(7) Improvement of Rural Infrastructures

6.73 The improvement plan of rural infrastructural facilities and social services covers the following four (4) sectors; i.e., a) education, b) public health, c) electric power supply and d) telecommunication. The development of these sectors should essentially be geared to the national development plan which would be prepared by ministries concerned. However, the definite development plans of these sectors have not been formulated yet on the national basis. The development plan has, therefore, been tentatively studied to provide the basic concept for the improvement of rural facilities in the Hajjah Province.

Education

6.74 Improvement of educational facilities, especially for elementary education, has long been one of the people's serious concerns. Although LDAs have constructed some schools, school enrollments remain still as low as 18 % compared to the national average of 26 %. Table 6.6 shows the education schemes that the provincial government of Hajjah have requested the Japanese Team to take into account in their master plan.

6.75 The following basic concepts for improvement of educational facilities are proposed:

a. promotion of elementary education through up-grading of existing 210 primary schools and construction of additional 57 primary schools as requested by the Hajjah government office,

b. introduction of an itinerant education system for the children living far from the schools,

c. promotion of adult education through establishment of public halls, equipped with audio-visual aids and library, in major towns.

6.76 The existing 210 primary schools will be up-graded to the six-grade schools, each having more than 100 pupils. The additional 57 primary schools are to be constructed to accommodate about 3,500 pupils in total who have not receive any elementary education so far. The additional schools will have 3 classrooms with 60 pupils on an average. The proposed plan is given in Table 6.7. Even if these plans are successfully accomplished, the school attendance would remain low due to the scattered population and the children's busy work of water fetching. In order to increase the school attendance, introduction of itinerant (travelling) school system would be very important. The integrated rural development would essentially require many educated workers, which largely determine the success of the development. For promotion of building the educated manpower resources, special attention should be given to the adult education. In this sense, it is proposed that seven (7) public halls be established in the major towns of Hajjah, Abs, Al Mahabisha, Washha, Shahara, Harad and Midi.

Health facilities

6.77 The extreme shortage of modern health care is one of the main reasons for the present low standard of public health in the Province. There is only one hospital in the town of Hajjah. Although small dispensaries were recently constructed in Kahlam, Midi, Al Mahabisha, Harad and Abs, these have not yet effectively been operating due to the lack of required medical service facilities and medical personnel. Even if they were well equipped, they would be in no sense sufficient for the whole population of some 400,000 of the Province. At present, the beds are always fully occupied and most of the patients stay in their villages without receiving any medical treatment.

6.78 The proposed development plan comprises:

a. up-grading of existing five (5) dispensaries at Kahlam, Midi, Al Mahabisha, Harad and Abs

b. construction of new facilities at At Tur, Washha and Shahara

c. unification of these facilities as branch hospital under existing main hospital in the town of Hajjah

d. up-grading of the existing main hospital in Hajjah

e. construction of eight (8) health centres and 21 rural health care units.

The details of the proposed development plan are shown in Tables 6.8 and 6.9.

Electric power supply

6.79 Electricity is another requisite for the well-being of rural inhabitants. Rural electrification would bring on safe and bright lighting, enabling the people to spend cultural life after sunset. Television set will open a new road to cultural, social, economic and political information. It would also give a better opportunity for rural industries. Relatively thickly settled areas including Mabyan, Al Mahabisha, Abs, Harad, Midi and Shahara will be given priorities and power network system would be established.

6.80 Judging from the distribution of housing areas and the topographic conditions of the Province, power supply system with a single power station would require a huge construction cost for transmission lines and related facilities and therefore be unlikely realistic and feasible. It is therefore proposed that electrification be programmed in small scale, preferably village-by-village basis. The electrification plan will be integrated with village water

supply schemes which will require power supply for pump operation. The electric power supply schemes will cover 25 towns and villages as shown in Table 6.10.

Telecommunications

6.81 Telecommunication networks are hardly available in the Province except telephone service between Hajjah and Sana'a for which the test operation is now underway. It is planned to connect Hajjah and Al Mahabisha by telecommunication system in 1979. However, the communication capacity, as a whole, is still very poor. Therefore, information and action lags occur in the Province especially in the economic sector, which shows the backwardness of this Province.

6.82 Rural inhabitants would get accurate and quick economic information through telecommunication equipment and could respond to the market situation more efficaciously. Telecommunication would also bring the latest news from relatives and friends living far away. Sub-provincial centers and other development centers would be connected by telephone aiming at efficient economic development. The proposed telecommunication network, together with other rural infrastructural facilities, is shown in Fig. 6.7.

VII IDENTIFICATION OF POSSIBLE PROJECTS AND PRELIMINARY IMPLEMENTATION SCHEDULE

(1) General

7.01 Although the Hajjah Province has some physical potential for development, exploitation of development potential is presently constrained by a number of physical, human and institutional factors. The expansion of agricultural production is definitely limited by the all-important factor "water" coupled with small area of arable land. Feeder roads connecting the farming areas have not been developed. Safe drinking water is very scarce and incidents of water-borne diseases are high. Manpower resources are still at very low level. There is eventually no branch offices of the government institutions to serve agriculture which is the key industry in the Province. Many of the rural inhabitants have more serious concerns for the immediate improvement of their living environment than the long-range on-farm improvement.

7.02 On the basis of full understanding for such present situations, the development concept and strategies have been established as stated in Chapter V and in line with the basic concept, various studies have been made on all the sectors involved in the integrated rural development. Thus, several possible projects concerning each sector have been identified as mentioned in previous chapters.

7.03 As stated in Chapter V, all the sectors are closely connected each other in the envisaged rural development and will have to be integrated into an overall development plan, paying due attention to the inter-relationship among the relevant sectors.

7.04 The overall development plan, which would constitute the first integrated rural development effort in the Hajjah Province, aims to improve the standard of living of 76,900 families living in the Province by increasing the productivity of about 141,000 ha of farmland. The plan would also aim to improve the condition of rural life by providing the people's basic needs for social services like clean drinking water, rural access roads, elementary education, health facilities and electricity.

(2) Identification of Possible Projects

7.05 The possible projects, which have been identified on the basis of the studies on each sector, are listed as follows:

a. Rural water supplies: Installation of 25 village water supply systems

b. Rural road network:

   i. Construction and upgrading of secondary roads; Hajjah - Khashim - Al Zuhra (60 km), Al Zuhra - Abs (45 km), Abs - Al Mahabisha (35 km), Al Mahabisha - Hajjah (45 km), and Abs - Harad (70 km)

   ii. Construction of a bridge on Wadi Mawr at the site where the Al Mahabisha - Hajjah road runs across

   iii. Construction and upgrading of 1,700 km of feeder roads

c. Agricultural development

   i. Agricultural research for promotion of midland agriculture through establishment of a comprehensive agricultural research station

ii. Promotion of water-saving irrigation techniques and farm mechanization in lowland through establishment of a research and training center for irrigation and mechanization

iii. Agricultural census and statistics

iv. Detailed physical resources survey

v. Collection of meteorological and hydrological records through establishment of observation network

vi. Institutional services for agricultural extension and farm inputs supply

vii. Agricultural credit services

viii. Multiplication and distribution of pure-line seeds of recommendable varieties

ix. Demonstration of small scale pump irrigation and horticulture techniques

x. Promotion of livestock improvement through veterinary services, improvement of animal feeds and breeding

d. Irrigation improvement:

i. Hydrological observation of wadi-flow

ii. Field trials on crop-water requirement and irrigation method for making the best possible use of the limited water

iii. Construction of irrigation facilities covering a total area of 10,000 ha; 8,500 ha in lowland, 500 ha at Al Mahabisha and 1,000 ha along wadi courses

e. Afforestation:

   i. Multiplication and distribution of seedlings of recommendable tree species through operation of a forest nursery and extension services

   ii. Pilot afforestation schemes for effective demonstration, covering 4 typical areas; Tihama lowland, range lands on rocky slopes, marginal terraced land, and gullied areas and/or severe erosion sites

f. Improvement of other rural infrastructures and social services:

   i. Expansion of educational facilities including a new construction of 57 primary schools, up-grading of existing 210 primary schools and establishment of 7 public halls

   ii. Improvement of public health facilities including construction of 3 branch hospitals, 8 health centers and 21 rural health care units

   iii. Electricity supplies in combination of pump operation for rural water supplies

   iv. Construction of telecommunication network connecting in between major towns

g. Organization and management:

   i. Establishment of a comprehensive implementation body (Project Office)

   ii. Recruitment and training of local staff

   iii. Expatriate expert services and training of counterpart staff

(3) Stagewise Development and Priority Area

7.06 Immediate execution of these possible projects would be very difficult due to a number of constraints involved. However, early implementation would be of rather serious requirement, even in part, in order to stop the continuous decline in economic growth of the Hajjah Province. Once decision is made for implementation of initial projects, however, success must be guaranteed. On the contrary, it is generally conceived that a project has an aspect of trial and error and is executed finally through many mistakes. This means that the initial projects will have the chances to experience a number of unexpected risks. Considering all these, it is proposed as already mentioned in Chapter V that, in order to minimize such risks and to lead the late-coming projects to full success, a small scale integrated project be established initially, which will be gradually expanded as more trials become known and more experience is obtained through implementation of the initial integrated project.

7.07 It is also proposed that the initial integrated project be formulated in a particular area where physical and economic environment is relatively favourable compared to other areas of the Province. In the first place, all the development efforts will be concentrated to this priority area. Development of other areas will be made progress successively on the basis of the achievement and results of the development carried out in the priority area.

7.08 The priority area should be selected according to the following criteria:

a. Satisfying development requisites: Aiming at successful and efficient implementation of the

possible projects, the priority area should comply with development requisites, which comprise:

i. to be economically advanced relatively to the other areas

ii. to be richly endowed with human resources both in quality and quantity in comparison with the other areas

iii. to be relatively well equipped with infrastructural facilities, especially transport facilities

iv. to have able and experienced development associations within its area

v. to have adequate capital saving for investment

b. Having typical condition in physical-economic-social context: The development of the priority area is to spearhead the successive development of the other areas of the Province. In other words, the development of the area will be a model project to be taken for a pattern of development in the Province. The area, therefore, should be representative of the Province in physical-economical-social context.

c. Having big development potential: Considering the importance of the success of the development of the area, the priority area should be selected out of these having higher physical potentials particularly in terms of water and land resources endowments. The greater production with higher productivity and improved standard of living attained will have strong persuasive power and give incentives to the initiation of development projects in other areas of the Province. Moreover, the capital

savings which may be realized through the successful achievements in the area could be invested in the projects to be carried out elsewhere in the Province.

(4) Preliminary Implementation Schedule

7.09 The preliminary implementation schedules for all the possible projects are illustrated on Fig. 7.1. The top priority projects will be described in detail in Chapter IX, "PRIORITY AREA AND DEVELOPMENT PLAN."

VIII ORGANIZATION AND MANAGEMENT

(1) General

8.01 The objectives of the integrated rural development are:

a. to increase agricultural production and stimulate economic growth, and
b. to improve the condition of rural life.

Several possible projects aiming at these objectives have been formulated, including rural water supplies, rural road networks, agricultural support services, irrigation improvement, afforestation, etc., as mentioned in the previous chapters.

8.02 The integrated rural development of the Hajjah Province will essentially involve almost all of the sectors which are closely connected each other. Each sector will have to give the greatest contribution to the overall development of the Hajjah Province, paying due attention to the inter-relationship among relevant sectors.

8.03 Since all the sectors should be integrated in the development of the Hajjah Province, a comprehensive implementation body will have to be newly established within the Province. The comprehensive implementation body will have to carry out all the necessary tasks for integrated rural development, including physical resources survey, planning and design, project preparation, construction, research, extension services and likes.

(2) Organization Structure

Coordination Committee

8.04 At the national level, a new coordination committee will have to be established for making the basic policy, designation of the key personnel, provision of necessary budget including foreign assistance and inter-ministerial regulation. The coordination committee will be chaired by the Minister of Agriculture and the members of the committee will consist of the representatives from Central Planning Organization (CPO), Ministry of Public Works, Agricultural Credit Bank (ACB), Confederation of Yemeni Development Associations (CYDA) and the Provincial Government of Hajjah.

Project Office

8.05 At the provincial level, the comprehensive implementation body tentatively named "Hajjah Province Integrated Rural Development Project Office" will be established for execution of all the necessary works including:

a) survey and study (soil, land use, statistics etc.)
b) observation (hydrological, meteorological)
c) agricultural research
d) agricultural extension service
e) agricultural credit service
f) farm input supply
g) irrigation water supply
h) farm mechanization
i) rural water supply
j) road construction
k) improvement of rural infrastructure

8.06 For execution of these works, the Project Office will have five (5) departments, seven (7) branch offices, and two (2) research and training institutions at full development stage as illustrated in Fig. 8.1.

(3) Stagewise Expansion of Project Office

8.07 Taking the limited budget available, weakness of manpower resources and anticipated slow progress of related works into consideration, it is not realistic to establish the complete organization of the Project Office at the initial stage of development. It should be developed stagewise; initially on a small scale, and will be gradually expanded. The proposed layout of the Project Office at the full development stage is given in Fig. 8.2.

8.08 The stagewise expansion of the Project Office will be as follows:

1st Step ... Establishment of the Project Office with three (3) Departments of Administration, Road Construction and Rural Water Supply for making the development implementation plan and detailed design of the road connecting Hajjah, Al Mababisha and Abs, and of the water supply facilities and major feeder roads within the priority area (Chapter IX, to be refered).

2nd Step ... Establishment of the Agricultural Research Station at Al Mahabisha and the Research and Training Center for Irrigation and Mechanization at Abs for creating the most recommendable agricultural techniques to be adopted in the midland area and the Tihama lowland, respectively.

3rd Step ... Opening the Agricultural Service Department and the Agricultural Credit Department at the main Project Office and the Branch Offices at Al Mahabisha and Abs for commencement of the construction works

of rural infrastructural facilities in parallel with institutional agricultural services in the priority area.

4th Step ... Establishment of the remaining Branch Offices at Mabyan, At Tur, Harad, Midi and Shahara.

(4) Agricultural Research Station

8.09 The proposed organization of Agricultural Research Station will consist of six (6) Departments with an administration section as illustrated on Fig. 8.3. Crop Research Department will carry out experimental work on food crops, fodder crops, cash crops including vegetables and fruit trees suitable for midland region collaborating with other Departments related. Livestock Department will take care of the research work for main livestock, i.e., cow, sheep, goats and poultry including veterinary examination, pathological nutrition and breeding studies. Irrigation Department will carry out field trials on effective irrigation method for the best use of limited water by using small scale pumps, together with meteorological and hydrological observations, in collaboration with Crop Research Department. Farm Management Department will make agricultural economic studies including agricultural statistics, market price investigation and farm economic survey. Afforestation Department will manage the forest nursery and pilot afforestation schemes. Information Department will prepare all the information translated from the results of research and experimental work conducted by each Department. Several subject-matter Specialists will be attached to this Department as a suspension bridge between the experiment and extension.

8.10 Proposed site of Agricultural Research Station will be in the Jaya area with gross area of about 10 ha. At the stage which the Project activities will get on the right track, the following branch stations will be established:

a. Stock Seed Stations: A Stock Seed Station with about one ha of field will play an important role as a center of seed improvement and multiplication of recommended varieties of respective crops. Extension seed will be multiplied by the progressive farmers in respective areas under the contract with the Seed Station.

b. Livestock Breeding Station: Under the supervision and guidance of the Livestock Department, a Livestock Breeding Station will be established for livestock improvement in each kind of main domestic animals. The site will be at Mabyan or At Tur with about 2 ha in size. At the same time, the veterinary service stations will be established in the local centers where the branch offices will be set up.

c. Horticulture Center: For further development of the activities of the Crop Research Department, especially on vegetables and fruit trees, at this stage, a Horticulture Center will be established at Tahannen area with about 10 ha of research farm. The Center will carry out the testing of trees species selected elsewhere in this country for their adaptability to local condition and also the multiplication of seedling of fruit-trees recommendable for the area.

d. Afforestation Office: As the pilot activities of afforestation, the Afforestation Department will make arrangement of the Pilot Afforestation schemes

with a total area of about 200 ha in and around Al Mahabisha. The schemes will be managed by the Afforestation Office to be established in the scheme areas under the supervision of the Afforestation Department of Agricultural Research Station. After the success of the pilot schemes in future, the expansion of the afforestation will be continuously carried out in other areas of the Hajjah Province.

(5) Research and Training Center for Irrigation and Mechanization

8.11 For the development of lowland area, two major development constraints, limited available water and labour shortage, will have to be eliminated. In this view, the "Research and Training Center for Irrigation and Mechanization" will be established within the Abs area where irrigation water is available from the Wadi Qur.

8.12 As for the organization, under the supervision of the Director, three Departments, i.e. Irrigation, Machinery and Administration, will be organized as illustrated in Fig. 8.4. Irrigation Department will carry out mechanized farming trials under spate irrigated condition, together with necessary irrigation trials for crop-water requirement and water application method for tropical crops, in order to find out the most suitable irrigated mechanization farming practices for the lowland region. Agronomic studies will not be essential because they have been well carried out in the Wadi Zabid Development Project area where physical conditions are almost same. The center will establish the meteorological stations and hydrological gauge network and collect these basic data for future irrigation development in the lowland. Machinery Department will be responsible for the operation and maintenance of machinery. Training

of the operator and mechanic will be the main work of this Department. Administration Department will take care of general administration of the Center.

8.13 The size of the Center will be about 20 ha. In future, with the development of the Wadi Harad, the Branch Station will be set up at Harad, having similar functions of the Center.

(6) Agricultural Support Services

8.14 Agricultural extension service in the Hajjah Province will be commenced at the 3rd step of development after the completion of initial stage of the Agricultural Research Station and the Research and Training Center for Irrigation and Mechanization. At this stage, the Agricultural Service Department and the Agricultural Credit Department will be put operation in the Project Office. Under the supervision of Director of the Agricultural Service Department, 7 senior extension officers will be appointed for the administration of the extension services in each working area at Quada level. At the Nahiya level, an area supervisor will station in each Nahiya for the promotion of extension activities. About 5-6 extension workers will be put under the supervision of the area supervisor.

8.15 In due consideration of present low level of skilled manpower, the basis of extension services will be training of extension workers. The trainees who intend to work as the extension worker, will be selected from the local community sent to the Central Agricultural Research and Training Station in Taiz for the pre-service training. After the graduation of the training course, these trainees would be appointed as the extension worker of the Hajjah Province.

8.16 Agricultural Input Supply Service will also be carried out under the responsibility of the Agricultural Service Department. A Senior Officer will be appointed for carrying out the input supply service under the supervision of Director of the Department. The arrangement of agricultural requisites will be made by this Department in collaboration with the Agricultural Credit Department. The farm input will be distributed to the farmer through the extension service channels.

8.17 Agricultural credit service will concurrently be started with the Agricultural Extension Service. In the Project Office, Agricultural Credit Department will be set up in close coordination with Agricultural Credit Bank (ACB)/Agricultural Credit Fund (ACF). It is recommended that this department functions as a local agent for ACB/ACF and promotes the establishment of farmer credit cooperatives.

8.18 For the execution of agricultural support services, expatriate assistance will be necessary at least during initial 5 years. The expatriate should be proficient in Arabic as well as adequate knowledge and experience in respective field.

IX PRIORITY AREA AND DEVELOPMENT PLAN

(1) Selection of Priority Area

9.01 The priority area was selected on the basis of the selection criteria proposed in the Section (3) of Chapter VII. The selected area extends over the catchment area of the Wadi Qur, as shown in Fig. 9.1, occupying a total area of 62,000 ha. The area comprises the two economically developed areas, i.e., Abs and Al Mahabisha.

9.02 The Al Mahabisha area is the most economically advanced area in the whole Hajjah Province. Although no precise record is available for the economic statistics of the Province, the farm economic survey results indicate that over 65 % of the total gross agricultural production value was earned in this area. The Abs area is also the most economically developed area in the Tihama plain of the Province.

9.03 The selected area is representative for the Province in the physical - economic - social context. As described before, the Hajjah Province is divided into three geographical regions, i.e., lowland, midland and highland. The proposed priority area contains all these areas with the Abs area standing for Tihama lowland, the Al Mahabisha area for highland and the areas in between these areas for midland. The development of priority area will thus be a model project to be taken for a pattern of development in the Province.

(2) Present Condition of Priority Area

Physical condition

9.04 The proposed priority area has relatively higher development potential in the Province. The proposed area

is relatively richly endowed with the water and land resources which generally impose crucial restriction on the development. The Al Mahabisha area is considered to be one of the high rainfall areas in the Province with the average annual rainfall of more than 600 mm. Besides, it has a couple of springs with average production rate of 20 l/sec. which could be utilized for small-scale irrigation in the area. In the Abs area, irrigation water could be taken from the Wadi Qur. Some 1,300 ha of land could supplementarily be irrigated in the Abs area, using the flood water during the rainy season. The priority area is favoured with relatively fertile soils with 31,200 ha of arable land. The lands in the priority area are highly utilized for crop production, being reflected in good agricultural conditions. The cropland occupy about 16,800 ha, or 27.1 % of the total land area compared with the provincial average of 14.7 %.

Socio-economic condition

9.05 In a relative sense, the selected priority area is richly endowed with human resources. It has a population of some 47,500 or 12 % of the total population of the Province. The literacy rate is higher in the Al Mahabisha area compared with the average figure for the Province. Although literacy rate is generally low in the Tihama area, the Abs area is presumed to be most advanced in this respect.

9.06 The proposed priority area is relatively well equipped with inland transport facilities. At present, the two principal towns of the proposed area, Al Mahabisha and Abs, are connected by a rough dirt road within 2 hours distance by car drive. Abs is connected with Hodeidah which is the major port for foreign trading in the country by road transport via Bajil within 5 hours distance. Another dirt road is under construction between Al Mahabisha

and Hajjah which will be jointed with Hajjah-Amran road which is also under construction.

9.07 The LDA activities in the Al Mahabisha and Abs areas have particularly been intensive and successful. The LDAs in the priority area are relatively well staffed with planning and administrative personnel and have been playing a significant role in the local development efforts in the Province.

9.08 No accurate information is obtainable about the amount of investment funds available in the priority area. However, judging from the prosperity of the Al Mahabisha area, it can be well presumed that capital savings which would be invested for development, is relatively abundant in the area.

(3) Integrated Rural Development Plan

Project components

9.09 The projects which would be integrated in the priority area, as a priority project, should be comprehensive and be directed towards overall improvement of rural incomes and living conditions.

9.10 The top priority projects which would be integrated and implemented in the priority area, would comprise:

a. Rural water supplies: Installation of 4 village water supply systems

b. Rural road network:

   i. Construction and up-grading of secondary roads; Abs - Al Mahabisha (35 km) and Al Mahabisha - Hajjah (45 km)

   ii. Construction of a bridge over the Wadi Mawr

iii. Construction and up-grading of 290 km of feeder roads

c. Agricultural development:

i. Collection of meteorological and hydrological records through establishment of observation network

ii. Establishment of agricultural research station

iii. Establishment of research and training center for irrigation and mechanization

d. Irrigation improvement: Construction of pilot irrigation projects; Abs area (1,300 ha), Jaya area (300 ha) and Sharhil area (100 ha)

e. Afforestation

i. Establishment of a forest nursery

ii. Pilot afforestation schemes for demonstration

f. Improvement of other rural infrastructures and social services:

i. Improvement of health facilities; construction and up-grading 3 branch hospitals (Abs, Sharhil, Al Mahabisha) as well as main hospital at Hajjah, and new construction of primary health care units.

ii. Electricity supplies in combination of pump operation for rural water supplies

g. Organization and management:

i. Establishment of a comprehensive implementation body (Project Office)

ii. Recruitment and training of local staff

iii. Expatriate expert services and training of counterpart staff

Rural water supplies

9.11 Rural water supplies would be provided to four (4) towns of Sharhil, Qufl Shamal, Al Shaafeen and Abs with population totalling 15,000 of inhabitants. Besides, the town of Al Mahabisha has another water supply project which is under construction with financial aid from West Germany. This project will serve population totalling 15,000 of inhabitants. After completion of these water supply schemes, about 63 % of rural inhabitants will have piped water in the priority area.

9.12 These four towns are located in more favourable conditions than other towns in the Province, as regards the distance from town to water source. The construction cost is, therefore, expected to be lower than other schemes. The water facilities will comprise intake boxes, electric driven pumps and storage tanks as described in Chapter VI. Four (4) power generating stations will be constructed for operating the pumps. The electric power will also be used for lighting at night and for other domestic uses.

Rural road network

9.13 The proposed road network, which consists of existing roads improvements and new constructions, is shown in Fig. 9.2. The secondary road connecting Hajjah and Al Mahabisha and Abs is the most important trunk in the priority area. Although the existing road between Abs and Al Mahabisha can be passable by four wheel drive vehicles, its poor horizontal and vertical alignments and narrow width will have to be improved. There also exists a dirt track between Al Mahabisha and Hajjah. However, it is suitable only for animal transport. This road runs across the Wadi Mawr. A bridgework with a total length of about 200 m will be newly required for assuring all season passage.

9.14 The construction of the feeder road which will run between Abs and Al Mahabisha via Qufl and Jaya will be a prerequisite for the implementation of the rural water supply schemes and agricultural research institutions, giving means of transportations and communications. The implementation of the Abs - Al Mahabisha feeder road, together with the Abs - Hajjah secondary road, will be accorded with top priority in the overall implementation schedule for the whole integrated rural development project in the priority area.

Agricultural development

9.15 The meteorological and hydrological data will be essential for future agricultural development. It is proposed that the observation network be established as early as possible. The proposed sites for observation gauges are shown in Fig. 9.1 (General Plan of Priority Projects). The observation network should be set up immediately after the establishment of the Project Office and all the records will be kept by the General Manager until the research institutions will be organized. The observation will be continuously carried out by the research institutions after their establishment.

9.16 The agricultural research station will be established in the Jaya area, 3 km southeast of Al Mahabisha. The proposed size will be 10 ha. The general layout of the station is given in Fig. 9.4.

9.17 The proposed site for the research and training center for irrigation and mechanization will be located within the Abs area where about 1,300 ha of the spate irrigated land will possibly be improved by constructing headworks on the Wadi Qur and canal system. The proposed size of the center will be 20 ha. The general plan of this institution is shown in Fig. 9.5.

Irrigation improvement

9.18 It is proposed that field trials on crop-water requirement and irrigation methods for making best possible use of the limited water, be carried out in the proposed research institutions.

9.19 The irrigation scheme covering about 1,300 ha around Abs will be constructed as a model scheme for irrigation of the wadi-delta plain (possible irrigation area: 7,500 ha). The water sources will be the Wadi Qur which has a catchment area of 243 km^2. The major facilities required will comprise 2 headworks, 15 km main canal and 4 supplementary tube wells.

9.20 In the Al Mahabisha area, there exist about 500 ha of irrigable area; 300 ha of Jaya area, 100 ha of Tahannen area and 100 ha of Sharhil area. There also exist about 200 ha of irrigable wadi lands along the Wadi Qur. These areas will be irrigated by construction of pumps and pipe lines.

Afforestation

9.21 A forest nursery will be established within the proposed agricultural research station. The size of the nursery will be one ha. The seedlings will be multiplied in the nursery and distributed to the farmers. For effective demonstration of the promising tree species, three (3) pilot afforestation schemes will be initiated in the priority area; each one for lowland, midland and highland areas. The total areas for the pilot afforestation schemes will be 200 ha.

Improvement of rural infrastructures

9.22 The priority will be given to, among other, a) improvement of health facilities and b) electric power

supplies. The improvement of health facilities will include the up-grading of 3 branch hospitals at Abs, Sharhil and Al Mahabisha, as well as the main hospital at Hajjah, and new construction of 2 primary health care units at Qufl Shamal and Al Shaafeen. The electric power supplies will be undertaken in combination of rural water supplies at Abs, Sharhil, Qufl Shamal and Al Shaafeen.

Organization and management

9.23 The Project Office will have to be first established within the town of Hajjah. The proposed layout of the Project Office is illustrated on Fig. 8.2. The Project Office will recruit the required number of local staff immediately after its establishment and will carry out all the necessary preparatory works for execution of the priority projects. In due consideration of scarce manpower resources, it is proposed that some expatriate experts will be deployed in the Project Office.

(4) Preliminary Implementation Schedule

9.24 The implementation schedule for the first integrated rural development project is tentatively prepared and shown in Fig. 9.6. The implementation schedule will have to be modified after full discussion with the representatives of the Local Development Associations who will be the core for execution of the project. It should also be subject to further studies on project components which would be carried out on the basis of more detailed field information, especially of agricultural statistics and meteoro-hydrological records.

(5) Preliminary Cost Estimate

9.25 The costs required for execution of the first integrated rural development project are estimated at about

YR252 million as shown below:

Project Cost Estimates

	Description	Amount ($\times 10^3$YRs)	Amount ($\times 10^3$US$)
1.	Project office	11,900	2,640
2.	Branch offices	2,400	530
3.	Meteoro-hydrological observation network	400	90
4.	Rural water supplies	12,900	2,870
5.	Rural road network	149,300	33,180
6.	Agricultural research station	6,800	1,510
7.	Research and training center for irrigation and mechanization	17,100	3,800
8.	Pilot irrigation projects	16,000	3,560
9.	Forest nursery	200	40
10.	Pilot afforestation scheme	1,000	220
11.	Rural infrastructures	34,000	7,560
	Total	252,000	56,000

The cost estimate has been roughly made on the basis of current prices (as of 1979) prevailing in YAR. The costs required for project operation and maintenance have not been estimated due to uncertain base for the estimate. The price contingencies for future inflation are not included in the estimate. The more detailed cost estimates are given in Table 9.1. The project costs thus estimated have been converted to annual fund requirement, in accordance with the implementation schedule, as shown in Table 9.2.

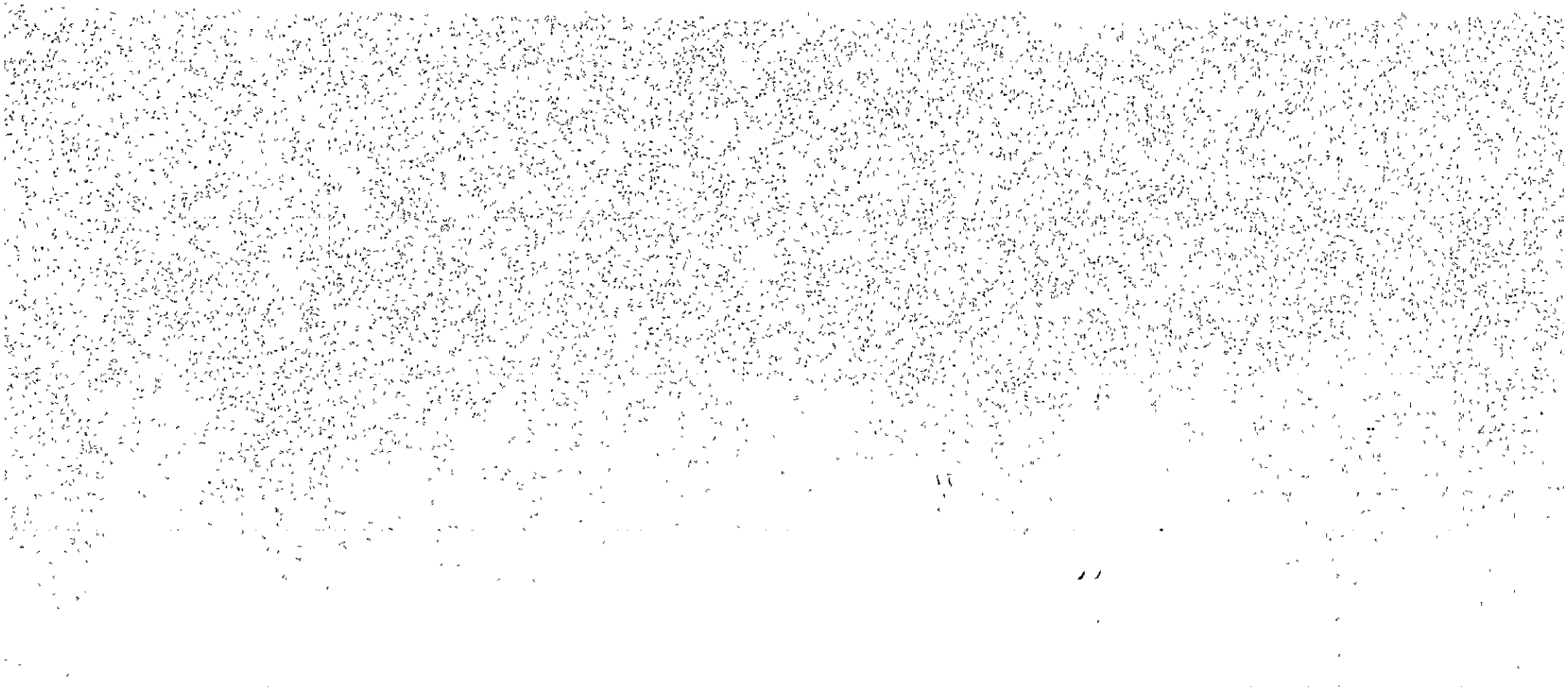


Table 2.1 Gross Domestic Product at Current Price

(Unit: $\times 10^6$ YRs)

	1969/70	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76
Commodity Sectors	884	1,143	1,324	1,532	1,977	2,760	2,834
Agriculture, Fishing & Forestry	742	969	1,113	1,263	1,582	2,335	2,305
Industry, Mining & Electricity	66	87	109	142	213	249	302
Cosntruction	76	87	102	127	182	176	227
Distribution Sectors	331	366	453	577	795	1,060	1,512
Trade	283	300	360	460	629	826	1,220
Finance & Baking	13	19	25	40	57	96	141
Transport & Communication	35	47	68	77	109	138	151
Services Sectors	184	237	314	405	488	654	835
Government	91	127	185	252	291	401	509
Housing	64	73	83	94	118	150	199
Other Services	29	37	46	59	79	103	127
GDP at Market Prices	1,399	1,746	2,091	2,514	3,260	4,474	5,181
Net Indirect Taxes	50	75	113	151	202	283	453
GDP at Factor Costs	1,349	1,671	1,978	2,363	3,058	4,191	4,728

Source: CPO and ECWA, National Accounts of YAR. 1969/70 - 1975/76

Table 2.2 Commodity Composition of Recorded Exports

(Unit: $\times 10^3$ YRs)

Fiscal Years ending June 30	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77
Agricultural	22,703	23,693	51,648	41,982	41,582	43,205
Raw Materials						
Cotton	10,799	12,821	37,053	30,954	24,583	24,953
Cotton Lint	(9,912)	(10,785)	(35,180)	(28,188)	(24,221)	(24,593)
Cotton Seeds	(887)	(2,036)	(1,873)	(2,766)	(362)	(-)
Coffee	5,534	5,469	6,461	4,972	7,588	10,223
Hides & Skins	3,271	3,325	6,241	4,404	8,040	6,129
Dried Fish	58	382	781	736	325	56
Live Animals	341	768	643	443	6	-
Potatoes	239	394	195	141	135	17
Fruits	66	224	143	116	164	26
Tobacco	25	44	74	172	382	668
Others	2,370	266	57	44	359	1,133
Processed Agricultural Products	100	1,143	1,896	3,453	4,322	5,640
Cotton Products	100	317	325	1,590	1,384	637
Fabrics	-	-	-	(1,193)	(775)	(165)
Sheets	(100)	(317)	(325)	(257)	(609)	(472)
Yarn	-	-	-	(140)	-	(-)
Biscuits	-	636	1,315	1,131	2,093	3,156
Confectionery	-	119	54	582	845	724
Oil Seed Cakes	-	71	202	150	-	1,123
Non-Agricultural Exports	1,898	433	1,838	7,531	4,159	1,689
Salt	1,412	27	26	-	1	-
Metal Scrap	247	102	356	9	343	-
Others	239	304	1,456	7,522	3,815	1,689
TOTAL	24,701	25,269	55,382	52,966	50,063	50,534

Source: Central Bank of Yemen.

Table 2.3 Commodity Composition of Private Imports

(Unit: $\times 10^6$ YRs)

Item	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77
Foodstuffs	93.2	181.5	367.3	422.2	748.6	879.6
Cereals & Products	45.0	74.3	154.4	165.1	235.1	296.7
Sugar & Products	20.7	40.8	101.7	119.4	242.1	166.6
Fruits & Vegetables	9.1	18.6	32.3	43.5	70.4	180.4
Margarine & Edible Oils	9.6	22.3	33.8	40.5	95.0	75.3
Coffee, Tea, & Spices	5.9	16.4	23.4	24.7	48.1	29.1
Dairy Products & Eggs	2.2	7.3	14.6	20.4	34.6	69.5
Meat & Live Animals	0.3	0.7	0.7	2.2	13.3	44.3
Fish & Fish Products	0.3	1.1	5.6	4.6	7.1	16.7
Others	0.1		0.8	1.8	2.9	1.0
Tobacco & Beverages	8.7	14.1	13.1	29.1	44.4	52.2
Manufactured Consumer Goods	23.7	61.8	114.1	151.3	271.2	425.9
Mineral Fuel, Gas, & Lubricants	12.5	19.1	33.9	36.8	82.4	61.1
Chemicals	6.0	16.1	25.3	45.0	57.2	112.8
Rubber, Wood, Leather & Paper Products	11.1	16.7	33.7	52.1	70.6	186.0
Construction Materials	14.3	19.0	30.2	40.6	44.3	141.6
Machinery and Equipment	25.2	56.5	85.9	149.6	289.6	965.6
Other Products	9.7	25.9	41.5	54.3	99.9	262.7
Total Private Imports	204.4	410.7	745.0	981.0	1,708.2	3,087.5

Source: Central Bank of Yemen, Annual Reports, 1977/78

Table 2.4 Land Use by Provinces, 1976/77

(Unit: $\times 10^3$ ha)

Province	Total Area	Cultivable Area	Marginal Area	Forest & Shrubs	Other Uses
Sana'a	8,000	400	600	100	6,900
Hodeidah	3,500	235	500	450	2,315
Taiz	1,200	250	100	500	350
Ibb	1,300	300	50	400	550
Hajjah	1,700	130	250	50	1,270
Sa'ada	1,800	60	200	-	1,540
Dhamar	1,000	100	200	100	600
Al Beidha	1,500	40	100	-	1,360
TOTAL	20,000	1,515	2,000	1,600	14,885

Note: Al Mahweet & Mareb Governorates' figures are included in the Governorates to which they were previously attached.

Source: Statistical Year Book, 1976 - 1977, YAR

Table 2.5 Cultivation Area by Type of Irrigation and Province, 1976/77

(Unit: $\times 10^3$ ha)

Province	Total	Rainfed	Flood	Perennial	Wells
Sana'a	400	374	-	20	6
Hodeidah	235	102	100	5	28
Taiz	250	220	10	18	2
Ibb	300	278	-	20	2
Hajjah	130	115	10	5	-
Sa'ada	60	60	-	-	-
Dhamar	100	91	-	5	4
Al Beidha	40	37	-	-	3
TOTAL	1,515	1,277	120	73	45

Note: Al Mahweet & Mareb Governorates' figures are included in the Governorates to which they were previously attached.

Source: Statistical Year Book, 1976 - 1977' YAR

Table 2.6 Area, Yield and Production of Crops, 1969/70 - 1976/77

	Barley			Wheat			Maize			Millet & Sorghum		
Province	Prod. ($X10^3$ tons)	Yield (ton/ha)	Area ($X10^3$ ha)	Prod. ($X10^3$ tons)	Yield (ton/ha)	Area ($X10^3$ ha)	Prod. ($X10^3$ tons)	Yield (ton/ha)	Area ($X10^3$ ha)	Prod. ($X10^3$ tons)	Yield (ton/ha)	Area ($X10^3$ ha)
1969/70	160	1.1	145	16	0.5	35	8	2.0	4	610	0.7	886
1970/71	154	1.1	140	33	1.1	30	30	1.9	16	730	0.8	973
1971/72	140	1.1	125	25	1.0	25	16	0.8	20	627	0.7	920
1972/73	120	1.1	110	50	1.0	50	70	1.4	50	809	0.7	1,080
1973/74	85	1.1	77	71	1.0	70	80	1.5	52	639	0.7	952
1974/75	80	1.1	73	56	1.1	50	79	1.6	50	1,008	0.8	1,215
1975/76	75	1.1	68	52	1.0	50	72	1.4	50	859	0.8	1,145
1976/77	54	0.9	60	51	0.9	55	111	1.7	67	660	0.8	786
Sana'a	24.0	0.8	30.0	17.6	0.8	22.0	3.0	1.5	2.0	114	0.6	190
Hodeidah	-	-	-	-	-	-	5.6	1.4	4.0	112	0.7	160
Taiz	4.0	1.0	4.0	2.4	0.8	3.0	46.8	1.8	26.0	140	1.2	117
Ibb	15.4	1.2	12.8	22.1	1.2	18.1	51.2	1.6	32.0	156	1.3	120
Hajjah	0.2	o.0	0.2	0.4	0.8	0.5	0.8	1.5	0.5	56	0.8	70
Dhamar	4.6	0.8	5.7	3.7	0.8	4.6	3.0	1.2	2.5	29	0.7	41
Others	5.8	0.8	7.3	4.8	0.7	6.8	0.2	1.2	0.2	53	0.6	88

Source: Statistical Year Book, 1976 - 1977, YAR

- to be continued -

Production, Yield and Area of Crops, 1969/70 - 1976/77

Year & Province	Sesame			Tobacco			Cotton		
	Prod. ($X10^3$ tons)	Yield (ton/ha)	Area ($X10^3$ ha)	Prod. ($X10^3$ tons)	Yield (ton/ha)	Area ($X10^3$ ha)	Prod. ($X10^3$ tons)	Yield (ton/ha)	Area ($X10^3$ ha)
1969/70	2.0	0.5	4.0	2.0	0.5	4.0	2.0	0.4	5.0
1970/71	4.0	0.5	8.0	3.0	0.8	4.0	10.0	1.0	10.0
1971/72	4.5	0.6	8.0	5.0	1.3	4.0	15.0	1.0	15.0
1972/73	4.0	0.5	8.0	5.0	1.2	4.2	18.5	0.9	20.0
1973/74	3.7	0.5	7.5	5.0	1.2	4.2	20.0	1.0	20.0
1974/75	5.0	0.6	9.0	5.0	1.2	4.2	27.2	1.0	28.3
1975/76	5.5	0.6	9.7	5.6	1.2	4.6	13.6	0.9	15.0
1976/77	6.4	0.6	10.2	6.4	1.2	5.3	5.1	1.0	5.2
Sana'a	0.1	0.5	0.2	-	-	-	-	-	-
Hodeidah	3.7	0.6	6.2	6.0	1.2	5.0	4.5	1.0	4.5
Taiz	1.5	0.7	2.2	0.3	1.5	0.2	0.5	0.8	0.6
Ibb	0.8	0.7	1.1	-	-	-	-	-	-
Hajjah	0.1	0.5	0.1	0.1	1.2	0.1	0.1	0.6	0.1
Dhamar	-	-	-	-	-	-	-	-	-
Others	0.2	0.5	0.4	-	-	-	-	-	-

- to be continued -

Production, Yield and Area of Crops, 1969/70 - 1976/77

Year & Province	Coffee			Date			Grapes		
	Prod. (X10³ tons)	Yield (ton/ha)	Area (X10³ ha)	Prod.	Yield kg/tree	No. of trees	Prod. (X10³ tons)	Yield (ton/ha)	Area (X10³ ha)
1969/70	4.0	0.4	10.0	3.0	-	-	10.0	2.5	4.0
1970/71	4.0	0.4	10.0	5.0	-	-	30.0	4.3	7.0
1971/72	3.5	0.4	9.0	5.0	-	-	35.0	4.7	7.5
1972/73	3.5	0.4	9.0	5.0	-	-	35.0	4.7	7.5
1973/74	3.5	0.4	9.0	5.0	-	-	31.0	3.9	8.0
1974/75	3.0	0.4	8.0	5.0	-	-	40.0	4.7	8.5
1975/76	3.0	0.4	7.0	5.0	-	-	42.4	4.8	8.8
1976/77	3.4	0.4	7.5	6.3	5	1,250	47.1	4.7	10.0
Sana'a	1.0	0.5	2.0	-	-	-	37.6	4.7	8.0
Hodeidah	0.1	0.3	0.2	5.0	5	1,000	-	-	-
Taiz	0.2	0.3	0.5	0.8	5	150	-	-	-
Ibb	0.9	0.5	1.7	-	-	-	-	-	-
Hajjah	0.4	0.4	1.0	0.5	5	100	4.8	4.8	1.0
Dhamar	0.3	0.4	0.8	-	-	-	-	-	-
Others	0.5	0.4	1.3				4.7	4.7	1.0

- to be continued -

Area, Yield and Production of Crops, 1969/70 - 1976/77

Year & Province	Fruits			Potatoes			Vegetables			Legumes		
	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield	Area
1969/70	23	5.8	4.0	20	5.0	4.0	50	6.2	8.0	50	1.0	50
1970/71	25	5.6	4.5	55	9.2	6.0	100	10.0	10.0	60	1.2	50
1971/72	28	5.6	5.0	58	11.6	5.0	137	9.1	15.0	60	1.0	60
1972/73	60	6.0	10.0	64	11.6	5.5	150	9.1	16.5	56	0.9	60
1973/74	60	6.0	10.0	64	10.8	5.9	150	9.4	16.0	64	1.0	65
1974/75	60	5.0	12.0	71	10.9	6.5	168	9.3	18.0	71	1.0	71
1975/76	65	5.3	12.3	76	11.2	6.8	183	9.2	20.0	76	1.0	76
1976/77	84	5.6	15.0	124	11.5	10.8	239	9.6	25.0	82	1.1	72
Sana'a	6.5	5.0	1.3	4.8	8.0	0.5	40.0	8.0	5.0	16.0	0.8	20.0
Hodeidah	35.0	6.0	6.0	0.8	8.0	0.1	40.0	10.0	4.0	7.0	0.7	10.0
Taiz	26.5	6.0	4.5	22.0	11.0	2.0	60.0	10.0	6.0	15.0	1.5	10.0
Ibb	15.0	5.0	3.0	96.0	12.0	8.0	93.0	10.0	9.3	40.5	1.5	27.0
Hajjah	-	-	-	0.8	8.0	0.1	1.6	8.0	0.2	0.8	0.8	1.0
Dhamar	0.5	5.0	5.0	0.8	8.0	0.1	2.7	9.0	0.3	0.7	0.7	1.0
Others	0.5	5.0	5.0		-	-	1.6	9.0	0.2	2.1	0.7	3.0

Table 2.7 Investment in the Five-year Plan

(Unit: YR×10^6)

	YR Million	Percent
Total Fixed Capital Formation	15,971	100
Sector Allocation		
(a) Agriculture	2,276	14
(b) Industry	3,996	25
Manufacturing	(1,998)	(12)
Electric Power & Water	(1,373)	(9)
Construction	(451)	(3)
Mining	(174)	(1)
(c) Transport & Communications	4,925	31
(d) Other Services	4,774	30
Housing	(2,090)	(13)
Public Administration	(1,963)	(12)
Trade & Banking	(721)	(5)
Program Responsibility		
(a) Government	5,400	34
(b) Mixed Enterprise	4,949	31
(c) Cooperatives	1,101	7
(d) Private Sector	4,521	28
Investment Financing		
(a) Domestic Financing	9,365	59
Government	(2,649)	(17)
Enterprises	(1,109)	(7)
Private Households	(5,607)	(35)
(b) Foreign Financing	6,606	41

Source: A World Bank Country Report, YAR, 1979

Table 4.1 Population of Hajjah Province

Quada	Nahiya	Population		
		Total	Female	Male
Hajjah		133,910	69,463	10,736
	Hajjah	22,053	11,317	10,736
	Mabyan	20,357	10,446	9,911
	Al Maghrabah	6,232	3,062	3,170
	Al Jamimah	5,441	2,788	2,653
	At Tur	16,065	8,119	7,946
	Beni Al Awam	16,606	8,795	7,811
	Kahlan Afar	11,452	6,017	5,435
	Maswar	16,612	8,890	7,722
	Najrah	6,682	3,510	3,172
	Al Shaghadrah	12,410	6,519	5,891
Midi		74,896	35,763	39,133
	Midi	7,294	3,535	3,759
	Harad	17,394	8,336	9,013
	Abs	25,421	12,603	12,818
	Kaidenah	24,832	11,289	13,543
Al Mahabisha		74,817	38,727	36,090
	Al Mahabisha	8,567	4,465	4,102
	Al Mufleh	7,298	3,803	3,493
	Aflah & Kheiran	26,790	13,911	12,879
	Al Qof	13,682	6,893	6,789
	Kahlan Al Sharaf	7,408	3,934	3,474
	Al Sharhil	11,072	5,721	5,351
Washha		64,033	33,420	30,613
	Aslam	16,918	8,481	8,437
	Washha	19,035	9,955	9,080
	Kasher	16,380	9,056	7,324
	Mustabah	11,700	5,928	5,772
Shahara		48,922	25,210	23,712
	Shahara	15,951	8,349	7,602
	Al Madan	9,394	4,874	4,520
	Al Qufla	8,182	3,989	4,193
	Swair	4,917	2,480	2,437
	Falimat Habour	10,478	5,518	4,960
	Total	396,578	202,583	193,995

Table 4.2 Location and Observation Period of Rain Gauge

Station	Location		Elevation (m)	Period of Observation
	Latitude	Longitude		1972 1973 1974 1975 1976 1977 1978
Sakain	16°50'N	43°27'E	2,230	
Bani Uwair	16°46'N	43°41'E	2,100	
Washhah	16°26'N	43°21'E	500	
Huth	16°14'N	43°58'E	1,850	
Shaharah	16°11'N	43°42'E	1,300	
Al Mahabishah	16°00'N	43°30'E	1,600	
Khamir	16°00'N	43°58'E	2,350	
Shibam	15°31'N	43°54'E	2,650	
Mahweet	15°29'N	43°36'E	2,100	
Hajjah	15°41'N	43°36'E	1,650	
At Tur	15°35'N	43°24'E	200	
Al Mikras	15°39'N	43°16'E	260	
Al Zuhra	15°44'N	43°01'E	70	
Gebel Al Milh	15°41'N	42°49'E	20	
Surdud	15°15'N	43'15'E	250	
Bahana	16°15'N	43°50'E	1,200	
Sana'a	15°21'N	44°12'E	2,300	

Full Year Observation Partial Year Observation

Table 4.3 Monthly Mean Rainfall

Unit: mm

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Total
Sakain	0	5.2	53.9	124.7	30.2	16.8	37.4	113.8	8.3	0	0	0	390.3
Bani Uwair	0	0	9.5	73.6	29.0	4.0	22.0	72.0	10.0	0	0	0	220.1
Washhah	48.3	ND	11.6	117.3	64.7	8.5	13.3	2.4	38.4	ND	ND	ND	ND
Huth	3.5	15.2	38.1	71.4	9.2	1.5	0	48.5	32.7	0	0	0	220.1
Shahara	0	0	44.6	62.3	19.5	43.4	107.0	91.7	99.3	0	0	0	467.8
Al Mahabisha	35.1	23.4	37.5	238.7	100.7	38.0	51.1	137.5	51.6	37.2	23.4	19.5	793.7
Khamir	2.4	1.0	36.9	126.2	39.5	14.0	58.6	105.4	2.6	0	0	7.7	394.3
Shibam	16.7	1.3	42.5	81.0	69.3	34.7	104.7	168.3	15.0	23.8	16.8	2.8	576.9
Mahweet	0	16.3	8.7	98.1	65.3	42.2	72.6	234.4	98.2	65.0	16.4	0	717.2
Hajjah	0.1	6.7	36.6	153.8	79.3	19.5	87.4	149.8	62.2	3.1	0.4	7.7	606.6
At Tur	9.1	1.0	18.7	125.2	115.9	106.5	85.5	235.5	127.0	88.9	34.4	0	947.7
Al Mikras	0	0	ND	ND	ND	ND	ND	59.0	44.4	8.2	0	0	ND
Al Zuhra	5.2	4.7	0.5	1.6	9.8	4.7	38.4	34.1	13.2	42.9	8.9	0.1	164.1
Gebel Al Milh	5.3	0	0.1	0	0	0	1.3	36.8	0	12.0	ND	ND	ND
Surdud	0	17.9	8.0	1.1	57.4	21.7	30.4	124.7	97.5	70.5	37.2	3.9	470.3
Baitna	12.8	4.8	47.9	36.1	77.6	28.1	137.5	115.3	38.8	23.4	7.6	0	529.9
Sana'a	1.7	1.0	18.1	47.3	38.9	2.3	27.3	63.3	3.4	24.5	6.7	1.1	235.6

Table 4.4 Result of Water Quality Analysis

Water samples		Hajjah Well	Wadi Masana	Bab el Hal Spring	Wadi Laah	WHO Criteria
PH		7.7	7.9	8.2	8.1	7.0 ∿ 8.5
E.C. Millimhos/cm		0.56	0.48	0.43	0.44	
Ca	meq	2.0	4.8	4.0	5.2	
	ppm	40	96	80	104	75
Mg	meq	4.4	2.8	2.2	0.6	
	ppm	53	34	27	7	50
K	meq	0.01	0.01	0.01	0.01	
	ppm	0.4	0.4	0.4	0.4	
Na	meq	2.8	2.3	2.3	3.5	
	ppm	64	53	53	81	
HCO_3	meq	5.76	5.28	4.48	6.24	
	ppm	351	322	273	381	
CO_3	meq	NIL	NIL	NIL	NIL	
	ppm					
Cl	meq	2.40	1.68	1.92	1.68	
	ppm	85	60	68	60	200
SO_4	meq	0.60	0.55	1.00	1.70	
	ppm	29	26	48	82	200
NO_3	meq	0.22	0.22	0.25	0.21	
	ppm	14	14	16	13	
Sum of Cations	meq	9.21	8.91	8.41	9.31	
	ppm	157.4	183.4	160.4	192.4	
Sum of Ca + Mg	meq	6.4	6.6	6.2	5.8	
	ppm	93	130	107	111	
Sum of Anions	meq	8.98	7.73	7.97	9.83	
	ppm	479	422	405	536	
SAR		1.6	1.3	1.3	2.1	

Table 4.5 Physiography and Soils

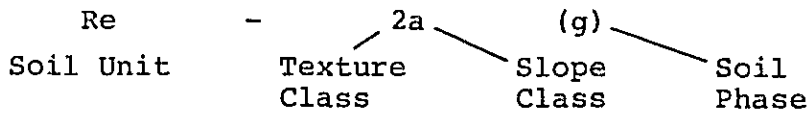
	Physiography/Terrain Units	Dominant 50%	Soil Units Associated 20 - 50%	Inclusions 20%	Land Class	Area (km^2)
L	LOWLAND					
L1	Salty flats	Zg - 2/3a	-	Zt - 2/3a	6	320
L2	Low dunes and sand sheets	Re - 1a	Je - Za	Yh - Za	4	1,160
L3	Recent wadi alluvium	Je - 1/2a	Jc - 1/2a	-	2	250
L4	Alluvial plain (old wadi alluvium)	Yh - 1a	Jc - 1/2a(g)	Re - 1a(g)	3	370
L5	Alluvial fan (Piedmont), gravelly surface	Yh - 2a(g)	Yk - 2a(g)	Je - 2a(g)	4	320
L6	Northern alluvial fan, medium textured	Je - 2a	Re - 2a	Yh - 2a	1	700
L7	Southern alluvial fan, coarse textured	Jc - 1a	Rc - 1a(g)	-	3	1,000
L8	Fluvial terrace (old wadi terrace)	Yh - 2a	Je - 2a	-	1	370
L9	Isolated hills	I	-	Yh - 2bc(1)	6	200
						(4,690)
M	MIDLAND					
M1	Piedmont, gravelly surface	Yh - 2a(g)	Yk - 2a(g)	-	4	250
M2	Colluvial slopes and talus	Je - 16(s)	Jc - 16(s)	Re - 1/2b	4	70
M3	Lower midland scarpment	I	Yh - 2b(1)	Yk - 2ab(1)	6	Nil
M4	Dissected upland, coarse textured	Je - 1a(g)	I	Xh - 1b(s)	4	890
M5	Dissected upland, medium textured	Xh - 2ab	Je - 1ab(g)	Xh - 2b(g)	3	710
M6	Higher midland scarpment	I	Yk - 2bc(1)	Yk - 2ab(1)	6	30
M7	Dissected plateau on Yemen Volcanics, gravelly surface	Re - 1a(g)	-	I	4	100
M8	Dissected plateau on inclined limestone and green shale, stony surface	Re - 1bc(1)	I	-	6	1,170
M9	Rock floor on Old Yemen Volcanics	I	-	Je - 1b(1)	6	870
						(4,090)
H	HIGHLAND					
H1	Highland scarpment	I	Je - 1c(g)	-	6	30
H2	Dissected mountain on Yemen Volcanics	Yk - 1ab(1)	Yh - 1ab(1)	I	6	200
H3	Highland plateau on limestone and shale	Xh - 2ab	Je - 2a	-	2	360
H4	Dissected mountain on granite and gneiss	Yk - 1ab(g)	I	-	4	170
H5	Small inter-mountain plain	Yh - 2a	Yk - 2ab	Re - 2ab	1	50
						(810)
						9,590

Table 4.6 Key to Soil Symbols

Soil Units*

R	Regosols	X	Xerosols
Re	Eutric Regosols	Xh	Haplic Xerosols
Rc	Calcaric Regosols	Z	Solonchak
J	Fluvisols	Zt	Takyric Solonchak
Je	Eutric Fluvisols	Zg	Gleyic Solonchak
Jc	Calcaric Fluvisols	I	Lithosols
Y	Yermosols		
Yh	Haplic Yermosols		
Yk	Calcic Yermosols		

Example of Symbol



Texture Class

1. Coarse textured: Sands, loamy sands and sandy loams with less than 18% clay, and more than 65% sand.
2. Medium textured: Sandy loams, loams, sandy clay loams, silty loams, silt, silty clay loams and clay loams with less than 35% clay and less than 65% sand.
3. Fine textured: Clays, silty clays, sandy clays, clay loams and silty clay loams with more than 35% clay.

Slope Class

a. Level to gently undulating (0 - 8%)
b. Rolling to hilly (8 - 30%)
c. Steeply dissected to mountainous (30% -)

Soil Phase

(g) Gravelly
(s) Stony
(l) Lithic

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* Definitions of the soil units are given in Volume I, Soil Map of the World.

Table 4.7 Land Classification

Land Class		Terrain Unit	Area (km^2)
Class 1 (Arable)	L6	Nothern alluvial fan, medium textured	700
	L8	Fluvial terrace	370
	H5	Intermountain plain	50
			1,120
Class 2 (Arable)	L3	Recent wadi alluvium	250
	H3	Highland plateau on limestone and shale	360
			610
Class 3 (Arable)	L4	Alluvial plain (old wadi alluvium)	370
	L7	Southern alluvial fan, coarse textured	1,000
	M5	Dissected uplands, medium textured	710
			2,080
Class 4 (Limited Arable)	L2	Low dunes and sand sheets	1,160
	L5	Alluvial fan (piedmont)	320
	M2	Colluvial slopes and talus	70
	M4	Dissected uplands, coarse textured	890
	M7	Dissected plateau on Yemen Volcanics	100
	M1	Piedmont, gravelly surface	250
	H4	Dissected mountain on granite and gneiss	170
			2,960
Class 6 (Non-arable)	L1	Salty flats	320
	L9	Isolated hills	200
	M3	Lower midland scarpment	Nil
	M6	Higher midland scarpment	30
	M8	Dissected plateau on inclined limestone and green shale, stony surface	1,170
	M9	Rock floor on Yemen Volcanics	870
	H1	Highland scarpment	30
	H2	Dissected mountain on Yemen Volcanics	200
			2,820
		Total	9,590

Table 4.8 Labour Force and Draught Power

Quada	Population	No. of household	No. of farm household	Active force labour	No. of farm labour	No. of farm labour/ farm	No. of cattle	No. of cattle/ farm
Hajjah	133,900	25,900	18,600	33,900	24,700	1.3	19,400	1.05
Midi	74,900	14,200	10,200	18,900	13,800	1.4	39,700	3.90
Al Mahabisha	91,800	18,200	13,100	23,200	16.900	1.3	14,000	1.06
Washha	47,100	9,200	6,700	11,900	8,700	1.3	7,400	1.10
Shahara	48,900	9,400	6,800	12,400	9,100	1.3	7,500	1.10
Total	396,600	76,900	55,400	100,300	73,200	Ave. 1.3	88,000	1.64

Table 4.9 Crop Production Value

Crops	Cultivated area (ha)	Unit yield (ton/ha)	Unit price (YRs/ton)	Products (tons)	Value ($\times 10^3$YRs)
Cotton	100	0.6	2,000	60	120
Coffee	1,000	0.4	28,000	400	11,200
Qut	6,800	2,200 bundles	70	$14,960 \times 10^3$	1,047,200
Wheat	500	0.8	2,000	400	800
Barley	400	1.0	1,800	400	720
Grapes	1,000	4.8	12,000	4,800	57,600
Vegetables	400	8.0	5,000	3,200	16,000
Legumes	1,000	0.8	6,000	800	4,800
Tobacco	100	1.2	21,000	120	2,520
Sesame	100	0.5	25,000	50	1,250
Potatoes	200	8.0	4,000	1,600	6,400
Maize	500	1.5	1,500	750	1,125
Sorghum/Millet	70,000	0.8	2,000	56,000	112,000
Fruits, etc.	1,800	8.0	6,000	14,400	86,400
Total	83,900				1,348,135

Table 4.10 Gross Crop Production Value, Production Cost and Net Crop Production Value (Hajjah Province)

Crops	(A) Cultivated area (ha)	(B) Gross production value (×10³YRs)	(C) Unit production cost (YRs/ha)	(D) Total production cost, (A)×(C) (×10³YRs)	(E) Production tax, (B)×10% (YRs)	(F) Gross production cost, (D)+(E) (×10³YRs)	(G) Net production value, (B)-(F) (×10³YRs)
Cotton	100	120	220	22	12	34	86
Coffee	1,000	11,200	4,000	4,000	1,120	5,120	6,080
Qut	16,800	1,047,200	4,000	27,200	104,720	131,920	915,280
Wheat	500	800	200	100	80	180	620
Barley	400	720	200	80	72	152	568
Grapes	1,000	57,600	15,000	15,000	5,760	20,760	36,840
Vegetables	400	16,000	2,500	1,000	1,600	2,600	13,400
Legumes	1,000	4,800	1,500	1,500	480	1,980	2,820
Tabacco	100	2,520	2,500	250	252	502	2,018
Sesame	100	1,250	2,000	200	125	325	925
Potatoes	200	6,400	2,500	500	640	1,140	5,260
Maize	500	1,125	270	135	115	250	875
Sorghum/Millet	70,000	112,000	240	16,800	11,200	28,000	84,000
Fruits, etc.	1,800	86,400	14,000	25,200	8,640	33,840	52,560
Total	83,900	1,348,135		91,987	134,816	226,803	1,121,332

- to be continued -

Table 4.11 Gross Livestock Production Value, Production Cost and Net Livestock Production Value (Hajjah Province)

(1) Meat Production

	Livestock population (heads)	No. of slaughtered animals (heads)	Meat production per head (kg)	Meat production (×10³ tons)	Unit price (YRs/kg)	Production value (×10³ YRs)
Cattle	88,000	—				
adult	—	6,330	200	1,260	15	18,990
calves	—	1,600	50	80	10	800
Sheep	168,000	58,800	10	588	30	17,640
Goats	195,000	68,250	10	683	20	13,650
Chickens	402,000	402,000	0.8	322	37.5	12,060
						63,140

(2) Milk and Eggs Production

	Livestock population (heads)	Off-take (%)	No. of adult (heads)	Production per head (litre, kg)	Production (×10³ litre, kg)	Unit price (YRs)	Production value (×10³ YRs)
Cattle	88,000	9.0	7,920	200	1,584	2	3,168
Sheep	168,000	35.0	58,800	17	999	2	1,998
Goats	195,000	35.0	68,250	17	1,160	2	2,320
Chickens	402,000	2.5	10,050	10	100	20	2,000
							9,486

(3) Production Cost

	No. of slaughtered animals (heads)	Feed per head (YRs)	Amount (×10³ YRs)
Cattle			
adult	6,330	1,050	6,646
calves	1,600	100	160
Sheep	58,800	100	5,880
Goats	68,250	100	6,825
Chickens	402,000	5	2,010
			21,521

(4) Net Production Value

	Production value: Meat (1)	Production value: Milk & eggs (2)	Cost (3)	Net production value (1)+(2)-(3) (×10³ YRs)
Cattle				
adult	18,990	3,168	6,646	15,512
calves	800	—	160	640
Sheep	17,640	1,998	5,880	13,758
Goats	13,650	2,320	6,825	9,145
Chickens	12,060	2,000	2,010	12,050
	63,140	9,486	21,521	51,105

Source: Appraisal of Livestock Credit and Processing Project, Yemen Arab Republic (World Bank authorization)

Table 6.1 List of Water Supply Schemes

Name of town or village	Planned service Population (persons)	Planned supply amount (m^3 per day)	Water resources
1. Hajjah	15,000	(existing)	
2. Suq Al Aman	1,800	144	Wadi Waru
3. Ash Shafadirah	9,500	760	Wadi Husayb
4. North Mabyan	5,400	432	Wadi Mawr
5. Jabal Al Dafir	4,800	384	Wadi Sharas
6. Mabyan	5,100	408	Wadi Mawr
7. Bani Kais	5,200	416	Wadi Laah
8. Bayt Idhaqah	5,200	416	Wadi Hijlah
9. Kuhlan	5,900	472	Wadi Umyan
10. Affar	3,700	296	Wadi Umyan
11. Sharhil	4,000	320	Wadi Yamaniyah
12. Qufl Shamal	2,300	184	Wadi Yamaniyah
13. Al Shaafeen	3,100	248	Wadi Yamaniyah
14. Al Mahabisha	15,000	(under construction)	
15. Miftah	2,000	160	
16. Kusher	3,400	272	Wadi Mawr
17. Al Muhanaq	4,000	320	Wadi Bawhal
18. Aslam	1,600	128	Wadi Bawhal
19. Habur	2,100	168	Wadi Hashid
20. Shahara	2,000	160	Wadi Hashid
21. Al Madan	6,700	536	Wadi Mawr
22. Washha	12,500	1,000	Wadi Harad
23. Abs	5,300	424	Wadi Bawhal
24. Harad	2,300	184	Wadi Harad
25. Midi	3,800	304	Wadi Harad
	(131,700)		

Table 6.2 Land Use and Rainfall

Land use category	Annual Rainfall (mm) 1 - 200 (km^2)	200 - 400 (km^2)	400 - 600 (km^2)	600 - 800 (km^2)	800 - (km^2)	Total area (km^2)
A. Irrigated cropland	15 (1.1%)	70 (5.0%)	75 (5.3%)	- (-)	- (-)	160 (11.4%)
B. Rainfed cropland/ annual cultivation	50 (3.5%)	245 (17.4%)	330 (23.5%)	95 (6.7%)	30 (2.1%)	750 (53.2%)
C. Rainfed cropland/ opportunistic sultivation	35 (2.5%)	75 (5.3%)	10 (0.7%)	- (-)	- (-)	120 (8.5%)
D. Rainfed cropland/ terraced	- (-)	- (-)	150 (10.6%)	110 (7.8%)	20 (1.4%)	280 (19.8%)
E. Cropland/ rangeland	100 (7.1%)	- (-)	- (-)	- (-)	- (-)	100 (7.1%)
Total	200 (14.2%)	390 (27.7%)	565 (40.1%)	205 (14.5%)	50 (3.5%)	1,410 (100.0%)

Table 6.3 Land Class and Rainfall

Land class	Annual Rainfall (mm) 0 - 200 (km^2)	200 - 400 (km^2)	400 - 600 (km^2)	600 - 800 (km^2)	800 - (km^2)	Total area (km^2)
A. Class 1 (arable)	250(6.6%)	410(10.8%)	390(10.2%)	60(1.6%)	10(0.2%)	1,120(29.4%)
B. Class 2 (arable)	10(0.2%)	180(4.7%)	250(6.6%)	160(4.2%)	10(0.2%)	610(16.0%)
C. Class 3 (arable)	510(13.4%)	900(23.6%)	450(11.8%)	180(4.7%)	40(0.8%)	2,080(54.6%)
Total	770(20.2%)	1,490(39.1%)	1,090(28.6%)	360(10.5%)	60(1.2%)	3,810(100.0%)
D. Unused arable land	570(24.1%)	1,100(46.6%)	525(22.2%)	155(6.6%)	10(0.5%)	2,360(100.0%)
E. Total cropland / Total arable land	26.0%	262%	51.8%	56.9%	83.3%	Ave. 37.0%
F. Unused arable land / Total arable land	74.0%	73.8%	48.2%	43.1%	16.7%	Ave. 63.0%

Table 6.4 Evaluation of Selected Crops

Crops	Water saving	Market-ability	Profit-ability	Technical adaptability
Lowland				
Sorghum	B	C	B	A
Millet	A	C	B	A
Maize	B	B	B	A
Cotton	B	C	B	A
Sesame	C	B	B	B
Potatoes	C	A	A	B
Tomatoes	C	A	A	A
Okra	C	B	A	A
Onion	C	A	A	C
Cucumber	C	A	A	B
Pepper	C	B	A	A
Papaya	C	A	B	A
Banana	C	A	A	A
Groundnuts*	B	B	B	B
Sunflower*	A	B	B	A
Midland				
Sorghum	B	C	B	B
Maize	B	B	B	A
Sesame	C	B	B	A
Potatoes	C	A	A	A
Tomatoes	C	A	A	B
Okra	C	B	A	B
Onion	C	A	A	A
Cucumber	C	A	A	A
Pepper	C	B	A	B
Papaya	C	A	B	B
Banana	C	A	A	B
Soybean	A	B	B	A
Groundnuts*	B	B	B	A
Highland				
Sorghum	B	C	B	B
Wheat	B	B	B	A
Barley	B	B	B	A
Potatoes	B	A	A	B
Grapes	B	A	C	A
Coffee	B	B	C	A
Qut	B	A	A	A
Rape seeds*	B	B	B	A
Soybean*	A	B	B	B
Pear*	C	A	B	B
Peaches*	C	A	B	B
Plum*	C	B	A	B

A: Good B: Fair C: Poor

*: New crops

Table 6.5 Future Crop Production (Hajjah Province)

Crops	Cultivation area (ha)	Unit yield (tons/ha)	Gross production value ($\times 10^3$ YRs)	Unit production cost (YRs/ha)	Total production cost ($\times 10^3$ YRs)	Net production value ($\times 10^3$ YRs)
Millet	65,500	0.8	104,700	700	56,300	48,400
Sorghum	37,100	1.0	74,200	700	33,400	40,800
Maize	34,600	2.0	103,800	1,000	45,000	58,800
Wheet & Barley	20,200	1.2	48,500	300	10,900	37,600
Legumes	11,200	1.4	94,100	2,200	34,000	60,100
Vegetables	7,100	10.0	568,000	5,000	92,300	475,700
Qut	6,800	2,200 bundles	1,047,200	4,000	132,000	915,200
Potatoes	5,700	16.0	364,800	5,000	64,900	299,900
Sesames	4,100	1.0	102,500	3,000	22,600	79,900
Coffee	1,500	0.6	25,200	6,000	11,500	13,700
Fruits	1,200	12.0	86,400	21,000	33,800	52,600
Grapes	1,000	6.3	75,600	19,500	27,100	48,500
Total	196,000		2,695,000		563,800	2,131,200

Table 6.6 Number of Schools Requested by Province

Quada	Nahiya	No. of Primary Schools	No. of Preparatory Schools	No. of Secondary Schools	No. of Religious Institutes
Hajjah	Hajjah	4		1	1
	Mabyan	3	1		
	Al Maghraban	1			
	Al Jamimah	1			
	At Tur	3	1		
	Bani Al Awam	2			
	Kuhlan Affar	2	1		
	Maswar	3			
	Najrah	1			
	Al Shaghadirah	2	1		
Midi	Midi	1	1		
	Harad	2		1	
	Abs	5	1	1	
	Kaydinah	3			
Al Mahabisha	Al Mahabisha	1	1		1
	Miftah	1			
	Aflah Khayran	3		1	
	Aslam	2			
	Al Quf	1			
	Sharhil	2	2		
	Kuhlan Ash-Sharaf	1			
Washah	Washah	3			
	Kusher	3			
	Mustaba	2			
Shahara	Shaharah	1	1		
	Al Madan	1	1		1
	Al Qaflah	1			
	Suwayr	1			
	Zulaymat Habur	1			
Total		57	11	4	3

Table 6.7 Improvement Plan of Primary Schools

	No. of Childrens to be attendant	No. of Schools	No. of Pupils	No. of School attendance (%)
Present Condition	75,500	210	13,500	18
Proposed Plan				
a. improvement		210	21,000	
b. new construction				
- Hajjah		22	1,320	
- Midi		11	660	
- Al Mahabisha		11	660	
- Washah		8	480	
- Shahara		5	300	
Sub-total		57	3,500	
Total	75,500	267	24,500	32

Table 6.8 Improvement Plan of Hospital Facilities

Description	Name of Towns	No. of Existing Beds in 1979	No. of Proposed Beds
Main Hospital	Hajjah	100	200
Branch Hospital	Kuhlam	10	30
	Midi	10	30
	Al Mahabisha	10	30
	Harad	10	30
	Sharhil	10	30
	Abs	20	30
	Al Tur	-	30
	Washah	-	30
	Shaharah	-	30
Total		170	470
		(Population/bed:	850)

Table 6.9 Improvement of Health Center Facilities

Quada	Nahiya	Health Center	Rural Health Units
Hajjah	Hajjah	1	
	Mabyan		1
	Al Maghrabah		1
	Al Jamimah		1
	At Tur	1	
	Bani Al Awam		1
	Kuhlan Affar		1
	Maswar		1
	Najrah		1
	Al Shaghadirah		1
Midi	Midi	1	
	Harad	1	
	Abs	1	
	Kaydinah		1
Al Mahabisha	Al Mahabisha	1	
	Maftah		1
	Aflah Khayran		1
	Aslam		1
	Al Quf		1
	Sharhil		1
	Kuhlan Ash-Sharaf		1
Washah	Washah	1	
	Kusher		1
	Mustaba		1
Shahara	Shaharah	1	
	Al Madan		1
	Al Qaflah		1
	Suwayr		1
	Sulaymat Habur		1
Total		8	21

Table 6.10 Electric Power Supply Scheme

Name of Town or Village	Planned Service Households	Capacity of Generator (kVA)
1. Hajjah	(existing)	
2. Suq Al Aman	170	75
3. Ash Shafadirah	2,200	1,000
4. North Mabyan	1,100	500
5. Jabal Al Dafir	1,700	750
6. Mabyan	1,700	750
7. Bani Kais	460	200
8. Bayt Idhaqah	1,100	500
9. Kuhlan	1,700	750
10. Affar	1,100	500
11. Sharhil	690	300
12. Qufl Shamal	170	75
13. Al Shaafeen	230	100
14. Al Mahabisha	(under construction)	
15. Miftah	690	300
16. Kusher	230	100
17. Al Muhanaq	1,100	500
18. Aslam	170	75
19. Habur	690	300
20. Shaharah	690	300
21. Al Madan	2,200	1,000
22. Washah	2,200	1,000
23. Abs	460	200
24. Harad	170	75
25. Midi	460	200

Table 9.1 Project Cost Estimates

Description	Amount ($\times 10^3$ YRs)	Amount ($\times 10^3$ US$)
1. Project office	11,900	2,640
2. Branch offices	2,400	530
3. Meteoro-Hydrological observation network	400	90
4. Rural water supplies	12,900	2,870
5. Rural road network	149,300	33,180
6. Agricultural research station	6,800	1,510
7. Research and training center for irrigation and mechanization	16,000	3,560
8. Pilot irrigation projects	16,000	3,560
9. Forest nursery	200	40
10. Pilot afforestation scheme	1,000	220
11. Rural infrastructures	34,000	7,560
Total	252,000	56,000

Item	Quantity	Unit	Rate (YR'000)	Amount (YR'000)
1. Project office				
Buildings	5,000	sq.m	2	10,000
Office, Guest house, Residence, etc.				
Civil works	3	ha	100	300
Fixtures	L.S.			500
Contingencies (10%)				1,100
Total				11,900

Item	Quantity	Unit	Rate (YR'000)	Amount (YR'000)
2. Branch office				
2.1 Al Mahabisha branch office				
Buildings	500	sq.m	2	1,000
Civil works	0.25	ha	100	25
Fixtures	L.S.			50
Contingencies (10%)				125
Sub-total				1,200
2.2 Abs branch office				
Buildings	500	sq.m	2	1,000
Civil works	0.25	sq.m	100	25
Fixtures	L.S.			50
Contingencies (10%)				125
Sub-total				1,200
Total				2,400
3. Meteoro-Hydrological observation network				
Meteorological station	5	place	40	200
Hydrological station	2	place	100	200
Total				400

Item	Quantity	Unit	Rate (YR'000)	Amount (YR'000)
4. Rural water supplies				
4.1 Sharhil				
Materials and installation		L.S.		2,700
Pumps, electrical equipments and pipes				
Civil works and buildings		L.S.		1,000
Contingencies (10%)				400
Sub-total				4,100
4.2 Qufl Shamal				
Materials and installation		L.S.		1,500
Pumps, electrical equipments and pipes				
Civil works and buildings		L.S.		1,000
Contingencies (10%)				300
Sub-total				2,800
4.3 Al Shaafen				
Materials and installation		L.S.		2,100
Pumps, electrical equipments and pipes				
Civil works and buildings		L.S.		1,000
Contingencies (10%)				300
Sub-total				3,400

Item	Quantity	Unit	Rate (YR'000)	Amount (YR'000)
4.4 Abs				
Materials and installation	L.S.			1,400
Pumps, electrical equipments and pipes				
Civil works and building	L.S.			1,000
Contingencies				200
Sub-total				2,600
Total				12,900
5. Rural road network				
5.1 Secondary road				
Hajjah — Al Mahabisha	47	km	800	37,600
Al Mahabisha — Abs	33	km	400	13,200
Contingencies (10%)				5,000
Sub-total				55,800
5.2 Bridge on Wadi Mawr	L.S.			6,000
5.3 Feeder roads				
Abs — Qufl — Al Mahabisha	47	km	300	14,100
Qufl — Sharhil	25	km	300	7,500
Other feeder roads				
a. Mountain region	144	km	300	43,200
b. Tihama region	75	km	200	15,000
Contingencies (10%)				7,700
Sub-total				87,500
Total				149,300

Item	Quantity	Unit	Rate (YR'000)	Amount (YR'000)
6. Agricultural research station				
Buildings Office, storage, etc.	2,300	sq.m	2	4,600
Land reclamation	10	ha	50	500
Farm operation equipment Hand tractors and attachments	L.S.			600
Laboratory equipments	L.S.			400
Workshop equipment	L.S.			100
Contingencies (10%)				600
Total				6,800
7. Research and training center for irrigation and mechanization				
Buildings Offices, residences, etc.	4,700	sq.m	1.5	7,000
Land reclamation	20	ha	50	1,000
Construction equipments Bulldozers, power shovels, etc.	L.S.			5,000
Farm operation equipment	L.S.			2,000
Workshop equipment	L.S.			400
Laboratory equipment	L.S.			100
Contingencies (10%)				1,600
Total				17,100

Item	Quantity	Unit	Rate (YR'000)	Amount (YR'000)
8. Pilot irrigation projects				
8.1 Wadi-delta plain — Abs area				
Diversion weirs	2	units	3,000	6,000
Main canals	15	km	150	2,250
Tubewells ϕ300mm × 100m	100×4	m	3	1,200
Farm roads, supply canals and land reclamation	L.S.			1,000
Contingencies				1,050
Sub-total				11,500
8.2 Swampy lands — Jaya, Tahannen and Sharhil area				
Tubewells ϕ300mm × 30m	30×9	m	3	810
Main pipe-lines	6	km	160	960
Farm roads, supply pipes and land reclamation	L.S.			500
Contingencies				230
Sub-total				2,500
8.3 Wadi lands	L.S.			2,000
Total				16,000

Item	Quantity	Unit	Rate (YR'000)	Amount (YR'000)
9. Forest nursery	L.S.			200
10. Pilot afforestation scheme	L.S.			1,000
11. Rural infrastructures				
11.1 Health facilities				
Main hospital	1	place	8,000	8,000
Branch hospitals	3	place	6,000	18,000
Rural health units	2	place	2,000	4,000
Sub-total				30,000
11.2 Electric power supplies (Costs of generaters were included in estimate of water supplies.)	L.S.			4,000
Total				34,000

Table 9.2 Annual Fund Requirement

(Unit: $\times 10^3$ YRs)

Description	Year in order										Total	
	1	2	3	4	5	6	7	8	9	10	($\times 10^3$ YRs)	($\times 10^3$ US$)
(1) Project office	11,900										11,900	2,640
(2) Branch offices				2,400							2,400	530
(3) Meteoro-Hydrological observation network		400									400	90
(4) Rural water supplies		5,000	7,000	900							12,900	2,870
(5) Rural road network		33,500	45,000	28,800	21,000	21,000					149,300	33,180
(6) Agricultural research station			4,000	2,800							6,800	1,510
(7) Research and training center for irrigation and mechanization			5,000	12,100							17,100	3,800
(8) Pilot irrigation project						4,000	5,500	6,500			16,000	3,560
(9) Forest nursery						150	50				200	40
(10) Pilot afforestation scheme						300	300	200	100	100	1,000	220
(11) Rural infrastructures			2,000	2,000	8,000	9,000	9,000	4,000			34,000	7,560
Total ($\times 10^3$ YRs)	11,900	38,900	63,000	49,000	29,000	34,450	14,850	10,700	100	100	252,000	
($\times 10^3$ US$)	2,640	8,640	14,000	10,890	6,450	7,660	3,300	2,380	20	20		56,000

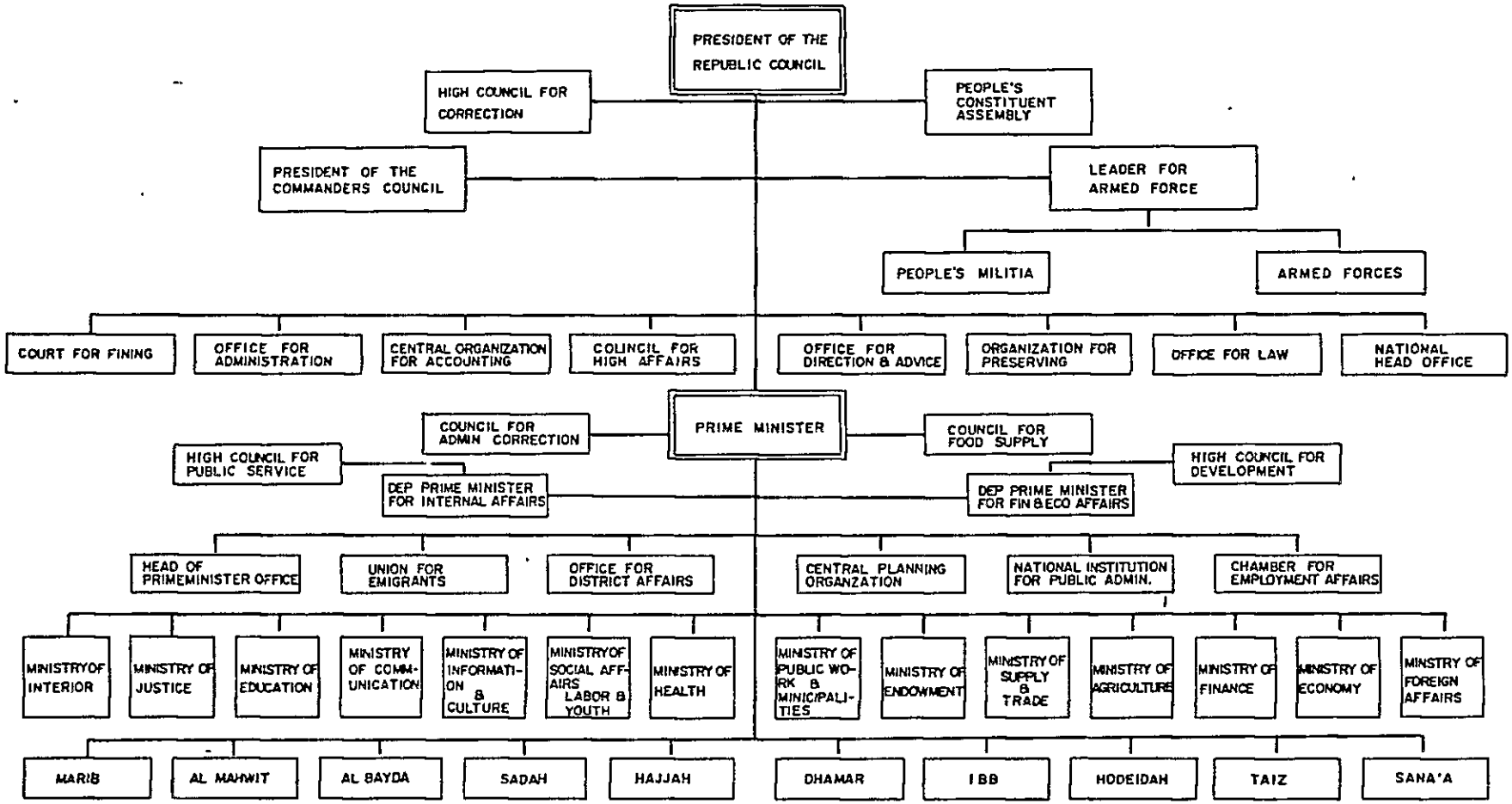


Fig 2 1 Organization of Government of the Yemen Arab Republic

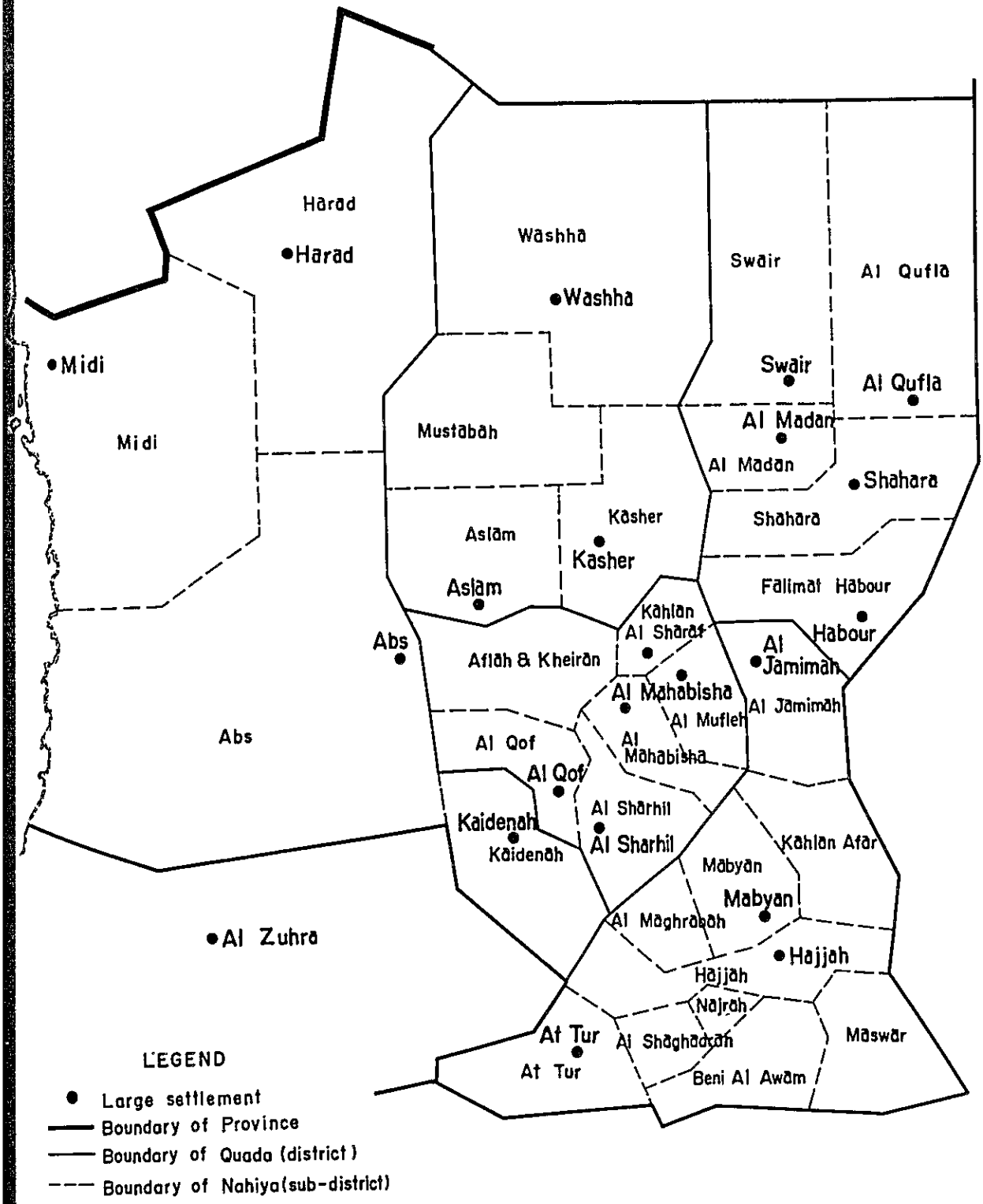


Fig.4.1 Administrative Division of Hajjah Province

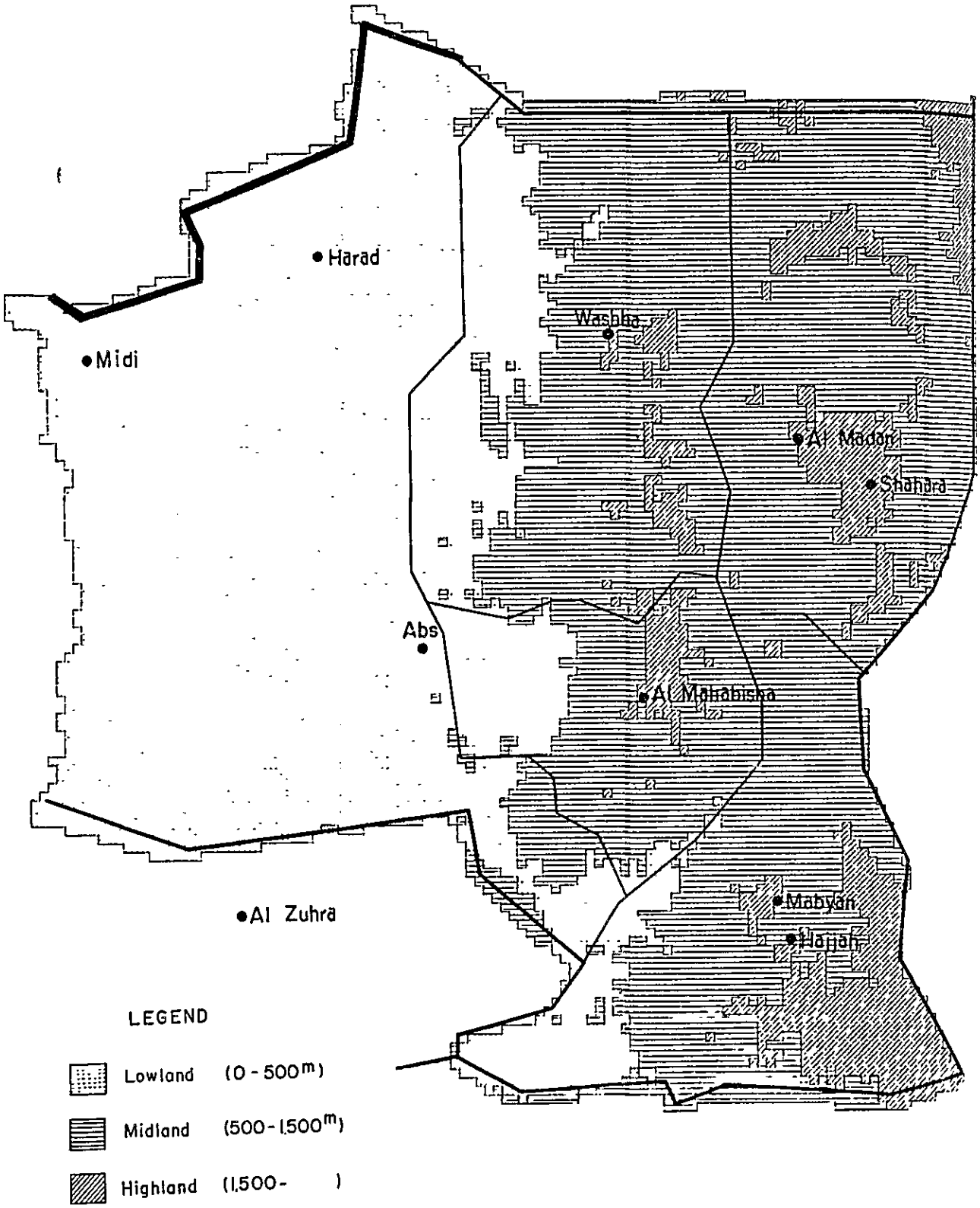
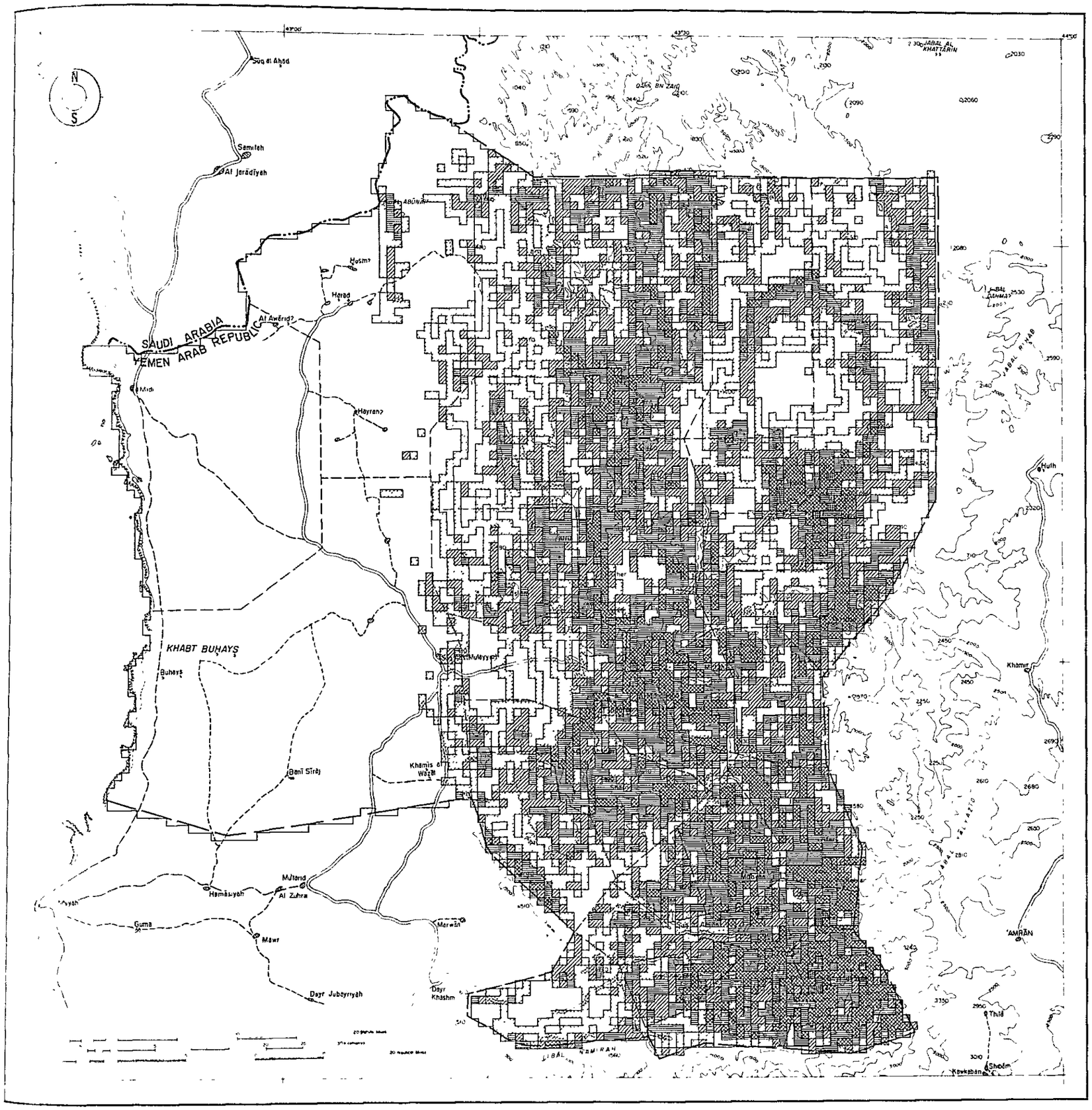


Fig. 4.2 Physiographical Regions



LEGEND

- 0 - 2 PERCENT SLOPE GRADIENT
- 2 - 6 PERCENT SLOPE GRADIENT
- 6 - 13 PERCENT SLOPE GRADIENT
- 13 - 25 PERCENT SLOPE GRADIENT
- 25 - 55 PERCENT SLOPE GRADIENT
- OVER 55 PERCENT SLOPE GRADIENT

Fig.4.3 Slope Analysis

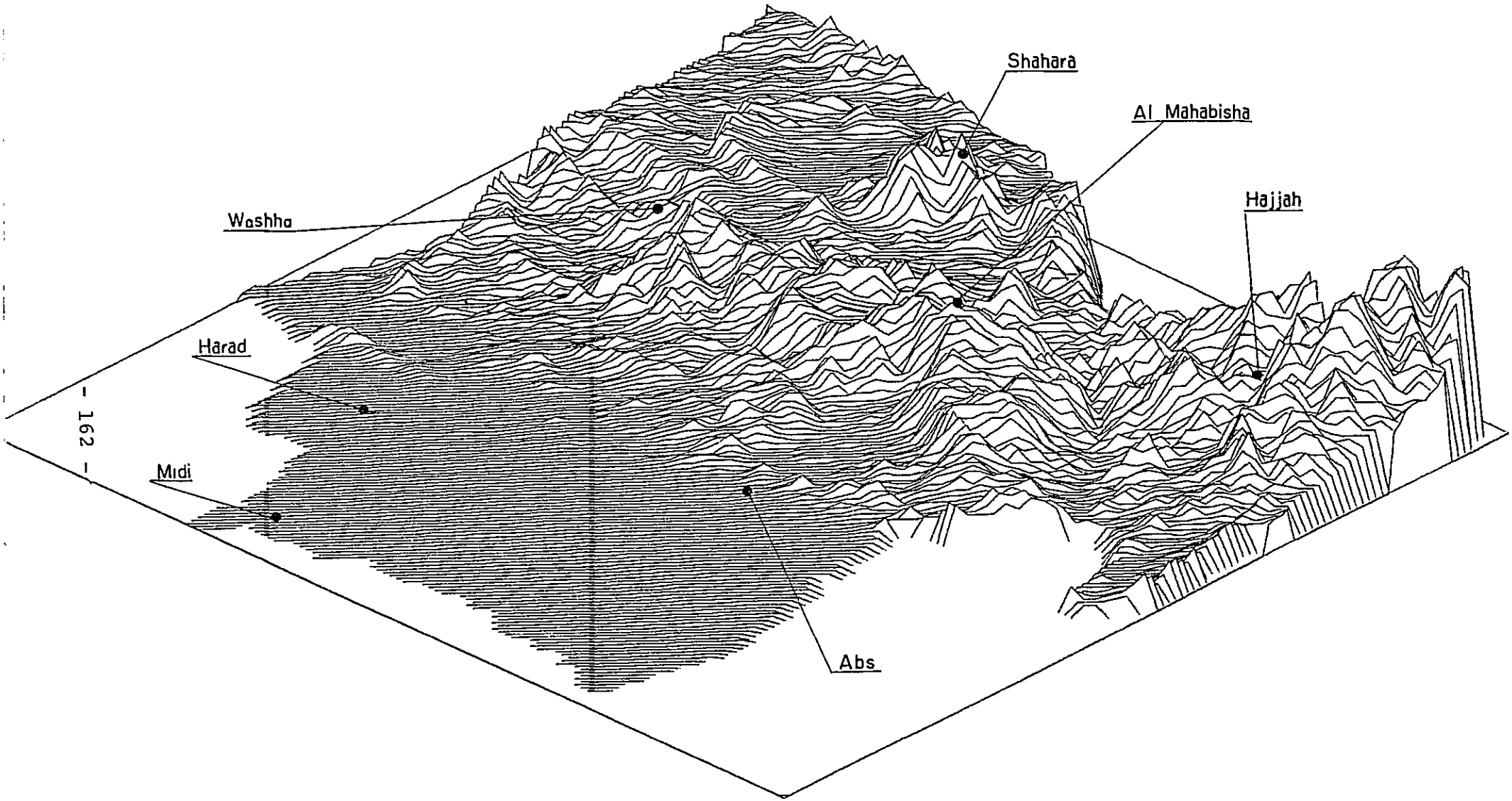
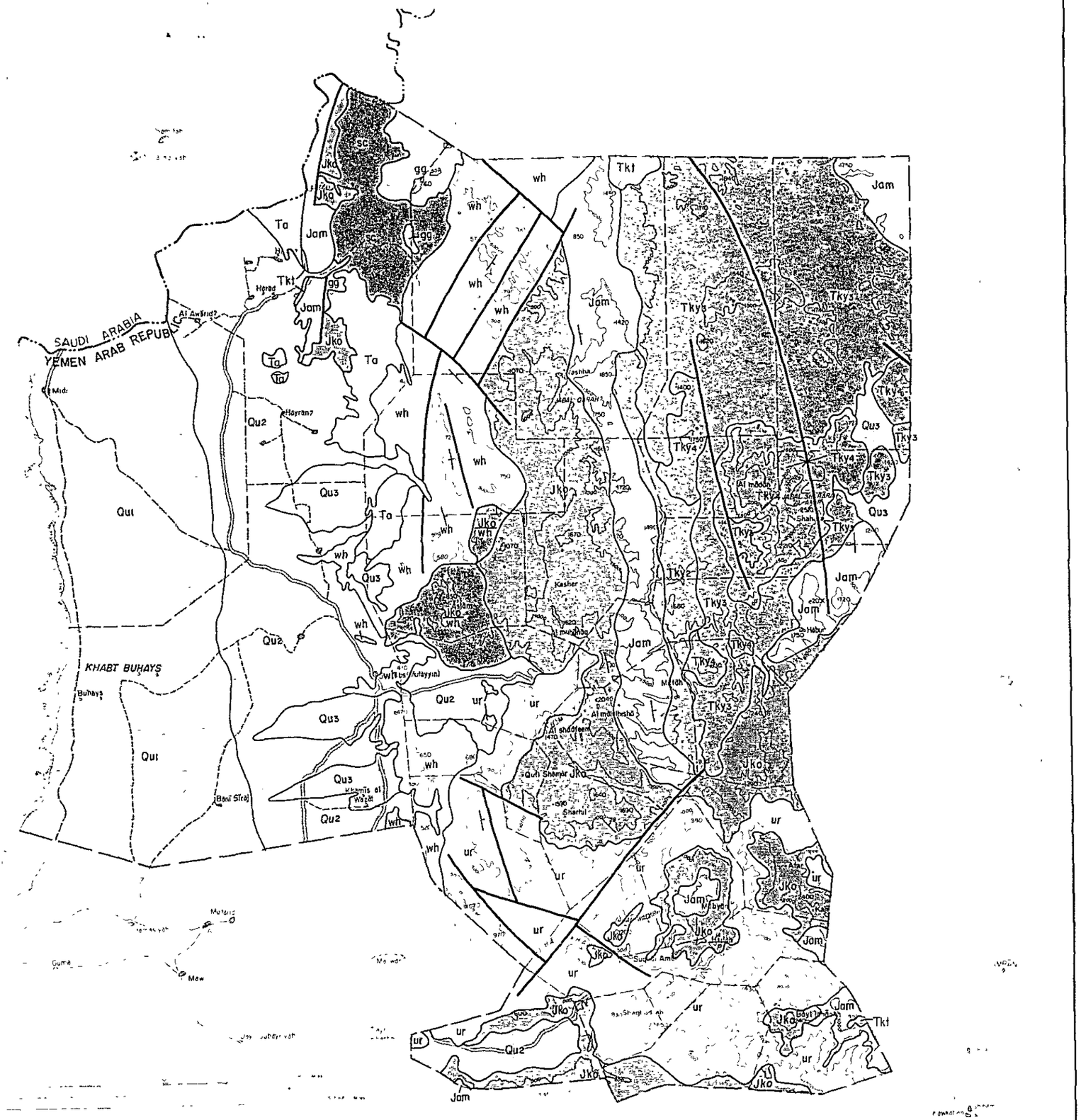


Fig. 4.4 Bird's-eye View of Hajjah Province



LEGEND

QUATERNARY

Qu

- Qu1 Coastal sand
- Qu2 Alluvial fans
- Qu3 River-terrace deposits

TERTIARY ~ CRETACEDUS

Miocene

- Ta Hypabyssal andesite and diabase intrusives

Lower Miocene — YEMEN VOLCANICS

Tky

- Tky4 Leucocratic felsic tuff with some dark basaltic flows
- Tky3 Predominantly felsic and tuffaceous older than Tky4
- Tky2 Predominantly felsic and tuffaceous older than Tky3

Eocene

- Tkt TAWILAH GROUP AND MEDJ-ZIR SERIES
  Continental type coarse crossbedded sandstone with lenses of conglomerate and gravel

JURASSIC

Upper

- Jam AMRAN SERIES
  Limestone, marl and shale

Lower

- Jko KOHLAN SERIES
  Green shale with sandstone and conglomeratic bands in lower part; sandstone and some conglomerates in upper part

PRE-CAMBRIAN

- ur Predominantly granite, gneiss
- wh Chlorite-sericite schist, amphibole schist, graphite schist, marble quartzite, slate, conglomerate and greenstone
- gg Gneissic granite, gneissic granodiorite and injection gneiss
- sc Low-grade metamorphosed sedimentary rocks
- Jko / wh Area includes two undifferentiated units

Fault — Dip and strike of bed

Syncline

Fig.4.5 Geology

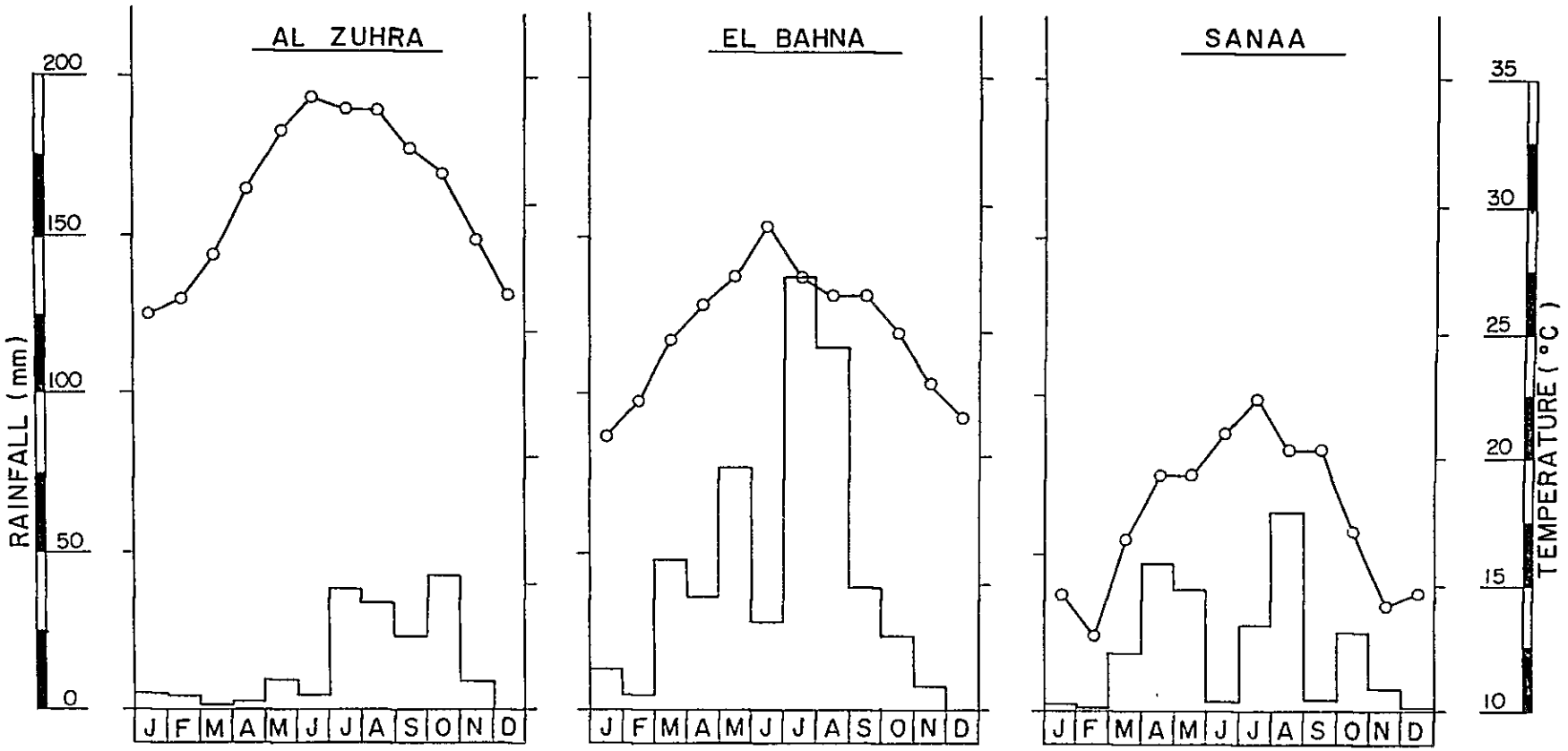


Fig. 4.6 Monthly Rainfall and Temperature

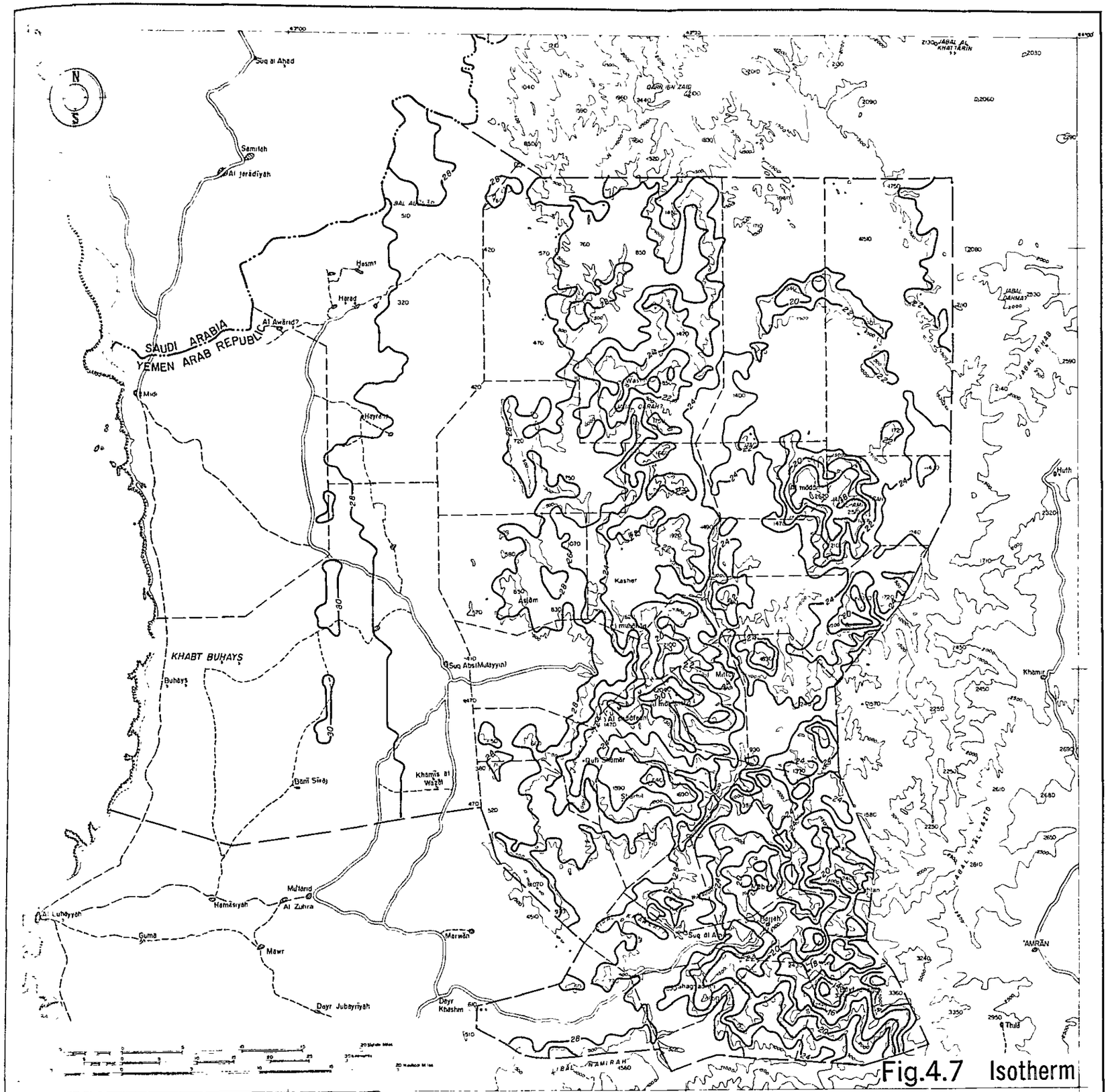
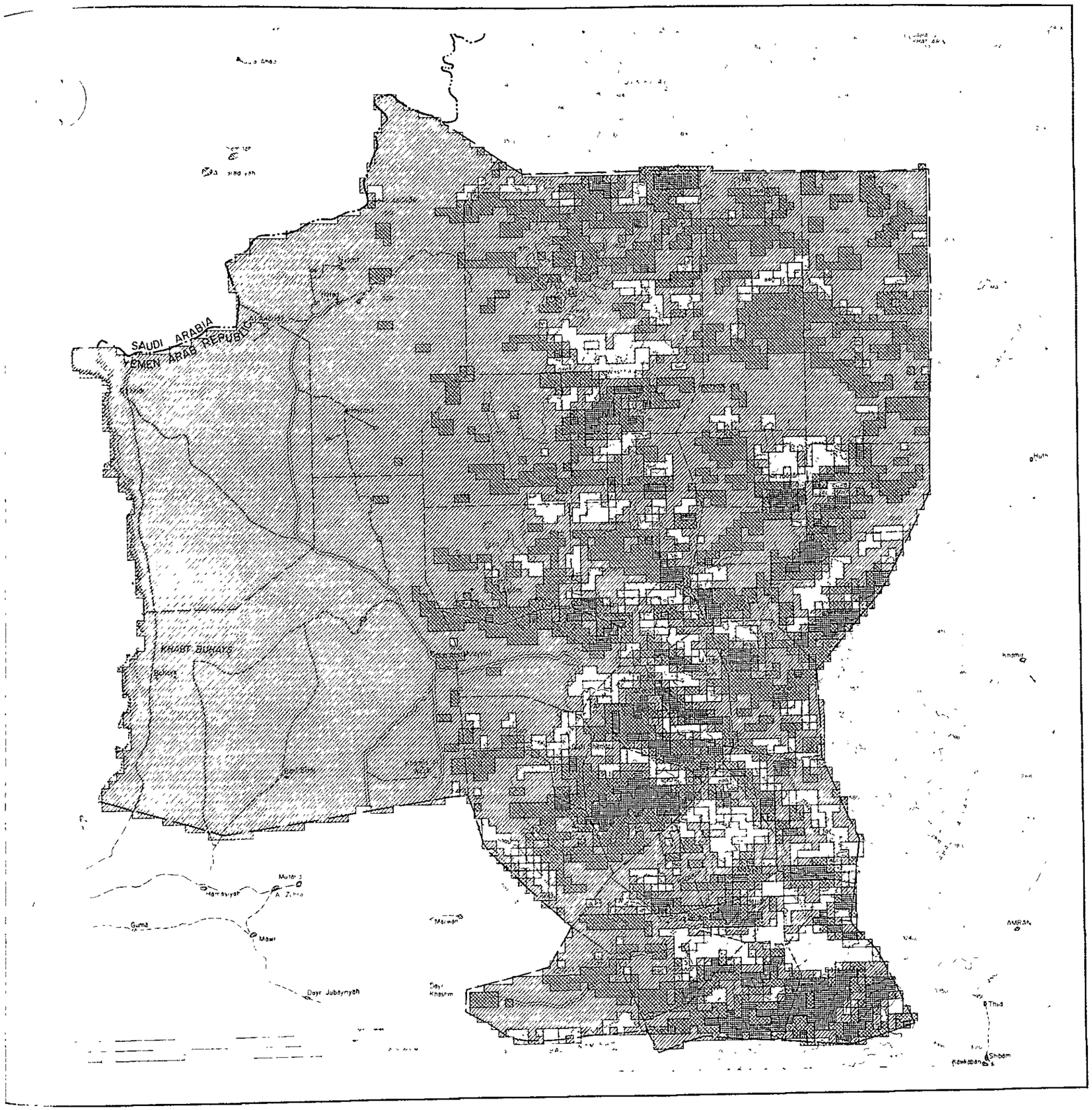


Fig.4.7 Isotherm



LEGEND

	LESS	THAN	50	PERCENT
	50	-	55	PERCENT
	55	-	60	PERCENT
	60	-	65	PERCENT
	OVER	65		PERCENT

Fig.4.8 Sunshine Intensity

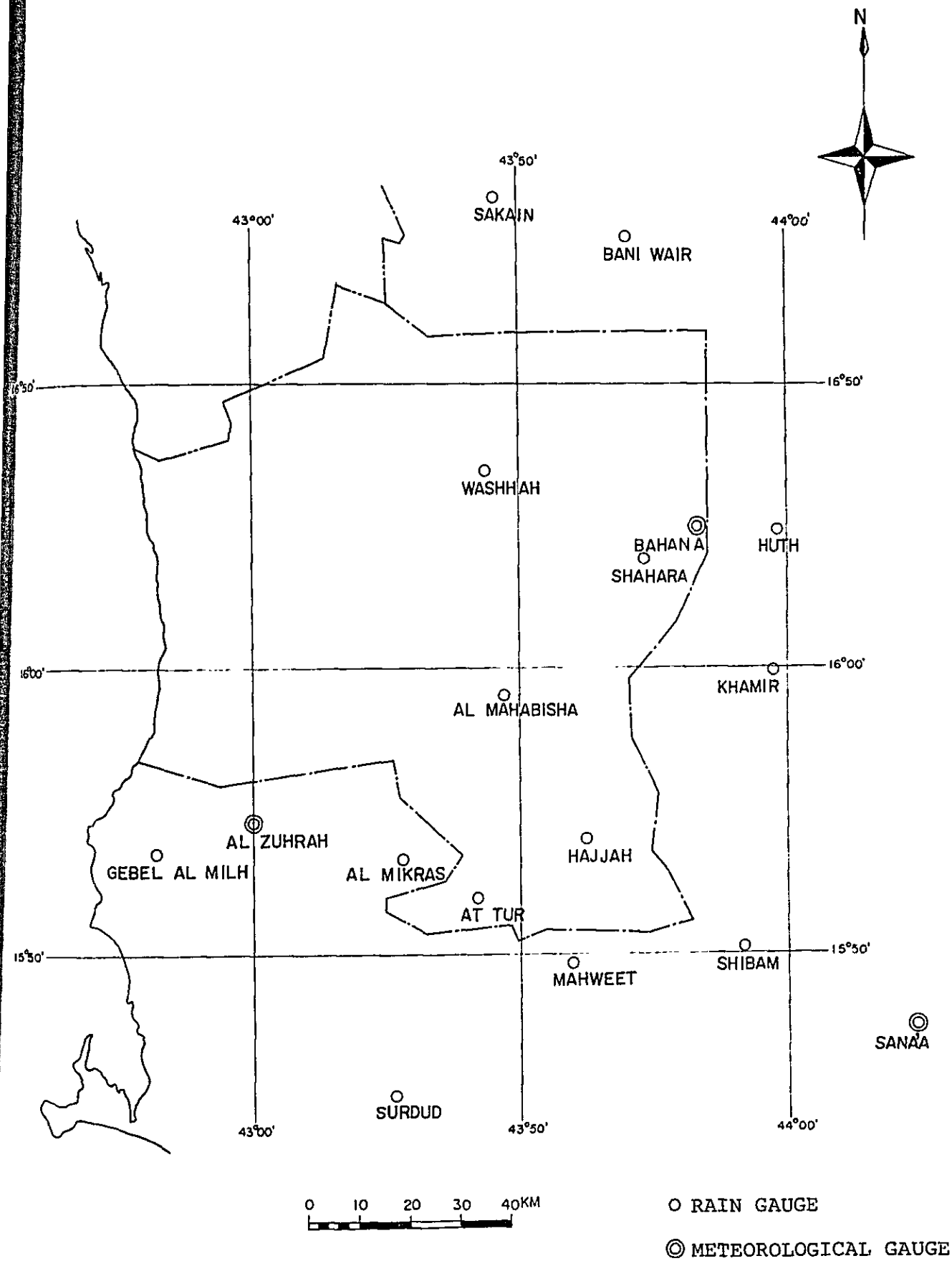


Fig. 4.9 Location of Gauge Station

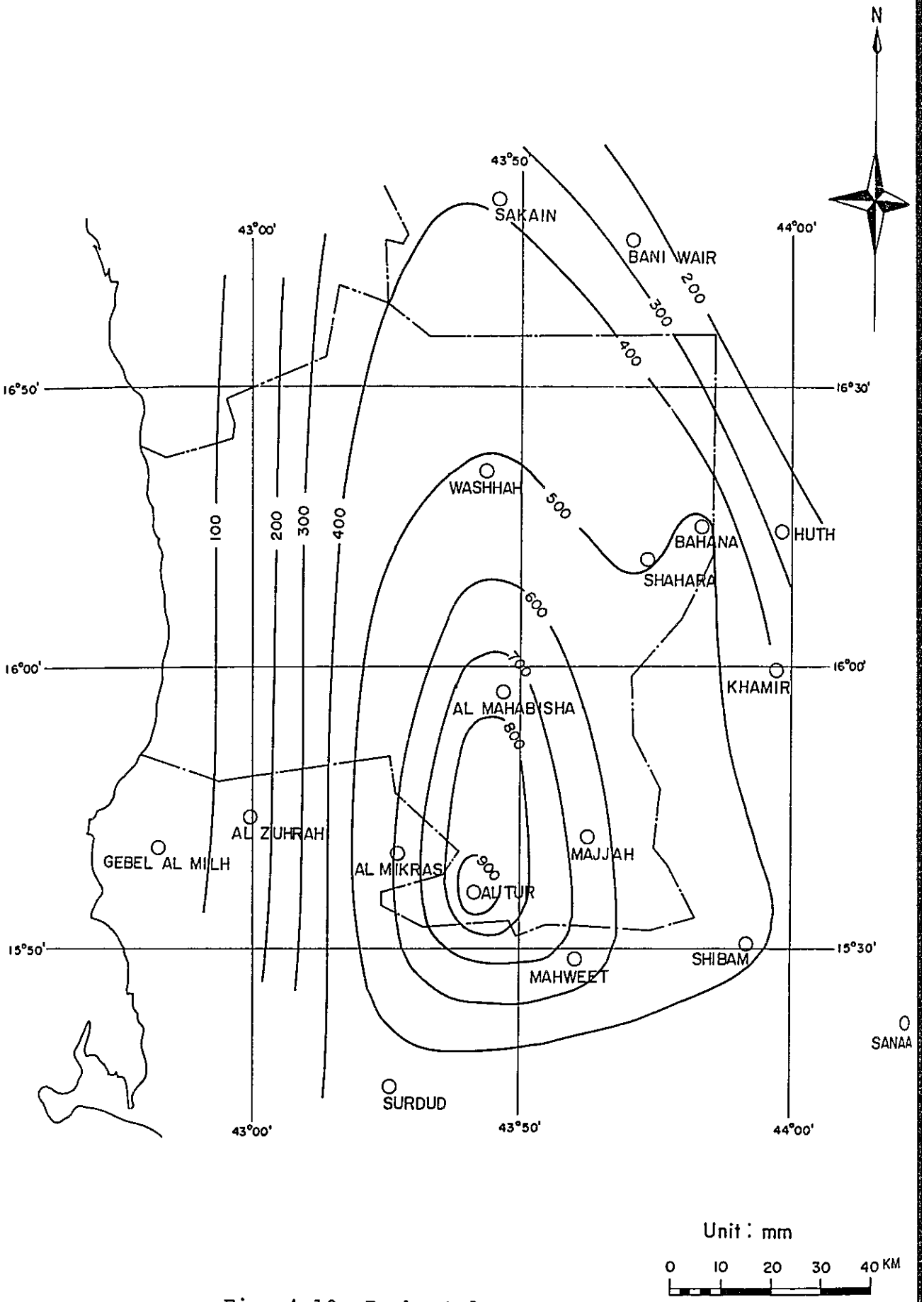


Fig. 4.10 Isohyetal Map

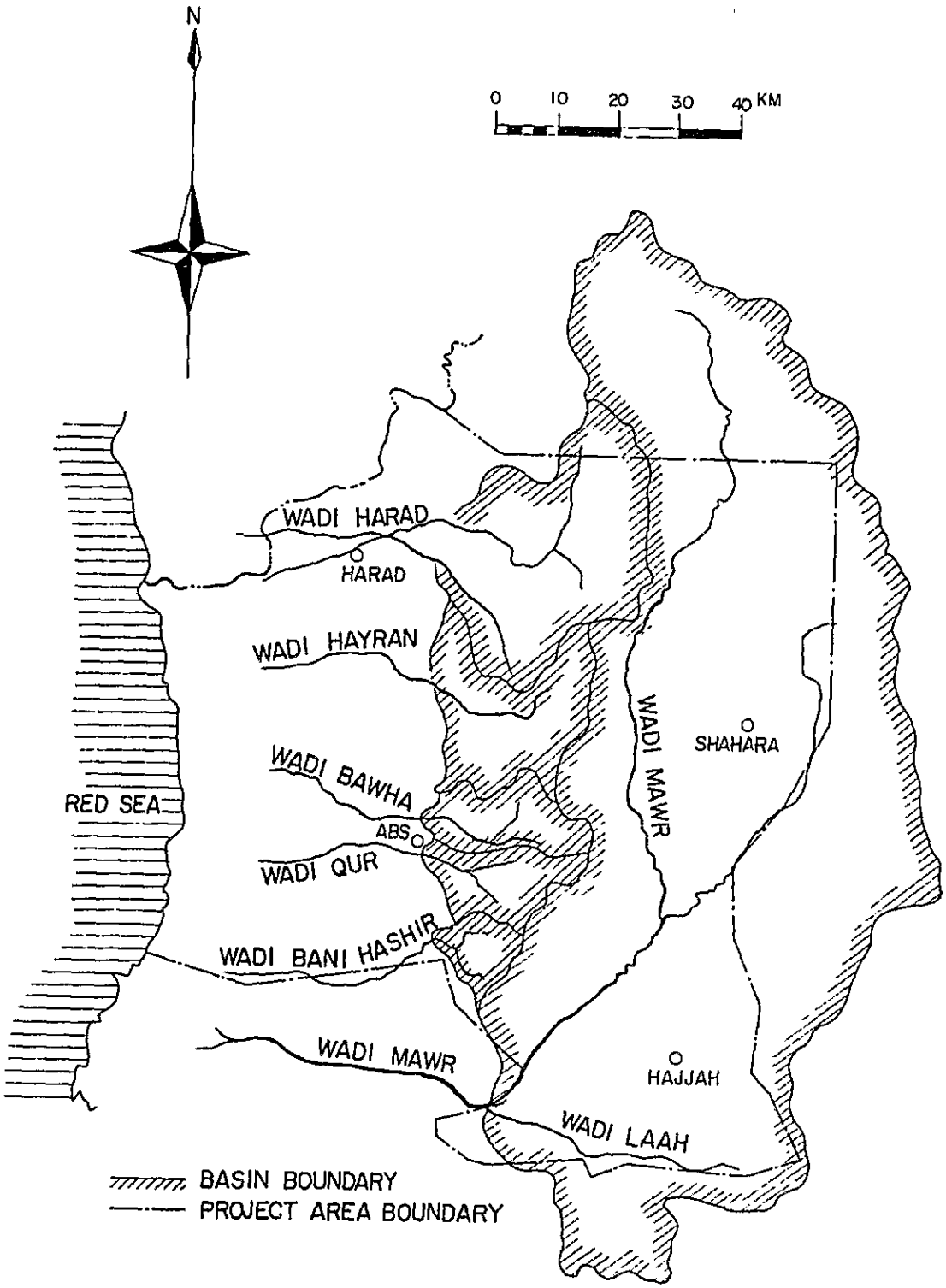


Fig. 4.11 River System and River Basin

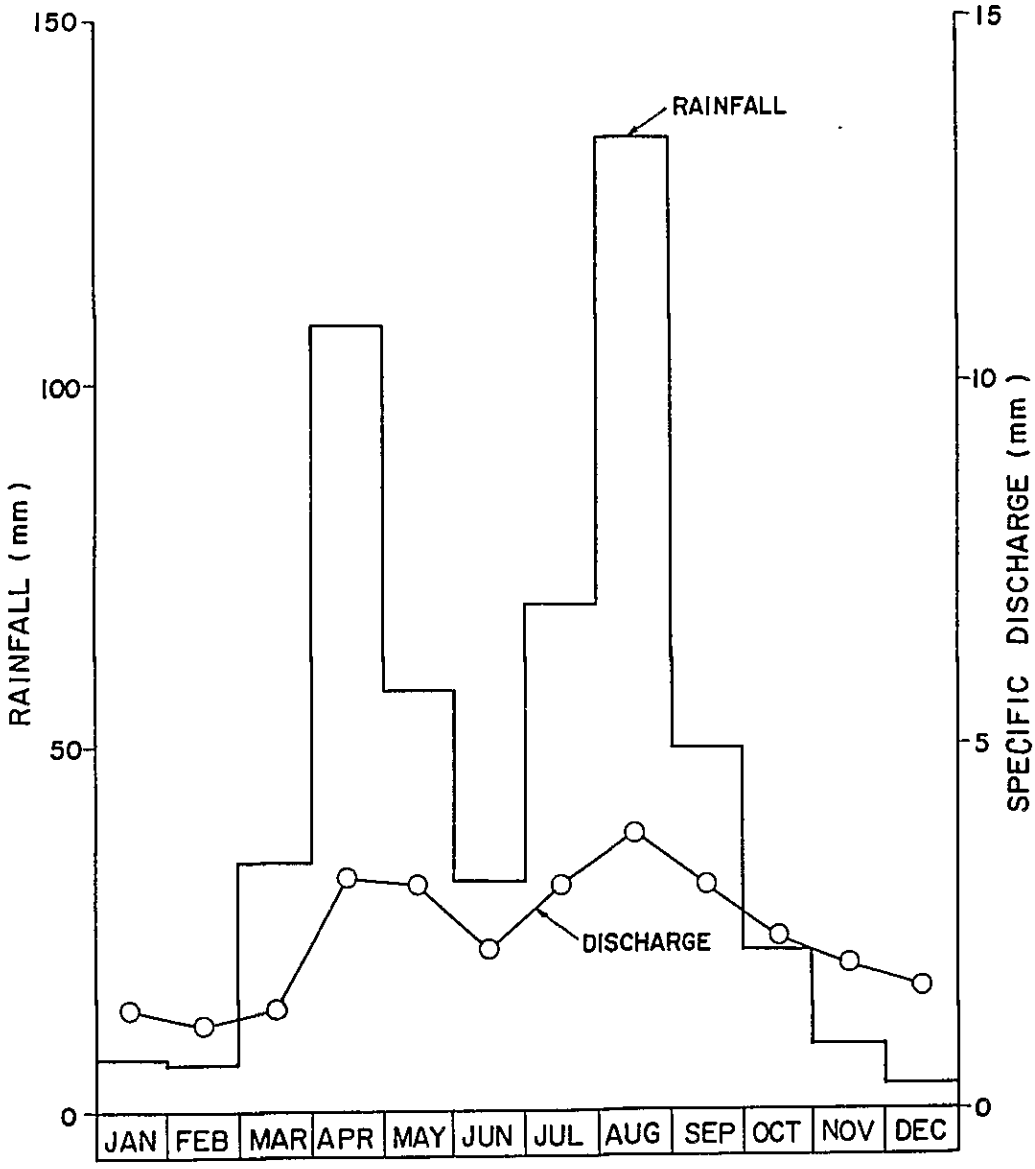
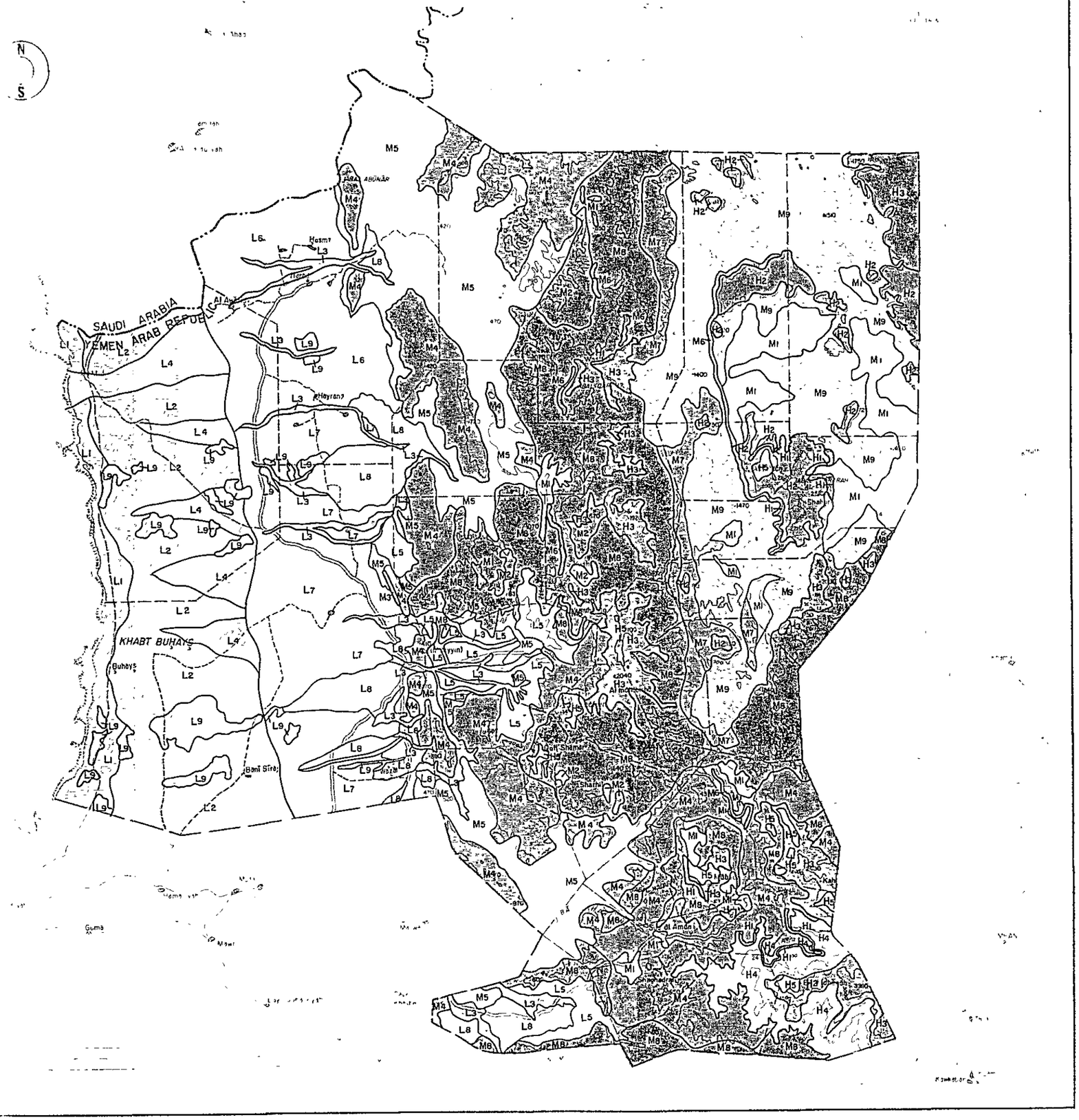


Fig. 4.12 Average Rainfall and Specific Discharge



LEGEND

Soil Units

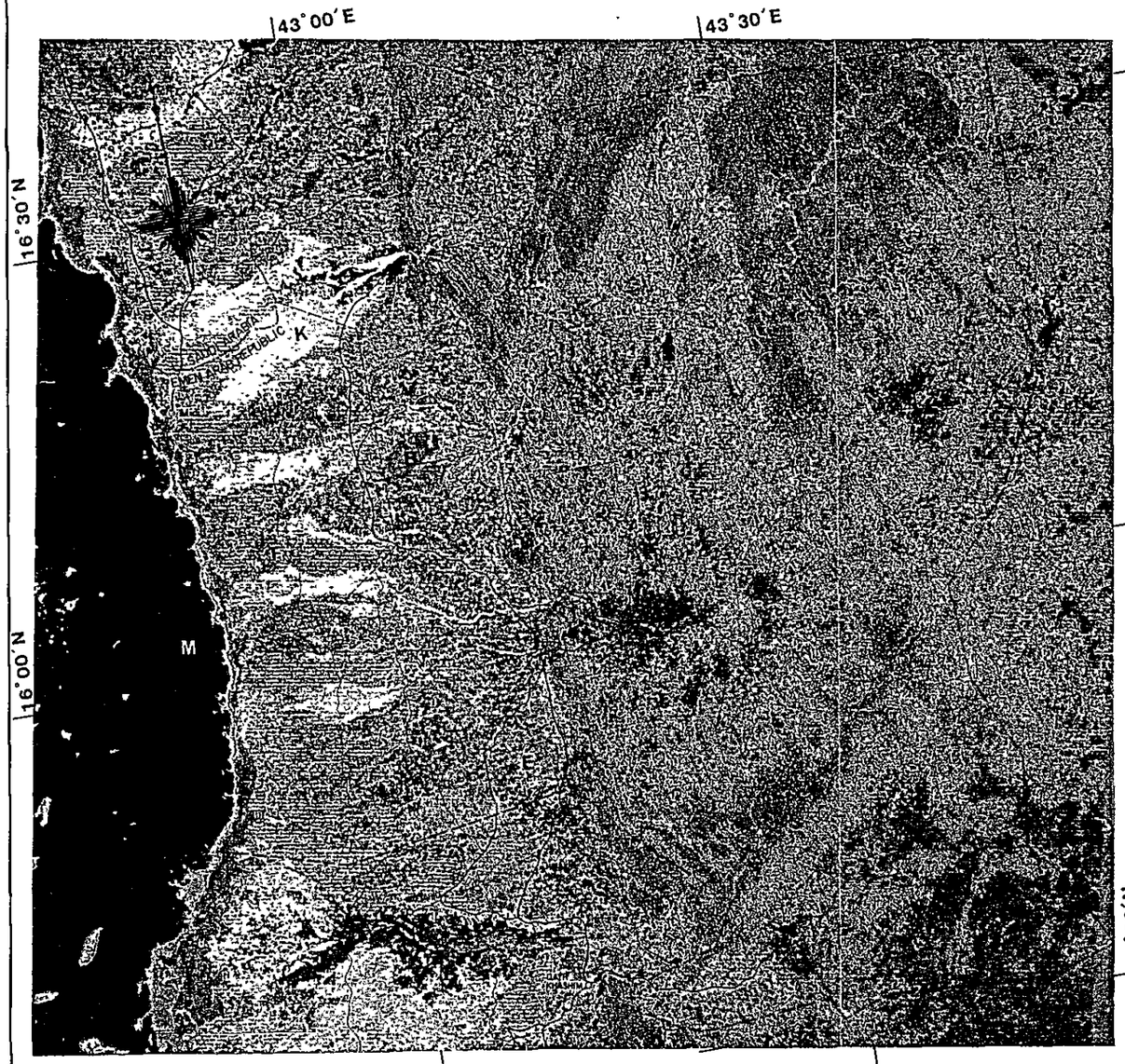
Physiography/Terrain Units	Dominant >50%	Associated Inclusions 20~50%	<20%	Land Suitability	Area (10^3ha)
L LOWLAND					469
L1 Salty flats	Zg-2/3a	–	Zt-2/3a	6	32
L2 Low dunes and sand sheets	Re-1a	Je-2a	Yh-2a	4	116
L3 Recent wadi alluvium	Je-1/2a	Jc-1/2a	–	2	25
L4 Alluvial plain(old wadi alluvium)	Yh-1a	Jc-1/2a(g)	Re-1a(g)	3	37
L5 Alluvial fan(piedmont),gravelly surface	Yh-2a(g)	Yk-2a(g)	Je-2a(g)	4	32
L6 Northern alluvial fan medium textured	Jc-2a	Re-2a	Yh-2a	1	70
L7 Southern alluvial fan, coarse textured	Jc-1a	Rc-1a(g)	–	3	100
L8 Fluvial terrace (old wadi terrace)	Yh-2a	Je-2a	–	1	37
L9 Isolated hills	I	–	Yh-2bc(ℓ)	6	20
M MIDLAND					409
M1 Piedmont, gravelly surface	Yh-2a(g)	Yk-2a(g)	–	4	25
M2 Colluvial slopes and talus	Je-1b(s)	Jc-1b(s)	Re-1/2b	4	7
M3 Lower midland escarpment	I	Yh-2bc(ℓ)	Yk-2ab(ℓ)	6	0
M4 Dissected upland, coarse textured	Je-1a(g)	I	Xh-1b(s)	4	89
M5 Dissected upland, medium textured	Xh-2ab	Je-1ab(g)	Xh-2b(g)	3	71
M6 Higher midland escarpment	I	Yk-2bc(ℓ)	Yk-2ab(ℓ)	6	3
M7 Dissected plateau on Old Yemen Volcanics, gravelly surface	Re-1a(g)	–	I	4	10
M8 Dissected plateau on inclined limestone and green shale, stony surface	Re-1bc(ℓ)	I	–	6	117
M9 Rock floor on Old Yemen Volcanics	I	–	Je-1b(ℓ)	6	87
H HIGHLAND					81
H1 Highland escarpment	I	Je-1c(g)	–	6	3
H2 Dissected mountain on Yemen Volcanics	Yk-1bc(ℓ)	Yh-1bc(ℓ)	I	6	20
H3 Highland plateau on limestone and green shale	Xh-2ab	Je-2a	–	2	36
H4 Dissected mountain on granite and gneiss	Yk-1ab(g)	I	–	4	17
H5 Small inter-mountain plain	Yh-2a	Yk-2ab	Re-2ab	1	5
					959

Fig.4.13 Physiography and Soils

LEGEND

		Area (10^3 ha)
1	CLASS 1 (ARABLE)	112
2	CLASS 2 (ARABLE)	61
3	CLASS 3 (ARABLE)	208
4	CLASS 4 (LIMITED ARABLE)	296
6	CLASS 6 (NON ARABLE)	282
		959

Fig.4.14 Land Classification



LEGEND	
Red	Cropland, Intensive cultivation, Dense vegetation cover
Orange	Cropland, Medium to low density vegetation cover
Magenta	Cropland, Dense vegetation cover
Purple red	Cropland, Medium density vegetation cover
Yellow	Cropland, Low density vegetation cover, Rangeland in Midland and Highland
Green yellow	Rangeland, Dwarf shrub grassland, Partially cropland for opportunistic planting
Green	Rangeland, Dense shrub and trees
Green blue	Rangeland, Dwarf shrub and grassland on Yemen Volcanics
Purple blue	Rangeland, Shrub and grassland on Limestone and Greenshale
Cyan	Rangeland, Shrub and grassland on Granite and Gneiss
K White	Wadi bed or flood plain, Partially cropland for opportunistic planting
Blue green	Salt affected land or wet sand, Rangeland on Granite and Gneiss (Midland)
M Blue	Water
N Grey	Beach sand or coral reef

Land Cover- October 1972

Fig.4.15 Land Cover Map (October 13, 1972)

LEGEND

Category of Land Use	Land Use Subdivision	
Irrigated Crop Land	A_1	Intensively cultivated under irrigation / Pumping and diverted stream flow / Sorghum, vegetables and tropical fruits
	A_2	Intensively cultivated under irrigation / Diverted stream flow/ Mainly sorghum
Rainfed Cropland/ Annual Cultivation	B_1	Densely cultivated / Irregular spate irrigation / Mainly sorghum
	B_2	Densely cultivated / Sorghum and millet
	B_3	Wadi lands / Vegetables and sub-tropical fruits
	B_4	Gently sloping lands receiving hill slope runoff / Sorghum and maize
Rainfed Cropland/ Opportunistic Cultivation	C	Mainly millet and sorghum
Rainfed Cropland/ Terraced	D_1	Densely cultivated/ Sorghum, wheat, barley, and qut
	D_2	Sparsely cultivated/ Sorghum, millet, wheat and barley
Rainfed Cropland/ Rangeland	E_3	Opportunistic planting otherwise dwarf shrub grassland/ Mainly millet
Rangeland	F_1	Dwarf grassland
	F_2	Trees and shrub
	F_3	Open shrub and grassland on rocky slopes
	F_4	Grassland and scattered shrub
Unused	G_1	Sand dunesand isolated hills
	G_2	Salt affected land
	G_3	Wadi bed

Fig.4.16 Present Land Use

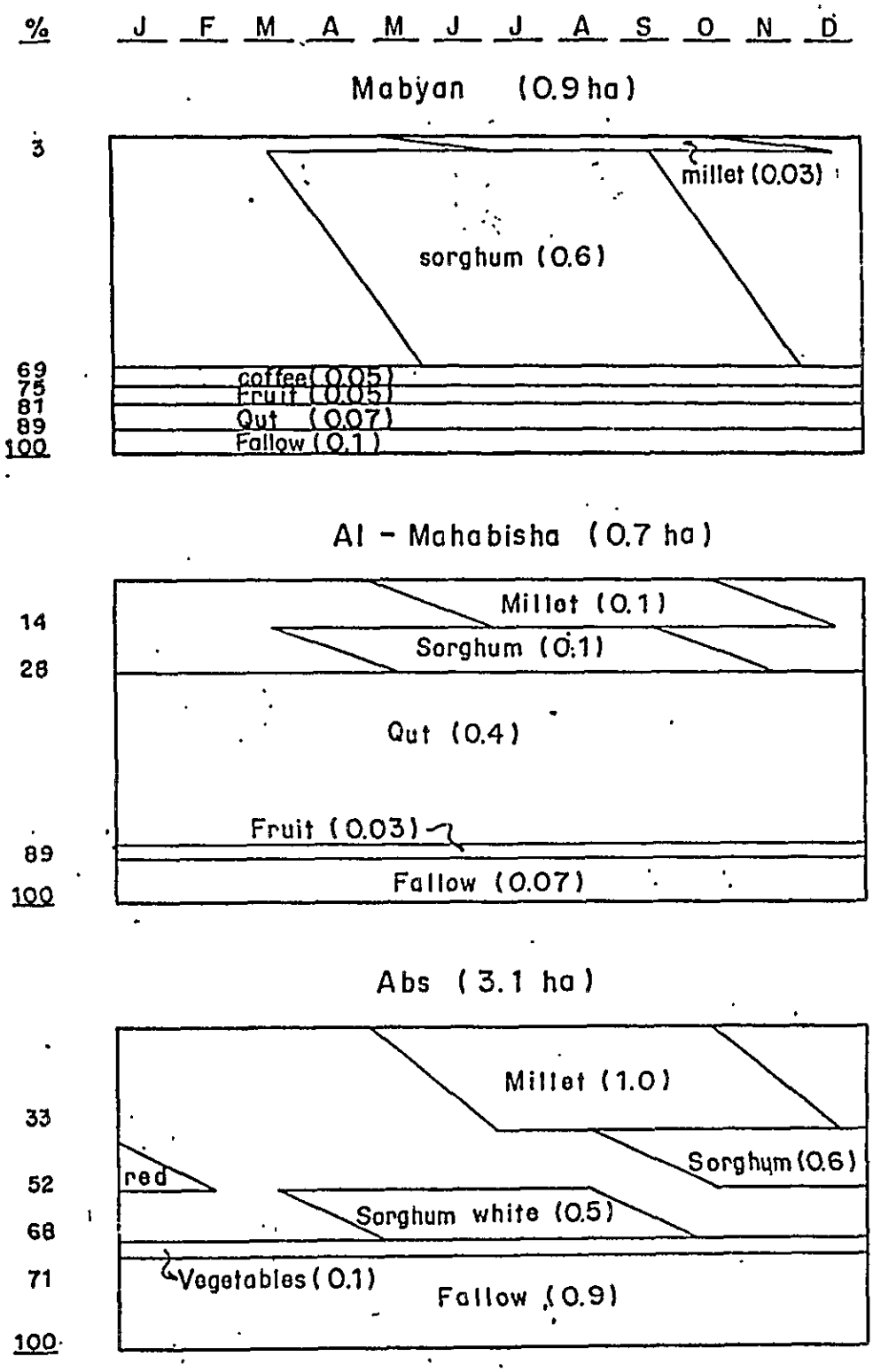
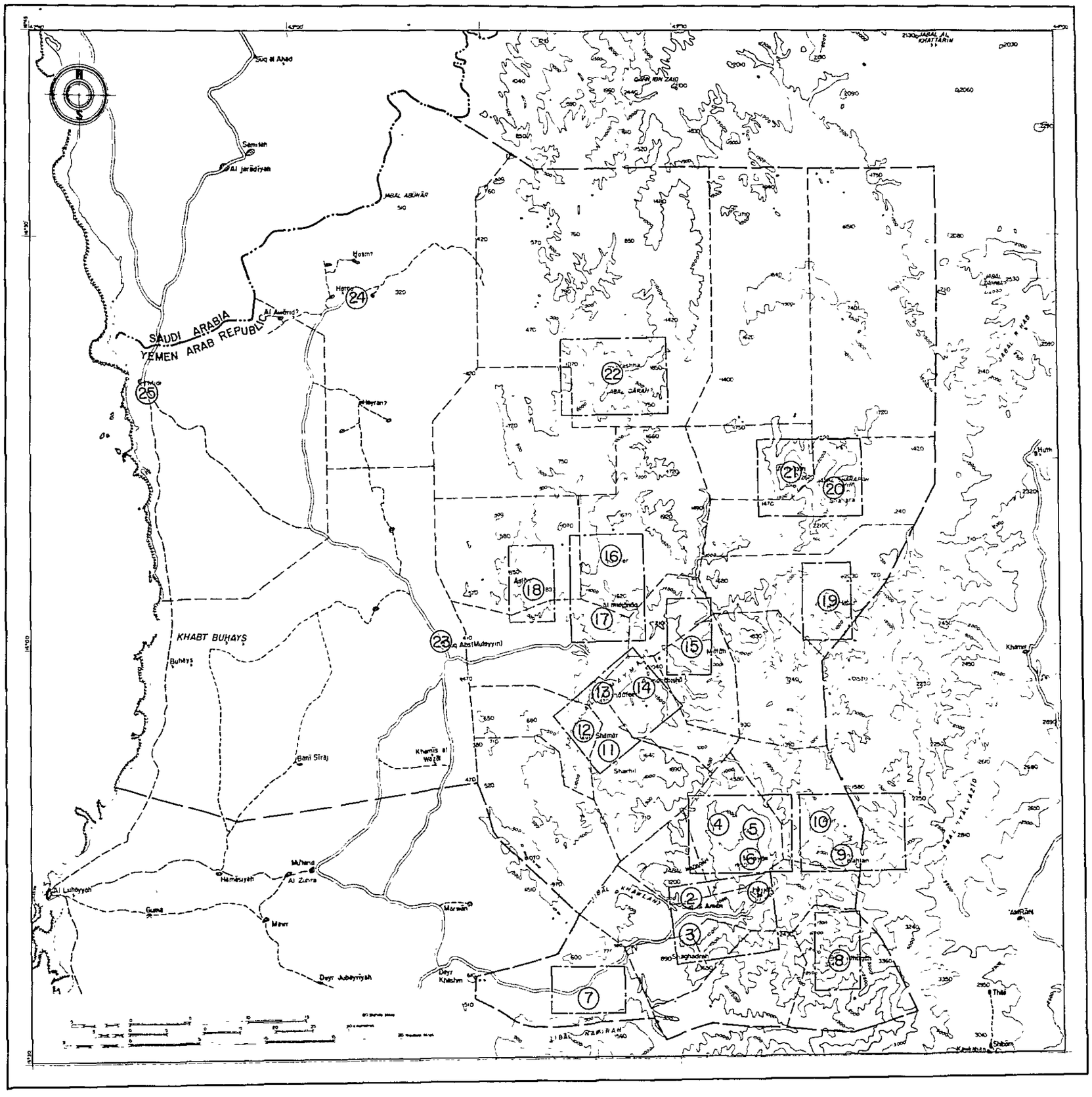


Fig. 4.17 Present Cropping Pattern



List of Water Supply Schemes

Name of Town or Village	Planned Service Population (Persons)
1 Hajjah	15,000
2 Suq Al Aman	1,800
3 Ash Shafadirah	9,500
4 North Mabyan	5,400
5 Jabal Al Dafir	4,800
6 Mabyan	5,100
7 Bani Kais	5,200
8 Bayt Idhaqah	5,200
9 Kuhlan	5,900
10 Affar	3,700
11 Sharhil	4,000
12 Qufl Shamal	2,300
13 Al Shaafeen	3,100
14 Al Mahabisha	15,000
15 Miftah	2,000
16 Kusher	3,400
17 Al Muhanaq	4,000
18 Aslam	1,600
19 Habour	2,100
20 Shahara	2,000
21 Al Madan	6,700
22 Washha	12,500
23 Abs	5,300
24 Harad	2,300
25 Midi	3,800

Boundary of Maps Scaled 1/50,000

Fig. 6.1 Location of Water Supply Scheme

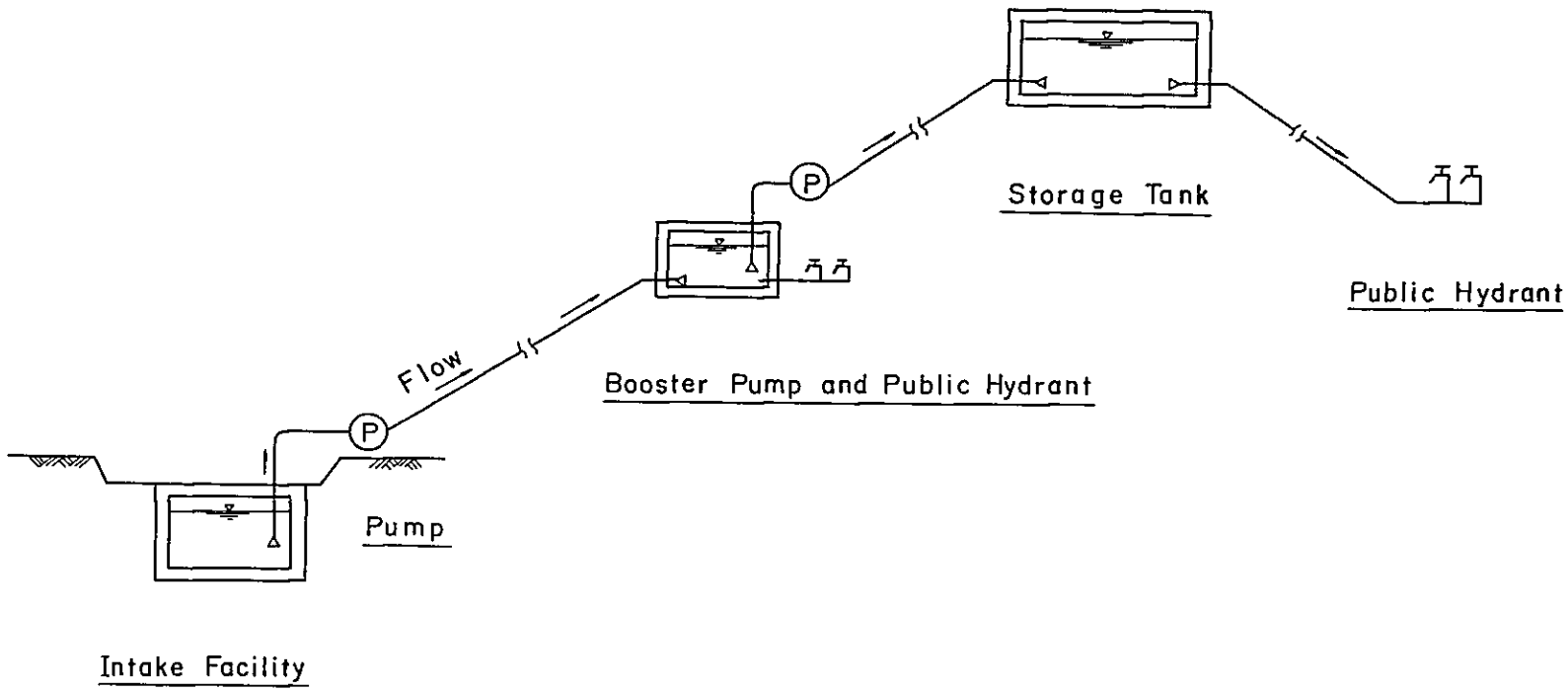


Fig. 6.2 Typical Profile of Water Supply System

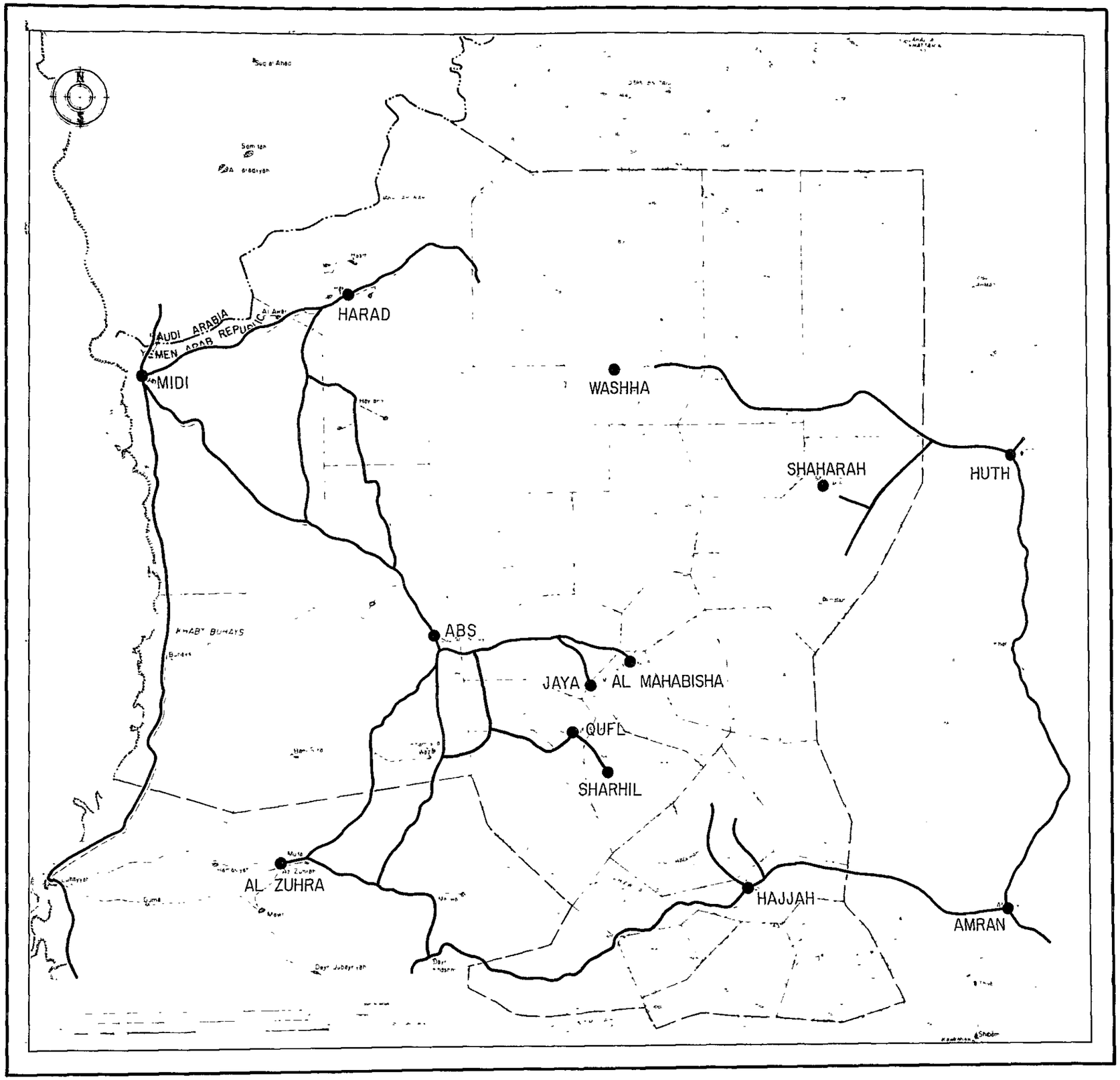


Fig. 6.3 Existing Road Network in Hajjah Province

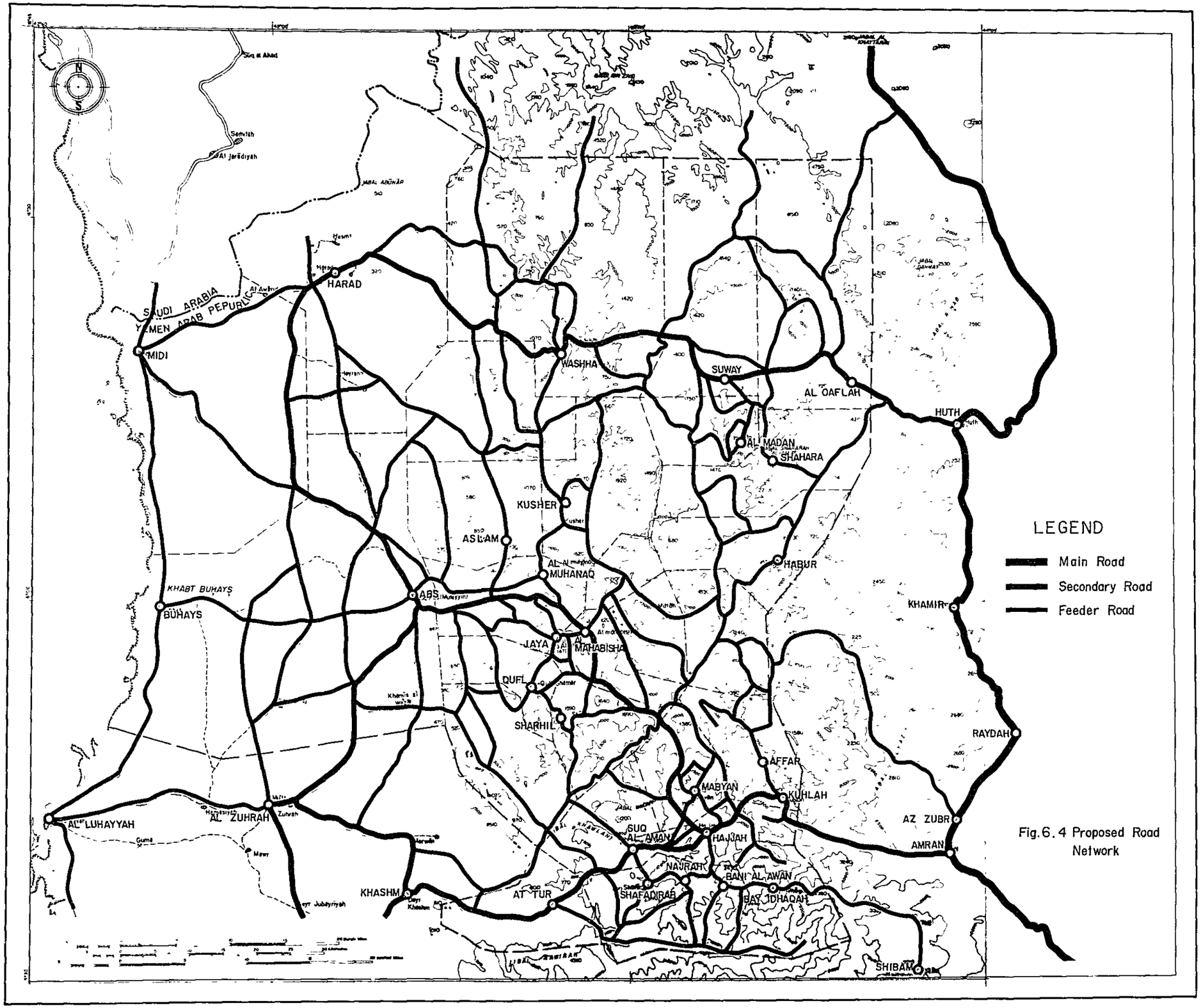


Fig.6.4 Proposed Road Network