement of health agencies (MOH, MMH, etc) in water supply and sanitation projects.
  . Safe disposal of human waste, solid waste and waste water.

- Economic aspects:
  . Financing of schemes; local contributions to investment and running costs; cost/benefit ratio's.
  . Financial management of operation and maintenance; system of contributions.
  . Increased production through health improvement.
  . New water supply schemes versus upgrading of existing facilities.
  . Cost effectiveness and adaption to local circumstances.

D. Irrigation
- Policy aspects:
  . Improvements of irrigation systems on regional level versus local (farm) level in relation to an alleviation of the position of rural poor;
  . The importance of irrgation water for the national food supply (as a contribution to economic independence of the country);
  . Use of well irrigation for qat production and its consequences for food production.
  . Netherlands involvement in planning and design services (studies, supervision) versus implementation services.
  . Pumpirrigation versus surface irrigatie.

- Social aspects:
  . Analysis of problems and possibilities in water harvesting and water management resulting from present developments in social structures in the project areas.
  . Study of distribution systems of irrigation water, possibly leading to suggestions for optimizing the water distribution systems.
  . Distribution of the benefits of the projects.

- Organization aspects:
  . Appropriate counterparts in project implementation, e.g. Rural Development Agencies, Central Government Agencies.
  . Organization of operation and maintenance.

- Technical aspects:
  . Physical implementation, including appropriate technology.
  . Functioning of the constructed systems.
  . Attention for water resources aspects in small scale projects.

- Health aspects:
  . Schistosomiasis transmission through field irrigation.
  . Domestic use of irrigation water.

- Economic aspects:
  . Financial and economic rentability of irrigation projects with due observance of investments at farm level as well as the necessity of large scale investment programmes on regional level in relation to scarce financial means.
  . Organisation of (re)payment of investments and running costs.

3.3 Specific topics per individual project

Apart from the general approach given under 3.1. and the points of attention for the various fields within the watersector mentioned under 3.2, a number of special topics will receive (extra) attention during the review of the individual projects of the co-operation programme.

For the two projects that are to be evaluated with a view on possible additional financing in 1985 these topics are mentioned in section 4. Regarding the other projects mentioned on page 1 the following issues are of importance.

A. Tihama Water Resources and Water Use Study"
- Depending on the stage of finalisation of the project document, discussions with the TDA management on the context of the project and further execution of the project, with special attention to the socio-economic component, the organisational structure of the project and the fitting in the TDA organisation, the development priorities within the Tihama as a whole and the co-operation with other donors.
- Storage of data obtained in phase I
- Present level of data collection.

B. "Al Bayda Water Resources Study"
- Review of the main conclusions of the Ilaco report in relation to possible follow-up of RIRDP
- Possibilities for further (ground) water development; role of the project
- Relation between surface and ground water; possible improvements of water retention (diversions, dams)
- Tasks and organisation of water resources monitoring unit; level of sophistication and amount of equipment required
- Application of ground water models
- Well siting techniques.

C. "Water and Sewerage Dhamar/Ibb"
- Review of the studies executed, including the recent change in design
- Discussions with NWSA on the successive phases of the project
- Link to health education
- Handling/use of treatment plant effluent

D. "Rada Integrated Rural Development/Water Section"
- Integration in local institutions/LDA, provincial council/RWSD activities
- Sanitation programma (technical report Ilaco)
- Relation construction section/Woman section
- Type of water facilities (house connections)

E. "Wadi Rima Irrigation Supervision"
- Functioning of the new irrigation system sedimentation problems; infiltration in canals)

F. "Irrigation component RIRDP"
- Possibility to influence water use/irrigation development
- Crops irrigated/priorities
- Water collection systems/dams

G. "Tihama Agricultural Extension (Irrigation component)"
- Effect of improved efficiency on water resources
- Possible extension of activities outside Tihama
- Effect on income position of various groups within the Tihama.

4. Project evaluations "Water Resources Assessment" and "Support RWSD"

4.1. Evaluation points project "Water Resources Assessment YAR" (WRAY)

In addition to what has been mentioned under section 3.2.A "General" and B: "Water Resources" the following points should be examined:

- Policy aspects
  - Were the original objectives in the framework of existing conditions realistic?
  - If the project encounters problems with improving office skill and work, how could improvements be reached?
  - Has a division on responsibilities taken place among the several governmental institutions involved in water study and development. What consequences does this have on the work of DOH?
  - What is the policy with regard to DOH's position now and in the future; e.g. in relation to the Supreme Water Council.
  - Who are the actual users of information provided by DOH? What is their opinion on DOH up till now? What is their opinion concerning DOH's future?
  - Should DOH itself execute regional studies or should DOH's task be limited to
    a. co-ordination (the water resources studies to be executed by others)
    b. centralized data processing (computerized data bank) and maintainance of a national hydro(geo)logical network
    c. provision of hydro(geo)logical data to users (NWSA, TDA, CAMA, RWSD, Sana'a University, Supreme Water Council, Regional Development Projects etc.)

- Organizational aspects
  - Relation between DOH and the project "United Geological and Water Resources Mapping of the Two Yemens" and the "Yemen Project for Joint Natural Resources"?

.Co-ordination between the several water resources studies executed recently (a.o. those supported by Netherlands: Tihama, Al Bayda and Sadah and Wadi Surdud) in terms of well numbering, accuracy, techniques (questionnaires, equipment), approach to data processing etc.

- Technical aspects
  - Standardisation of computer equipment within the several institutions (DOH, TDA, CAMA, etc)
  - How much of the existing data (hydro(geo)logical, meteorological have been collected so far? What were the bottlenecks? What is their quality?
  - Results of the fieldwork, (quantative and qualitative) in Sada and Wadi Surdud
  - What insight has been obtained in the water resources of YAR as a whole?
  - How are the collected data processed and stored?
  - How is the accessability of the data for further use?

- Economic aspects
  - Cost comparison with similar studies executed in YAR.

4.2. Points of attention for evaluation "Support Rural Water Supply"

In addition to what has been mentioned under section 3.2. A: "General" and C: "Domestic Water Supply and Sanitation" the following points should be examined:

- Objectives and progress
  - Were the original objectives realistic? Did or do they need reformulation?
  - Which is the relation between the three project components (reinforcement RWSD; 16 implementation schemes; 3 pilot projects)? Did this materialize?
  - Were the proposed project activities appropriate to reach the objectives?
  - Assessment of the progress being made in relation to objectives and original time schedule. Were adaptations necessary? Which are the achievements and constraints? Are target groups/target villages being defined and priorities set?

- Organizational aspects
  - The position of the project within the RWSD
  - The relation between and the co-ordination of WHO support activities and Netherlands support activities within RWSD
  - Intergration of Netherlands experts in the RWSD
  - Co-operation between Yemini and Netherlands project personnel and division of responsibilities and tasks
  - Procedures to identify needs and priorities for village water supplies (preparation of a national rural water supply master plan).
    .The role of the RWSD in relation to other governmental, private and external donor agencies aiming at rural water supply and/or integrated rural development.
  - The role of the RWSD in relation to organizations and institutions involved in water resources assessment and water recources management. Which steps have been taken to actual co-operation and co-ordinaton?
  - Possibilities and contraints to include sanitation activities in the water supply projects.
  - Possibilities and constraints to include hygiene education in the water supply projects (given the fact that this is primarily the responsibility of MOH/PHC programmes)

.Appropriate structure and organization for operation and maintenance of village water supply and sanitation facilities
. Should Netherlands support be more directed to strenghtening of institutional and administrative structures or to physical implementation of water supply and sanitation facilities?
. Is direct Netherlands support to CYDA/LDA's recommended in water supply and sanitation activities?

- Technical aspects:
  . Technical support in site selection of wells, and design, preparation and construction of water supply schemes
  . Tendering and construction of water supply systems. Experiences with local contractors compared to foreign contractors
  . Installation of sanitary facilities
  . Water quality control
  . Monitoring of water resources; geophysical measurements and set up and adequate sampling of drilled formations
  . Design and construction of three pilot water supply schemes

- Economic aspects:
  . Is a cost benefit or cost effectiveness analyses of the three project components possible and desireable.
  . Cost and quality comparison with other Water Supply Projects (e.g. LDA-schemes).

- Manpower requirements:
  . Review of manpower requirements and the availability of skilled staff
  . Review of training needs
  . Assessment of formal and informal training activities within the project.

5. **Reporting**

The draft report and conclusions will be submitted to and discussed with the Yemeni Authorities before departure. The final report, including the annexes will be submitted to the Government of the Yemen Arab Republic, the Government of the Netherlands and the various projects involved before 15 December 1984.

Annex 2: Composition of the Dutch eveluation mission

The Dutch evaluation mission was composed as follows:

- W.A. Segeren, Land and Water Development Specialist, teamleader of the mission
- J. Blom, Water Sector Specialist
- M.T. Boot, Development Sociologist
- A. Kuyvenhoven, Economist
- E. Schultz, Civil Engineer/Hydrologist
- G.J. Tempelman, Rural Sociologist

J.L. IJzermans, desk officer YAR of the Netherlands Ministry of Foreign Affairs, accompanied the mission as a resource person.

Annex 3: List of organizations and people met.

Ministry of Agriculture
- Dr. Al Hamdani, Minister
- Mr. Lutf Al Ansi, Director of projects
- Mr. Ali Khawlani, Director of integrated rural development
- USSR team (hydrological study Sana'a basin)

Ministry of Public Works
- Mr. Al Kurshumi, Minister
- Mr. Al Hamdani, Deputy Minister

British Embassy
- Mr. Harry M. Robertson, Attache technical cooperation
- Mr. Jeremy Macadie, Attache technical cooperation

Confederation of Yemeni Development Associations (CYDA)
- Mr. Muhammed M. Al Shabri, Deputy Chairman Foreign Relations Committee
- Mr. Ali At-Mikdad, Chief of information committee
- Mr. Ashari Mohammed, Translator
- Mr.Ahmed Al Atab, Chief of Food and Nutrition Committee
- Mr. Mohammed Al-Hadad, Director Assistant of Foreign Relations Committee
- Mr Abedul Salam Mohammed, Manager of Foreign Relations Department
- Mr. Kaid Saif, Chairman of specialized co-operatives Committee

Consultants for Management of Development Programmes (CDP)
- Mrs. Riet Turksma, consultant

Department of Hydrology (DOH)
- Mr. Ahmed Wahib, Director
- Mr. Saad Saleh, Observer Saadah area
- Mr. Tahir Mosle, Technician
- Mr. Abdel-Latif
- Mr. Mohamed Abdul Hamid
- Mr. Noory Gamal
- Mr. Mohammed Danikh

Dhamar Governorate Health Services Programme (DGHSP)
- Mr. K. Schaapveld, Co-manager
- Mrs. T. de Haas, Public Health Supervisor
- Mr. S. Smits, Co-director Dhamar hospital
- Mr. E. Coster, Public Health Officer
- Mr. R. van Dijk, Sociologist

DHV Consulting Engineers
- Mr. J. Oosterman
- Mr. H. Borgstein

Hydrosult Inc.
- Mr. Ismail Nojjar

Local Development Associations
- Mr. Abdulla Zeid Amran, Head LDA Dhamar Area
- Mr. Mohammed Abdul Al-Qater, Chairman LDA-Rada

National Water and Sewerage Authority
- Deputy Director
- Mr. Rihlman, Technical advisor
- Mr. Adel Abbas M. Ali, Resident Engineer Dhamar
- Mr. Jim Ziegler,
- Mr. Ali A. Almohanni, Hydrologist

Organization of Netherlands volunteers
Stichting Nederlandse Vrijwilligers (SNV)
- Mr. R. Wanrooy, Director

Pacific Consultants International (PCI)
- Mr. Fetsuji Niwano

Primary Health Care Clinic (Mother and Child Care) Rada
- Mr. Anwar, Director
- Mrs. Ann Kristen, Mid-wife

Provincial Office Ministry of Health, Dhamar
- Mr. Klywani, Director

Rada Integrated Rural Development Project (RIRDP)
- Mr. Samawi, Project manager
- Mr. J.W. Erdman, Team leader Technical Assistance Unit
- Mr. Shimmy, Extension Specialist
- Mr. J. Dop, Advisor water engineering section
- Mrs. Nadia, Head women participation section
- Mrs. M. Boonman, Home economics extension worker
- Mr. J. Duys, Water resources specialist
- Mr. M. Peek, Agricultural specialist
- Mr. D. Bekker, Sanitation specialist
- Mr. Hassan
- Mr. A. Vriens
- Mr. Adil
- Mr. G.J. Winkelhorst
- Mrs. Loni Scheffer, Research assistant
- Mr. H. Wissink (ILACO)

Rada Town Council
- Mr. Ali Abu Alrigal, Head of office

Royal Netherlands Embassy
- Mr. Alphons Hennekens, First secretary
- Mr. Maarten A. Poolman, Fist secretary
- Mrs. N.H. Jurriens

Rural Water Supply Department (RWSD)
- Mr. Abdul Albari Saleh, Director General RWSD
- Mr. Ibrahim Al Shami, Dep. Gen. RWSD
- Mr. Mohammed Mahdi, Director Design Department
- Mr. A. Malik, Director Drilling and Hydrogeology section
- Mr. Mardi, Engineer
- Mr. Gazali, Engineer
- Mr. Osman Nuri
- Mr. Yaya Sannabanni, RWSD representative Dhamar
- Mr. Dinkar Shresta, Surveyor
- Mr. Bashir ul Haq, Civil Engineer

Support Rural Water Supply Department Project (SRWSD)
- Mr. T. Haagsma, Project manager
- Mr. J. Noteboom, Assistant construction supervisor
- Mr. A. v.d. Perk, Construction supervisor
- Mr. D. v.d. Meer, Hydrologist
- Mr. M. Keyzer, Associate expert Hydrologist

Ministry of Water and Electricity
- Mr. Basaïd, Head technical bureau

Tihama Development Authority (TDA)
- Mr. Ahmed Ali Humad, Chairman
- Mr. Ibrahim Eldomi, Deputy Director
- Mr. Mohammed Anwar, Head hydrology department

Transcentury
- Mr. D. Carner
- Mrs. Susan Hoops, Sanitary Engineer

United Nations Development Programme
- Mrs. Chr. Abel, Assistant resident representative

UNICEF
- Mr. K.R.R. Pandian, Project manager water supply
- Mr. Taha Amar, Counterpart, Surveyor
- Mr. P. Manandar, Project officer water supply

USAID
- Mrs. Lynn Carter

Water Resources Assessment YAR (WRAY) Project
- Mr. J. v.d. Gun, Project co-manager
- Mr. P. Nauta
- Mr R. van Overmeeren

WHO project to strenghthen the RWSD
- Mr. Juliusz Kozinski, Project manager

World Bank representatives
- Mr. D. Coyaud
- Mr. P.J. Bonron

Yemen Oil and Mineral Corporation (YOMINCO)
- Mr. Mohammed Ahmed Al Saidi
- Mr. Abdullah Salam Nagi, Deputy director

Interpretor: Mrs. Kawkab Al Joofi