CHAPTER-5 THE PROJECT

CHAPTER 5 THE PROJECT

5.1 OBJECTIVES

The productivity of land in the Study Area is low and farming is unstable, even though its land resources are rich, due to the following factors that prevent the agricultural development in and around the Study Area:

a. Shortage of irrigation water
b. Poor irrigation system
c. Poor farming system
d. Non-improvement of marketing system

The Project is formulated with the intention of improving the living standards of the farmers in the Project Area by introducing the irrigation farming system and improving the marketing and transportation systems in order to cope with the above troublesome factors.

The proposed development plan will become the model for the further agricultural development schemes in the arid zones of Baluchistan and other similar areas.

5.2 PROJECT FORMULATION

5.2.1 Basic Development Concepts

This irrigation development plan is formulated on the basis of the following basic development concept:

(1) Groundwater Development Plan

The development of the moving groundwater has the top priority. However, the development of the stagnant groundwater is also considered in the case of no moving groundwater resources around the possible irrigation development area.

(2) Land Use Plan

a. The irrigation development areas are selected in the areas as near the proposed well sites as possible.

b. The area to be covered by the groundwater coming from a well becomes one farm-unit in the irrigation area.

c. The poorly drained areas are excluded from the development areas.

(3) Irrigation/Drainage Plan

a. The irrigation facilities with less expensive operation and maintenance costs and simple operation are designed in view of the future farming system.

b. Less-water-use irrigation system is considered.

c. The conveyance of irrigation water is designed with lined open canals in consideration of the big water loss from un-lined canals.

d. The flood control against the discharge from the entire basin is not considered. The drainage in the areas is studied at the farmland level, focusing on the proposed farming conditions.

(4) Village Improvement Plan

a. In consideration of the advancement of the living standards of villagers, the improvement of the connection roads as well as farm roads is considered.

b. The domestic water supply facilities are planned in coordination with the irrigation plan.

c. The electricity supply system is planned in consideration of cheap power for pump facilities and improvement of living standards of the villagers.

(5) Agricultural Development Plan

a. To introduce less-water-use irrigation farming.

b. To reinforce agricultural extension services.

c. To diversify the crops, to stabilize crop production, to improve cropping intensity and to increase crop yield.

d. To select crops suitable for the area in consideration of the following:

. Higher marketability
. Higher productivity
. Higher farm-gate price
. Lower transportation cost
. Easier cultivation
. Traditional crops

5.2.2 Selection of the Project Area

Based on the results of aerial gamma-ray spectro prospecting, well tests, seismic prospecting, field investigations of existing wells and analyzed present groundwater balance, four (4) areas, QT-D and QT-E in Quetta Area and KL-B and KL-C in Kalat Area, are selected as the Project Area (FIG 5.2.1) in consideration of the following:

- Soil capability
- Gradient of land
- Existing flood stream areas
- Extensibility of the Area
- Accessibility to the Area
- Susceptibility against inundation or erosion
- Water quality

These selected areas will have high potentials for agricultural development as well as groundwater development, and are expected to become a model of the agricultural development schemes in the similar areas.

5.2.3 Groundwater Development Plan

(1) General

As described in 4.2.2, Chapter 4, the groundwater development in the northern part of the Quetta Area should be carefully studied due to its present over-utilization from the viewpoint of the water balance in the entire watershed. There will be no specific problem against the groundwater development in other areas due to its insufficient development progress at present.

On the basis of finalized possible yield and groundwater veins, the groundwater development plan is prepared in coordination with the farm management and irrigation plans.

(2) Determination of Design yield

As described in 4.5.2, Chapter 4, KL-JICA-1 test well drilling in Vein A of the Kalat Area could not obtain good results. In KL-JICA-2 in Vein B and KL-JICA-3 in Vein C of the Kalat Area, test well drilling could obtain good results. The tentative water sampling tests and pump tests show the existence of aquifers in these two Veins. The final pumping tests for these test holes show the specific capacity of 17 $m^3/d/m$ at KL-JICA-2 and 78 $m^3/d/m$ at KL-JICA-3, respectively. The groundwater development of Veins B & C will be hopeful only in their northern parts, judging from the cutting samples, electric logs and existing electrical survey data. Also the tentative water sampling tests of QT-JICA-1 in Vein E and QT-JICA-2 in Vein D show the existence of aquifers and now the reaming for 10" casing are being undertaken.

The design yield from the groundwater development in the Project Area is tentatively estimated based on the available data as shown in TABLE 5.2.1.

TABLE 5.2.1 ESTIMATED DESIGN YIELD

(Unit: l/sec)

Area	QT-D	QT-E	KL-B	KL-C	Total
Vein	D	E	B	C	
No. of wells 1/	4	5	4	3	
Unit Yield	15 2/	5 2/	5	15	
Total Yield	60	25	20	45	150

1/ including four test wells, one for each area.
2/ expected from water sampling test.

The design yields in the respective veins are checked from the viewpoints of water balance based on the estimated present water balance shown in TABLE 4.2.1. The results of the analysis show that there will be still surplus in all the veins as shown in TABLE 5.2.2.

TABLE 5.2.2 WATER BALANCE WITH PROJECT

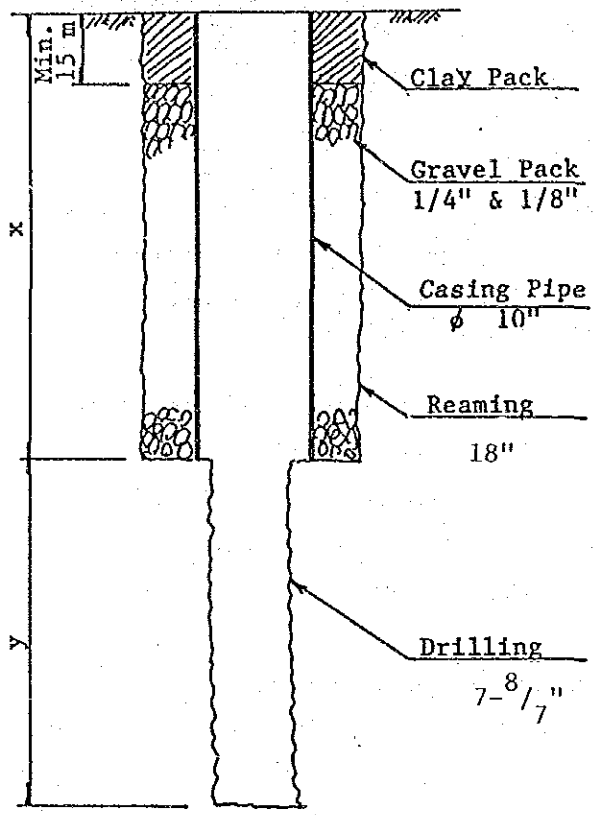
(Unit: m^3/day)

	Item	QT-D	QT-E	KL-B	KL-C
1.	Yearly Recharge	4,679	17,111	78,971	65,884
2.	Present Un-used Groundwater	4,632	16,853	57,829	64,651
3.	Design Yield 1/	3,888	1,620	1,296	2,916
4.	Balance	744	15,233	56,533	61,735
5.	4/1 (%)	15.9	89.0	71.6	93.7

1/ 18 hour pump operation per day

(3) Design of Well

The production wells in the respective Project Area are determined as follows:



Area	x (m)	y (m)	Total (m)
QT-D	150	100	250
QT-E	100	100	200
KL-B	150	100	250
KL-C	200	100	300

Note: 1. The total length of strainer pipes (mild steel slotted pipe) for each well is tentatively set at 50 m.

2. The casing pipe (ϕ6") for the bedrock section is not considered at this moment.

5.2.4 Land Use Plan

The Project Area covers QT-D and QT-E Areas in the Quetta Area and KL-B and KL-C Areas in the Kalat Area.

Each Area has tube wells at intervals of about one kilometer. Depending on the actual water discharge from every tube well, one farm unit of irrigation development area should be determined accordingly. It is estimated to be 5 - 15 ha based on the results of well tests.

Land use of one unit is as follows.

1. site for a tube well
2. site for a farm pond
3. vegetable field and orchard
4. canals and farm roads

The proposed connection road system that connects each farm unit and provides the access to the national or provisional road will improve the transportation conditions for agricultural input materials and products.

5.2.5 Irrigation/Drainage Plan

(1) Irrigation Requirements

1) Procedures of Estimation

Irrigation requirements are determined by multiplying net irrigation requirements (crop water requirements minus effective rainfall) by irrigation efficiency. The crop water requirements are calculated using the "Blaney-Criddle Method"[1/] as shown below on the basis of humidity, wind and sunshine data, since this method is most widely used for other projects in the Province. Climatic data used for the Study are obtained from the nearest meteorological stations located at Spezand for the Quetta Area and at Kalat for the Kalat Area. Calculation procedure is shown in FIG 5.2.6.

$$ETcrop = kc \times ETo$$

where, ETcrop = crop evapotranspiration (crop water requirements) (mm/day)

kc = crop factor

ETo = reference crop evapotranspiration estimated with Blaney-Criddle method (mm/day)

2) Crop Water Requirements (ETcrop)

ETo is estimated using "Blaney Criddle Method" as shown in TABLE 5.2.3.

1/ FAO Irrigation and Drainage Paper 24 "Crop Water Requirements", Rome 1977

TABLE 5.2.3 ESTIMATED ETo

(Unit: mm/day)

Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Quetta	0.9	1.0	2.0	4.5	6.0	7.7	7.2	6.7	5.2	4.2	1.7	0.8
Kalat	0.8	1.1	2.0	4.0	5.3	7.5	6.6	6.1	4.8	3.6	2.5	1.2

ETcrop is likewise estimated as shown in TABLE 5.2.4. Details of the estimation are show in APPENDICES.

TABLE 5.2.4 ESTIMATED ETcrop

(Unit: mm/day)

Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Quetta	0.1	0.1	0.7	2.6	3.7	5.0	3.6	4.6	3.7	1.8	0.4	0.1
Kalat	0.1	0.1	0.7	2.1	3.6	4.5	4.3	4.8	2.9	2.0	0.9	0.2

3) Effective Rainfall

According to the existing projects and previous reports on agricultural development in West Baluchistan, the concept of effective rainfall is rarely involved. However, the agriculture in the Study Area basically depends on the precious rainfall. The sowing season, March to April, belongs to the rainy season. Consequently, the concept of effective rainfall is introduced in the irrigation plan of the Project.

a. Dependable Rainfall

Crop water requirements are fully or partly supplemented by rainfall. However, rainfall for each period varies from year to year. Therefore, the level of dependable rainfall has to carefully be selected. In the Project, the annual rainfall probability of 80% (say 4 out of 5 years) is adopted.

Dependable annual rainfall is divided into dependable monthly rainfalls based on the mean monthly/annual rainfall ratio computed using long term observation data.

b. Effective Rainfall

Some of the rainfall may be lost due to runoff, percolation and evaporation. So that, effective rainfall which can enter and be stored in the root zone is to be estimated.

Effective rainfall can be estimated with the evapotranspiration/precipitation ratio method recommended by FAO. The estimated effective monthly rainfalls are shown in TABLE 5.2.5.

TABLE 5.2.5 MONTHLY EFFECTIVE RAINFALL

(Unit: mm/month)

Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Quetta	15.4	13.4	13.7	-	-	-	-	-	-	-	-	-	42.5
Kalat	16.1	13.9	11.5	-	-	-	12.5	-	-	-	-	-	54.0

4) Net Irrigation Requirements

Net irrigation requirements (crop irrigation requirements minus effective rainfall) are determined as shown in TABLE 5.2.6. The maximum net water requirements are 5.0 mm/day in June in the Quetta Area and 4.8 mm in August in the Kalat Area.

TABLE 5.2.6 NET WATER REQUIREMENTS

(Unit: mm/day)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Quetta												
ETcrop	0.1	0.1	0.7	2.6	3.7	5.0	3.6	4.6	3.7	1.8	0.4	0.1
Effective Rainfall	0.5	0.5	0.4	-	-	-	-	-	-	-	-	-
Net Water Requirements	-	-	0.3	2.6	3.7	5.0	3.6	4.6	3.7	1.8	0.4	0.1
Kalat												
ETcrop	0.1	0.1	0.7	2.1	3.6	4.5	4.3	4.8	2.9	2.0	0.9	0.2
Effective Rainfall	0.5	0.5	0.4	-	-	-	0.4	-	-	-	-	-
Net Water Requirements	-	-	0.3	2.1	3.6	4.5	3.9	4.8	2.9	2.0	0.9	0.2

5) Irrigation Requirements

Irrigation requirements are finally determined considering the irrigation efficiency (Ei) which consists of field canal efficiency (Eb) and field application efficiency (Ea). The irrigation efficiency has a great effect on the quantity of irrigation water, the capacity of various irrigation facilities and project cost.

Field canal efficiency is set sufficiently at 85% for the concrete-lined open canal. Field application efficiency for the basin system is generally designed at the level of 80 to 95% in the field. In the Project, the efficiency is set at 90% in consideration of the field conditions and farming practices.

Therefore, the irrigation efficiency (Ei) is determined as follows:

$$Ei = Eb \times Ea = 0.85 \times 0.90 = 0.76 \fallingdotseq 0.75$$

The irrigation requirements (gross duty of irrigation water) can be computed from the following equation:

$$Q = \frac{10 \times ETcrop \times A}{3.6 \times Ei \times Ti}$$

where, Q = Irrigation requirements (1/sec)
ETcrop = Crop water requirements (mm/day)
Ei = Irrigation efficiency
Ti = Irrigation time (hr)
A = Irrigation area (ha)

The operations of pump facilities and irrigation facilities are set at 18 hrs and 8 hrs a day, respectively. Irrigation interval is set at 5 days considering readily available moisture of soil and the actual interval adopted in the Study Area at present. The acreage of a farm-unit is set at 10 ha as a model.

Therefore, irrigation requirements in the Study Area for 10 ha farm-unit are estimated as shown in TABLE 5.2.7.

TABLE 5.2.7 IRRIGATION WATER REQUIREMENTS

Area	ETcrop (mm/day)	Ei	A (ha)	Ti (hr)	Q (1/sec)
Quetta	5.0	0.75	10.0	18	Q18 = 10.2
	5.0	0.75	10.0	8	Q8 = 23.1
Kalat	4.8	0.75	10.0	18	Q18 = 9.9
	4.8	0.75	10.0	8	Q8 = 22.2

(2) Irrigation Methods

Irrigation methods are categorized as follows:

- Surface irrigation
  - Border method
  - Contour ditch method
  - Basin method
  - Furrow method
- Drip irrigation
- Spray irrigation
  - Sprinkler method
  - Perforated pipe method

The basin method is proposed in the Project considering the following characteristics:

a. Border method and furrow irrigation need a large quantity of irrigation water.

b. The perforated pipe method is disadvantageous due to lack of uniformity in distribution, resulting in irregular irrigation efficiency and salt accumulation, although this method is constructed at relatively low cost.

c. Drip and sprinkler irrigation with fixed facilities is not practical for cultivating vegetables and fodder crops,since frequent planting and plowing are required. Although drip irrigation is the most water saving method, the construction cost is relatively high.

d. Although the basin method is envisaged to require large amount of irrigation water generally, water saving would be expected due to the good experiences of the farmers. Because the method is widely adopted in the Study Area. And also the soil in the Study Area belongs to silt range with lower permeability of 10^{-5} - 10^{-6} ft/min.

(3) Drainage

The farmers are utilizing irrigation water to the maximum extent in the traditional cultivation "Sailaba" under the severe conditions of limited water resources. Annual rainfall in the Study Area is approx. 200 m and its intensity is low. Therefore, no existing drainage facilities exist in the Study Area.

In consideration of the soil conditions and irrigation method proposed in the Project, the excess discharge from the pump which might happen due to the mis-operation of pump or mis-watering to the field will not affect the cultivation. As a result, no drainage facility is considered in the Project.

(4) Irrigation Facility Plan

1) General

Irrigation system which is composed of facilities from a farm pond to the farm is divided into the following three categories:

. Farm pond
. Irrigation canal
. Other ancillary facilities

A farm-unit is set at 10 ha (24.7 acres) as a model. The farm-unit and water management block is shown on FIG 5.2.4.

2) Farm Pond

Farm pond aims to make water management flexible on the field. Actually, a farmer explained that he made a farm pond to reduce his watering time. And also as more important reason, he quoted the storage of water is necessary because of undependable water resources and power supply.

a. Capacity

Capacity of a farm pond is calculated with the following formula:

$$V = 3.6 \times Qp\ (T1 - T2)$$

where, V = Capacity of farm pond (m^3)
Qp = Discharge of pump (l/sec)
T1 = Operating time of pump facility (hr)
T2 = Watering time in the field (hr)

Area	Qp (l/sec)	T1 (hr)	T2 (ha)	V (m3)
Quetta	10.2	18	8	367
Kalat	9.9	18	8	356

b. Structure of Farm Pond

There are several types of structure such as brick lining, reinforced concrete, concrete lining and rubber sheet lining.

From the viewpoint of workability, durability and availability of materials, it is proposed that the farm ponds have brick linings with mortar surfacing.

An inlet chamber and outlet words of pond is installed at each farm pond.

3) Irrigation Facilities

a. Main Canal

From the viewpoint of durability, cost, and availability of materials, open canal system is planned. Among the several canal types such as concrete flume, mortar lining, wet-masonry, and earth flume, mortar lining type is adopted due to its cost, workability, less conveyance problems, etc.

The design discharge is Q = 23.1 l/sec for 10 ha farm unit and the average canal gradient is 1/300 to 1/500.

b. Secondary canal

The secondary canal that convey the irrigation water directly to the field from main canal is of earth lining, because of the cost and reformability of the field. The conveyance loss will be decreased because the soil belongs to silt with low permeability. The design discharge in Q = 5.8 l/sec.

4) Ancillary Facilities

As the ancillary facilities, the following structures and works are planned.

- Farm roads
  to access to the farming plots

- Turnouts
  to distribute irrigation water from the main canals to the secondary canals

- Culverts
  at the farm road crossing points

- Land levelling
  Land levelling including gravel removing works is benefitable to increase and keep the field application efficiency with making the water reach the far end of the basin uniformly.

5.2.6 Village Improvement Plan

In parallel with the irrigation development, the basic infrastructures to improve the Project Area shall be constructed by the Project. Connection roads and farm roads not only provide transportation of agricultural products but also improve the communication with other areas. Electricity supply to the tube wells provides easy extension of electricity to rural areas

around the Project Area. The extracted groundwater for irrigation also can be used as safe water for the farmers. In the Project, connection roads as the access to the Project Area from existing Provincial/National roads, installation of electricity feeder lines to the tube wells and the water tanks for domestic use are planned.

(1) Connection Road

The connection roads connect the existing Provincial/National roads with the Project Area for the agricultural activities. They are aligned also to connect all the tube wells in the Project Area and designed as a gravel-paved road with 3.0 m effective width and a right of way of 10 m width which facilitate water runoff and avoid ponding and deterioration of the road surface. The length of connection roads for each Project Area is as follows:

TABLE 5.2.8 LENGTH OF CONNECTION ROAD

(Unit: km)

Area	Length	Connection
QT-D	9.0	National Highway No. 55 and 25
QT-E	5.0	Provincial road
KL-B	8.5	Provincial road and District road
KL-C	4.0	District road under improvement
Total	26.5	

The farm roads, a part of on-farm facilities, are diverted from the connection roads. It is planned that the farm roads will also be used as the access roads during the construction works.

At the crossing with the Wadi (drain), a submersible-type cross structure is planned. At the crossing with irrigation canals, reinforced concrete culverts are planned.

(2) Electricity Feeder Line

The extension of existing electricity feeder lines with 11 KVA is required in order to supply proposed tube wells with electricity. Alignment of the feeder line extension is planned to run in parallel with the proposed connection roads. The length of the required feeder line extension of each Project Area is estimated as follows:

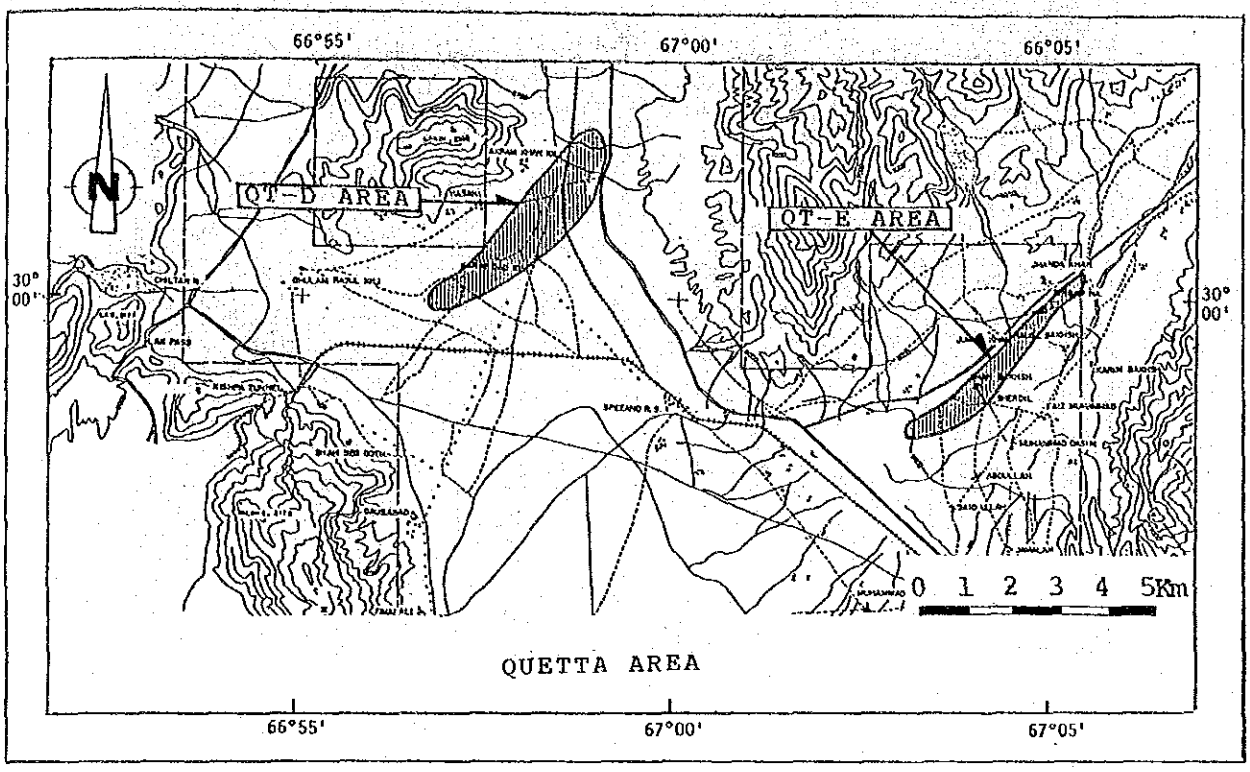
TABLE 5.2.9 LENGTH OF ELECTRICITY FEEDER LINE

Area		Length
QT-D	:	2.5 km
QT-E	:	3.5 km
KL-B	:	10.0 km
KL-C	:	6.0 km
Total	:	22.0 km

Each tube well is supplied with electricity from these feeder lines through proper installation of a transformer and switch/meter panel. The feeder line extension and other facilities required shall be designed in accordance with the standard/specification of WAPDA.

(3) Communal Water Tank

No facilities of rural water supply, such as supply and service taps are planned. For the domestic use, a communal water tank for each tube well will be sufficient and the amount of domestic water consumption is quite a few compared with irrigation water requirements. The required communal water tanks are included in the irrigation facilities.



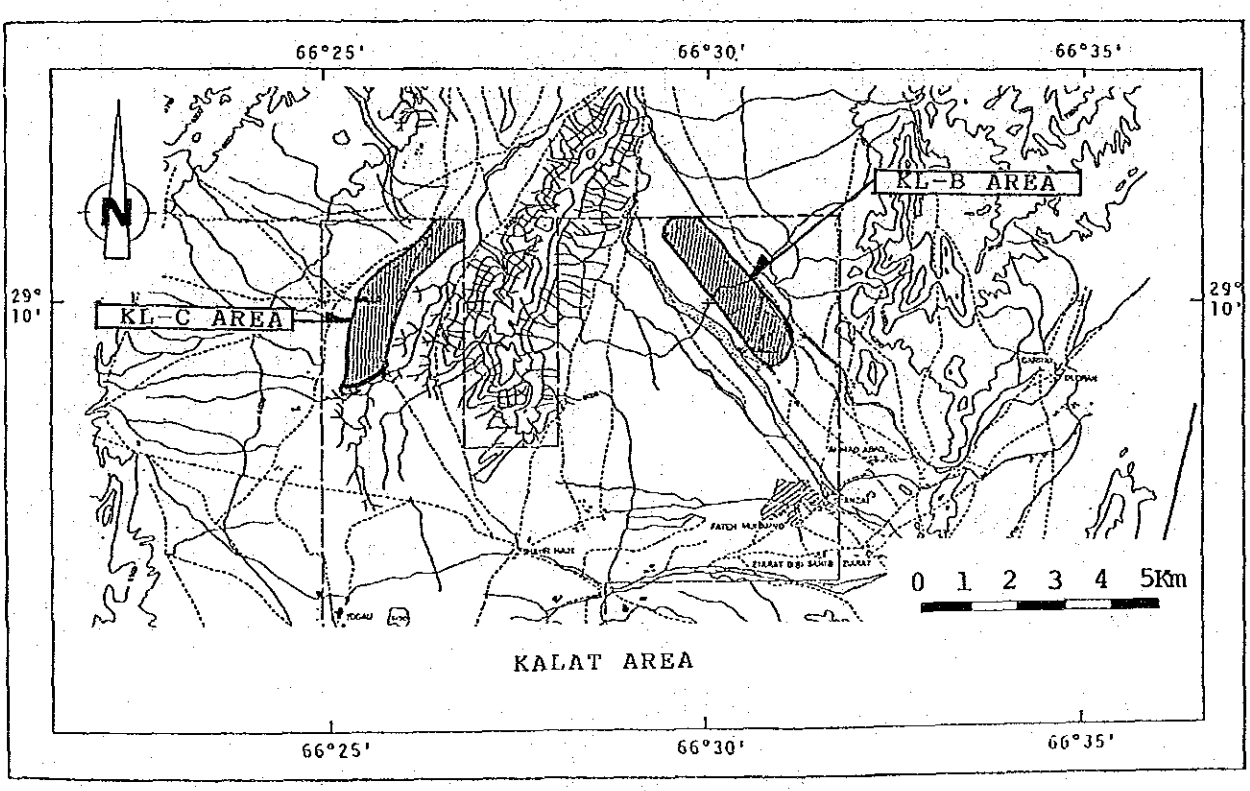
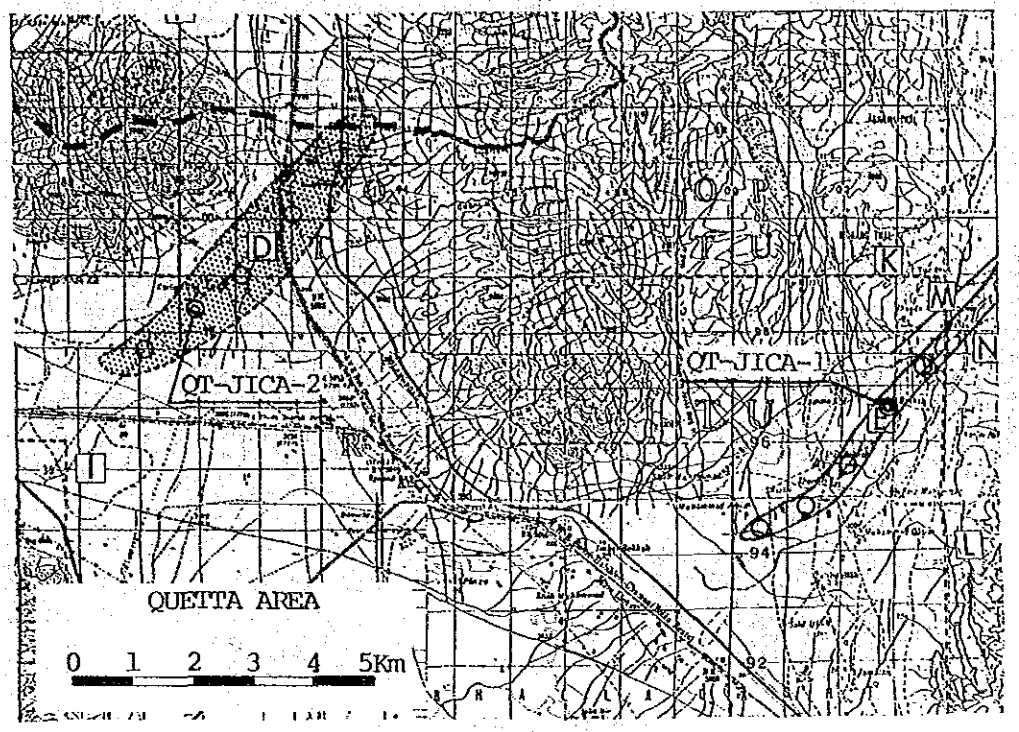


FIG 5.2.1 PROPOSED PROJECT AREA



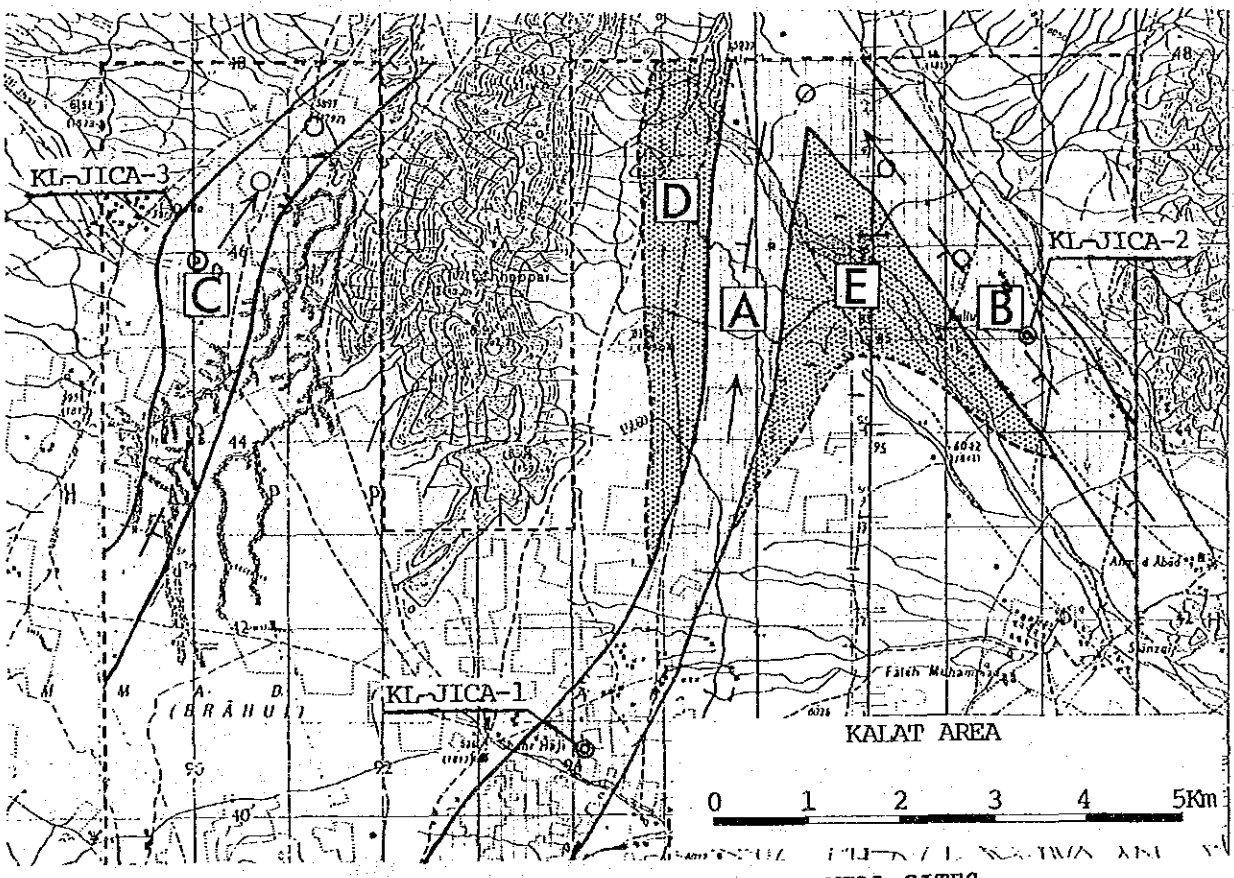


FIG 5.2.2 LOCATION OF PROPOSED WELL SITES

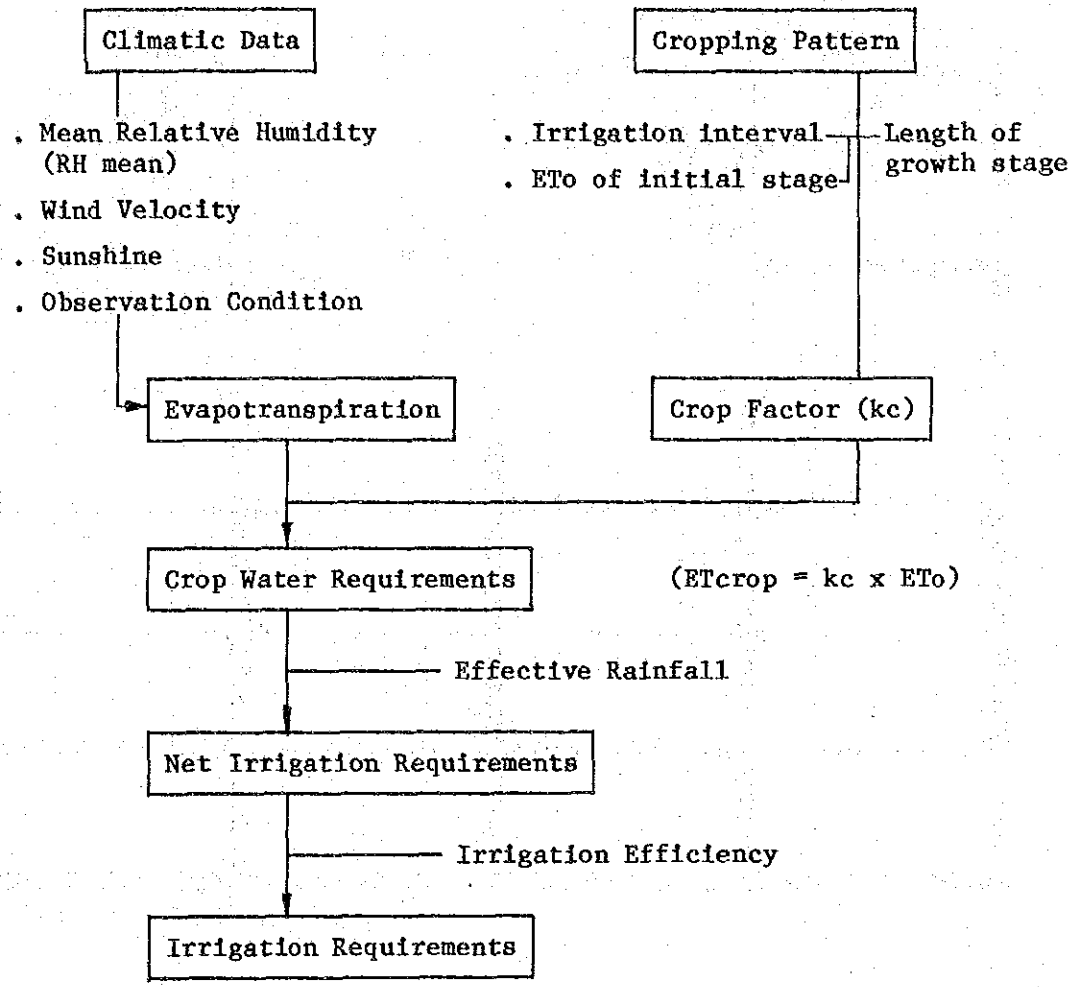
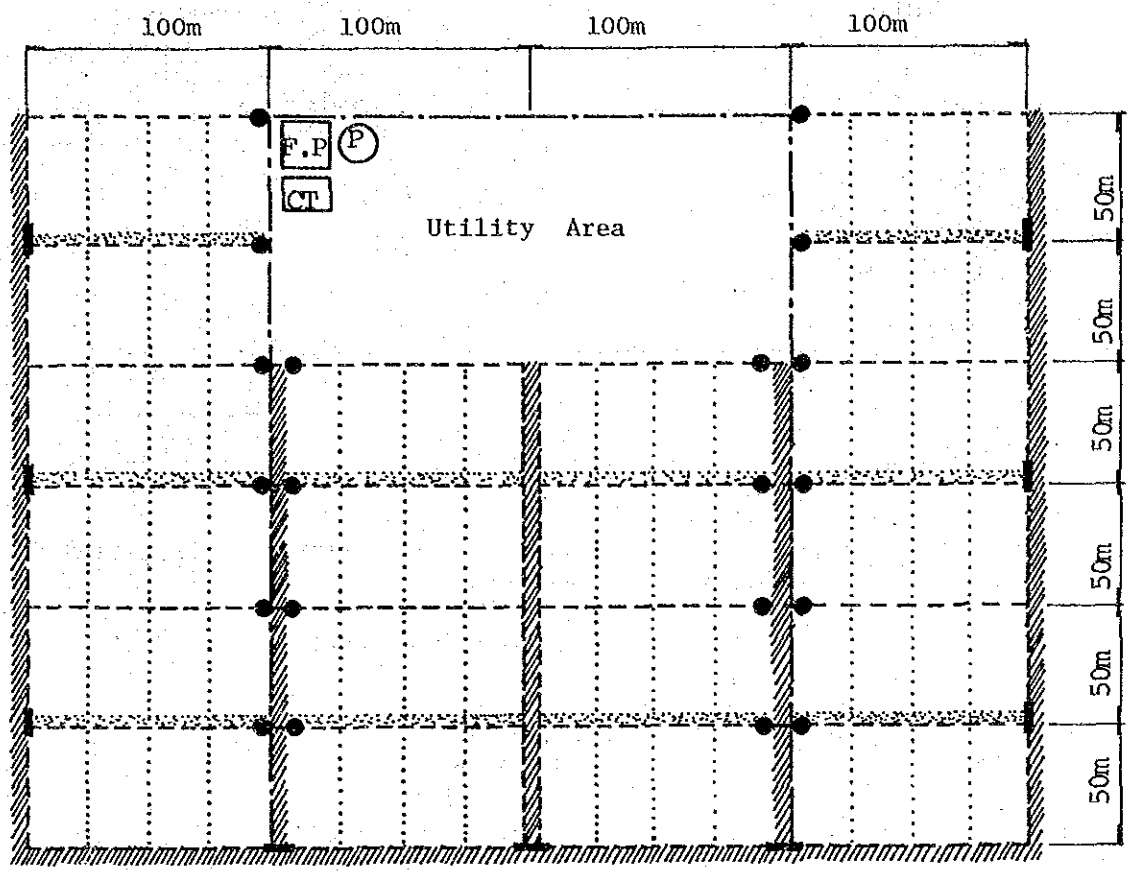


FIG 5.2.3 FLOW CHART OF ESTIMATION OF IRRIGATION REQUIREMENTS



LEGEND

Main canal		P	Tube well
Branch canal		F.P	Farm pond
Levee		C.T	Communal tank
Main farm road		●	Turnout
Branch farm road		▬	Culvert

FIG 5.2.4 TYPICAL LAYOUT OF IRRIGATION FACILITIES

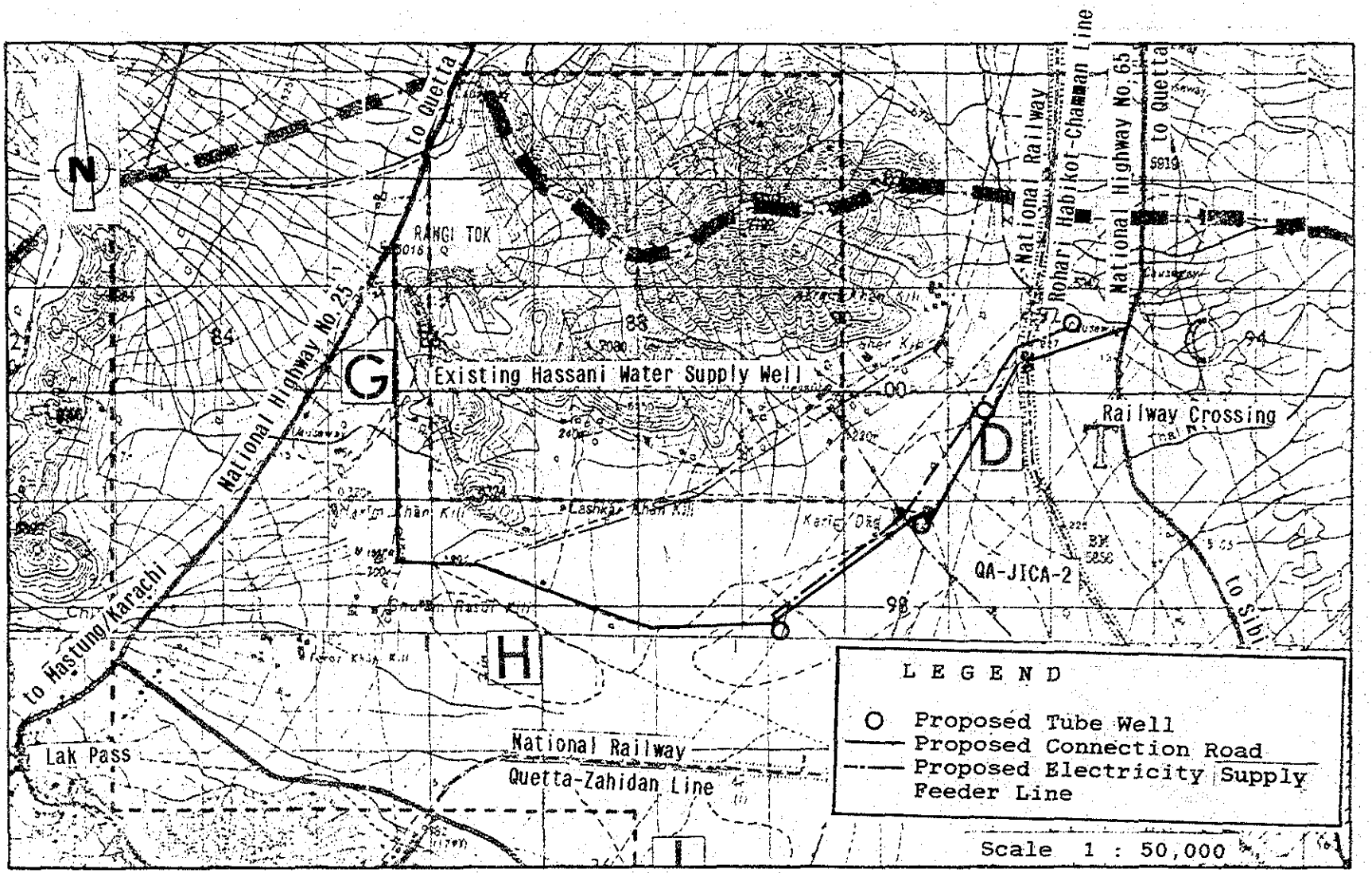


FIG 5.2.5 PRELIMINARY LAYOUT OF INFRASTRUCTURES IN QT-D AREA

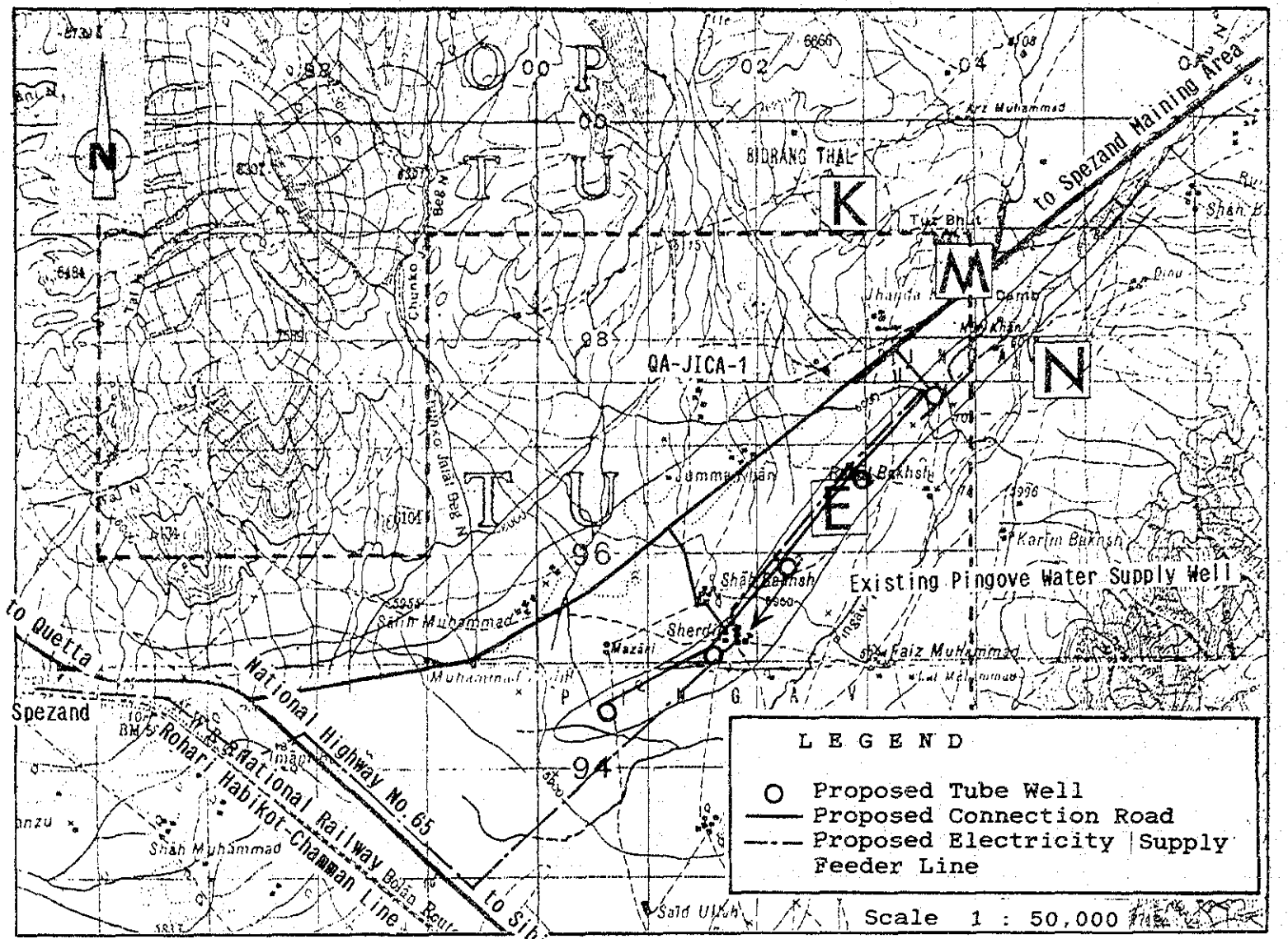


FIG 5.2.6 PRELIMINARY LAYOUT OF INFRASTRUCTURES IN QT-E AREA

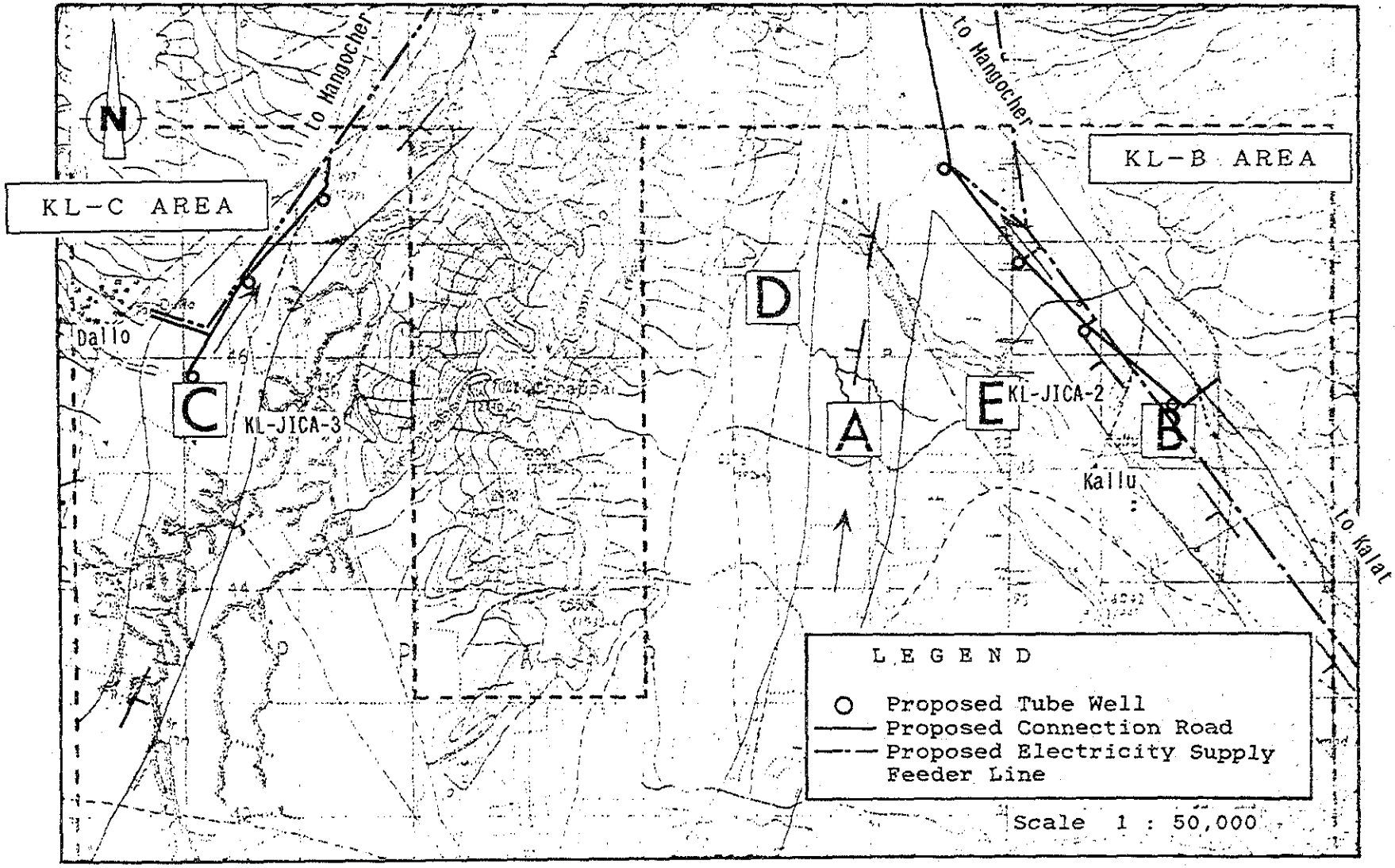


FIG 5.2.7 PRELIMINARY LAYOUT OF INFRASTRUCTURES IN KALAT AREA

5.3 PROPOSED AGRICULTURE DEVELOPMENT PLAN

5.3.1 Agricultural Production Plan

(1) Cropping Pattern

Regarding soils in the Project Area, there will be no limitation in selecting crops, because soils in the Project Area is generally silt in texture. However, various other factors such as expected future demand of crops, labor distribution for cultivation and transportation to the market have to be considered in the planning of a cropping pattern.

The proposed three-year rotation cropping pattern of vegetables and orchard is prepared in consideration of the above factors and the data available in the Agricultural Extension Offices through discussions with the staff of the said offices. As the intercrops of non-bearing apple orchards, alfalfa, onion and potato are introduced (TABLE 5.3.1).

(2) Outline of Cultivation Method

Generally, land preparation will be carried out by tractors. Making levee is performed by animals while other farmworks are done by manpower. The reason is that main crops are vegetables which require intensive farming works.

Onion, potato and alfalfa will be cultivated as intercrops in apple orchard during the first five years of apple growing.

Agricultural input materials by crop are shown in TABLE 5.3.2.

TABLE 5.3.1 CROPPING PATTERN

Cropping Pattern	First Year		Second Year		Third Year	
			(100%)	(80%)	(100%)	(80%)
Quetta - A	Onion		Cumin,	Turnip	Peas,	Cabbage
- B	Potato		Broad B,	Turnip	Tomato,	Cabbage
	(100%)	(80%)				
- C	Chillies,	Carrot	Okra,	Broad B,	Cucumber,	Radish
		(80%)		(80%)		(80%)
- D	Apple	(Alfalfa)	Apple	(Alfalfa)	Apple	(Alfalfa)
- E	Grape			Grape		Grape
Kalat - A	Onion		Cumin,	Radish	Tomato,	Broad B.
- B	Potato		Carrot,	Turnip	Broad B.,	Cabbage
		(80%)		(80%)		(80%)
- C	Apple	(Onion)	Apple	(Potato)	Apple	(Onion)
- D	Grape			Grape		Grape

TABLE 5.3.2 AGRICULTURAL INPUT MATERIALS BY CROP (per ha)

Crops	Seed	Fertilizer N-P-K (kg)	Compost (t)	Labor (hr)
Onion	12.5 kg	150-150-150	10	1,949
Potato	1,865.0 "	225-150-113	10	1,397
Peas	70.0 "	DAP125, U250	5	1,551
Carrot	5.0 "	DAP125, U250	5	2,124
Turnip	2.5 "	DAP125, U250	5	1,271
Radish	5.0 "	113-113-93	5	1,344
Cabbage	1.8 "	113-175-188	5	2,184
Broad B	100.0 "	DAP125, U250	10	1,841
Cucumber	1.5 "	DAP125, U250	5	1,451
Tomato	25,000 plants	225-150-150	5	2,648
Okra	5.0 kg	DAP125, U250	5	1,366
Chillies	5.4 "	37-58-63	5	2,461
Cumin	30.0 "	113-113-93	5	506
Alfalfa	30.0 "	DAP25, UEA100	-	605
Apple	178 trees	225-150-150	10	4,682
Grape	918 trees	300-225-150	10	4,689

Notes: U = Urea, DAP = Diammonium Phosphate

(3) Target Yield by Crop

Target yield for each crop is set as listed in TABLE 5.3.3. These target yields will be attained only on the conditions that the irrigation water be properly utilized and that the advanced agricultural techniques together with the higher yield varieties be introduced in accordance with the instructions of the Agricultural Extension Offices in respective Tehsils.

The target year to attain the target yield of the vegetables is determined to be three years after the Project completion year. While orchard takes eight to ten years to reach the full development stage; eight years for grape and ten years for apple.

The premises above-mentioned are determined through discussion with Department of Agricultural Extension Office.

(4) Agricultural Production

The Project will enable the entire proposed area to be irrigated adequately when completed and will allow the agricultural production of the Area to be increased sharply with the cropping intensity being raised from present 100% to 160%.

The anticipated stable irrigation water supply will raise the efficiency of investment in the form of agro-chemicals and fertilizer to result in bringing the synergy effect to agricultural productions.

The expected production from one farm-unit (assumed to be 5, 10 and 15 ha) in the Project Area both in Quetta and Kalat Areas is as follows (TABLE 5.3.4):

Area	5 ha		10 ha		15 ha	
	Vegetables (t)	Fruits (t)	Vegetables (t)	Fruits (t)	Vegetables (t)	Fruits (t)
Quetta	106.5	19.4	213.3	38.8	319.8	58.2
Kalat	88.9	31.0	177.8	62.0	266.7	93.0

TABLE 5.3.3 DEVELOPMENT OF TARGET YIELD

(Unit: t/ha)

VEGETABLES

Crops	1st Year	2nd Year	3rd Year
Onion	10.2	13.6	17.0
Potato	9.0	12.0	15.0
Peas	6.6	8.8	11.0
Carrot	10.8	14.4	18.0
Turnip	10.8	14.4	18.0
Radish	9.0	12.0	15.0
Cabbage	10.2	13.6	17.0
Broad B.	6.0	8.0	10.0
Cucumber	9.0	12.0	15.0
Tomato	10.2	13.6	17.0
Okra	8.0	10.0	12.0
Chillies	4.5	6.0	7.5
Cumin	0.5	0.6	0.7
Alfalfa	20.0	26.0	30.0

ORCHARD

Crops	3rd	4th	5th	6th	7th	8th	9th	10th	11th year
Apple	-	-	1.8	5.4	9.0	14.4	16.2	18.0	18.0
Grape	1.3	3.8	6.5	10.4	11.7	13.0	13.0	13.0	13.0

TABLE 5.3.4 AGRICULTURAL PRODUCTION BY DEVELOPMENT AREA

Area	Crops	Yield/ha (t/ha)[1/]	5 ha		10 ha		15 ha	
			Acreage (ha)	Product (t)	Acreage (ha)	Product (t)	Acreage (ha)	Product (t)
Quetta	Onion	17.0	0.42	7.1	0.84	14.3	1.26	21.4
	Potato	15.0	0.42	6.3	0.84	12.6	1.26	18.9
	Peas	11.0	0.83	9.1	1.66	18.3	2.49	27.5
	Carrot	18.0	0.42	7.6	0.84	15.1	1.26	22.7
	Turnip	18.0	0.83	14.9	1.66	29.9	2.49	44.8
	Radish	15.0	0.42	6.3	0.84	12.6	1.26	18.9
	Cabbage	17.0	0.83	14.1	1.66	28.2	2.49	42.3
	Broad B.	10.0	0.42	4.2	0.84	8.4	1.26	12.6
	Cucumber	15.0	0.42	6.3	0.84	12.6	1.26	18.9
	Tomato	17.0	0.42	7.1	0.84	14.3	1.26	21.4
	Okra	12.0	0.42	5.0	0.84	10.1	1.26	15.1
	Chillies	7.5	0.42	3.2	0.84	6.3	1.26	9.5
	Cumin	0.7	0.42	0.3	0.84	0.6	1.26	0.9
	Alfalfa	30.0	0.50	15.0	1.00	30.0	1.50	45.0
	Sub Total			106.5		213.3		319.8
	Apple	18.0	0.63	11.3	1.26	22.7	1.89	34.0
	Grape	13.0	0.62	8.1	1.24	16.1	1.86	24.2
	Sub Total			19.4		38.8		58.2
	Total		8.44	125.9	16.88	252.1	25.32	378.0
Kalat	Onion	17.0	1.03	17.5	2.06	35.0	3.09	52.5
	Potato	15.0	0.76	11.4	1.52	22.8	2.28	34.2
	Cucumber	15.0	0.50	7.5	1.00	15.0	1.50	22.5
	Radish	15.0	0.50	7.5	1.00	15.0	1.50	22.5
	Carrot	18.0	0.50	9.0	1.00	18.0	1.50	27.0
	Turnip	18.0	0.50	9.0	1.00	18.0	1.50	27.0
	Tomato	17.0	0.50	8.5	1.00	17.0	1.50	25.5
	Broad B.	10.0	1.00	10.0	2.00	20.0	3.0	30.0
	Cabbage	17.0	0.50	8.5	1.00	17.0	1.50	25.5
	Sub Total			88.9		177.8		266.7
	Apple	18.0	1.00	18.0	2.00	36.0	3.00	39.0
	Grape			3.0		26.0		54.0
	Sub Total			21.0		62.0		93.0
	Total		7.99	109.9	15.58	239.8	23.37	359.7

1/ Yield/ha: marketable quantity

Quetta

CROPS	%	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ONION	8.25												
CUMIN TURNIPS	8.25 (6.60)												
PEARS CABBAGE	8.50 (6.80)												
POTATO	8.25												
BROAD-B TURNIPS	8.25 (8.25)												
TOMATO CABAGE	8.50 (8.50)												
CHILIES CARROT	8.25 (8.25)												
OKRA BROAD-B	8.25 (8.25)												
CUCUMBER RADISH	8.50 (8.50)												
APPLE	12.50												
GRAPES	12.50												

LEGEND: Cropping / Harvesting . ( ): Secondary Cropping

Kalat

CROPS	%	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ONION	10.00												
CUMIN RADISH	10.00 (8.00)												
TOMATO BROAD-B	10.00 (8.00)												
POTATO	10.00												
CARROT TURNIPS	10.00 (10.00)												
BROAD-B CABAGE	10.00 (10.00)												
APPLE	20.00												
GRAPES	20.00												

LEGEND: Cropping / Harvesting. ( ): Secondary Cropping

FIG 5.3.1 CROPPING CALENDAR

5.3.2 Supporting Services

The agricultural extension service in the Project Area is at present unsatisfactory despite the fact that its activities have been strengthened in recent years.

The enlargement of staff and provision of vehicles for the extension offices are indispensable for the intensification of agricultural extension services to a large extent.

Furthermore, the provision of sufficient number of irrigation technicians is prerequisite to the success of irrigated agriculture to be introduced under the Project.

The required number of agricultural irrigation staff is as follows:

Mastung Tehsil Agricultural Extension Office : 3
Kalat Tehsil Agricultural Extension Office : 3
- One water management specialist
- One orchard cultivation specialist
- One vegetables cultivation specialist

5.4 INFRASTRUCTURE FACILITIES PLANNED

5.4.1 Groundwater Development Facilities

One tube well is installed in each farm unit considering the groundwater development potentiality.

(1) Borehole

a. Borehole Depth

The depth of a tube well is determined considering the following items:

1. Depth of the water-bearing zones
2. Aquifer thickness
3. Screen length required for producing the design yield of water
4. Length of pump housing, blank casing, bail plug, etc.

b. Borehole Diameter

The construction of a tube well starts with small diameter as a pilot hole for lithology and electric logging and water sampling. After getting the good conditions, the hole is reamed to bigger diameter hole to accommodate a pump-housing casing that will allow easy pump and screen installation and uniform placement of gravel screen. The construction cost is estimated on the condition of 7-7/8" for pilot hole and 18" for production well.

(2) Tube Well

The proposed tube well structure is planned as shown in FIG 5.4.1 in consideration of several elements such as pump-housing casing, blank casing and well screen.

(3) Pump

a. Pump type

Comparing a vertical turbine pump and submersible pump, the submersible pump is selected for the following reasons:

i. In general, borehole diameter required for a submersible pump is smaller than that for a turbine pump for the same discharge, resulting in lower initial cost.

ii. Simple installation in the tube well without special tools or equipment, resulting in less maintenance problems.

iii. More economical operation because of higher efficiency.

b. Pump Capacity

Design yield, pump head, pump elevation should be determined based on the actual pumping test results at the proposed site. In the Project, the following six (6) cases are considered:

Pump Head (m)	Discharge (l/sec)
100	5
	10
	15
150	5
	10
	15

(4) Pump House

The pump house is constructed to protect pump machinery and tube well structure itself. The pump house does not have the operator's quarter in it. Because it is envisaged that the tube well operators will be employed and stay in their villages.

The outer space of pump house is 10 feet x 10 feet (100 sq.ft). This size is often observed in Baluchistan. At the center of the house, a high concrete pedestal (1 x 1 x 1 m) fixes the tube well. For the pump installation and maintenance, two pillars of 15 feet support an M.S. girdor of 14 feet long. At the time of pump installation and/or maintenance, a pulley will be hung on the girdor for lifting up the machinery. The entrance door is of ready-made type which is easily obtained at a market.

(5) Electricity Supply

Electricity connection to each tube well from the existing and proposed 11 KV lines is provided through a 25 KVA, pole-mounted transformer substation, a 440 volts service cable and a KWH energy meter.

Detailed design of the proposed electricity supply system is made in accordance with WAPDA technical standards and specification.

5.4.2 Irrigation Facilities

(1) Canals

a) Main Canals

The cross section is rectangle, 0.3 m wide x 0.3 m high. Longitudinal slope of canal is 1/300 - 1/500, considering the slope of the field. As the canal structure, 2 types are considered. One is of fire-burned brick type with mortar surfacing of 5 cm thick. The canal of this type is planned for the portion along the connection road. The other is of mortar lined type (5 cm thick). This canal is constructed inside the farm. Total length of main canal is 1,000 m.

b) Secondary Canals

Secondary canal is of earth-lined type and the cross section is 0.3 x 0.3 m. Total length of secondary canal is 3,000 m.

c) Turnouts

Turnout structure adopted in "On-farm Water Management Project" is applied. The structure is of burned brick with mortar surfacing. The gates used in the structure is of 30 cm size commercially available.

(2) Farm pond

a) Farm Pond

The design volumes of the farm pond are 180 m^3, 360 m^3 and 540 m^3 considering the respective design discharges of 5, 10 and 15 l/sec. The basement sizes are 14 x 14 m, 20 x 20 m and 24 x 24 m. The depth is 1 m with 1:1

internal side slope. Based on the existing farm pond condition, the pond is placed on the embankment of 0.5 m.

The structure is enclosed with embankment. The inner surface is covered with fire-burned bricks with mortar surfacing of 5 cm thick. As the ancillary structure, inlet chamber from the pump and outlet structure to the canal are placed.

b) Inlet Chamber

For protecting the farm pond from the impact of cropping water, inlet chamber is placed at a corner of the pond. The size of the chamber is 2.5 m long, 1.5 m wide and 0.75 m deep. The structure is of fire-burned brick with mortar surfacing.

c) Outlet Works

The steel pipe of 100 mm dia. is placed at the elevation of the pond base to convey the water to the main canal. In the section of the outlet work, opencut would work as spillway with the size of 1.0 m width and 0.1 m depth.

(3) Farm Road

The proposed farm road is summarized as follows:

Item	Main	Branch
Total width (m)	3.5	2.5
Effective width (m)	3.0	1.5
Embankment (m)	0.5	0.3
Pavement	Gravel 10 cm	-
Total length (m)	1,600	1,000

(4) Communal Water Tank

The size of communal water tank is 2.0 x 2.0 m wide and 1.0 m deep. The total volume is 4,000 liters. The structure is of fire-burned bricks with mortar surfacing. Water is conveyed to the tank from the inlet chamber of the farm pond with 4" dia. pipe.

5.4.3 Village Improvement Facilities

(1) Connection road

The proposed connection road has the following dimensions:

- Right of way : 10 m
- Effective width : 3.0 m
- Pavement : Gravel (15 cm thick)

Through the connection road of 26.5 km in total, submersible-type structures crossing Wadi are planned; 300 m for KL-C Area, 500 m for both QT-D Area and KL-B Area. At both sides of the structure (5 m wide), concrete edges with 30 cm wide x 100 cm high are placed. The crossing structure is paved with bitumen of 15 cm thick.

(2) Electricity Supply

For each Project Area, 11 KV feeder line is installed for electricity supply with the standard of WAPDA. Total length of supply line is 22.0 km.

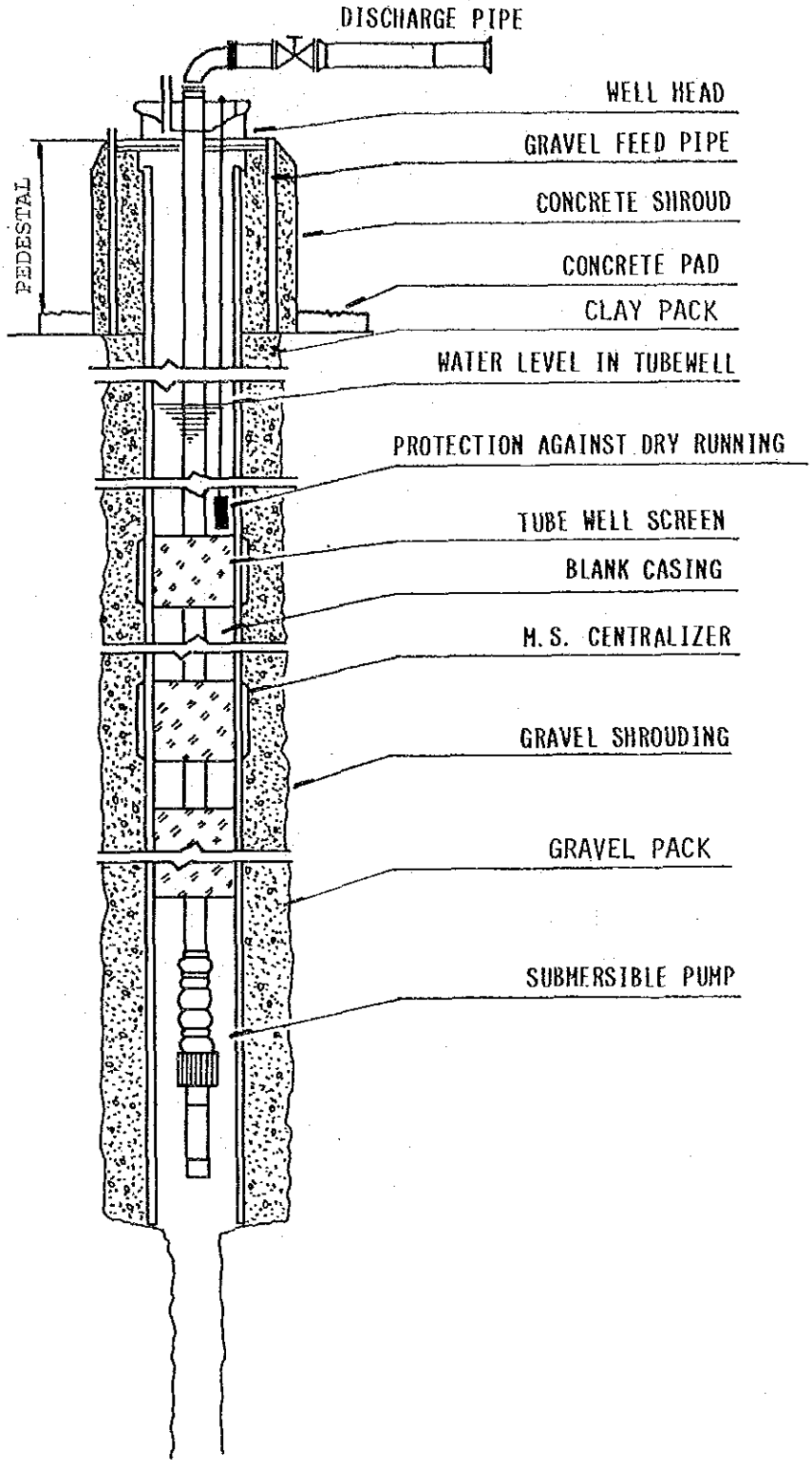


FIG 5.4.1 TYPICAL SECTION OF TUBE WELL

CHAPTER-6 PROJECT IMPLEMENTATION AND OPERATION

CHAPTER 6 PROJECT IMPLEMENTATION AND OPERATION

6.1 EXECUTING AGENCY

In order to facilitate the implementation and operation of the Project, the project-related tasks such as design, construction planning and construction works should be concentrated on one organization. In this connection, it is advised that the Hydrogeology Project WAPDA, Quetta, plays the role as the executing agency which will be responsible for the implementation of the Project.

It is also advised that I & P Department of the GOB assist the Hydrogeology Project WAPDA, Quetta, in the implementation of the Project mainly for the construction of irrigation facilities and other related ones.

6.2 ARRANGEMENT FOR PROJECT CONSTRUCTION

6.2.1 Construction Schedule

The overall construction period will be approx. one year (FIG 6.2.1.).

The final design of production wells will be made on the basis of the results of the actual drilling and well tests. The construction drawings for irrigation facilities based on the detailed topo-survey will also be carried out after the construction of a well is successful and it is converted to a production well.

In order to provide a period for investigation of the groundwater level and further study, the staged construction is proposed; that is, the development in the areas of QT-E and KL-C is to be carried out in the first stage and the development in the areas of QT-D and KL-B in the second stage.

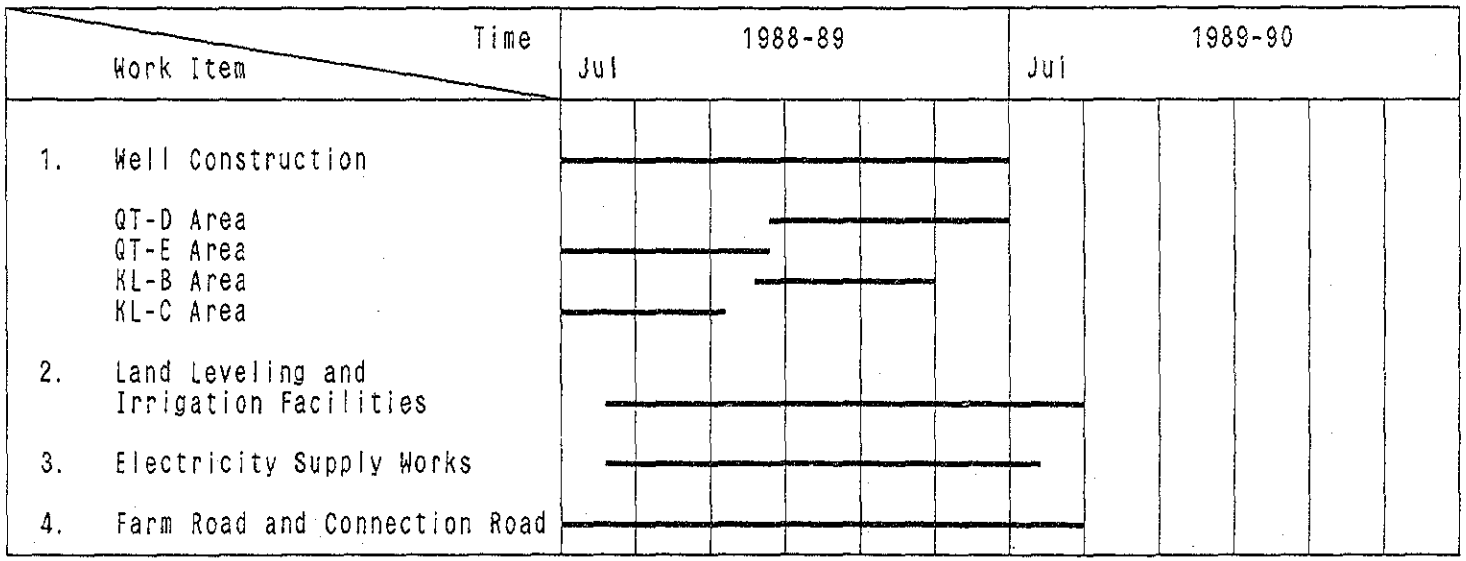
6.2.2 Construction Method

It is proposed that the whole construction works be executed directly by the Hydrogeology Project WAPDA, Quetta, the Executing Agency of the Project. The dimensions of pump units to be installed on the production wells should be fixed on the basis of the results of respective well tests. The detailed topo-survey necessary for preparation of the construction drawings of irrigation facilities should be conducted after the locations of production wells are fixed.

6.2.3 Land Acquisition

The land required for the construction of facilities and structures such as production wells, farm ponds, irrigation canals and farm roads should be acquired by the Executing Agency before the commencement of the respective construction works.

FIG 6.2.1 IMPLEMENTATION PROGRAM



6.3 PROJECT COST

The project cost consists of the construction cost and physical and economic contingencies. However, it will be changed due to the actual conditions of wells to be drilled.

6.3.1 Conditions for Cost Estimate

The cost estimate of the Project is made subject to the following conditions:

(1) Basic Cost

1) Basic Cost

Basic costs such as wages and equipment and materials costs are estimated on the basis of September 1987 local market prices.

2) Price of Imported Items

Prices of the imported construction equipment and materials include CIF Karachi, domestic transportation cost, import tax (CIF x 25%) and sales tax (CIF x 3%).

3) Unit Cost

Unit costs for respective work items are prepared based on the basic costs.

4) Indirect Cost

Indirect costs for construction works representing the administration cost, overhead, etc. of the Executing Agency are estimated to be 25% of the direct construction costs.

5) Foreign Exchange Rate

The current exchange rates of US$1 = Rs.17.5 as of September 1987 are applied in the estimation.

6) Contingency

Physical contingency is set as 10% of the construction cost and other costs. Economic contingency is set as 8% and 2% per annum for local and foreign currency, respectively.

(2) Estimation Cases

Construction cost varies depending on the design yield and pump head. Therefore, 3 cases of design yield (5 l/sec, 10 l/sec and 15 l/sec) and 2 cases of pump head (100 m and 150 m) are estimated at each Project Area. Then the Project cost is estimated based on the combination of each design conditions of Project Area, respectively.

6.3.2 Project Cost

(1) Construction Cost

The total construction cost is approximately Rs.26,605,000 of which the direct cost is Rs.19,954,000 and indirect cost Rs.6,651,000 (TABLE 6.3.1). The land acquisition cost is excluded from the above cost.

TABLE 6.3.1 CONSTRUCTION COST

(Unit: 10^3 Rs.)

Area	Yield	Pump Head	No. of Site	Wells	Irrigation Facilities	Connection Roads/ Electricity Supply	Total
QT-E	5 l/s	150	5	4,540.2	1,412.2	329.7	6,282.1
KL-C	15 l/s	100	3	3,378.1	2,397.5	728.9	6,504.5
QT-D	15 l/s	100	4	3,988.2	3,119.1	564.5	7,671.8
KL-B	5 l/s	100	4	3,768.2	1,155.6	1,222.7	6,146.5
Total (%)	-	-	16	15,674.7 (59%)	8,084.4 (30%)	2,845.8 (11%)	26,604.9 (100%)

Note: The above figures include indirect costs but exclude land acquisition cost.

(2) Project Cost

The Project cost is estimated to be Rs.31,948,000, the breakdown of which is shown in TABLE 6.3.2.

TABLE 6.3.2 PROJECT COST

(Unit: 10^3 Rs.)

	Description	Cost
1.	Construction Cost	26,604.9
2.	Land Acquisition	731.0
3.	Physical Contingency	2,733.6
4.	Economic Contingency	1,878.8
	Total	31,948.3

6.4 OPERATION AND MAINTENANCE

6.4.1 Responsible Organizations

For the purpose that the proposed facilities/structures may function adequately after their completion, an agency should take the responsibility of the operation and maintenance of the facilities/structures. In this connection, it is advised that the Agriculture Department of the GOB undertake this function.

The daily operation and maintenance work should be done by the Mastung and Kalat Agricultural Extension Offices under the direction of the Agriculture Department. Regarding the monitoring of the groundwater level, the assistance and advice of the Hydrogeology Project WAPDA, Quetta, will be definitely required.

The operation and maintenance work in the Project will include but not limit to the following:

a. Operation and maintenance of pumping facilities;

b. Maintenance of irrigation and drainage canals, farm ponds and farm roads with the cooperation of I & P Department;

c. Irrigation water management for respective farm-units; and

d. Monitoring of groundwater level with the assistance of Hydrogeology Project WAPDA, Quetta.

6.4.2 Operation and Maintenance Costs

(1) Annual Operation and Maintenance Cost

The annual operation and maintenance cost is Rs.124,700, of which 80% for operation of pump facilities and 20% for maintenance of facilities/structures. The cost required for the administration should be borne by the GOB.

TABLE 6.4.1 ANNUAL OPERATION AND MAINTENANCE COST

(Unit: 10^3 Rs.)

Item	QT-D	QT-E	KL-B	KL-C	Total
1. Operation of Pumping Unit	31.5	29.5	15.8	23.6	100.4 (80%)
2. Maintenance of Facilities	7.7	6.3	6.1	6.5	26.6 (20%)
Total	39.2	35.8	21.9	30.1	127.0 (100%)

(2) Replacement Cost

The durable years of the pump unit will expire before the termination of the project life of thirty (30) years. Therefore, it has to be replaced with new one during the project life. The cost required for its replacement will be Rs.3,339,000 (TABLE 6.4.2).

TABLE 6.4.2 REPLACEMENT COST

(Unit: 10^3 Rs.)

Item	QT-D	QT-E	KL-B	KL-C	Total
Facilities	876	1,150	656	657	3,339

CHAPTER-7 PROJECT EVALUATION

CHAPTER 7 PROJECT EVALUATION

7.1 GENERAL

The Project evaluation is undertaken essentially to provide a basis of assessment of its feasibility from the economic, financial and socio-economic viewpoints. The criteria employed to evaluate the economic performance of the Project are economic internal rate of return (EIRR), economic net present value (ENPV) and benefit-cost ratio at the discount rate of 10%. Sensitivity analysis is also undertaken in order to assess the effects on the Project's performance of the changes in the basic economic parameters, i.e., benefit, benefit accrual period, construction period and construction cost.

Financial evaluation is made through farm budget analysis and cost recovery. Since the project cost will all be borne by the government budget allocation, preparation of investment and repayment schedule will not be attempted.

Finally, feasibility of the Project is also investigated through brief analysis of socio-economic impacts of the Project implementation on its beneficiaries and environment.

7.2 PROJECT BENEFIT

7.2.1 Benefit Estimation

The Project benefit comprises primarily agricultural production benefit and domestic water supply benefit.

The agricultural production benefit is measured by the incremental net production value as occasioned by the project implementation. The incremental net production value is difference in the net production value between the with and without project conditions in the future. Agricultural production benefit considered is the incremental net income from vegetables and fruit which is derived from increase of crop yield and expansion of irrigated area. The relevant benefit is estimated for sixteen (16) farm units in the Project Area under the proposed agriculture development plan.

As for domestic water supply benefit, proxy is valued in terms of the time saved in obtaining water. Time required for obtaining water at present is estimated using the farm economic survey.

Improvement of connection/farm roads in the Project is expected to provide not only easier access for farm input/output to the markets but also tremendous socio-economic opportunities in the Project Area. Road improvement benefit has been quantified essentially by transport cost saving. The net improvement value is the difference of the transportation times, gasoline consumption etc. between the with and without project conditions in the future. The benefit, however, has turned out to be negligible companied with the agricltural production benefit, and thus is not considered in the estimation of project benefit.

7.2.2 Development of Benefit Accrual

The gestation period between the completion of the project construction works and the full agricultural benefit accrual is estimated at three (3) years for vegetables, ten (10) years for apple and eight (8) years for grape.

The development of year-wise incremental agricultural benefit after the project implementation for each of crop area is estimated as follows:

TABLE 7.2.1 GESTATION FACTORS

Crop \ Year	1	2	3	4	5	6	7	8	9	10
Vegetables	0.70	0.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Apple	-	-	-	-	0.10	0.30	0.50	0.80	0.90	1.00
Grape	-	-	0.10	0.30	0.50	0.80	0.90	1.00		

Domestic water supply benefit is assumed to accrue immediately after construction of the facilities.

7.3 ECONOMIC EVALUATION

7.3.1 General Parameters

The following are the general parameters with which the Project benefit and cost are estimated.

(1) Conversion Factors

The following World Bank estimate of 1982 is employed as the conversion factors:

Standard	:	0.90
Construction	:	0.87
Labor	:	0.80
Consumption	:	0.96

(2) Exchange Rates

The exchange rate of the Pakistani Rupee to the US Dollar averages 17.5 which is the approximate rate during the Phase-II Field Survey (September/October, 1987).

(3) Price Basis

The prices used for the project evaluation are expressed on September 1986 basis.

(4) Project Life and Implementation Period

The life of the Project is assumed to be thirty (30) years, while the Project works would be completed over one-year implementation period.

(5) Opportunity Cost of Capital

The estimated EIRR is subjected for comparison to the opportunity cost of capital (discount rate), which indicates the social marginal productivity of capital invested to the Project. The discount rate for Pakistan estimated by the World Bank is ten (10)%.

7.3.2 Benefit Parameters

The following describes the estimation procedures of Project input and output prices, which are either farmgate prices or delivery prices at the project site.

(1) Input Prices

For estimation of financial prices of internationally traded/tradable farm input (fertilizer only), the prices are derived from June 1987 World Bank Commodity Forecast for 1995 prices expressed in 1985 constant U.S. Dollar. These are adjusted using Manufacturing Unit Value (MUV) Index at the relevant exchange rate to arrive at the 1987 price.

Farmgate prices are estimated by making appropriate adjustments between the border (Karachi) and the Project Area such as freight, handling and storage, processing, tax and margins, and quality differences. The economic farmgate prices are estimated by adjusting local costs through application of relevant conversion factors.

The financial farmgate prices of domestically traded (local) farm input are estimated on the basis of Provincial Department of Agriculture Statistics and farmgate prices in the Project Area collected during the field survey. Economic price of the bullock and tractor power is assumed to be equal to the financial price.

(2) Output Prices

Financial and economic prices of farm products which are traded only domestically are undertaken basically on the same principle as the input prices.

(3) Economic Cost of Farm Labor

During Rabi (winter season: mid-October to mid-June), farm labor requirement in wheat and vegetable production is generally met by the family labor force drawing the female, child and old labor force as well. Hired laborers, though limited, are reportedly required during the harvesting period at the rate ranging from Rs.25 to 35 man-day (share cropping in common) or about Rs.30 on an average.

Farm work becomes scarce and the demand for farm labor declines during the Kharif (summer season: mid-June to mid-October) and the daily wages fall by some margins. Economic cost of farm labor is estimated through application of World Bank's conversion factor of 0.80, which is adjusted to account for the above farm peak and slack periods.

7.3.3 Project Benefit

(1) Crop Benefit

Based on the above concept and parameters, the economic crop benefit is estimated for the four (4) representative cases below (refer to VOL. II APPENDICES for detail). Similar estimation is made for the remaining cases.

TABLE 7.3.1 REPRESENTATIVE PROJECT

Area	Drilling Depth (m)	Pump Head (m)	Pump Discharge (l/sec)	Irrigable Area per Well (ha)	No. of Wells
QT-D	250	100	15	14.7	4
QT-E	200	150	5	4.9	5
KL-B	250	100	5	5.1	4
KL-C	300	100	15	15.2	3

(2) Water Use Benefit

The primary benefit derived from the installation of communal tank is the domestic water supply throughout the year. The benefit of water supply at the communal tank is estimated on the basis of the labor hours saved in obtaining the water between with and without project conditions. It is assumed to accrue to 20 households per well, which is determined by the probable population density. The water use benefit per well is estimated below. The labor requirement per day without project is estimated on the basis of the farm economic survey.

TABLE 7.3.2 ESTIMATED WATER USE BENEFIT

	Labor Requirement per Day (hrs/family)	Annual Labor Requirement (hrs/family)	No. of Beneficiary Households per well (households)	Annual Benefit (Rs 1,000)
1. Without Project	6.0	1,800	20	-
2. With Project	4.0	1,200	20	-
3. Difference	2.0	600	20	19.2

Note: Child labor is assumed to be mobilized for the purpose, which is equivalent to 0.4 of grown-up labor or Rs.9.6/day (6 hours, economic).

(3) Incremental Project Benefit

Annual project benefit for the representative cases is summarized below (refer to Appendix).

TABLE 7.3.3 ESTIMATION OF PROJECT INCREMENTAL BENEFIT

(Unit: 10^3 Rs)

	QT-D		QT-E		KL-B		KL-C	
	W/O	W/	W/O	W/	W/O	W/	W/O	W/
Crops								
Wheat	57.8	-	24.1	-	19.3	-	43.3	-
Cumin	6.6	-	2.8	-	2.2	-	5.0	-
Sorghum	0.2	-	0.1	-	0.1	-	0.1	-
Barley	2.5	-	1.1	-	0.8	-	1.9	-
Onion	-	232.7	-	97.0	-	99.7	-	224.4
Carrot	-	227.4	-	94.7	-	43.3	-	97.4
Cabbage	-	345.3	-	143.9	-	-	-	-
Broad Bean	-	451.5	-	188.1	-	182.8	-	411.2
Chillies	-	411.8	-	171.6	-	-	-	-
Potato	-	-	-	-	-	19.2	-	43.1
Tomato	-	-	-	-	-	23.8	-	53.5
Apple	-	379.3	-	158.1	-	210.7	-	474.2
Grape	-	153.2	-	63.8	-	85.1	-	191.4
Water Supply	-	76.8	-	96.0	-	76.8	-	57.6
Total	67.1	2,278.0	28.1	1,013.2	22.4	741.4	50.3	1,552.8
Project Incremental Benefit		2,210.9		985.1		719.0		1,502.5

Note: W/O: without Project condition
W/ : with Project condition

7.3.4 Cost Parameters

The total project cost over 30-year project life consists of project cost, operation and maintenance costs and replacement cost. Residual value of facilities and equipment at the end of project life is ignored due to its negligible nature.

(1) Project Cost

The project cost is constituted by:

a. Construction cost
b. Land acquisition cost
c. Physical and economic contingencies

These costs are initially estimated using the financial prices and are broken down into the foreign and local currency portions in order to derive the economic project cost. The foreign currency portion is evaluated by the border price at the conversion factor of 1.0. The local currency portion of the project cost, however, has been converted into economic one by applying the construction conversion factor.

Summary of the project cost for the representative four (4) areas is given in TABLE 7.3.4.

TABLE 7.3.4 ESTIMATED PROJECT COST

(Unit: 10^3 Rs)

Project Cost Item	QT-D		QT-E	
	Financial	Economic	Financial	Economic
1. Construction Cost				
- Well Facilities	3,988.2		4,540.2	
- On-Farm Facilities	3,119.1	6,973.6	1,412.2	5,710.4
- Social Facilities	564.5		329.7	
2. Land Acquisition	279.2	242.9	127.9	111.3
3. Base Cost	7,951.0	7,216.5	6,410.0	5,821.7
4. Physical Contingencies (10%)	795.1	721.7	641.0	582.2
5. Economic Contingencies	547.8	-	439.7	-
Total	9,293.9	7,938.2	7,490.7	6,403.9

Project Cost Item	KL-B		KL-C	
	Financial	Economic	Financial	Economic
1. Construction Cost				
- Well Facilities	3,768.2		3,378.1	
- On-Farm Facilities	1,155.6	5,587.1	2,397.5	5,912.7
- Social Facilities	1,222.7		728.9	
2. Land Acquisition	119.4	103.9	204.5	177.9
3. Base Cost	6,265.9	5,691.0	6,709.0	6,090.6
4. Physical Contingencies (10%)	626.6	569.1	670.9	609.0
5. Economic Contingencies	429.7	-		-
Total	7,322.1	6,260.1	7,841.5	6,699.6

(2) O & M and Replacement Costs

The recurrent operation and maintenance costs cover pump equipment, material supply, electricity, etc. These costs together with the replacement costs are converted into economic costs through application of the construction conversion factor. Annual O & M cost and replacement cost of pump unit for every 10 years for the representative cases are summarized in TABLE 7.3.5.

TABLE 7.3.5 O & M AND REPLACEMENT COSTS

(Unit: 10^3 Rs)

Cost Item	QT-D		QT-E	
	Financial	Economic	Financial	Economic
1. O & M Cost				
- Pump-Running	31.5	27.4	29.5	25.7
- Maintenance	7.7	6.7	6.3	5.4
- Total	39.2	34.1	35.8	31.1
2. Replacement Cost				
(Pump Unit)	876.0	762.1	1,150.0	1,000.5

Cost Item	KL-B		KL-C	
	Financial	Economic	Financial	Economic
1. O & M Cost				
- Pump-Running	15.8	13.8	23.6	20.5
- Maintenance	6.1	5.3	6.5	5.7
- Total	21.9	19.1	30.1	26.2
2. Replacement Cost				
(Pump Unit)	656.0	570.7	657.0	571.6

7.3.5 Economic Evaluation

Based on the flow of project benefit and cost estimated as above, the economic internal rate of return (EIRR), the economic net present value (ENPV) and the benefit-cost ratio at 10% discount rate for the representative four (4) cases are estimated as follows:

TABLE 7.3.6 RESULT OF ECONOMIC EVALUATION

Project Area	EIRR (%)	ENPV (10%) (10^3 Rs)	B/C Ratio (10%)
QT-D	18.1	7,600	1.88
QT-E	10.2	140	1.02
KL-B	6.9	-1,842	0.73
KL-C	13.5	2,749	1.38
Overall	12.9	8,627	1.29

The EIRR shows that with the possible pump discharge of 5 l/sec, KL-B may not be economically feasible if considered independently. The pump discharge of 10 l/sec would be the criteria that possibly sustains the economic feasibility of each Project Area.

In view of the government concern for socio-economic development of the Project Area which is one of the least developed areas, however, some allowance would have to be made in determining the project feasibility as a whole.

7.3.6 Sensitivity Analysis

The sensitivity analysis is undertaken for the following cases:

Case 1 : 10% project cost overrun which reflects changes in the material and equipment cost as well as increase in the physical contingencies

Case 2 : 10% project benefit decrease due to depressed crop yield and price and/or increased production cost

Case 3 : Two-year delay in agricultural benefit accrual at each unit of Project Area due to insufficient production incentive, technical and organizational difficulty in water supply and extension services.

Case 4 : One-year delay in construction due to administrative or financial constraints

Case 5 : Combination of Case 1 and Case 2

Case 6 : Combination of Case 1, Case 2 and Case 3

Case 7 : Combination of Case 1 to Case 4

The result of sensitivity analysis for the Overall Case is presented below.

TABLE 7.3.7 RESULT OF SENTIVITY ANALYSIS

Case	EIRR (%)	ENPV (10%) (10^3 Rs)	B/C Ratio (10%)
Original	12.9	8,627	1.29
Case 1	11.8	5,897	1.18
2	11.6	4,679	1.16
3	11.6	4,778	1.16
4	12.2	6,352	1.23
5	10.6	1,949	1.06
6	9.5	-1,520	0.95
7	9.0	-2,950	0.90

The results indicate that the Project would be more sensitive to the benefit side and less sensitive to the cost side. Unless there is a significant decline in these parameters combined, the sensitivity analysis shows that the Project feasibility would be sustained against possible changes in the parameters.

7.4 FINANCIAL EVALUATION

The financial feasibility of the Project is investigated from the viewpoint of the beneficiary farmers. The criteria employed are farm budget and cost recovery. Financial revenue and cost are estimated using current market prices.

7.4.1 Farm Budget Analysis

It is not yet known how the developed farm unit will be allocated among the farm households. Therefore, the farm budget will be analyzed for the four (4) representative farm units.

The size of farm units is determined in accordance with the possible pump discharge and the irrigation area. The additional farm income for farm unit is derived from increased production in the irrigated area. Farm labor is assumed to be all hired from outside.

The Project implementation would in general increase in farm income net revenue of the farm unit by Rs. 150-170 thousand per 5 1/sec of pump discharge or 5 ha of irrigable area at 1987 price level as follows (refer to VOLUME II APPENDICES for detail):

TABLE 7.4.1 ESTIMATED FARM INCOME

(Unit: 10^3 Rs)

Area	QT-D	QT-E	KL-B	KL-C
Irrigation Area (ha)	14.7	4.9	5.1	15.2
Pump Dis. (1/sec)	15	5	5	5
Without Project	16.2	5.4	5.4	16.2
With Project	525.4	175.1	156.4	469.5
Increment	509.2	169.7	151.0	453.3

Assuming that the developed farm unit is allocated to, say, ten (10) non-irrigated farm households for the representative cases, the project implementation would help substantially to raise the standard of living above the possible poverty line of Rs.20,000 per household especially among those in QT-D and KL-C Areas.

7.4.2 Cost Recovery

Recovery of the project cost including the recurrent O & M and replacement costs would be analyzed through the beneficiary's farm unit ability-to-pay under the with project condition.

At present, the GOB imposes the irrigation water charge on the farmers within an irrigation scheme usually developed by the I & P Department. This is designed to recover primarily the O & M expenditures. The water charge ranges from RS.11 to 112 per acre depending on cropped area and use. Tube well schemes are excluded probably because the most are privately owned.

Assuming that the GOB is committed to recover from the beneficiary farm unit both the project cost and O & M and replacement costs under the with project condition in future, analysis is made of the farm unit's ability-to-pay the water charge that fulfills the reimbursement of the respective cost. The payment capacity of farm unit is established in relation to the net revenue estimated from the farm budget.

With the grace period of 5 years, repayment period of 25 years and interest rate of 10%, the cost-recovering charge for respective cost item for each farm unit of the four (4) representative cases (at 1987 price) is estimated.

TABLE 7.4.2 COST RECOVERY CHARGE

		QT-D	QT-E	KL-B	KL-C
1.	Farm Unit Area (ha)	14.7	4.9	5.1	15.2
2.	Water Charge Recovery (Rs 1,000/year)				
	2.1 Project Cost	387.9	250.2	305.7	436.5
	2.2 O & M Cost	14.0	10.2	7.8	14.3
	2.3 Replacement Cost	19.7	20.4	14.6	19.7
	2.4 Total	421.6	280.8	328.1	470.5
3.	NPV (Rs 1,000/year)	525.4	175.1	156.4	469.5
4.	Ratio (%)				
	4.1 2.1/3	74	143	195	93
	4.2 2.2/3	3	6	5	3
	4.3 2.3/3	4	12	9	4
	4.4 2.4/3	80	160	210	100

It is confirmed that if the pump discharge is less than 15 l/sec or so i.e. cases QT-E and KL-B, the project would not be financially viable.

7.5 SOCIO-ECONOMIC IMPACT

In addition to the project benefit that can be quantified and valued in monetary terms, every project entails cost and benefit that are intangible and do not lend themselves to valuation. Because these cost and benefit are a factor for project selection, it is important that these are identified and, if possible, quantified. Probable impacts are as follows:

a. Reduction in Regional Disparity

Improvement of the living conditions among the project farmers would have a significant socio-economic impact in the neighboring areas in terms of encouraging the similar induced investment in the physical and institutional infrastructure. This would greatly help reduce the regional disparity which is the current concern of the GOP and also contribute to the maintenance of national security in the sensitive border area. More settled agricultural life and increased farm income would also encourage farmers to invest more in education and other social services, which would improve the communication and thus accelerate the integration of the local population.

b. Improvement in Farming Practice

Introduction of more stable irrigated agriculture would encourage the project farmers to engage in more intensive and improved farming practice away from the current extensive farming. This would give rise to more opportunities for the farmers to learn and train themselves in modern agriculture and also to more wide-spread use of input materials which would also contribute to the development of forward-linkaged industry and employment.

c. Development of Local Transportation System

Along with the problem of water shortage, the difficulty in local transportation is the primary concern at present among the local residents, which has long confined them to the narrow socio-economic base in the remote area. The Project implementation that involves construction of farm and connection roads would not only bring about tremendous socio-economic opportunities but also integrate the rural population more into the line of government development effort.

d. Improvement in Health and Sanitary Conditions

Installation of communal tank would provide more stable supply of domestic water and this would improve the health and sanitary conditions in the Project Area.

e. Social Impact

Impact of the tube well development on the socio-economic life in the Project Area will most evidently be manifested in the increased tendency to leave away from normadic habits into more settled agricultural life style, which suggests more stable farm income and employment.

This would eventually create more demand for social services such as health and education and induce more investment in physical infrastructure such as road and electricity, which altogether would significantly contribute to the enhanced living standards in the Project Area. Traditions, customs and cultural attitude are also likely to change.

7.6 COMPREHENSIVE EVALUATION

The Project implementation is well within the technical and managerial capability of the local government, and as indicated by the economic criteria estimated above, it is also economically liable as a whole, but unless the pump discharge is possibly higher than 10 l/sec, an individual project may not be economically feasible. Financial indicators also support the same view. Other significant socio-economic impacts that are not quantifiable in monetary terms should not be overlooked in judging the justification of the Project.

In view of the government concern for one of the least development areas, some allowance would have to be made in judging the project feasibility as a whole.

CHAPTER-8 RECOMMENDATIONS

CHAPTER 8 RECOMMENDATIONS

1. The development of other areas should be made in consideration of the progress of the proposed Project implementation and monitoring of the change of groundwater level. The proposed Project will become a model of the development of other areas.

2. The careful attention should be paid on the development of the QT-D Area, because its groundwater is estimated to be stagnant one.

3. The land ownership of the proposed irrigation development areas should be determined through discussions among the GOB, tribal leaders and owners of original lands, after the farmlands to be irrigated are fixed.

4. It is also advisable that the proposed tube wells be privately owned from the beginning with easy access to credit if necessary and that the water users association be headed by the tribal leader and technically assisted by the government field officer. In this manner, the leader will be able to take the initiative in the allocation of water and land resources to be developed.

5. When the new groundwater resources are explored by the Project , the water right should be carefully settled in consideration of traditions and the Government laws.

6. In general, the drawdown of groundwater level during pumping operation should be maintained within about 20 m in consideration of safe yield of the objective well and also those of surrounding wells.

7. However, the design drawdowns of respective wells should be determined at the site in consideration of the expected yield, influence to the existing wells located around the proposed well, economy of the proposed irrigation development scheme, etc.

8. The quality of groundwater and soils in the Project Area will be suitable for cultivation at this moment. However, the periodical monitoring of quality and quantity of groundwater and quality of soil is recommended in due consideration of the probable salinity problems in the futire.

ANNEX

ANNEX

1. JICA STUDY TEAM MEMBER LIST

2. SCOPE OF WORK

JICA STUDY TEAM MEMBER LIST

Assignment	N a m e	in charge of
1. Tean Leader	Mr.Masahito YAMANAKA	Overall management
2. Geologist/ Hydrogeologist	Mr.Sachio HOSHINO	Geology,hydrogeology
3. Irrigation,Drainage Engineer		Irrigation and drainage
Meteo-hydrologist	Mr.Keiji MATSUMOTO	Planning and meteo-hydrology
4. Geophicicist	Mr.Katsumi SAKAGUCHI	Seismic prospecting
5. Geophicicist	Mr.Yoshio KOBAYASHI	Seismic prospecting
6. Agronomist	Mr.Hirokazu KOURIKI	Agriculture,soil
7. Agro-economist	Mr.Yoshio BANNO	Agro-economy
8. Facility Planner Cost Estimator	Mr.Seishiro SUZUKI	Facility plan and cost estimate
9. Leader for Aerial Gamma-ray Prospecting	Dr.Toshio OCHIAI	Overall management for aerial gamma-ray prospecting
10. Sub-leader for Aerial Gamma-ray Prospecting	Mr.Hironao KAWASAKI	Assistance for Dr.Ochiai
11. Chemist/ Hydrogeologist	Mr.Yoshiatsu OHTA	Chemical analysis in the field nad home office
12. Chemical Analist Hydrogeologist	Mr.Tomohiro SAKAMAKI	Survey for ground marks and Administration
13. Chemical Analist Hydrogeologist	Mr.Kazutaka IKEDA	Data processing for aerial gamma-ray prospecting
14. Chemical Analist	Mr.Harumi NAKAMURA	Chemical analysis in Japan
15. Pilot	Mr.Kiyoshi MORIOKA	Helicopter operation
16. Pilot	Mr.Kazuhiro TSUE	Helicopter operation
17. Groundman	Mr.Mitsuo TANIGUCHI	Groundman for helicopter
18. Groundman	Mr.Toshio SHIBATA	Groundman for helicopter

Appendix 7

SCOPE OF WORK

FOR
MASTER PLAN STUDY
ON
BALUCHISTAN IRRIGATION DEVELOPMENT PROJECT

THROUGH
GROUNDWATER DEVELOPMENT
IN
THE ISLAMIC REPUBLIC OF PAKISTAN

AGREED UPON BETWEEN
GOVERNMENT OF BALUCHISTAN
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY

QUETTA, 24th March, 1986

Mr.S.R.Poonegar,
Additional Chief Secretary,
Government of Baluchistan

Mr. Toru HASE
Leader of the Japanese
Preliminary Study Team

THE JAPAN INTERNATIONAL
COOPERATION AGENCY

Economic Affairs Division,
Ministry of Economic Affairs & Finance,
GOVERNMENT OF PAKISTAN.
(Muhammad Faheem)
Deputy Secretary
Economic Affairs Division
Islamabad.

I. INTRODUCTION

In response to the request of the Government of the Pakistan, the Government of Japan decided to conduct the master plan study on Baluchistan Irrigation Development Project through Groundwater Development (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan.

The Japan International Cooperation AGency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will carry out the Study in close cooperation with the authorities of the Government of Pakistan.

The present document sets forth the Scope of Work for the Study.

II. OBJECTIVES OF THE STUDY.

This study aims to survey groundwater resources in Quetta/Kalat Districts of approx. 40,000 ha. in Baluchistan, and to formulate the Master Plan for an irrigation development project through the development of groundwater resources.

III. STUDY AREA.

The Study Area covers a basin area of approx. 40,000 ha. of Quetta/Kalat Districts of Province of Baluchistan for groundwater survey, mainly by the helicopter - borne aerial gamma rays spectro prospecting apparatus.

IV. SCOPE OF WORK.

(1) Composition of the Study.

The study consists of two phases as follows:

Phase-I: (i) Study of groundwater resources.

(ii) Preliminary study of irrigation development.

Phase-II: (i) Study of groundwater with test boring.

(ii) Study of irrigation development.

(2) Phase-I Study.

(i) Collection and review of the existing data and information for the study of Groundwater Resources:-

a) Topography (1/50,000 scaled map).

b) Hydrogeological Map.

c) Meteorology and Hydrology.

d) Geology and groundwater including survey of existing wells.

e) Land use.

f) Soil and Vegetation.

(ii) Collection and review of the existing data and information for preliminary study of irrigation development:-

a) Agriculture including crops and agronomy.

b) AGricultural infrastructure including irrigation and drainage, and rural infrastructure.

c) Agricultural economy.

d) Agricultural institutions.

e) Social and economic aspects.

iii) Geophysical Survey under the Study Programme:-

a) Exploration of groundwater resources with a airbone r-ray spectrometry.

b) Mapping for groundwater distribution.

c) Estimation of possible yield and safe yield of groundwater.

d) Formulation of groundwater development plan.

iv) Formulation of basic concepts for Irrigation Development under the Study Programme.

a) Rough delineation of possible areas for irrigation development utilizing groundwater development.

b) Formulation of basic concepts for irrigation development in possible areas for irrigation development.

(3) Phase-II Study.

(i) Study of groundwater with test boring:

a) Necessary test boring with well test.

b) Confirmation of possible yeild and safe yield estimated in Phase-I Study.

(ii) Study of Irrigation Development:- Collection and review of the existing data and information on possible areas for irrigation development roughly delineated in Phase-I Study.

a) Agriculture including crops and agronomy.

b) Agricultural infrastructure including irrigation and drainage and rural infrastructure.

c) Agricultural economy.

d) Agricultural institutions.

e) Social and economic aspects.

(iii) Formulation of the Master Plan of Irrigation Development Project:

a) Land use and land reclamation plan.

b) Pumping plan

c) Irrigation and drainage plan.

d) Farm road plan.

e) Cropping plan.

f) Agricultural management plan.

g) Estimation of Project cost.

h) Project implementation plan.

i) Operation and maintenance plan.

j) Evaluation of the Project.

k) Identification of stagewise development of the Project.

l) Water supply.

m) Power supply.

V. WORK SCHEDULE.

The Study will be undertaken in accordance with the attached tentative work schedule of the Study referred to Annex.

VI. REPORT.

JICA shall prepare and submit the following reports in English to the Government of Pakistan:-

1.	Inception Report	Thirty(30) copies, at the commencement of the first stage field work.
2.	Field Report	Thirty(30) copies at the end of the each stage field works.
3.	Interim Report	Thirty(30) copies before the commencement of the second stage field work.
4.	Draft Final Report	Thirty(30) copies at the end of the second stage home office work.

The Government of Pakistan and Government of Baluchistan are requested to provide its comments on the Draft Final Report within one(1) month after its receiving.

5. Final Report: Fifty(50) copies within two(2) months after receiving the comments on the Draft Final Report.

VII. UNDERTAKING OF THE GOVERNMENT OF PAKISTAN.

1. To facilitate smooth conduct of the Study, the Government of Pakistan shall take necessary measures:

(i) To secure the safety of the Japanese Study Team and airborne exploration.

(ii) To permit the members of the Japanese study team to enter, leave and sojourn in Pakistan for the duration of their assignment therein, and exempt them from alien registeration requirements and consular fees.

(iii) To exempt the members of the Japanese Study Team from taxes, duties, fees and other charges on equipment, machinery and other materials brought into Pakistan for the conduct of the Study.

(iv) To exempt the members of the Japanese Study Team from income tax and other charges of any kind imposed on or in connection with any emolument or allowance paid to the members of the Japanese Study Team for their services in connection with the implementation of the Study.

(v) To provide necessary facilities to the Japanese Study Team for the remittance as well as utilization of the funds introduced into Pakistan from Japan in connection with the implementation of the Study.

(vi) To secure permission for entry into private properties or restricted area for the conduct of the Study, unless prohibited by laws/regulation.

(vii) To secure permission to take all data and documents related to the Study including photographs and videos out of Pakistan to Japan by the Japanese Study Team.

(viii) To provide medical services as needed. Its expenses will be chargeable on the members of the Japanese Study Team.

(ix) To provide transportation and accommodation if necessary.

2. The Government of Pakistan shall bear claims, if any arise, against the member of the Japanese Study Team resulting from, occuring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or wilful misconduct on the part of the member of the Japanese Study Team.

3. The Government of Baluchistan shall act as counterpart agency to the Japanese Study Team and also as coordinating body to other relevant organizations for the smooth implementation of the study.

4. The Government of Baluchistan shall, at its own expense, provide the Japanese Study Team with the following, in cooperation with other agencies concerned, if necessary;

(i) available data and information related to the study,

(ii) counterpart personnel,

(iii) suitable office space with necessary equipment and furniture,

(iv) flight licence for the airborne r-ray intensity survey,

VIII. UNDERTAKING OF JICA.

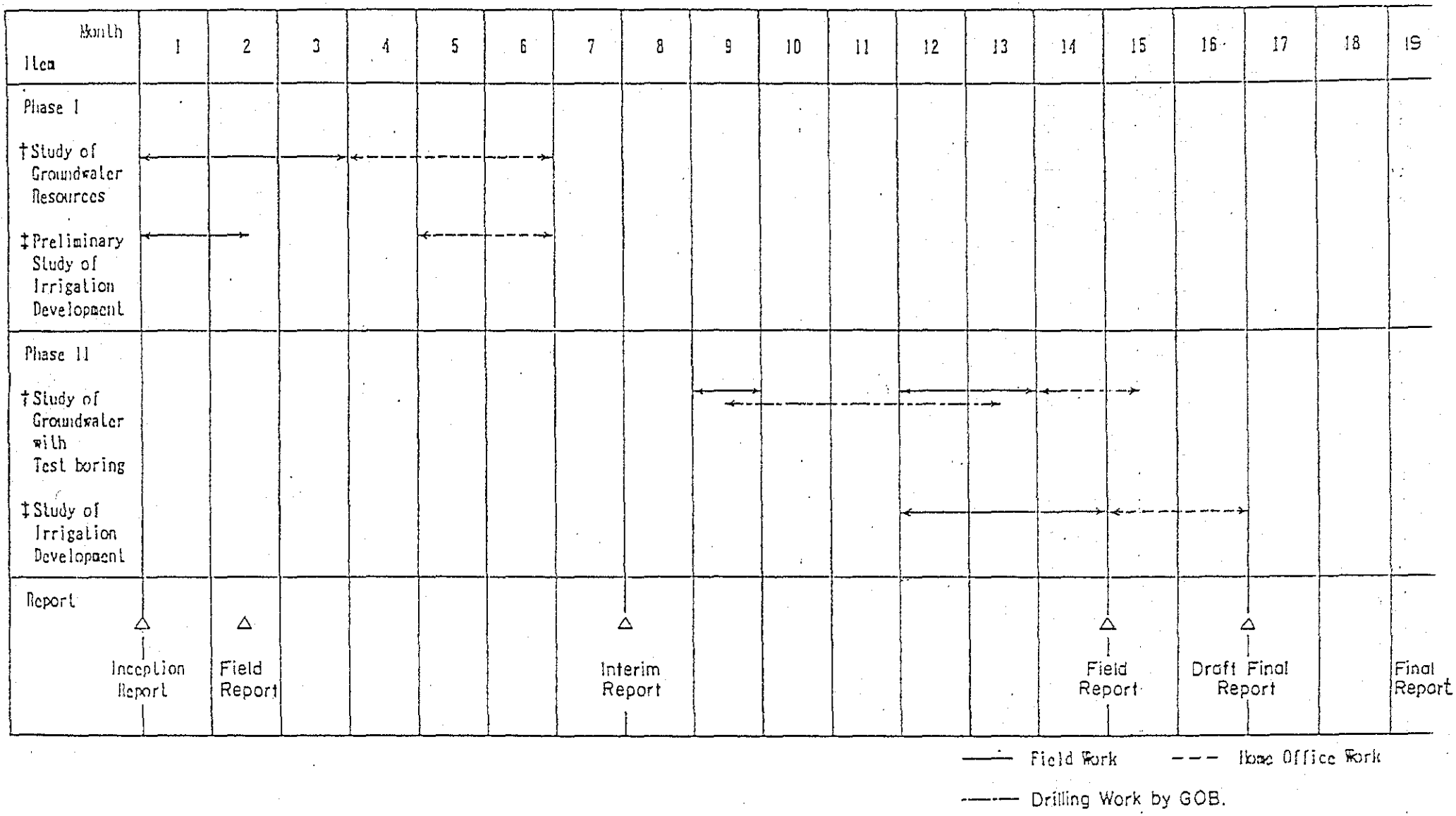
For the implementation of the Study, JICA shall take the following measures:-

1. To dispatch, at its own expenses, study teams in accordance with the attached tentative work schedule, and

2. To pursue technology transfer to the Pakistan counterpart personnel in the course of the Study.

JICA and the Government of Baluchistan will consult with each other in respect of any matter that is not agreed upon in this document and may arise from or in connection with the Study.

TENTATIVE WORK SCHEDULE



MINUTES OF MEETING

FOR

MAST ER PLAN STUDY

ON

BALUCHISTAN IRRIGATION DEVELOPMENT PROJECT

THROUGH

GROUNDWATER DEVELOPMENT

IN

THE ISLAMIC REPUBLIC OF PAKISTAN

QUETTA, 24TH MARCH, 1986

Mr. S.R. Poonegar,
Additional Chief Secretary
Government of Baluchistan
THE GOVERNMENT OF PAKISTAN

Mr. Toru MASE
LEADER OF THE JAPANESE
PRELIMINARY STUDY TEAM
THE JAPAN INTERNATIONAL
COOPERATION AGENCY

MINUTES OF MEETING

In order to ensure smooth implementation of the Master Plan Study on Baluchistan Irrigation Development Project through Groundwater Development (signed s/w on 24th March, 1986), the Japanese Preliminary Study Team, JICA headed by Mr. T. Mase (hereinafter referred to as "the Team") and the Government of Baluchistan (hereinafter referred to as "GOB) exchanged views about the Project as follows:-

1. Study Area (referred to III in s/w):

   1) Both sides agreed that the purpose of the groundwater survey is to find undiscovered groundwater resources (mainly in fractured and fissured zones) in comprehensive measures.

   2) Both sides agreed that further details of the Project areas of groundwater survey will be decided between the coming study team and GOB.

   3) Both sides agreed that the areas to be included in the master plan study shall be identified specifically on the basis of the results of groundwater survey mentioned above.

2. Composition of the Study Team:

   1) The team tentatively estimated the composition of the coming Japanese Study Team as 12 persons including Pilot, Navigator, Mechanical Engineer, Geologist, Hydrologist, Irrigation Engineer and Agronomist.

2) The team requested that GOB provides counterpart services of at least 5 experts, including Co-pilot of Helicopter, Geologist, Hydrologist, Irrigation Engineer and Agronomist.

3. Technical transfer (referred to VIII in s/w).

GOB strongly requested technical transfer especially in the field of airborne r-ray spectorometry to the Pakistani personnels.

Accordingly the team promised best endeavours to realize the GOB's request for imparting training to Pakistanis both in Pakistan and Japan in order to meet one of the main purposes of the Project which is technical transfer of the Japanese high technology.

4. Undertaking of the GOB (referred to VII-3 in s/w).

1) As mentioned under s/w, the counter body to execute the Project is GOB through Hydrogeology Project, WAPDA, Quetta. Accordingly GOB promised not only the execution of the Project but also their best efforts in getting necessary cooperation of the relevant organizations in Pakistan in the following matters:-

a) Security ensurance by providing security guards at its own expense.

b) Smooth custom clearance for necessary equipments especially Helicopter, its optional radio wave devices, other support equipment including a special car and vehicles.

c) Obtaining of flight permission for the helicopter, permission for construction of helipads and making other arrangements to facilitate the operation of the helicopter.

d) Permission to take photographs including videos by helicopter and to carry these to Japan for further study.

e) Permission to carry aerial photographs and other maps of importance connected with the above study to Japan for further use.

2) GOB explained their problem in providing vehicles and one truck required for the study and requested the team to arrange some of these from Japan.

3) The Government of Pakistan and Baluchistan shall designate the Planning and Development Department of the Baluchistan Government (the Department) as the executing agency for the Study and shall cause the Department to utilize the services of the Hydrogeology Project, Quetta of the Water and Power Development Authority (hereinafter called the Hydrogeology Project) in the implementation of whole of the Study including all drilling works.

4) The team requested that in order to meet the drilling requirements of the Project, some number of drilling rigs out of those being imported from Japan during 1986 under Japanese Grant should be put at the disposal of the Hydrogeology Project, WAPDA.

5. Undertaking of JICA (VIII).

1) On the request of GOB, the team explained that JICA shall make necessary arrangements to despatch at its own expenses, the Study Team in accordance with the attached tentative work schedule and finance the expenditures in foreign and local exchange on account of remuneration, per diem, allowances, international/domestic air travel, transport and other expenses to be incurred by the members of the Study Team for the performance of their services.

2) JICA shall require the Study Team to designate a Team Leader. The team leader shall be responsible for liason with the GOB, implementing agency and other agencies.

6. Others

The GOB and JICA shall execute an agreement indicating the scope of work and the undertaking by the Government of Pakistan/ Baluchistan. The agreemetn shall be endorsed by the Economic Affairs Division of the GOP. In the agreement the list of equipment shall not be mentioned at this stage. But the team assured the GOB that the list shall be submitted prior to importation of the equipment.

JICA