The detailed design is carried out by the consultant to establish the detailed plan for the facilities and equipment, based upon the field survey in the sites involved in the Project. During the field survey, special attention is paid to clarify the situation of land to be used for the construction work, particularly concering the courses of pipelines, with the cooperation and coordination of the RWSD and the LCCDs so that no questions would be raised among villagers during the actual work. The results of the detailed design are reflected in the subsequent preparation of tender documents, and the schedule of the tender is decided with the consent of concerned offices and agencies of the government of Japan. The consultant administers and contols the process of tendering for and on behalf of the executing agency, evaluates its results and assists the executing agency in concluding the contract with an elligible Japanese firm.

As a first step during the construction stage, the consultant's staff carries out the transfer of the Project sites to the construction firm, and as the work proceeds, they engage in supervising it with the cooperation and coordination of the concerned offices and agencies as well as the executing agency on the Yemeni side. When the construction of the facilities is completed, they conduct the inspection and direct technological transfer on the operation and maintenance. Upon completion and delivery of facilities, the final completion report is prepared by the consultant.

5.5.3 Procurement Plan

(1) Local Procurement

In Yemen the supply of oil products is stable thanks to the currently vigorous development in this sector. In addition, cement, its main industrial product other than oil, has steadily been supplied, and can be obtained without difficulty. As a result of the survey of the local market, the following materials are recommended to be procured in this country for the execution of the Project.

1) Cement

Cement is produced by the Basil Plant with its annual capacity of 250 thousand tons completed with the Soviet assistance and the Amran Plant with a 500 thousand ton capacity constructed by a Japanese firm, which maintain the stable supply in the market.

2) Concrete Block

Concrete blocks as building material are being supplied in abundance by small house industries across the country.

3) Aggregate and Water

Aggregate in general is of degraded quality, with coase aggregate made of crushed basaltic rock and fine one containing much silt. However, a steady supply, relatively good in quality, is found in the suburbs of the capital, and procurement mainly in this area is planned for the Project. The water used for the work can be obtained in and around the sites.

4) Fuel

Although prices have been raised, the production and supply of petroleum and diesel oil have been stable, and are expected to hardly raise problems for the operation of construction vehicles and equipment.

5) Vertical Shaft Pumps

The great majority of deep well pumps in this country are shared by diesel engine driven vertical shaft pumps, imported from European countries such as Italy, Denmark, Cyprus, etc. Since the procurement of their spare parts are much easier and local conditions for maintenance are better than with submersible motor pumps, this type of pumps are planned to be purchased locally for use in the facilities where high-lifting capacities are not required. Diesel engines for the pumps are to be procured, based upon the recommendation of the pump

manufacturer.

(2) Procurement in Japan

Most of equipment and materials for the construction of water supply facilities are imported ones in Yemen, and their procurement has long been in difficult conditions due to severe import restrictions by the government, deriving from shortages of foreign reserves. To make the matter worse, progressive inflation since the outbreak of the Gulf war has sent market prices of all imported products skyrocketing. Under the present circumtances, therefore, main equipment and materials are planned to be procured in Japan, since they are stable both in quality and prices. These products are listed as follows:

1) Materials for water well construction
   Well casing and well screen

2) Pumps
   Submersible motor pumps for deep wells and multi-stage volute pumps for booster pumps (Vertical shaft pumps shall be locally purchased, as described in the foregoing section.)

3) Power drive units
   Diesel engine driven generator (Diesel engines for vertical shaft pumps shall be procured with pumps as an assembly as recommended by pump manufacturers.)

4) Steel panel tanks

5) Plumbing materials
   Steel pipe, fittings and valves

(3) Construction Equipment and Vehicles

The Project sites are dispersed countrywide, with the construction work planned to proceed simultaneously in two separate sites. Under such a situation, the headquarters for construction work is planned to be stationed in capital of Sana'a where the main office of the RWSD is located for the purpose of developing the most effective and efficient controlling of the work. For the

headquarters' management and control of the quality and progress of work, cargo trucks for transportation of equipment/materials and 4-wheel drive vehicles, etc. are required as well as for the execution of work developed in vast areas of the sites. In addition, one unit of crane truck is necessary for handling heavy equipment/materials. Local acquisition of such construction equipment/vehicles is not easy either through procurement or through lease. In this view, they are proposed to be procured in Japan.

(4) Temporary Facilities

For temporary facilities such as offices and lodgings quarters, etc., both in Sana'a and in the sites, a similar difficult situation is prevalent. These facilities are planned to be procured in Japan as well.

5.5.4 Implementation Schedule

The implementation schedule of the Project with grant aid from the government of Japan is to proceed in accordance with the procedure as described hereunder.

1) Exchange of Notes between the governments of Japan and the Republic of Yemen
2) Consulting contract
3) Detailed design and preparation of tender documents
4) Tendering and conclusion of the contract
5) Procurement of equipment and materials
6) Shipping of procured equipment and materials and their customs clearance
7) Field construction work
8) Delivery of completed facilities

The pre-construction stage in this procedure from the Exchange of Notes to the conclusion of the contract takes about four (4) months, and the subsequent process for the procurement, about five (5) months until equipment/materials are delivered for the site construction.

The contractor's field construction as the final stage consists of diverse types of works including drilling, civil and mechanical works, and the periods necessary for construction in the respective five (5) sites, selected on the basis of priority as well as their cost-effectiveness for investment, are estimated to range from 10 to 12 months after the conclusion of the contract, requiring a full construction team covering such diverse works. Taking this situation into account, it is judged to be necessary to divide the entire construction work into phases. The most pertinent division is planned to be three (3) phases, based upon priority and contents of the work, with the arrangement of the five sites in the three phases proposed as follows:

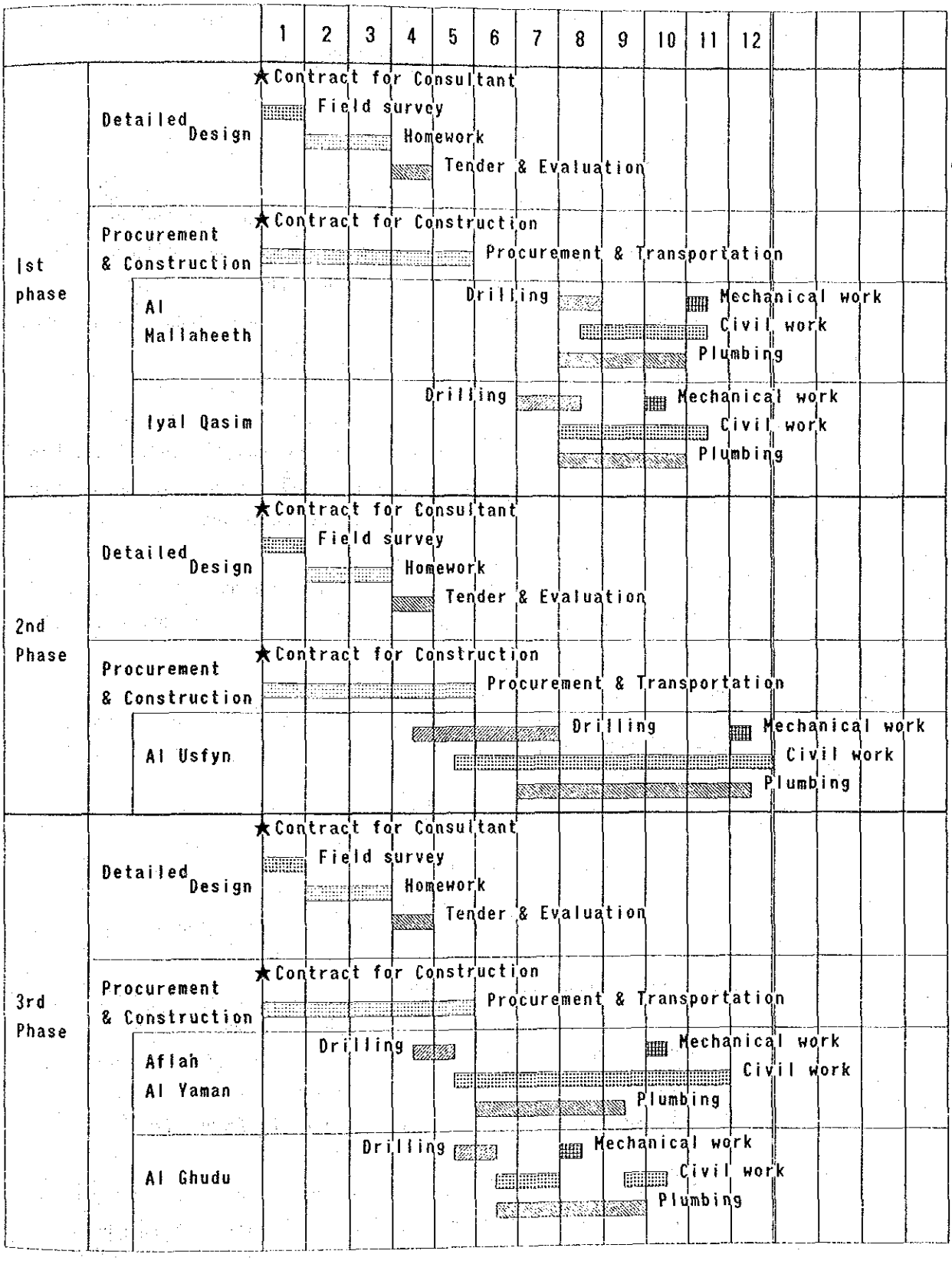
Phase I Al Mallaheeth (Sa'dah) and Iyal Qasim (Sana'a)

Phase II Al Usfyn (Taizz)

Phase III Aflah Al Yaman (Hajjah) and Al Ghudu (Marib)

The detailed implementation schedule in each phase thus divided is shown in Fig. 5.10.

Table 5.10 IMPLEMENTATION SCHEDULE



5.5.5 Scope of Responsibilities

The responsibilities of both the Yemen and the Japanese sides for the implementation of the Project are summarized as follows:

(1) Responsibilities of the Yemen Side

1) To acquire, clean and grade the land necessary for the construction of the water supply facilities including water wells, pump stations, water tanks, pipelines with service facilities and others as well as for the contractor's temporary facilities such as site offices, lodgings, yards, etc., in the respective sites.

2) To provide and maintain access roads to the locations of facilities to be constructed within the sites and to improve and repair roads within the premises of the sites where such measures are required for the construction work.

3) To install distribution lines using piping materials supplied under the Project in the four (4) sites out of five (5) included in the Project.

4) To construct other facilities than those included in this basic design study, the installation of which might be decided on the Yemeni side.

(2) Responsibilities of the Japanese Side

1) To construct the water supply systems consisting of:

a. water source (s),
b. intake facilities such as deep well pump stations,
c. transmission facilities such as booster pump stations,
d. distribution facilities such as water reservoirs,
e. and service facilities such as public fountains,

as planned in the basic design study for the Project in the five (5) sites located in Yemen as designated hereunder:

a. Al Mallaheeth (Sa'dah governorate),
b. Iyal Qasim (Sana'a governorate)
c. Al Usfyn (Taizz governorate)
d. Aflah Al Yaman (Hajjah governorate)
e. Al Ghudu (Marib governorate)

2) To bear the cost of all equipment and materials, temporary facilities, construction equipment and vehicles and others necessary for accomplishing the work other than those to be borne by the Yemeni side.

3) To provide vehicles for operation and maintenance, including two (2) units of water tankers to be used for Al Usfyn for serving water to the mountainous villages.

4) To supply piping materials for the extension of distribution lines from the ends of those planned to be installed by the Japanese side to villages in the four (4) Projects sites other than Al Usfyn.

5) To provide the consulting service to supervise the constructionwork of the Project.

CHAPTER VI

PROJECT EVALUATION AND CONCLUSION

CHAPTER VI PROJECT EVALUATION AND CONCLUSION

6.1 PROJECT EVALUATION

This Project is aimed at construction water supply facilities at five (5) sites ranking higher in the priority list of the Yemen government involving the present population of 39,500 for the planned served population of 57,600 in total. It has an effect to contribute to one of the government's top-priority policies to promote the rural water supplies through the activities of the RWSD of the MEW.

In the Project sites, painstaking labor by women and children for daily water fetching through long, rugged mountainous paths has been continuing from ancient times. The construction of facilities near dwelling areas of inhabitants can save much of such hard work and help to switch saved labor to other productive activities. As one of the largest effects resulting from the implementation of the Project, the improvement of sanitation and health in environment of sites will stabilizeand upgrade the rural life. In addition, the commencement of management and operation of facilities by the local communities themselves is expected to contribute to bracing the communal life, enhancing cooperation and coordination among inhabitants. Various effects anticipated from the Project implementation are compared with the present conditions as follows:

Table 6.1 Effects of the Project/Extent of Improvement

Current Situation/ Difficulties	Measures Taken by the Project	Anticipated Effects/ Improvement Range
The 5 Projects sites are typical mountainous villages where no water supply facilities exist. Inhabitants of 39,500 in total depend upon costly water to sell	The Project is planned to construct water supply systems in the respective sites for the planned served population of 57,600, composed of deep well sources in wadi low-	Upon completion, the inhabitants can receive safe and stable water service in premises of their dwelling areas in mountainsides. A rate of consumption is

Current Situation/ Difficulties	Measures Taken by the Project	Anticipated Effects/ Improvement Range
for their drinking and cooking water, but main water sources remain to be un-sanitary cisterns and hand-dug wells likely to run dry in dry seasons, with their consumption limited to less than 20 lit.per capita per day. This water practice has been the main cause of incidence of waterborne infectious diseases, among inhabitants, producing chronic spread of bilharzia.	land, transmission facilities extending from the sources up to mountains, distribution and service facilities in the mountainous dwelling areas. A planned supply rate is 30 lit. per capita per day (40 lit. for Al Mallaheeth and Aflah Al Yaman where demand increases, due to dominant tropical weather), except Al Usfyn where a water source development scheme is planned with appurtenant supply facilities.	increases from 10 - 20 lit./c/d to 30 - 40 lit./c/d. This Project directly meets the BHN of the inhabitants, and improves sanitation and health in the mountainous dwelling areas, keeping the incidence of epidemics in check.
The current prices of water for drinking and cooking range from YR100 - YR200 on the average. Since average monthly incomes per household are YR1,600 to YR3,000, the purchase of water by an ordinary household is limited to 2 or 3 times in a month. Such spending for water amounts to more than 10% in their incomes, causing a heavy burden on inhabitants.	The respective LCCDs are to establish operation and maintenance systems for the completed facilities. which are locally managed through water billing to beneficiaries.	The estimated cost for operation & maintenance composed of operators' salaries and fuel cost, etc., is YR13 at its highest,mostly 1/10 of the current water prices.A share of one household for the O/M cost is estimated to be less than 4% in its income, in compliance with the IRDB/ IDA's recommendations that the share of spending for water in the income of the poorer classes should be less than 5% in developing countries.

6.2 CONCLUSION

As one of the top-priority policies in the National Development Planning, the government of the Republic of Yemen is promoting to expand the coverage of water supply for the rural population making up over 80% of the entire nation for the improvement of the quality of their life as well as the regional development through activities of the concerned offices and agencies supported by bilateral assistance. However, its progress is lagging behind with the present coverage hovering around 50% because of technical difficulty as well as a financial constraint in the construction of facilities in harsh natural conditions.

This Project is aimed at urgently providing safe and stable domestic water to five (5) mountainous sites dispersedly located in five (5) governorates of the country where the shortages of water are acute, by means of constructing water supply facilities composed mainly of deep well sources in wadi lowlands, transmission facilities which pump up water to mountainsides and distribution facilities including reservoirs and part of distribution lines connected with service facilities. This measure is expected to improve environment in these mountainous areas a great deal with direct effects on the promotion of health and sanitation of inhabitants in these sites. Moreover, since they are relying their drinking and cooking water mostly on the costly water to sell in the mountains, the installation of facilities will result in drastically alleviating their current economic burden. Further, it will result in saving of labor in current practice of water fetching from distant sources, which may be turned over to other productive activities in rural areas, invigorating and upgrading rural life.

The implementation of the project is controlled by the Rural Water Supply Department (RWSD) of the Ministry of Electricity and Water (MEW), which is responsible for the planning, surveying and construction of the countrywide rural water supply projects. Upon completion, the facilities are to be transferred to the Local Councils for Cooperation and Development (LCCDs) under the Ministry of Local Administration (MLA), which are in charge of local development enterprises in the respective regions, for their operation and

maintenance to be supported by the RWSD's technical service. This style is the ongoing administration system of rural water facilities throughout the country, and was employed by the communities in the previous projects with assistance from Japan as well, where the respective systems have been run autonomously, collecting water bills from beneficiaries based upon the agreements among inhabitants within the communities. The facilities to be installed under this Project are also anticipated to stimulate the development of autonomous activities of the local communities.

The implementation of the Project not only meets the BHN of inhabitants in the concerned communities but is anticipated to make a contribution to one of the top-priority policies in the National Development Planning. In view of these benefits, the Project is judged to be worthwhile and feasible for the extension of grant aid by the government of Japan.

6.3 RECOMMENDATIONS

The implementation of the Project is expected to produce benefits such as improved sanitary environment, upgrading of living standards and contribution to the regional development. To maintain sustained operation of the respective facilities in an effective manner for the intended purpose, the recommendations are presented as follows:

(1) The government's agencies and local communal bodies concerned should cooperate to review and improve the ongoing system and organization for operation and maintenance for better management of water facilities. It is recommended in particular that a measure for the establishment of a responsible organization for repairing facilities on occasions of troubles be promptly taken.

(2) In this Project, a flow meter and a water level measurement equipment are installed in each of the deep well stations for the effective control and maintenance of the deep well sources. The agencies responsible for operation and maintenance are advised to

direct its operators to establish a practice to measure and keep daily records of yields and drawdowns of the wells so that the data could provide basic information to be used for the future planning for the extension of facilities as well as the operation program.

(3) The continuous efforts of the responsible authorities are encouraged for promoting the education of the rural population on the meaning of a stable supply of safe water and for inspiring them towards understanding the significance of conserving sanitary environment through effective use of water.

(4) The RWSD is required to make arrangements for the earlier resumption of the training course for the local operators in charge of the facilities to improve and upgrade their capabilities.

(5) One of the trend in the rural water supplies is that a project plan is required to cover an increasingly extensive area for supply, in places involving a regional development of groundwater resources. The RWSD which is responsible for the countrywide rural supply projects is recommended to keep a close tie with the High Water Council, and to formulate an effective and efficient program for the promotion of the projects in consistency with the comprehensive water resources development and conservation plan which may be established soon through the coordination of concerned agencies with the High Water Council.

APPENDIX

I. SITE SURVEY

II. NATURAL / SOCIAL ENVIRONMENT

III. WATER SOURCE

IV. WATER SUPPLY FACILITIES

V. BASIC DESIGN DRAWINGS

APPENDIX I

SITE SURVEY

APPENDIX I - a Minutes of Meeting

MINUTES OF DISCUSSIONS

BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY PROJECT IN THE REPUBLIC OF YEMEN

In response to a request from the Government of the Republic of Yemen, the Government of Japan decided to conduct a Basic Design Study on the Project for Rural Water Supply (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Yemen a study team, which is headed by Mr. Takeshi Sakai, Chief Engineer, Engineer Section, Saitama Prefectural Showa Water Filtration Plant, and is scheduled to stay in the country from April 23 to June 22, 1991.

The team held discussions with the officials concerned of the Government of Yemen and conducted a field survey at the study area.

In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The team will proceed to further works and prepare the Basic Design Study report.

Sana'a, June 18, 1991

Mr. Takeshi Sakai
Team Leader
Basic Design Study Team
JICA

Mr. Abdul Bari Saleh
Director General
Rural Water Supply Dept.
Ministry of Electricity and Water
Republic of Yemen

ATTACHMENT

1. Objective

The objective of the Project is to construct water supply facilities for the people in order to improve and stabilize the social condition of the rural areas of the Republic of Yemen.

2. Project Sites

The Project sites are listed as follows, with their construction priorities affixed in the order of the listing:

Priority	Site No.	Name of Site
1	(14)	Al Mallaheeth
2	(1)	Iyal Qasim
3	(3)	Khamis Bany Hajaj
4	(6)	Al Usfyn
5	(5)	Al Husha
6	(11)	Aflah Al Yaman
7	(9)	Al Ghudu
8	(12)	Bait Al Sultan
9	(4)	Bani Afif
10	(7)	Al Jaboob
11	(2)	Mahalat Nagar

3. Executing Agency

The Ministry of Electricity and Water is responsible for the land acquisition, water rights, implementation, operation and maintenance of the Project.

4. Items Requested by the Government of Yemen

After discussions with the Basic Design Study Team, the following items were finally requested by the Yemen side.

1) Construction of water facilities in the aforementioned Project sites.

T. S.

2) Procurement of materials and equipment for construction of water facilities in the above Project.

3) Procurement of services for the implementation of the Project.

However, the final components of the Project will be decided after further studies.

5. Japan's Grant Aid System

(1) The Government of Yemen has understood the system of Japanese Grant Aid explained by the team.

(2) The Government of Yemen will take necessary measures, described in Annex I for the smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

6. Schedule of the Study

(1) Based on the Minutes of Discussions and technical examination of the study results, JICA will prepare the draft report in English and dispatch a mission in order to explain its contents around September 1991.

(2) In case the contents of the report is accepted in principle by the Yemen side, JICA will complete the final report and send it to the government of Yemen by December 1991.

* * * * *

T. S.

ANNEX I

UNDERTAKINGS BY THE GOVERNMENT OF YEMEN

1. To provide data and information necessary for the Project

2. To provide, secure, clear and level land and access at each construction site prior to the commencement of construction of water facilities.

3. To ensure speedy unloading, tax exemption, customs clearance at the port of disembarkation and prompt inland transportation, of products purchased for the Project in accordance with the agreement to be concluded between the Government of the Republic of Yemen and the Government of Japan.

4. To make necessary arrangements for the entry into and stay in the Republic of Yemen, of Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contracts for the Project.

5. To exempt Japanese nationals involved in the Project from customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Yemen with respect to the supply of equipment/machines and services under the verified contracts for the Project in accordance with the agreement to be concluded between the Government of the Republic of Yemen and the Government of Japan.

6. To bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement for the Project.

7. To bear all expenses, other than those to be borne by the Grant Aid necessary for the execution of the Project.

8. To assign exclusive counterpart staff in the Ministry of Electricity and Water for the execution of the Project including siting, drilling, installation of water facilities, etc. prior to the commencement of the Project.

9. To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant Aid for the Project.

* * * * *

T. S.

SUPPLEMENTARY AGREEMENT
FOR BASIC DESIGN STUDY
FOR RURAL WATER SUPPLY PROJECT
IN THE REPUBLIC OF YEMEN

In reference to the minutes of discussions for the Basic Design Study on the Rural Water Supply Project in the Republic of Yemen which was signed by the representatives of the Rural Water Supply Dept., Ministry of Electricity and Water, the Republic of Yemen and JICA Basic Design Study Team on June 18, 1991, both parties have hereby agreed on the scope to be undertaken by the Japanese side concerning the two sub-projects of a large scale as follows:

(1) Site No. 5 Al Husha (Taizz)

Scope of water supply facilities planned to be constructed by the Japanese side under this phase of the Project:

From the new deep wells for water sources in Wadi Tuban to the water tank for the supply system for the city of Doulan (Central area supply system as shown in the drawing submitted on June 16, 1991)

(2) Site No. 6 Al Usfyn (Taizz)

Scope of water supply facilities planned to be constructed by the Japanese side under this phase of the Project:

From the deep wells for water sources in Wadi Attaryan to the water tank near Taizz-Al Rahidah Road, the design of which will be proposed in the Draft Final Report

T. S.

In case any alterations concerning the scope of the works for the above-sites are required by the Yemeni side, such matters shall be requested to the Government of Japan through the official channel.

In witness of the above statement, both parties have signed hereunder on this date of June 18, 1991.

Mr. Takeshi Sakai
Team Leader
Basic Design Study Team
JICA

Mr. Abdul Bari Saleh
Director General
Rural Water Supply Dept.
Ministry of Electricity and
Water, Republic of Yemen

MISUTES OF DISCUSSIONS

BASIC DESIGN STUDY ON THE PROJECT
FOR THE RURAL WATER SUPPLY
IN THE REPUBLIC OF YEMEN
(CONSULTATION ON DRAFT REPORT)

In April 1991, the Japan International Cooperation Agency (JICA) dispatched a basic design study team on the Project for the Rural Water Supply in the Republic of Yemen (hereinafter referred to as "the Project") to the Republic of Yemen, and through discussions, field survey, and technical examination of the results in Japan, has prepared the draft report of the study.

In order to explain and to consult the Republic of Yemen on the components of the draft report, JICA sent to Yemen a study team, which is headed by Mr. Shinichi Mori, Team Leader, the Basic Design Study Team, JICA, and is scheduled to stay in the country from November 3 to November 11, 1991.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Sana'a, November 10, 1991

Mr. Shinichi Mori
Team Leader
Basic Design Study Team
JICA

Mr. Abdul Bari Saleh
Director General
Rural Water Supply Department
Ministry of Electricity and Water,
Republic of Yemen

ATTACHMENT

1. Components of Draft Report

The Government of the Republic of Yemen has agreed and accepted in principle the components of the Draft Report proposed by the team.

2. Japan's Grant Aid System

a. The Government of Yemen has understood the system of Japanese Grant Aid explained by the team.

b. The Government of Yemen will take the necessary measures, described in Annex I, for smooth implementation of the Project on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

3. Further Schedule

The team will make the final report in accordance with the confirmed items, and send it to the Government of Yemen by the end of December 1991.

* * * * * *

ANNEX I

NECESSARY MEASURES TO BE TAKEN BY THE GOVERNMENT OF THE REPUBLIC OF YEMEN

1. To clear and level the land necessary for the facilities prior to the commencement of construction in the sites.

2. To construct the access roads to the locations of facilities prior to the commencement of construction in the sites.

3. To bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.

4. To exempt taxes and to take necessary measures for customs clearance of the materials and equipment brought for the Project at the port of disembarkation under the laws and regulations of the Republic of Yemen.

5. To accord Japanese nationals whose services may be required in connection with the supply of products and the services under the verified contract such facilities as may be necessary for their entry into the Republic of Yemen and stay therein for the performance of their work.

6. To assign exclusive counterpart staff in the Ministry of Electricity and Water for the execution of the Project including siting, drilling, installation of water facilities, etc., prior to the commencement of the Project.

7. To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant.

8. To bear all the expenses other than those to be borne by the Grant, necessary for the construction of facilities as well as for the transportation and the installation of the equipment.

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APPENDIX I - b Itineray of Field Survey

No.	Date	Week	Stay at :	Activity
1	Apr.23	Tue		Leave Tokyo for Frankfurt
2	24	Wed		Leave Frankfurt for Sana'a
3	25	Thu	Sana'a	Courtesy call to Embassy of Japan, MPD and RWSD
4	26	Fri	Sana'a	Preparetion for Site Survey
5	27	Sat	Sana'a	Meeting with RWSD
6	28	Sun	Iyal Qasim	Site Survey in No.1 Iyal Qasim
7	29	Mon	Iyal Qasim	Site Survey in No.1 Iyal Qasim
8	30	Tue	Iyal Qasim	Site Survey in No.1 Iyal Qasim
9	May 1	Wed	Mahalat Najr	Site Survey in No.2 Mahalat Najr
10	2	Thu	Sana'a	Data Collection and Analysis
11	3	Fri	Sana'a	Data Collection and Analysis
12	4	Sat	Khamis Bani Hajaj	Site Survey in No.3 Khamis Bani Hajaj
13	5	Sun	Khamis Bani Hajaj	Site Survey in No.3 Khamis Bani Hajaj
14	6	Mon	Sana'a	Meeting with RWSD
15	7	Tue	Ash Sharaqi	Site Survey in No.10 Ash Sharaqi
16	8	Wed	Ash Sharaqi	Site Survey in No.10 Ash Sharaqi
17	9	Thu	Aflah Al Yaman	Site Survey in No.11 Aflah Al Yaman
18	10	Fri	Aflah Al Yaman	Site Survey in No.11 Aflah Al Yaman
19	11	Sat	Aflah Al Yaman	Site Survey in No.11 Aflah Al Yaman
20	12	Sun	Al Mallaheeth	Site Survey in No.14 Al Mallaheeth
21	13	Mon	Al Thaiah	Site Survey in No.13 Al Thaiah
22	14	Tue	Sana'a	Trip from Hudaydah to Sana'a
23	15	Wed	Sana'a	Data Collection and Analysis
24	16	Thu	Sana'a	Meeting with RWSD
25	17	Fri	Sana'a	Meeting within Team
26	18	Sat	Sana'a	Meeting with MPD and RWSD
27	19	Sun	Marib	Trip from Sana'a to Marib
28	20	Mon	Al Ghudu	Site Survey No.9 Al Ghudu
29	21	Tue	Majzar	Site Survey No.8 Majzar
30	22	Wed	Sana'a	Data collection & Analysis

No.	Date	Week	Stay at :	Activity
31	May 23	Thu	Sana'a	Meeting with RWSD
32	24	Fri	Sana'a	Data Collection and Analysis
33	25	Sat	Sana'a	Meeting with RWSD
34	26	Sun	Al Jabub	Site Survey in No.7 Al Jabub
35	27	Mon	Al Jabub	Site Survey in No.7 Al Jabub
36	28	Tue	Al Husha	Site Survey in No.5 Al Husha
37	29	Wed	Al Husha	Site Survey in No.5 Al Husha
38	30	Thu	Al Husha	Site Survey in No.5 Al Husha
39	31	Fri	Bani Afif	Site Survey in No.4 Bani Afif
40	June 1	Sat	Bani Afif	Site Survey in No.4 Bani Afif
41	2	Sun	Bani Afif	Site Survey in No.4 Bani Afif
42	3	Mon	Sana'a	Data Collection and Analysis
43	4	Tue	Sana'a	Data Collection and Analysis
44	5	Wed	Sana'a	Data Collection and Analysis
45	6	Thu	Sana'a	Courtesy call to Embassy and RWSD
46	7	Fri	Sana'a	Meeting within Team
47	8	Sat	Sana'a	Meeting with RWSD
48	9	Sun	Bait Al Sultan	Site Survey in No.12 Bait Al Sultan
49	10	Mon	Sana'a	Meeting with RWSD
50	11	Tue	Al Usfyn	Site Survey in No.6 Al Usfyn
51	12	Wed	Al Usfyn	Site Survey in No.6 Al Usfyn
52	13	Thu	Al Usfyn	Site survey in No.6 Al Usfyn
53	14	Fri	Al Usfyn	Site Survey in No.6 Al Usfyn
54	15	Sat	Sana'a	Trip from Aden to Sana'a
55	16	Sun	Sana'a	Meeting with RWSD and Embassy of Japan
56	17	Mon	Sana'a	Meeting with RWSD
57	18	Tue	Sana'a	Signing of Minutes of discussions
58	19	Wed	Sana'a	Meeting with RWSD
59	20	Thu	Leave Sana'a	Leave Sana'a for Frankfurt
60	21	Fri	Leave Frankfurt	Leave Frankfurt for Tokyo
61	22	Sat	Arrive Tokyo	Arrive at Tokyo

APPENDIX I - c Member List of The Study Team

BADIC DESIGN STUDY TEAM FOR THE PROJECT FOR THE RURAL WATER SUPPLY IN THE REPUBLIC OF YEMEN		
Assignment	Name	Affiliation
Team Leader	Takeshi SAKAI	Showa Water Plant, Water Works Department, Public Enterprise Bureau, Prefectural Government of Saitama, Japan
Project Coordinator	Eiji INUI	First Basic Design Study Division, Grant Aid Study and Design Department, Japan International Cooperation Agency
Water Supply Planner	Tetsuji NIWANO	Japan Techno Co., Ltd.
Hydrogeologist	Akira SATOH	Japan Techno Co., Ltd.
Water Supply Planner	Masaru NAKAYAMA	Japan Techno Co., Ltd.
Facilities Planner	Yositaka HAMANAKA	Japan Techno Co., Ltd.
Cost Estimation	Shoji TAKAMATSU	Japan Techno Co., Ltd.

DRAFT FINAL MISSION TEAM		
Assignment	Name	Affiliation
Team Leader	Shinichi MORI	Grant Aid Div., Economic Assistance Bureau, Ministry of Foreign Affairs
Water Supply Planner	Tetsuji NIWANO	Japan Techno Co., Ltd.

APPENDIX I - d List of Persons Visited

1. MINISTRY OF PLANNING AND DEVELPOMENT

Vice Minister : Mr. Mutaher Assaiedi
Deputy Minister : Mr. Abdul Wali S. Al Agel
Director of Japan/Australia Div.
Bilateral Department : Mr. Hisham Sharaf Abdalla

2. MINISTRY OF ELECTRICITY AND WATER

Minister : Dr. Abdul-Wahab Mahmood
Vice Minister: Mr. Mohammed Abdul Aleem Alw an

Rural Water Supply Department

General Director: Mr. Abdul Bari Saleh
Deputy Director : Mr. Ibrahim Al Shami
Project Div. : Mr. Mohadi Mohammed Mohadi (Director)

Pubilc Relations Div.: Mr. Mohamad Al Jabry (Director)
Mr. Abdul Latif Salah (Deputy)

Bilateral Div.: Mr. Fawsy Al Khirbash (Director)
Mr. Abdul Momen Mutah (Civil Engineer)
Mr. Hamud Gilan (Coördinator)

Drilling & Hydrogeology Div.:
Mr. Abdullar Abdul Mullick (Director)
Mr. Ahmed Hussein Al Shahary (Deputy)
Mr. Abdul Hakim Al Ramah (Hydrogeologist)

3. CENTRAL BANK OF YEMEN

Manager of Foreign Relation Dept.: Mr. Mahmoud Qaid

Deputy Manager of Foreign Relation Dept.: Mr. Kamal Y. Al Rabei

Research Department/Financial & Monetary Studies Div.:
Mr. Hassan Mohassin

4. REPRESENTATIVES OF LOCAL BODIES

Chairman of the Iyal Surayh LCCD: Mr. Abdullah Ahjmed Rageh

Governor of the Marib Govenorate: Mr. Yahia Al Shami

District Director of the Majzl District: Mr. Abdul Ahmed

5. EMBASSY OF JAPAN

Ambassador Extraordinary and Plenipotentiary:
Mr. Kazuo Wanibuchi
(at the time of the Draft Final Mission)
Mr. Masaki Noguchi
(at the time of the Basic Design Survey)

Charge d'affaire: Mr. Yuichi Ishii

First Secretary: Mr. Yasuo Nakano

APPENDIX II

NATURAL / SOCIAL ENVIRONMENT

APPENDIX II-a Economic Structure (1986-1990)

Macroeconomic indicators	Yemen:the North				Yemen:the South				United Yemen
	1986	1987	1988	1989	1986	1987	1988	1989	1990[A]
GDP at producer' prices $ mn	3,983	4,212	5,907	6,865[A]	1,159	1,246	1,275	1,304[A]	11,231
Real GDP growth %	9.4	4.8	19.2[B]	12.0[A]	-9.0	3.5	0.3	2.0[A]	8.0
GDP par a person	430	441	601	678	522	547	545	539	869
Consumer price inflation % [A]	29.3	21.8	22.0	22.0	1.0	3.0	2.5	5.0	30.0
Exports FOB $ mn [C]	16.1	48.2	447.0	606.0	30.4	70.9	82.2	113.8	800.0
Imports FOB $ mn [C]	796.6	1,189.4	1,309.4	1,282.7	447.9	456.9	596.1	553.9	1,900.0
Current account $ mn	-125.3	-452.2	-694.3	-579.0	-175.7	-129.7	-404.5	-416.6	-1,000.0
Reserves excl gold $ mn	431.7	539.5	285.1	279.2	138.0	97.1	79.9	45.2	-
Total external debt $ mn	2,366	2,636	3,034	3,324	1,733	1,936	2,240	2,505	-
Exchange rate(av) 1$= YR/YD	9.639	10.342	9.772	9.760	0.345	0.345	0.345	0.345	12.020

March 4, 1991 1 $=11.997YR[D], 1 $=0.461YD[E]

A: Estimates, B: World Bank estimate, C: Balance of payments basis,
D: Devalued on February 19, 1990, E: Devalued on May 10, 1990

Origins of gross domestic product (%)	Yemen: the North[A] (1987)	Yemen: the South[B] (1989)	Components of gross domestic product (1988, %)	Yemen :the North
Agriculture, forestry & fisheries	27.9	14.1	Personal consumption	80.2
Mining & quarrying	1.6	9.5	Government consumption	19.6
Manufacturing	11.1			
Electricity & water	1.1		Investment	12.2
Construction	3.3	11.8		
Trade	11.9	9.7	Change in Stocks	-
Hotels & restaurants				
Transport & communications	10.9	11.0	Exports	16.1
Finance, insurance & real estate		1.0		
Gouvernment & other services	24.3	29.6	Imports	-28.6
Indirect taxes less subsidies		13.3		
GDP incl others at producers' prices	100.0	100.0	GDP	100.0

Principal exports (1988) $mn	Yemen :the North[A]	Yemen :the South	Principal imports (cif) (1988) $mn	Yemen: the North[A]	Yemen :the South[D]
Food & beverages & live aminals	56.5	22.6	Food & beverages	460.8	206.7
Mineral fuels & lubricants	397.9		Manufactured goods	371.1	131.2
Raw materials	12.5		Mineral fuels & lubricants	197.3	113.2
Petroleum products		48.4	Machinery & Transport equipments	189.2	137.5
GDP incl others	471.5	82.2	Total incl others	1,384.0	653.2
Main destinations of exports 1989	Yemen :the North[C]	Yemen :the South[E]	Main origins of imports 1989	Yemen :the North[C]	Yemen :the South[E]
West Germany	28.7	21.5	Soudi Arabia	12.5	4.5
USA	25.9		France	5.9	
Italy	12.3	13.4	Australia	5.1	
Japan	9.8	8.6	USA	4.6	
Singapore	5.9		West Germany	4.3	
North Yemen		17.0	Ethiopia		5.7
India		7.2	UK		5.1
			Denmark		4.6
			Singapore		4.5

A: Estimated by AFESD, Arab Countries: Economic Indicators, 1989
B: Provisional, C: IMF, Direction of Trade Statistics.
D: Not including petroleum re-exported after processing.
E: IMF, Direction of Trade Statistics, not including trade with USSR.

Appendix II-b

Allocations of Sectorial Investiments in Five-Year Plans of North Yemen

(%)

	First Three Year Plan 1973/74-75/76 actual	First Five Year Plan (1976/77-80/81)		Second Five Year Plan (1982-86)		Third Five Year Plan (1987-1991)
		planned	actual	planned	actual	planned
Agriculture	14.8	14.3	7.5	15.8	11.6	8.0
Manufacturing	9.8	22.2	24.9	36.5	30.7	38.6
Electricity & water	-	-	7.5	8.3	15.8	6.7
Mining & quarrying	-	-	0.6	3.2	1.6	14.1
Construction	10.4	2.8	7.4	2.3	1.6	0.5
Housing	-	13.1	28.4	13.3	17.1	8.0
Trade	4.4	3.9	-	10.2	4.1	5.1
Transport & communications	31.2	30.8	26.4	16.5	14.8	12.5
Banking & finance	-	0.6	-	0.4	1.1	0.8
Services	29.4	12.3	13.8	17.5	25.7	35.4
Total * investiment	936	16,550	11,558	28,100	19,871	38,582

* YR million
Source: Central Planning Organisation

Appendix II-c Record of Japanese Financial Assistance to Republic of Yemen (1976-1990)

Loan Aid

Unit = 100 million yen

YEAR	YEMEN ARAB REPUBLIC		PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN	
	DESCRIPTION	AMOUNT	DESCRIPTION	AMOUNT
1977	Rural Water Supply Project	38.80	—	—
1978	—	—	—	—
1979	Las Katib Thermoelectric Power Plant	82.00	—	—
1980	—	—	—	—
1981	—	—	—	—
1982	Construction Project for the 7th berth of Hodeidah Port	82.00	—	—
1983	—	—	—	—
1984	—	—	—	—
1985	—	—	—	—
1986	—	—	—	—
1987	—	—	—	—
1988	Construction Project for the Mafraq Cement Factory	220.70	—	—
1989	—	—	Aden City Telecommunication Network Expansion Project	69.69

Grant Aid

YEAR	YEMEN ARAB REPUBLIC		PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN	
	DESCRIPTION	AMOUNT	DESCRIPTION	AMOUNT
1976	Food Aid	3.08	Food Aid	0.92
1977	Food Aid	3.63	Fishery Training Boat	4.50
			Food Aid	2.59
1978	Food Aid	4.21	Food Aid	1.64
1979	Aid for Increased Food Production	5.00	—	—
	Debt Relief	0.05		
1980	Debt Relief	0.16	—	—
1981	Rural Water Supply Project I	5.00	—	—
	Food Aid	2.78		
	Debt Relief	0.25		
1982	Rural Water Supply Project II	5.00	Disaster Relief (for flood)	0.57
	Aid for Increased Food Production	5.00		
	Debt Relief	0.66		
	Disaster Relief (for earthquake)	1.17		
	Study Equipment for Sana'a University	0.45		

YEAR	YEMEN ARAB REPUBLIC		PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN	
	DESCRIPTION	AMOUNT	DESCRIPTION	AMOUNT
1983	Rural Water Supply ProjectⅢ	6.00	Food Aid	1.41
	Reconstruction Project for Earthquake Disaster	8.00		
	Aid for Increased Food Production	5.00		
	Debt Relief	0.84		
1984	Expansion of the National Tuberculosis Center I	9.18	—	—
	Reconstruction Project for Earthquake Disaster	2.50		
	Aid for Increased Food Production	6.00		
	Debt Relief	0.47		
1985	Expansion of the National Tuberculosis Center Ⅱ	10.80	Fisheries Culturing Research Center	9.41
	Aid for Increased Food Production	5.00		
	Debt Relief	1.55		
	Scanning Electron Microscope for Sana'a Univ.	0.41		
1986	Rural Water Supply ProjectⅣ	3.19	—	—
	Aid for Increased Food Production	5.00		
	Debt Relief	1.06		
1987	Rural Water Supply ProjectⅤ	9.15	—	—
	Aid for Increased Food Production	5.00		
	Debt Relief	2.00		
1988	Rural Water Supply ProjectⅥ	9.61	Rehabilitation project for Fishery Training Boat	1.95
	Aid for Increased Food Production	4.00		
	Debt Relief	2.90		
1989	Rural Telecommunication Network Expansion Project	5.40	Disaster Relief (for flood)	0.14
	Aid for Increased Food Production	2.50	Aid for Increased Food Production	2.00
	Debt Relief	1.72		
	Debt Relief	2.86		
	Equipment for Producing Educational and Cultural Programs to the National Television Corporation	0.47		
	Small-Scale Grant Aid	0.11		
	REPUBLIC OF YEMEN (after unification)			
1990	Rural Telecommunication Network Expansion Project			6.63

APPENDIX II - d Infection Diseases Reported During 1975-1986

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	TOTAL
ENTERITIS	17,909	29,028	33,226	31,574	112,170	123,174	104,721	169,978	159,177	221,111	116,262	92,795	1,211,125
MALARIA	8,118	15,078	22,542	30,907	74,508	45,079	59,980	-	179,155	180,104	13,677	15,712	644,860
AMEEBIC DYSENTERY	6,289	3,053	2,512	6,208	26,410	53,155	30,417	71,828	69,986	95,928	42,494	40,492	448,772
BLIHARSI	3,932	4,706	4,245	11,733	14,561	35,427	37,924	34,044	27,439	35,961	43,754	43,634	297,360
MEASLES	801	2,654	9,983	6,531	18,692	14,254	10,355	20,045	25,707	34,389	9,387	10,849	163,647
WHOOPING	1,888	2,904	5,971	5,854	11,587	13,488	13,533	25,490	27,534	20,309	16,053	9,753	154,364
T.B.LEPROST	2,705	4,540	7,714	7,604	10,895	17,078	16,060	18,561	32,755	24,130	2,078	2,175	146,295
INFECTIONS HEPATITIS	537	1,988	2,369	3,288	5,434	6,652	5,308	7,779	9,986	14,111	1,112	9,689	68,253
MUMPS	119	358	1,247	1,179	2,882	2,902	3,780	5,131	7,134	9,533	4,831	5,809	44,905
CHICKEN POX	79	88	112	18	214	702	1,337	936	2,301	6,141	2,808	3,680	18,416

APPENDIX II - e Climate Data at Major Stations in North Yemen

STATION	ITEM	JAN. 1984	JAN. 1985	JAN. 1986	JAN. 1987	JAN. 1988	FEB. 1984	FEB. 1985	FEB. 1986	FEB. 1987	FEB. 1988	MAR. 1984	MAR. 1985	MAR. 1986	MAR. 1987	MAR. 1988	APRIL 1984	APRIL 1985	APRIL 1986	APRIL 1987	APRIL 1988	MAY 1984	MAY 1985	MAY 1986	MAY 1987	MAY 1988	JUNE 1984	JUNE 1985	JUNE 1986	JUNE 1987	JUNE 1988
Sana'a	R	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.3	37.4	2.0	0.0	45.8	6.2	1.2	10.2	37.1	60.8	15.2	67.4	39.8	58.8	4.0	19.4	0.0	13.0	0.0	23.6	18.9	0.0
	T	13.2	14.6	12.8	12.6	15.0	14.2	15.2	15.9	15.4	16.9	17.7	17.8	18.6	18.2	19.6	20.6	18.2	17.3	19.3	18.8	20.4	19.7	21.3	20.6	21.5	22.4	21.1	22.8	23.0	22.9
	H	—	39	42	44	—	—	43	56	44	—	—	52	55	56	—	—	65	66	51	—	—	54	42	37	—	—	51	42	32	—
	P	783.9	784.1	787.4	789.0	788.1	783.6	784.5	785.9	788.0	787.4	783.3	784.4	786.6	786.9	787.9	783.2	784.4	786.1	788.4	787.3	782.7	784.2	786.4	787.6	787.8	781.3	783.2	784.4	786.5	786.1
Taizz	R	0.0	0.0	0.0	0.5	0.5	T	1.6	10.8	3.9	9.1	18.0	48.8	28.0	137.6	9.9	0.0	73.2	63.7	35.3	42.1	118.2	34.3	49.0	114.8	72.0	34.3	110.1	48.8	16.2	71.4
	T	17.3	19.1	16.9	17.5	17.8	19.0	18.2	18.9	18.7	19.8	22.5	20.9	21.5	20.6	22.3	22.2	22.3	22.2	21.4	22.7	22.9	24.6	23.8	22.5	24.6	24.9	25.2	24.6	24.6	24.4
	H	—	69	68	61	—	—	66	67	55	—	—	49	53	71	—	—	59	62	60	—	—	53	60	68	58	—	51	56	—	—
	P	858.0	857.6	857.1	859.0	—	857.3	856.8	—	857.7	856.2	856.7	857.9	856.5	855.8	—	856.1	855.8	855.9	856.7	854.9	853.9	854.6	855.5	855.1	—	—	853.4	852.4	854.0	852.7
Hudaydah	R	2.3	0.0	0.0	0.8	—	0.0	0.0	8.5	0.0	0.0	0.0	4.0	12.0	0.0	0.0	0.0	0.0	15.0	32.5	39.0	0.0	9.9	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
	T	24.5	25.2	24.4	24.6	25.8	24.9	25.5	26.2	25.3	27.2	26.6	27.1	26.7	27.4	28.8	29.5	30.0	29.1	29.2	29.9	31.3	30.9	31.2	31.2	31.9	32.4	32.0	32.9	32.5	33.4
	H	—	88	85	81	—	—	82	90	86	—	—	88	92	85	—	—	88	94	78	—	—	84	83	82	—	—	79	80	82	—
	P	1009.3	1013.5	—	1013.3	1011.0	1012.7	1012.2	—	1011.0	1009.0	1005.3	1007.4	1010.9	1007.5	—	1009.1	1008.9	1008.3	1007.9	1005.2	1007.5	1007.0	1008.1	1005.2	1004.5	1004.3	1005.4	1003.5	—	1002.0
Mocha	R	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.6	0.0	0.0	0.0	0.0	1.6	1.8	0.0	0.0	0.0	12.1	29.7	0.0	0.0	14.9	0.0	27.0	3.1	0.0	0.0	0.0	0.0	0.0
	T	25.0	26.7	23.9	25.2	25.9	25.0	26.5	25.9	25.1	27.1	26.8	28.7	26.8	27.0	27.8	29.2	30.5	28.9	28.7	28.7	31.3	32.4	30.8	30.6	31.1	32.2	33.1	31.5	31.5	32.3
	H	—	69	80	—	—	—	70	77	—	—	—	65	76	—	—	—	64	77	—	—	—	69	79	—	—	—	71	80	—	—
	P	1015.2	1013.9	1012.3	1013.9	1011.9	1013.7	1013.6	1011.7	1011.1	1009.2	1010.6	1010.6	1010.3	1008.3	1008.6	1009.4	1009.7	1009.1	1008.3	1005.1	1007.5	1007.9	1008.4	1006.3	1004.7	1004.8	1005.8	1004.0	1003.2	1002.1
Marib	R	0.0	0.0	0.9	0.0	—	0.0	0.0	20.0	0.0	—	0.0	0.0	9.0	68.8	—	0.0	23.3	111.6	46.2	—	0.0	5.0	—	0.0	—	0.0	—	1.5	0.0	—
	T	18.1	21.1	18.7	18.0	18.6	—	20.3	22.3	22.2	22.9	—	25.7	25.5	26.5	25.4	27.8	28.3	26.3	25.9	26.8	28.7	31.2	—	—	29.1	—	30.0	32.5	32.3	31.1
	H	—	54	35	—	—	—	38	46	—	—	—	33	44	—	—	—	40	53	—	—	—	30	—	—	—	—	—	24	—	—
	P	896.8	890.4	—	898.0	—	—	887.2	893.7	894.2	—	—	886.0	893.9	891.6	—	891.0	889.6	891.7	893.5	—	—	885.3	—	—	—	—	—	887.1	885.7	—

R: Rainfall (Month) H: Humidity (Average)

T: Temperature (Average) P: Atmospheric Pressure (Average)

APPENDIX II - e Climate Data at Major Stations in North Yemen

STATION	ITEM	1984	1985	1986	1987	1988	1984	1985	1986	1987	1988	1984	1985	1986	1987	1988	1984	1985	1986	1987	1988	1984	1985	1986	1987	1988	1984	1985	1986	1987	1988
		JULY					AUG.					SEP.					OCT.					NOV.					DEC.				
Sana'a	R	0.0	0.0	8.1	0.0	73.2	0.0	0.0	63.5	21.3	20.7	0.0	4.8	2.1	20.8	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.8	0.0	3.4	13.8	0.0
	T	23.0	22.8	22.5	24.1	21.9	22.3	22.8	21.3	22.7	22.2	20.4	20.8	20.1	20.9	20.9	15.8	16.4	16.6	18.3	16.7	15.4	14.9	15.9	13.8	13.2	13.8	12.8	14.4	14.2	12.9
	H	—	38	48	34	—	—	48	49	48	—	—	42	42	39	—	—	46	34	37	—	—	37	40	40	—	—	38	50	43	—
	P	780.2	783.0	784.5	785.2	784.1	781.6	783.6	784.4	785.3	784.6	782.8	785.3	786.6	787.3	785.8	785.5	787.9	788.6	788.5	788.0	784.5	786.2	786.8	789.3	789.2	784.0	786.2	787.2	789.3	788.4
Taizz	R	53.8	97.5	39.1	19.7	32.5	9.4	216.8	36.1	45.7	117.1	70.6	23.7	105.5	41.7	77.2	0.0	13.5	0.2	22.3	17.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	8.7	0.0
	T	24.1	24.1	24.0	25.3	24.7	24.2	24.3	23.6	24.9	23.4	22.1	22.8	21.1	24.1	22.5	20.4	22.0	20.9	21.5	21.5	18.5	19.5	18.5	19.5	18.5	18.1	17.6	18.2	18.6	17.8
	H	—	61	57	57	—	—	62	62	57	—	—	59	60	54	—	—	52	53	59	—	—	66	57	50	—	—	62	73	63	—
	P	851.4	852.3	852.9	852.1	850.8	853.4	851.9	852.8	852.5	851.5	854.7	853.7	855.4	854.6	852.9	—	856.6	857.7	856.5	856.1	857.6	857.7	857.5	857.6	858.4	857.3	858.0	858.5	858.3	858.3
Hudaydah	R	0.0	0.0	4.0	0.0	23.3	0.0	0.0	0.0	0.0	61.4	0.0	0.0	0.0	0.0	27.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	1.9	0.0
	T	32.4	32.0	33.1	33.3	33.4	31.8	32.3	32.6	33.3	32.4	31.1	31.7	32.0	33.0	31.7	29.4	30.1	29.8	31.1	30.0	26.0	27.7	27.8	27.9	26.3	25.1	25.3	25.7	26.3	25.0
	H	—	80	78	83	—	—	85	79	79	—	—	81	57	80	—	—	77	88	76	—	—	82	83	71	—	—	84	85	79	—
	P	1003.4	1004.4	1004.5	1001.1	1000.3	1004.6	1004.4	1001.7	1001.3	1000.8	—	1006.8	1004.6	—	1001.7	1011.3	1010.7	1004.6	1007.3	1006.5	1013.7	1012.5	1010.0	1010.0	1010.4	1013.8	1014.6	1009.7	1011.8	—
Mocha	R	0.0	0.0	9.2	0.0	20.9	0.0	0.0	18.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.2	0.0	0.0
	T	32.7	33.0	32.0	32.0	31.1	32.9	32.1	32.4	32.1	31.0	32.0	31.7	31.6	31.9	31.8	29.5	29.6	29.1	29.9	29.4	27.8	27.2	27.9	27.8	26.8	26.7	25.1	26.1	27.2	25.7
	H	—	70	77	—	—	—	77	74	—	—	—	75	76	—	—	—	78	70	—	—	—	83	65	—	—	—	87	66	—	—
	P	1003.8	1004.9	1005.1	1001.6	1000.9	1005.3	1004.2	1004.8	1001.9	1001.9	1007.8	1006.4	1006.1	1004.4	1002.8	1012.1	1010.8	1009.1	1007.5	1007.6	1013.8	1012.6	1006.8	1010.6	1011.9	1014.1	1014.7	1009.9	1012.6	1011.9
Marib	R	0.0	0.0	0.0	0.0	—	0.0	0.0	0.0	5.1	—	0.0	0.0	0.0	0.0	—	0.0	0.0	0.0	0.0	—	0.0	0.0	0.0	0.0	—	0.0	0.0	4.2	13.0	—
	T	29.8	33.5	33.7	33.3	31.7	31.5	34.5	32.4	32.3	32.3	28.6	29.7	29.9	30.6	30.1	—	25.0	25.4	26.3	25.0	22.9	21.8	22.8	20.3	20.1	20.3	—	19.3	18.3	17.7
	H	—	25	29	—	—	—	28	34	—	—	—	38	25	—	—	—	40	29	—	—	—	32	35	—	—	—	—	46	—	—
	P	—	886.5	885.9	887.0	—	—	855.6	—	886.9	—	—	890.1	—	890.4	—	—	894.8	—	893.2	—	—	895.5	892.5	896.3	—	—	—	896.0	897.3	—

R: Rainfall (Month) H: Humidity (Average)

T: Temperature (Average) P: Atmospheric Pressure (Average)

APPENDIX II - e Climate Data at Major Stations in North Yemen

STATION	ITEM	JAN					FEB					MAR					APR					MAY					JUN				
		1984	1985	1986	1987	1988	1984	1985	1986	1987	1988	1984	1985	1986	1987	1988	1984	1985	1986	1987	1988	1984	1985	1986	1987	1988	1984	1985	1986	1987	1988
Al Hazem	R	—	0.0	0.0	0.0	0.0	—	0.0	0.0	0.0	11.5	—	0.0	50	10.3	0.0	—	12.2	—	2.8	26.0	—	37.6	0.0	—	0.0	—	0.0	0.0	0.0	0.0
	T	—	—	18.2	19.1	19.5	—	—	22.6	21.8	25.0	—	—	25.9	26.3	26.4	—	—	—	26.9	26.9	—	—	30.1	—	30.9	—	—	31.7	30.0	32.0
	H	—	—	39	—	—	—	—	33	—	—	—	—	42	—	—	—	—	—	—	—	—	—	33	—	—	—	—	31	—	—
	P	—	—	—	—	891.0	—	—	886.4	889.4	889.2	—	—	885.3	887.6	—	—	—	—	—	—	—	—	878.6	—	886.2	—	—	874.0	—	—
Damar	R	—	—	0.0	0.4	0.0	—	—	23.1	39.2	15.2	—	—	42.5	78.0	5.2	—	—	68.2	62.1	93.8	—	—	—	21.2	6.9	—	—	5.0	12.8	26.0
	T	—	—	—	11.1	12.8	—	—	13.7	13.5	13.9	—	—	16.3	14.9	16.3	—	—	16.4	16.0	16.9	—	—	—	18.5	19.6	—	—	19.4	20.7	20.3
	H	—	—	—	47	—	—	—	—	40	—	—	—	—	64	—	—	—	—	55	—	—	—	—	49	—	—	—	—	44	—
	P	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Albolin	R	—	—	—	0.0	0.0	—	—	—	0.0	38.9	—	—	—	5.8	0.0	—	—	—	22.0	61.1	—	—	—	20.5	0.0	—	—	—	2.3	2.1
	T	—	—	—	—	14.3	—	—	—	15.0	17.0	—	—	—	17.6	18.0	—	—	—	18.3	18.0	—	—	—	20.1	19.4	—	—	—	21.9	20.8
	H	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sa'dah	R	—	0.0	0.0	—	1.2	—	0.0	0.0	—	3.0	—	0.0	25.0	—	0.0	—	0.0	47.1	—	26.6	—	5.2	3.6	—	0.0	—	20.6	1.2	—	1.0
	T	—	18.2	13.2	—	15.2	—	19.0	16.7	—	17.5	—	21.6	19.9	—	20.7	—	20.1	19.0	—	20.4	—	22.2	23.4	—	23.8	—	23.9	24.8	—	24.6
	H	—	—	54	47	—	—	—	46	43	—	—	—	50	53	—	—	60	58	49	—	—	71	46	40	—	—	57	33	29	—
	P	—	—	—	—	—	—	—	810.3	—	—	—	—	808.7	—	813.7	—	—	813.0	—	813.5	—	—	—	—	814.0	—	—	—	—	—
Jehana	R	—	—	—	—	20.3	—	—	—	—	5.3	—	—	—	—	1.8	—	—	—	—	63.1	—	—	—	—	—	—	—	—	—	0.0
	T	—	—	—	—	14.9	—	—	—	—	17.0	—	—	—	—	18.9	—	—	—	—	19.1	—	—	—	—	20.2	—	—	—	—	22.1
	H	—	—	—	—	—	—	—	—	46	—	—	—	—	62	—	—	—	—	54	—	—	—	—	38	—	—	—	—	31	—
	P	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	

R: Rainfall (Month) H: Humidity (Average)

T: Temperature (Average) P: Atmospheric Pressure (Average)

APPENDIX II - e Climate Data at Major Stations in North Yemen

STATION	ITEM	JULY 1984	JULY 1985	JULY 1986	JULY 1987	JULY 1988	AUG. 1984	AUG. 1985	AUG. 1986	AUG. 1987	AUG. 1988	SEP. 1984	SEP. 1985	SEP. 1986	SEP. 1987	SEP. 1988	OCT. 1984	OCT. 1985	OCT. 1986	OCT. 1987	OCT. 1988	NOV. 1984	NOV. 1985	NOV. 1986	NOV. 1987	NOV. 1988	DEC. 1984	DEC. 1985	DEC. 1986	DEC. 1987	DEC. 1988
Al Hazem	R	—	0.0	0.0	0.0	2.5	—	0.0	3.7	0.0	0.0	—	0.0	0.0	0.0	0.0	—	0.0	0.0	0.0	0.0	—	0.0	0.0	0.0	0.0	—	0.0	0.0	13.9	0.0
	T	—	—	32.0	33.4	32.9	—	—	31.8	—	—	—	28.0	29.4	31.1	31.1	—	25.5	25.2	—	27.1	—	22.2	22.8	21.0	20.4	—	—	—	20.4	17.4
	H	—	—	30	—	—	—	—	31	—	—	—	22	31	—	—	—	32	29	—	—	—	38	33	—	—	—	—	—	—	—
	P	—	—	873.4	—	—	—	—	873.1	—	882.1	—	—	—	—	—	—	—	888.4	—	889.6	—	—	884.3	—	892.4	—	—	—	—	—
Damar	R	—	—	54.6	18.2	—	—	—	112.5	74.2	38.0	—	—	5.8	24.8	36.5	—	—	0.0	0.0	0.0	—	—	0.0	0.0	0.0	—	—	—	17.0	—
	T	—	—	20.0	21.1	—	—	—	19.2	19.1	18.4	—	—	17.4	18.0	17.6	—	—	15.2	15.9	15.0	—	—	14.3	12.1	11.9	—	—	—	12.6	—
	H	—	—	53	50	—	—	—	52	59	—	—	—	43	44	—	—	—	36	40	—	—	—	40	37	—	—	—	—	42	—
	P	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Albolin	R	—	—	—	24.9	56.9	—	—	—	68.6	39.7	—	—	—	18.8	—	—	—	—	0.5	—	—	—	—	0.0	—	—	—	—	17.6	—
	T	—	—	—	22.2	21.5	—	—	—	—	21.0	—	—	—	19.8	—	—	—	—	—	—	—	—	—	13.1	—	—	—	—	13.3	—
	H	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sa'dah	R	—	3.2	16.5	—	40.6	—	15.2	19.8	—	8.1	—	0.0	7.0	—	0.0	—	0.0	0.0	—	0.0	—	0.0	0.0	—	0.0	—	0.0	2.6	—	3.0
	T	—	25.1	24.7	—	23.7	—	25.3	24.0	—	23.6	—	22.2	23.0	—	23.3	—	19.5	19.8	—	19.1	—	17.4	17.9	—	14.9	—	14.8	15.1	—	12.5
	H	—	—	45	35	—	—	—	50	50	—	—	—	35	29	—	—	36	30	31	—	—	45	50	41	—	—	43	52	45	—
	P	—	—	—	—	813.3	—	—	—	—	811.5	—	—	—	—	809.1	—	—	—	—	809.5	—	—	812.9	—	811.5	—	—	815.3	—	818.0
Jehana	R	—	—	—	—	—	—	—	—	—	1.5	—	—	—	—	20.5	—	—	—	—	0.0	—	—	—	—	0.0	—	—	—	—	0.0
	T	—	—	—	—	—	—	—	—	—	—	—	—	—	—	19.1	—	—	—	—	16.2	—	—	—	—	12.8	—	—	—	—	—
	H	—	—	—	36	—	—	—	—	43	—	—	—	—	33	—	—	—	—	43	—	—	—	—	45	—	—	—	—	45	—
	P	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

R: Rainfall (Month) H: Humidity (Average)

T: Temperature (Average) P: Atmospheric Pressure (Average)

Cuverage Monthly Climatic Data at Major Stations (1984 - 1988)

STATION	ITEM	1984~1988 JAN.	1984~1988 FEB.	1984~1988 MAR.	1984~1988 APRIL	1984~1988 MAY	1984~1988 JUNE	1984~1988 JULY	1984~1988 AUG.	1984~1988 SEP.	1984~1988 OCT.	1984~1988 NOV.	1984~1988 DEC.
Sana'a	R	0.0	8.2	11.1	38.1	24.4	11.1	16.3	21.1	6.5	0.0	0.0	6.8
	T	13.6	15.5	18.4	18.8	20.7	22.4	22.9	22.3	20.6	16.8	14.6	13.6
	H	41.6	47.6	54.3	60.7	44.3	41.6	40.0	48.3	41.0	39.0	39.0	43.7
	P	786.5	785.9	785.8	785.9	785.7	784.3	783.4	783.9	785.6	787.7	787.6	787.0
Taizz	R	0.2	6.3	11.0	42.9	77.7	56.2	48.5	85.0	63.7	10.8	0.0	2.6
	T	17.7	18.9	18.4	22.2	23.7	24.7	24.4	24.1	22.5	21.3	18.9	18.1
	H	66.0	62.7	57.7	60.3	60.0	53.5	58.3	60.3	57.7	54.7	57.7	66.0
	P	857.9	857.0	856.7	855.9	854.8	853.1	851.9	852.4	854.3	856.7	857.8	858.1
Hudaydah	R	1.6	1.7	3.2	17.3	2.1	0.0	5.5	12.3	5.5	0.0	0.0	0.9
	T	24.9	25.8	27.3	29.5	31.1	32.6	32.8	32.5	31.9	30.1	27.1	25.5
	H	84.7	86.0	88.3	86.7	83.0	80.3	80.3	81.0	72.7	80.3	78.7	82.7
	P	1011.8	1011.2	1007.8	1007.9	1006.5	1003.8	1002.7	1002.6	1004.4	1008.1	1011.3	1012.5
Mocha	R	0.0	2.3	0.7	8.4	9.0	0.0	6.0	4.0	0.0	1.0	0.0	9.4
	T	25.3	25.9	27.4	29.2	31.2	32.1	32.2	32.1	31.8	29.5	27.5	26.2
	H	79.5	73.55	70.5	70.5	74.0	75.5	73.5	75.5	75.5	74.0	74.0	76.5
	P	1013.4	1011.9	1009.7	1008.3	1007.0	1004.0	1003.3	1003.6	1005.5	1009.4	1011.1	1012.6
Marib	R	0.0	5.0	19.5	45.3	1.7	0.5	0.0	1.3	0.0	0.0	0.0	3.4
	T	18.9	21.9	25.8	27.0	29.7	31.5	32.4	32.6	29.8	25.4	21.6	18.9
	H	44.5	42.0	38.5	46.5	30.0	24.0	27.0	31.0	31.5	34.5	33.5	9.20
	P	859.1	891.7	890.5	891.5	885.3	886.4	886.5	871.3	890.3	894.0	894.8	896.7

R: Rainfall (Month) H: Humidity (Average)

T: Temperature (Average) P: Atmospheric Pressure (Average)

Cuverage Monthly Climatic Data at Major Stations (1984 - 1988)

STATION	ITEM	1984~1988 JAN.	1984~1988 FEB.	1984~1988 MAR.	1984~1988 APRIL	1984~1988 MAY	1984~1988 JUNE	1984~1988 JULY	1984~1988 AUG.	1984~1988 SEP.	1984~1988 OCT.	1984~1988 NOV.	1984~1988 DEC.
Al	R	0.0	2.9	15.1	13.7	12.5	0.0	0.6	0.9	0.0	0.0	0.0	3.5
Hazem	T	18.9	23.1	26.2	26.9	30.5	31.2	32.8	31.8	29.9	25.9	21.6	18.9
	H	39.0	33.0	42.0	—	33.0	31.0	30.0	31.0	26.5	30.5	35.5	—
	P	891.0	881.3	886.5	—	882.4	874.0	873.4	877.6	—	889.0	888.4	—
Damar	R	0.1	25.8	41.9	74.7	14.1	14.6	36.4	74.9	22.4	0.0	0.0	17.0
	T	11.9	13.7	15.8	16.3	19.1	20.1	20.6	18.9	17.7	15.4	12.8	12.6
	H	47.0	40.0	64.0	55.0	49.0	44.0	52.0	55.5	43.5	38.0	38.5	42.0
	P	—	—	—	—	—	—	40.9	—	—	—	—	—
Albolin	R	0.0	19.5	2.9	41.6	10.0	2.2	21.9	54.2	18.8	0.5	0.0	17.6
	T	14.3	16.0	17.8	18.2	19.8	21.4	21.9	21.0	19.8	—	13.1	13.3
	H	—	—	—	36.9	—	—	—	—	—	—	—	—
	P	—	—	—	—	—	—	—	—	—	—	—	—
Sa'dah	R	0.4	1.0	8.3	24.6	2.9	7.6	20.1	14.4	2.3	0.0	0.0	0.8
	T	15.5	17.7	20.7	19.8	23.1	24.4	24.5	24.4	22.8	19.5	16.7	14.1
	H	—	44.5	51.5	55.7	52.3	39.7	40.0	50.0	32.0	32.3	45.3	46.7
	P	—	810.3	812.2	813.3	814.0	—	813.3	811.5	809.1	809.5	812.2	816.7
Jahana	R	20.3	5.3	1.8	63.1	—	—	—	1.5	20.5	0.0	0.0	0.0
	T	18.9	17.0	18.9	19.1	20.2	22.1	—	—	19.1	16.2	12.8	—
	H	—	46.0	62.0	54.0	38.0	31.0	36.0	43.0	33.0	43.0	45.0	45.0
	P	—	—	—	—	—	—	—	—	—	—	—	—

R: Rainfall (Month) H: Humidity (Average)

T: Temperature (Average) P: Atmospheric Pressure (Average)

Appendix II-f List of Villages Composing The Project Site

Site Number	1				
Priority order	②				
Site name	Iyal Qasim				
Governorate	Sana'a			District	Dahi-bin
Population	Present total (1991)		1,500	Planned Service pop. (2006)	2,200
Number of Villages	9	Planned Area for Water Service	7.5㎢	Population density	293pers./㎢

Location No.	Name of Villages	No. of Houses	Population in 1991	Estimated Population in 2006
1	Bait Al-Nafaish	25	180	263
2	Al-Agluu	40	270	394
3	Bitan	35	180	263
4	Al-Hayyit	45	270	394
5	Bait Daghar	20	110	160
6	Bait Al-Azant	20	110	160
7	Bait Saliman	20	140	204
8	Bait Marish	30	180	263
9	Al-Sahamah	10	60	88
Total	9	245	1,500	≒ 2,200

Site Number	2
Priority order	⑪

Site name	Mahalat Najr				
Governorate	Sana'a			District	Amran
Population	Present total (1991)	2,000		Planned Service pop. (2006)	2,900
Number of Villages	1	Planned Area for Water Service	3㎢	Population density	967pers./㎢

Location No.	Name of Villages	No. of Houses	Population in 1991	Estimated Population in 2006
1	Najr	200	2,000	2,918
Total	1	200	2,000	≒ 2,900

Site Number	3
Priority order	③

Site name	Khamis Bani Hajaj				
Governorate	Sana'a			District	Thila
Population	Present total (1991)	5,400		Planned Service pop. (2006)	7,900
Number of Villages	7	Planned Area for Water Service	8㎢	Population density	988pers./㎢

Location No.	Name of Villages	No. of Houses	Population in 1991	Estimated Population in 2006
1	Ash Shim	50	600	875
2	Al-Mahali	35	350	511
3	Ad Darb	150	1,600	2,334
4	Bani Uqayf	40	450	657
5	Bait Ar Rabui	50	600	875
6	Bait Umar	35	300	438
7	Al-Ayn	150	1,500	2,189
Total	7	510	5,400	≒ 7,900

Site Number	4				
Priority order	⑨				
Site name	Bani Afif				
Governorate	Taizz			District	Turbat Al Mawasit
Population	Present total (1991)	7,300		Planned Service pop. (2006)	10,700
Number of Villages	9	Plannes Area for Water Service	14㎢	Population density	764pers./㎢

Location No.	Name of Villages	No. of Houses	Population in 1991	Estimated Population in 2006
1	Al-Minam	130	960	1,401
2	Al-Areth	320	2,340	3,414
3	Al-Maqam	60	550	802
4	Al-Ujaylah	90	690	1,007
5	Arradah	40	280	409
6	Annaberah	60	550	802
7	Al-Quhaym	80	830	1,211
8	Al-Miqtar	40	410	598
9	Suwamah	80	690	1,007
Total	9	900	7,300	≒10,700

Site Number	5				
Priority order	⑤				
Site name	Al Husha				
Governorate	Taizz			District	Al Husha
Population	Present total (1991)	13,000		Planned Service pop. (2006)	19,000
Number of Villages	3 Areas (about 60 Villages)	Planned Area for Water Service	120㎢	Population density	158pers./㎢

Location No.	Name of Villages	No. of Houses	Population in 1991	Estimated Population in 2006
1	Eastern area		5,000	7,295
2	Central area *		5,000	7,295
3	Western area		3,000	4,377
Total			13,000	≒ 19,000

* This project area is only the central area.

Site Number	6				
Priority order	④				
Site name	Al Usfyn				
Governorate	Taizz			District	Al Qabaitah
Population	Present total (1991)	28,500		Planned Service pop. (2006)	41,600
Number of Villages	20	Planned Area for Water Service	160㎢	Population density	260pers./㎢

Location No.	Name of Villages	No. of Houses	Population in 1991	Estimated Population in 2006
1	Ashariqah			
2	Jabal Annaby			
3	Daish			
4	Al-Rabyn			
5	Wadi Thamran			
6	Najd Thamran			
7	Al-Ayfoa *			
8	Qarath			
9	Aireem			
10	Al-Aqrath			
11	Al-Hallaqeno			
12	Al-Karb **			
13	Arrazoq			
14	Wadi Al-Hanakah			
15	Al-Laqaa			
16	Tabab			
17	Al-Marabha			
18	Al-Akrob			
19	Al-Jalliha			
20	Al-Qaidah			
Total	20	20	28,500	≒ 41,600

* Al-Ayfoa (Al-Jabl), ** Al-Karb (Anafat)

Site Number	7				
Priority order	⑩				
Site name	Al Jabub				
Governorate	Ibb			District	Ar Radmah
Population	Present total (1991)	2,000		Planned Service pop. (2006)	2,900
Number of Villages	6	Planned Area for Water Service	10㎢	Population density	290pers./㎢

Location No.	Name of Villages	No. of Houses	Population in 1991	Estimated Population in 2006
1	Hirrimah	35	270	394
2	Aqham *	50	330	481
3	Al-Jabub	20	220	321
4	Kawlat Bahal	50	540	788
5	Al-Khubaniyah**	30	320	467
6	Habar ***	25	320	467
Total	6	210	2,000	≒ 2,900

* Aqham & Al-Mallahah, ** Al-Khubaniyah & Qarn Ambari, *** Habar & Bait Badr

Site Number	9				
Priority order	⑦				
Site name	Al Ghudu				
Governorate	Marib			District	Sirwah
Population	Present total (1991)	1,770		Planned Service pop. (2006)	2,600
Number of Villages	14	Planned Area for Water Service	15㎢	Population density	173pers./㎢

Location No.	Name of Villages	No. of Houses	Population in 1991	Estimated Population in 2006
1	Al-Faras	15	100	146
2	Al-Aqrab	10	80	117
3	Al-Oblly	8	60	88
4	Al-Qaran	10	80	117
5	Al-Attweal	10	80	117
6	Al-Hazienn	20	150	219
7	Al-Saleh	15	130	190
8	Al-Saif	15	140	204
9	Al-Had *	20	150	219
10	Abu Aeen	10	100	146
11	Mohal Athail	10	100	146
12	Al-Ahmed **	15	150	219
13	Mahal Al-Faheed	20	200	292
14	Mahal ***	25	250	365
Total	14	203	1,770	≒ 2,600

* Al-Had & Al-Dowoqh, ** Al-Ahmed Hassien, *** Mahal Al-Waqatayn

Site Number	11
Priority order	⑥

Site name	Aflah Al Yaman				
Governorate	Hajja			District	Aflah Al Yaman
Population	Present total (1991)		4,500	Planned Service pop. (2006)	6,600
Number of Villages	22	Planned Area for Water Service	7.5㎢	Population density	880pers./㎢

Location No.	Name of Villages	No. of Houses	Population in 1991	Estimated Population in 2006
1	Al-Qaadh	25	170	248
2	Al-Qhareb	90	670	977
3	Assahl	30	250	365
4	Assoaq	15	130	190
5	Qaddat *	20	170	248
6	Al-Manather	15	130	190
7	Al-Athariah	20	130	190
8	Morssa	20	170	248
9	Al-Anad	25	210	306
10	Bait Saleh	25	240	350
11	Al-Mahrabah	25	170	248
12	Addeer	15	80	117
13	Al-Dakhwazh	30	250	365
14	Adharr	35	300	438
15	Assoadamh	15	130	190
16	Al-Akawrrh	12	80	117
17	Al-Kawllah	10	80	117
18	Al-Handy	40	340	496
19	Asswady	30	210	306
20	Arrubu	20	130	190
21	Astrabah	30	210	306
22	Al-Kanah	30	250	365
Total	22	577	4,500	≒ 6,600

* Qaddat Al-Thallath

Site Number	12				
Priority order	⑧				
Site name	Bait Al Sultan				
Governorate	Ar Rajam			District	Al Mahweet
Population	Present total (1991)	3,600		Planned Service pop. (2006)	5,300
Number of Villages	11	Planned Area for Water Service	14㎢	Population density	379pers./㎢

Location No.	Name of Villages	No. of Houses	Population in 1991	Estimated Population in 2006
1	Bait Al-Sultan	85	600	875
2	Bait Abu Qail	40	300	438
3	Bait Qahwash	50	350	511
4	Al-Lutha	50	350	511
5	Dar Milh	35	250	365
6	Al-Waqeayn	40	350	511
7	Al-Arkaz	35	300	438
8	Bani Shahab	45	450	657
9	Al-Half	30	200	292
10	Al-Manarah	30	200	292
11	Bait Mazzad	30	250	365
Total	11	470	3,600	≒ 5,300

Site Number	14					
Priority order	①					
Site name	Al Mallaheeth					
Governorate	Sa'dah			District	Al Dhaher	
Population	Present total (1991)		3,180	Planned Service pop. (2006)		4,600
Number of Villages	9	Plannes Area for Water Service	14㎢	Population density		329pers./㎢

Location No.	Name of Villages	No. of Houses	Population in 1991	Estimated Population in 2006
1	Al-Mallaheeth	200	1,200	1,751
2	Al-Marwy:Alalla	40	400	584
3	Al-Marwy:Assfal	60	420	613
4	Assaqen *	40	280	409
5	Al-Matla **	35	350	511
6	Al-Ladh	10	50	73
7	Assafia ***	35	200	292
8	Tarrany	20	160	233
9	Marrwa	15	120	175
Total	9	455	3,180	≒ 4,640

* Ashaqen & Assabbar, ** Al-Matla & Al-Mathamy, *** Assafia & Al-Naqrh

APPENDIX II - g Road Conditions from Sana'a to The Project Sites

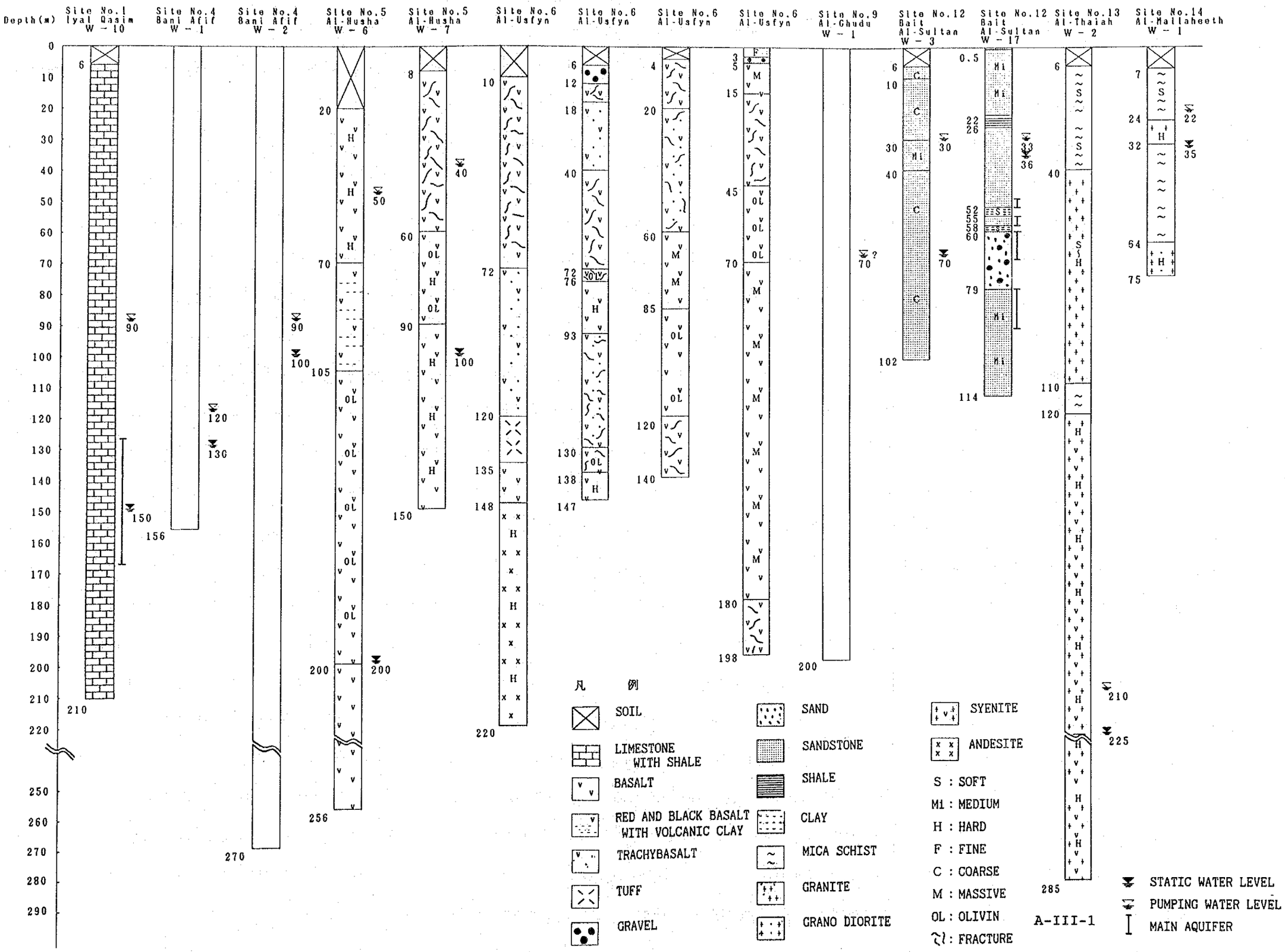
SITE NAME		Paved	Feeder	M.	Total
1. Iyal Qasim	Sana'a —70— Al-Raidah —20— Qa Shams ·10· Iyal Qasim	70	20	10	100
2. Mahalat Nair	Sana'a —50— Amran ·2· Mahalat Najr	50	0	2	52
3. Khamis Bani Hajaj	Sana'a —55— Thuila ·4· Al-Shaim	55	0	4	59
4. Bani Afif	Sana'a —265— Taizz —55— Ash ShamSarah ·7· Bani Afif	320	0	7	327
5. Al Husha	Sana'a —136— Yarim —90— Qatabah ·45· Zuran	226	0	45	271
6. Al Usfyn	Sana'a —230— Taizz —60— Ar Rahidah	290	0	0	290
7. Al Jabub	Sana'a —136— Yarim —40— Al Jabub	176	0	0	176
8. Majzar	Sana'a —110— Al Farda —30— Barakish	140	0	0	140
9. Al Ghudu	Sana'a —145— Al Jidan ·15· Al Ghudu	145	0	15	160
10. Ash Sharaqi	Sana'a —120— Hajjah ·18· Alhan	120	0	18	138
11. Aflah Al Yaman	Sana'a —120— Hajjah —60— Al Khashim —50— Shafal ·20· Bani Yus	170	60	20	250
12. Bait Al Sultan	Sana'a —50— Shibam —60— Ar Rajam	50	60	0	110
13. Al Thaiah	Sana'a —120— Hajjah —60— Al Khashim —110— Harad —55— Al Mallaheeth —18— Al Thaia	230	133	0	363
14. Al Mallaheeth	Sana'a —120— Hajjah —60— Al Khashim —110— Harad —55— Al Mallaheet	230	115	0	345

—— Paved Road —— Feeder Road ····· M. Mountainous Road Distance (km)

APPENDIX III

WATER SOURCE

APPENDIX III - a LITHOLOGY OF BOERHOLES IN THE PROJECT AREA



APPENDIX III - b Geoelectric Prospecting

During the field survey, the geoelectric prospecting was carried out. The results are shown as follows:

1. Objective

The objective of the prospcting is to obtain basic data for on the geological structure determining the well depths in the respective sites.

2. Outline of the survey

A.) Equipment: a. Type ESG1 Specific Earth Resistance Tester
b. Type MCOHM Specific Earth Resistance Tester

B.) Prospecting points and depth

Site name	Number of prospcting points	Measuring Depth(m)
No.2 MAHALAT NAJR	1	120
No.4 BANI AFIF	1	170
No.5 AL-HUSHA	4	200
No.7 AL-JABUB	2	200
*No.13 AL-THAIAH	2	130
No.14 AL-MALLAHEETH	1	150

* canceled site

C.) Measuring method: Wenner's 4-electrode configuration

Electrode separation:

1 m	interval 0-4 m
2 m	interval 4-32 m
4 m	interval 32-100 m
10 m	interval 100m -

Analysis: Sundberg's standard curve method combined with direct

reading method

3. Results of prospecting

No.2: MAHALAT NAJR

The curve shows 4 layers

Resistivity layer	Depth(m)	Resistivity value(Ω•m)	Geological Features	Formation Group
No.1	0 - 4	12.8	Wadi deposits composed of clayey fine sand	Alluvium
No.2	4 - 12	20.2	Weathered and clayey deposits	Quaternary volcanic rocks
No.3	12 - 100	130-1000	Basalt lava with interbeds of tuff breccia	
No.4	100 -	94	Limestone	Amran seris

According to the analysis, a depth of 56-84m in the layer of No.3 is judged to be a fractured zone of basalt, indicating the aquifer ranges from 40 to 100m in depth. The depth of a new well is determined to be 100m.

No.4: BANI AFIF

The curve shows 7 layers

Resistivity layer	Depth(m)	Resistivity value(Ω•m)	Geological Features	Formation Group
No.1	0 - 4	100	Wadi deposits composed of sand	Alluvium
No.2	6 - 10	480	Basalt lava	Yemen Volcanics
No.3	10 - 28	84-124	Weathered clayey basalt	
No.4	28 - 76	300 - ? (High)	Basalt lava	
No.5	76 - 92	112	Fractured zone of basalt	
No.6	92 - 150	120 - 600	Basalt lava with interbeds of fractured zones	
No.7	150 -	110	Fractured zone of basalt	

Fractured zones are analyzed to occur in No.5(76-92m), No.6(115-130m) and No.7(150m-), indicating the aquifer ranges from 70 to 170m in depth. In considaration of the conditions of existing well, the depth of a new well is recommended to be 150m.

No.5: AL-HUSHA

In this site, the measurements at 4 prospecting points (depth=250m) were carried out. The apparent resistvity curves show different shapes from one another, suggesting the facies of Yemen volcanics composing this site are quite complex.

Prospecting point (1)

Resistivity layer	Depth(m)	Resistivity value(Ω•m)	Geological Features	Formation Group
No.1	0 - 10	54 - 100	Wadi deposits composed of sand-clayey sand, gravel, clay	Alluvium
No.2	10 - 110	4 - 96	To 22m: Weathered zone of clay 32-44m, 72-76m, 84-110m Fractured zone	Yemen Volcanics
No.3	110 - 150	72	Slightly hard basalt	
No.4	150 - 170	14	Fractured zone	
No.5	170 -	40	Slightlyt hard basalt	

At this point the aquifer starts at a depth of 44m. The two existing wells(W-6, W-7) near this point are supporsed to tap this aquifer.

Prospecting point (2)

Resistivity layer	Depth(m)	Resistivity value(Ω•m)	Geological Features	Formation Group
No.1	0 - 8	6 - 57	Wadi deposits composed of sand and clay	Alluvium
No.2	8 - 22	9 - 37	Clayey - brecciated basalt by weathering	Yemen Volcanics
No.3	22 - 80	56 -110	Slightly hard basalt Fractured zone (52-56m)	
No.4	80 - 120	42 - 56	Slightly hard basalt(80-92m) Fractured zone (92-120m)	
No.5	120 - 140	170	Hard basalt	
No.6	140 - 160	46	Fractred zone	
No.7	160 -	74	Slightly hard basalt	

The aquifer is judged to lie from 50 to 160m in depth, and the depth of a new well is recommended to be 200m.

Prospecting point (3)

Resistivity layer	Depth(m)	Resistivity value(Ω•m)	Geological Features	Formation Group
No.1	0 - 10	12 - 92	Wadi deposits composed of sand and clay	Alluvium
No.2	10 - 52	22 - 30	Clayey deposits by weathering	Yemen Volcanics
No.3	52 - 84	320	Hard basalt	
No.4	84 - 120	18	Fractured zone	
No.5	120 - 150	240	Hard basalt	
No.6	150 - 170	120	Fractured zone	
No.7	170 -	84	Slightly hard basalt	

The aquifer is judged to lie at 50-60m, 80-90m, 110-125m 150-180m in depth, and the depth of a new well is recommended to be 200m.

Prospecting point (4)

Resistivity layer	Depth(m)	Resistivity value(Ω•m)	Geological Features	Formation Group
No.1	0 - 4	50	Wadi deposits composed of sand	Alluvium
No.2	4 - 10	148	Wadi deposits composed of gravel	Yemen Volcanics
No.3	10 - 80	18 -260	Weathered clay (10-30m) Hard basalt (30-36m) Fractured zone (36-80m)	
No.4	80 - 110	500	Hard basalt	
No.5	110 - 140	8	Fractured zone	
No.6	140 - 160	380	Hard basalt	
No.7	160 - 180	16	Fractured zone	
No.8	180 -	320	Hard basalt	

The aquifer is judged to lie from 35 to 180m in depth, and the depth of a new well is recommended to be 200m.