IV-3 HYDROGEOLOGIC STRUCTURE

The hydroelogic structure in Islamabad rural area was determined from the results of electrical resistivity surveys conducted at sixty-eight (68) sites, drilling data at twenty-five (25) sites obtained from WAPDA and CDA, and field observations for eighty (80) shallow wells. Twelve (12) cross sections of the hydrogeologic structure have been drawn including seven (7) sections in the same direction as the general topographical gradient, four (4) sections at right angles to the gradient and one section in Shah Allah Ditta village (FIG. IV-8).

(1) A-A' Cross Section (FIG. IV-9)

This section shows the thirty (30) km long hydrogeologic structure running from site E-20 in Kot Hathial village to the Kurang River, Kuri village, Gumreh Kas, Farash village, Malal Kas, Kirpa village, Darwala village, the Soan River, Sihala village and the Ling River through to site E-62 in Churki Mohra village.

In Kot Hathial village, Quaternary deposits of about 40m in thickness alternating strata of a sand and gravel layer and a clay and silt layer. The sand and gravel layer in the upper part of the Quaternary deposit is about 10m thick forming a highly productive unconfined aquifer. The lower sand and gravel layer of about 5m in thickness forms a relatively high productive confined aquifer.

Between Murree road and the Kurang River, exposed bedrocks intervene the ground water flow from or to the Kurang River.

On both sides of the Kurang River, Quaternary deposits about 30m thick consist mainly of clay and silt forming a relatively high productive unconfined aquifer.

Bedrocks are composed of sandstone and shale with low permeability.

In the loessic uplands between the exposed bedrocks and rivers, uncofined aquifers are formed in weathered bedrocks or a sand and grvel layer in the lower part of the loessic deposits. Loessic deposits are thin with a low productive yield. In Kuri, Farash, Kirpa, and Darwala villages, unconfined aquifers are discontinuous due to the occurrence of numerous detached bedrock outcrops.

On both sides of the Gumreh Kas, Quaternary deposits of about 15m thick are comprised of a sand and gravel layer and form a relatively high productive unconfined aquifer.

On both sides of the Soan River, Quaternary deposits of about 40m thick consist of alternating strata of a sand and gravel layer and a clay and silt layer, and forming an unconfined aquifer. The thickness of the sand and gravel layer exceeds 10m. Permeability of the sand and gravel layer at site FC-40 is 1.9×10^{-1} cm/sec (WAPDA, 1966), constituting the maximum value of unconfined aquifers. The sand and gravel layer forms a highly productive unconfined aquifer.

(2) B-B' Cross Section (FIG. IV-10)

This section shows the hydrogeologic structure from site E-21 in Kot Hathial village to the Kurang River and Pind Begwall village through to site E-11 in Tamair village.

In Kot Hathial village, Quaternary deposits about 40m thick consist of alternating strata of sand and gravel layers and clay and silt layers. An upper snd and gravel layer 10m thick forms a highly productive unconfined aquifer. A lower sand and gravel layer of 5m thick forms a relatively high productive confined aquifer.

In the other part of this cross section, exposed bedrocks and loessic deposits are widely distributed. Loessic deposits are thin with low productive yields. An unconfined aquifer in the loessic uplands is formed in weathered rocks or a sand and gravel layer.

(3) C-C' Cross Section (FIG. IV-11)

This cross section shows the hydrogeologic structure running from Saidpur village to the west side of Rawal Lake, the National park area, Tarlai Kalan village, Bhokar village and the Soan River through to Rawat village.

Typical basin-like aquifers are formed in the National Park area. Quaternary deposits with a maximum thickness of about 80m consist of alternating strata of sand and gravel layers and clay and silt layers. Sand and gravel layers are divided into 2 groups. The upper layer forms an unconfined aquifer at sites FC-23 and CDA4 with the unconfined aquifer

converted into a confined aquifer at site FC-21. permeability of the unconfined aquifer at site CDA4 in Tarlai Kalan village is 2.4 x 10^{-3} cm/sec (WAPDA, 1979). The lower layer forms a highly productive confined aquifer. Transmissibility of the lower layer is 2.4 x 10^{-3} cm^2/sec (WAPDA, 1979).

In Bhokar village, exposed bedrocks are widely distributed.

On both sides of the Soan River, Quaternary deposits about 80m in thickness are comprised of alternating strata of sand and gravel layers and clay and silt layers. Upper sand and gravel layers form highly productive unconfined and confined aquifers. The lower part of the Quaternary deposit consists of clay and silt layers.

(4) D-D' Cross Section (FIG. IV-12)

This section runs from the National Park area to Mohra Nur village, Balagh village and Athul village through to Maira village.

The thickness of Quaternary deposits exceeds 100m in the National Park area. Quaternary deposits more than 100m in thickness form three sand and gravel layers. The middle sand and gravel layer of about 20m in thickness forms a highly productive confined aquifer. Transmissibility of the middle layer is 5.5 x 10^{-3} m^2/sec at CDA3 in Pandori village (WAPDA, 1979).

In the other part of this section, exposed bedrocks and thin loessic deposits are widely distributed.

(5) E-E' Cross Section (FIG. IV-13)

This cross section shows the hydrogeologic structure from the National Park area to Muhrian village and Kolian village through to Jandala village.

Following the same pattern as the D-D' cross section, aquifers are classified into two groups:

i) highly productive aquifers comprised of thick Quaternary deposits in the National Park area.

ii) a thin unconfined aquifer in the rest of this section.

(6) F-F' Cross Section (FIG. IV-14)

This cross section traverses the southern National Park area from Tarlai village to Alipur village, Jang Sayidan village, Thanda Pani village and Harno village through to Tamair village.

As with cross sections LD-D' and E-E', aquifers are classified into two groups; highly productive aquifers in the National Park ara and a thin unconfined aquifer in the rest of this section.

(7) G-G' Cross Section (FIG. IV-15)

This cross section shows the hydrogeologic structure from the left side of the Soan River in Humak village to Niazian village, Mohra Anne village, Thaliala village and Darwala village through to Mohri Zamindaran village.

On both sides of the Soan River, Quaternary deposits more than 100m in thickness consist of alternating strata of sand and gravel layers and clay and silt layers. Sand and gravel layers are distributed in the upper part of Quaternary deposits forming highly productive aquifers.

A thin unconfined aquifer is formed in the other part of this section.

(8) H-H' Cross Section (FIG. IV-16)

This cross section runs through Shah Allah Ditta in a south to north direction.

The colony is located on an exposed bedrock upland. Strata overlying shallow bedrocks have very low productive yields. There are three springs emerging from fissures of limestone. The yield of springs observed total approximately 100ℓ/min with spring water used mainly for domestic supply.

(9) I-I' Cross Section (FIG. IV-17)

This cross section shows the hydrogeologic structure from the National Park area and the Gumreh Kas through to site E-27 in Jagiot village.

Following the patterns of cross sections of D-D', E-E' and F-F', a highly productive aquifer in the National Park area and a thin unconfined aquifer in the other part of this seciton are formed.

(10) J-J' Cross Section (FIG. IV-18)

This cross section runs through Charah village in a northwest to southeast direction.

A thin unconfined aquifer dominates this section.

(11) K-K' Cross Section (FIG. IV-19)

This cross section runs from the west side of Rawal Lake along the left side of the Kurang River through to Shah Pur village.

On the east side of Rawal Lake, Quaternary deposits 60m in thickness are comprised of two sand and gravel layers about 10m thick. An upper sand and gravel layer forms an unconfined aquifer with the lower sand and gravel layer forming a confined aquifer.

(12) L-L' Cross Section (FIG. IV-20)

This cross section shows the hydrogeologic structure from site FC-2, Kot Hathial village through to Bhara Kau village.

In Kot Hathial village, Quaternary deposits about 40m in thickness consist of alternating strata of sand and gravel layers and clay and silt layers. An upper sand and gravel layer about 10m in thickness forms a highly productive unconfined aquifer with a lower sand and gravel layer about 5m thick forming a relatively high productive confined aquifer.

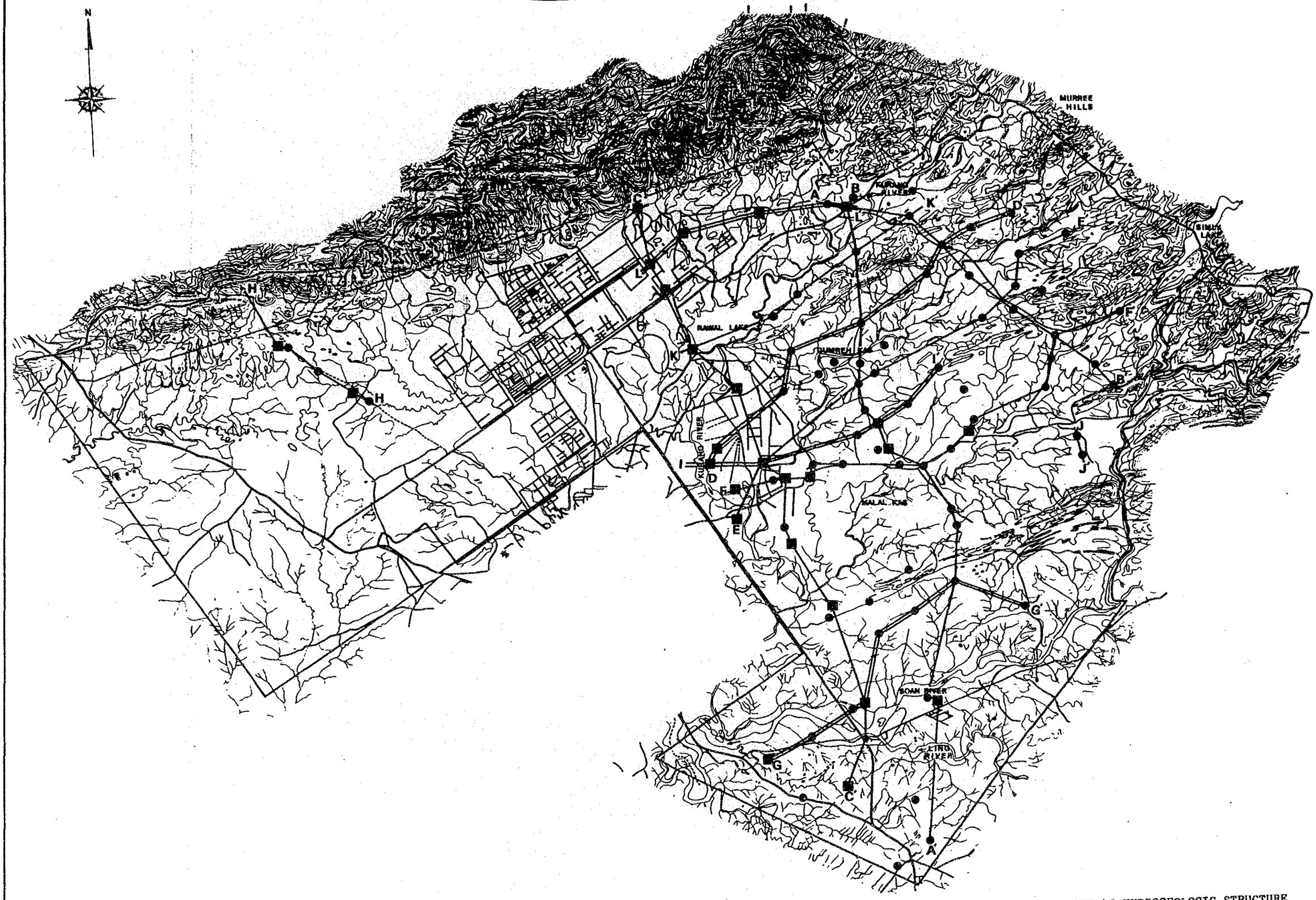


FIG. IV-8 CROSS SECTIONS OF HYDROGEOLOGIC STRUCTURE

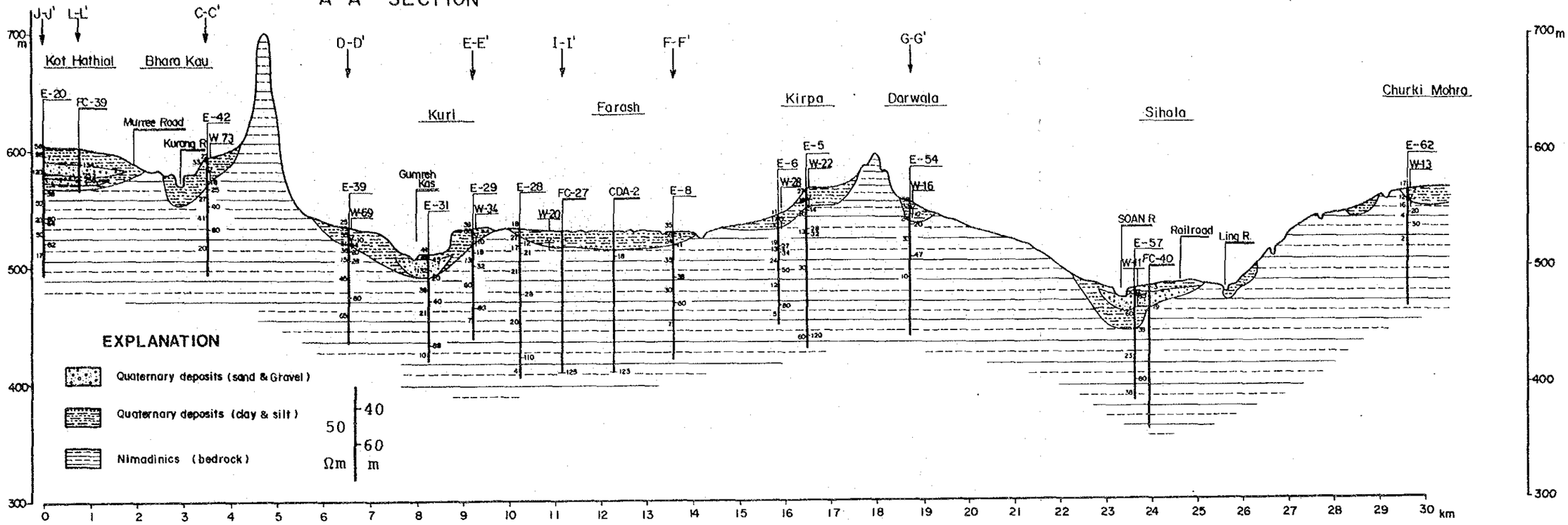


FIG. IV-9 A-A' CROSS SECTION

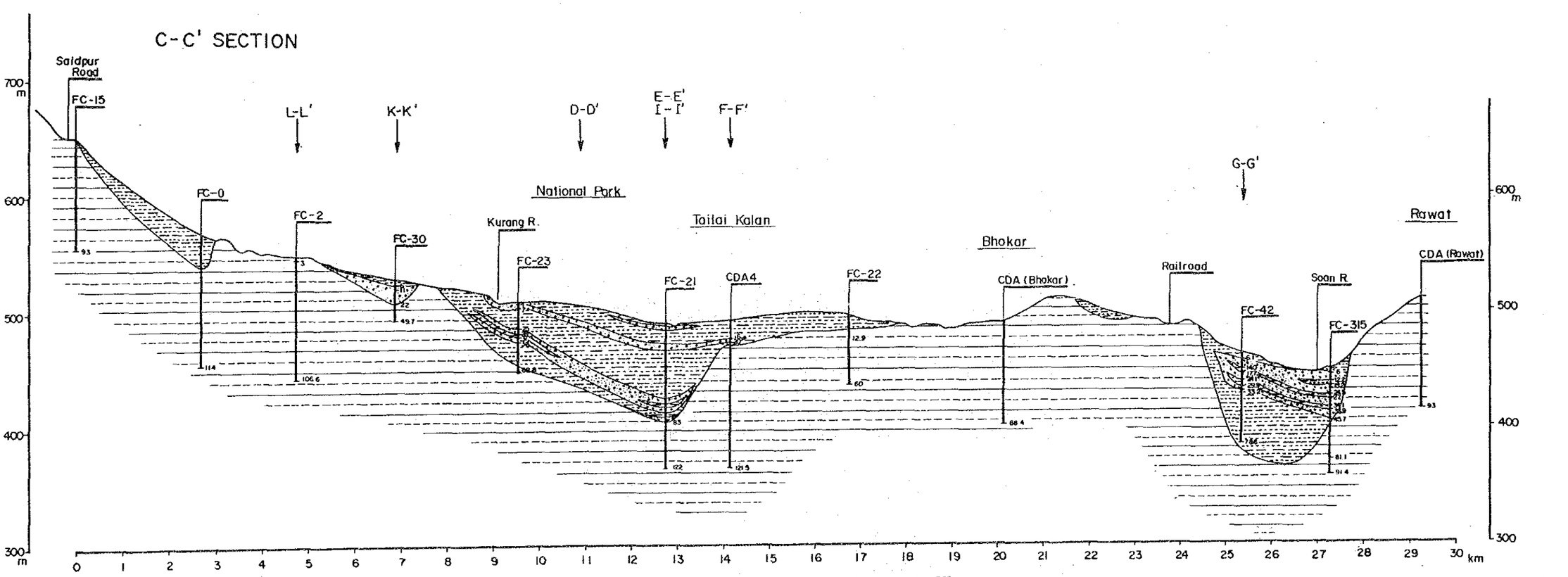


FIG. IV-11 C-C' CROSS SECTION

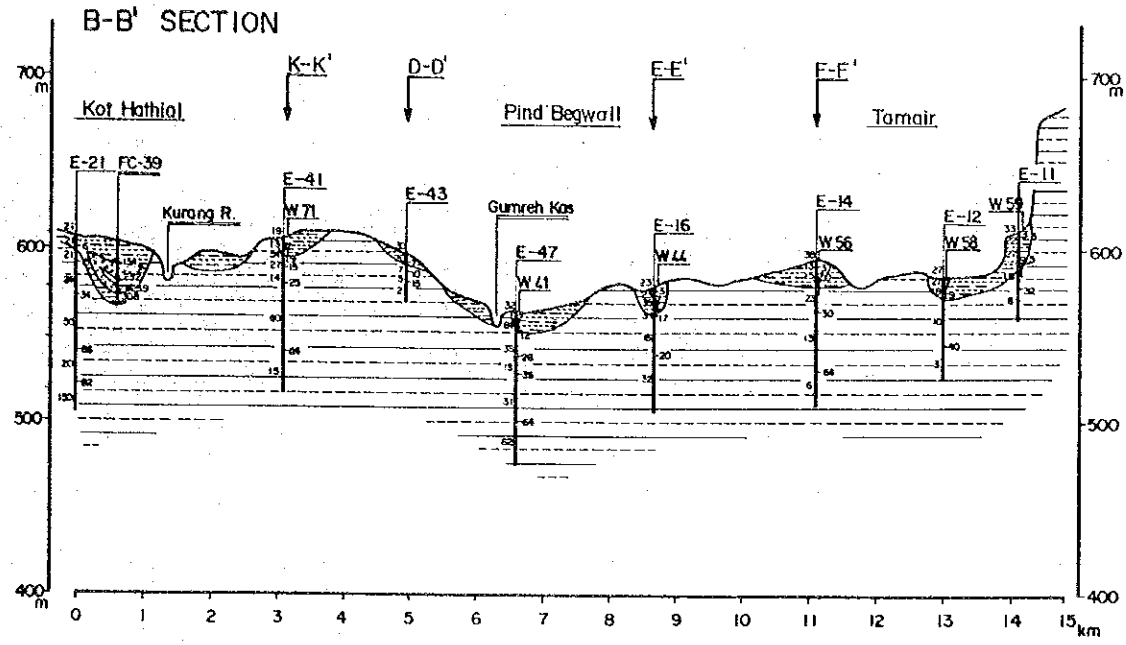


FIG. IV-10 B-B' CROSS SECTION

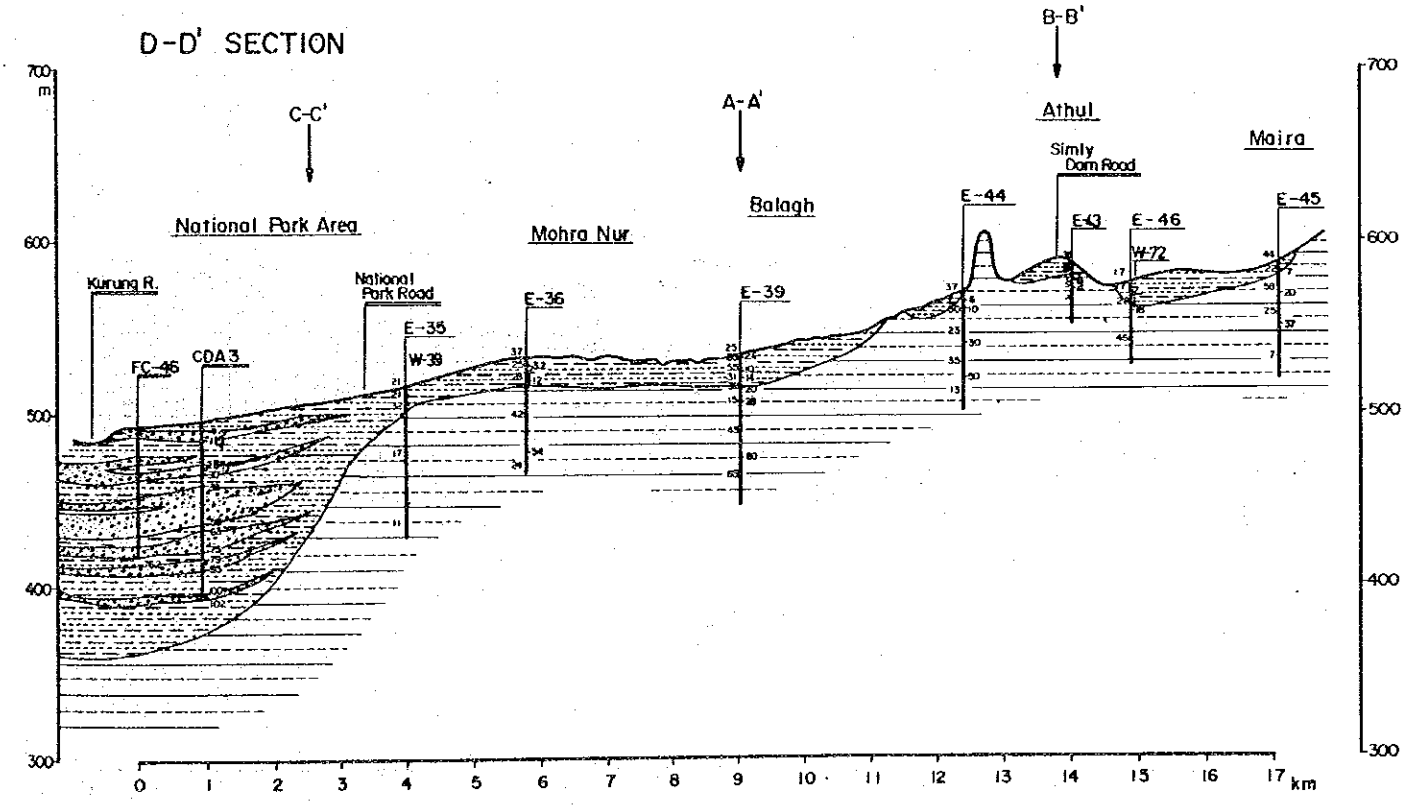


FIG. IV-12 D-D' CROSS SECTION

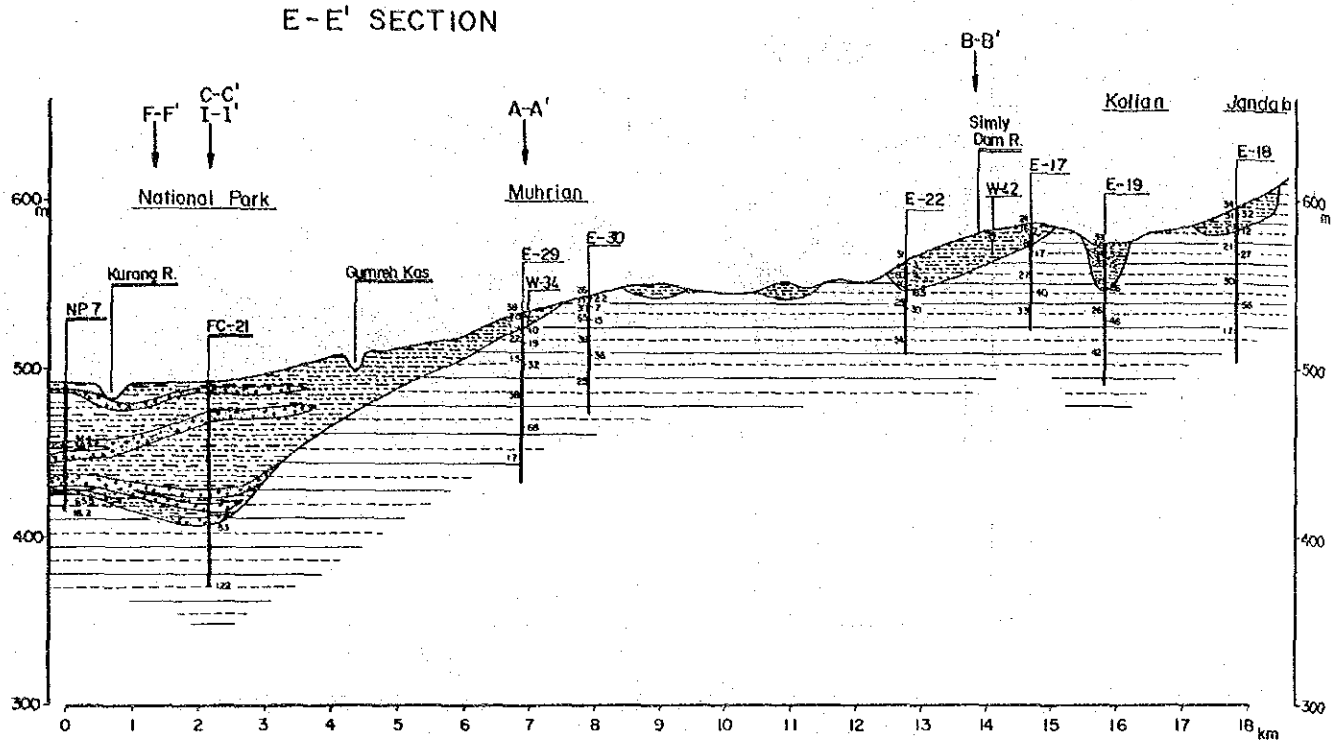


FIG. IV-13 E-E' CROSS SECTION

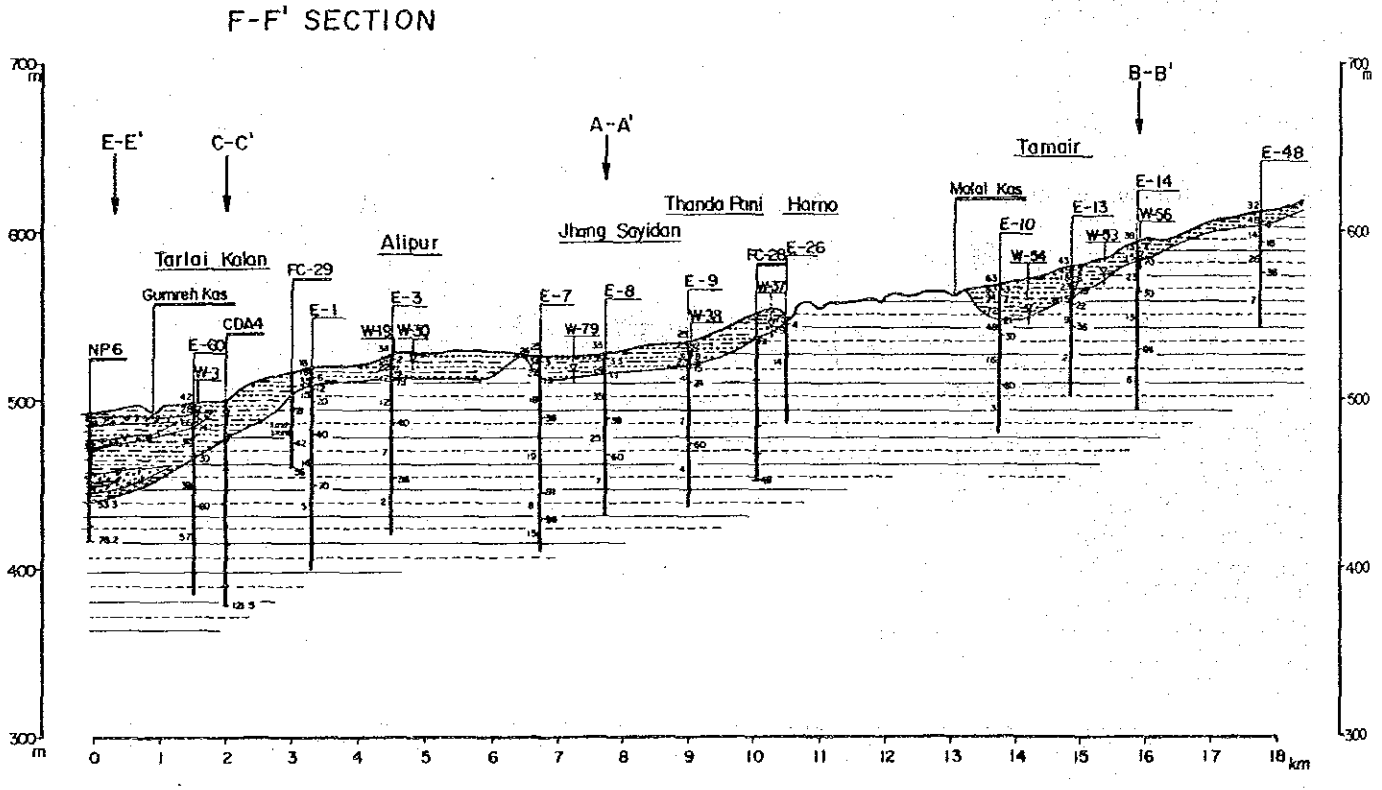


FIG. IV-14 F-F' CROSS SECTION

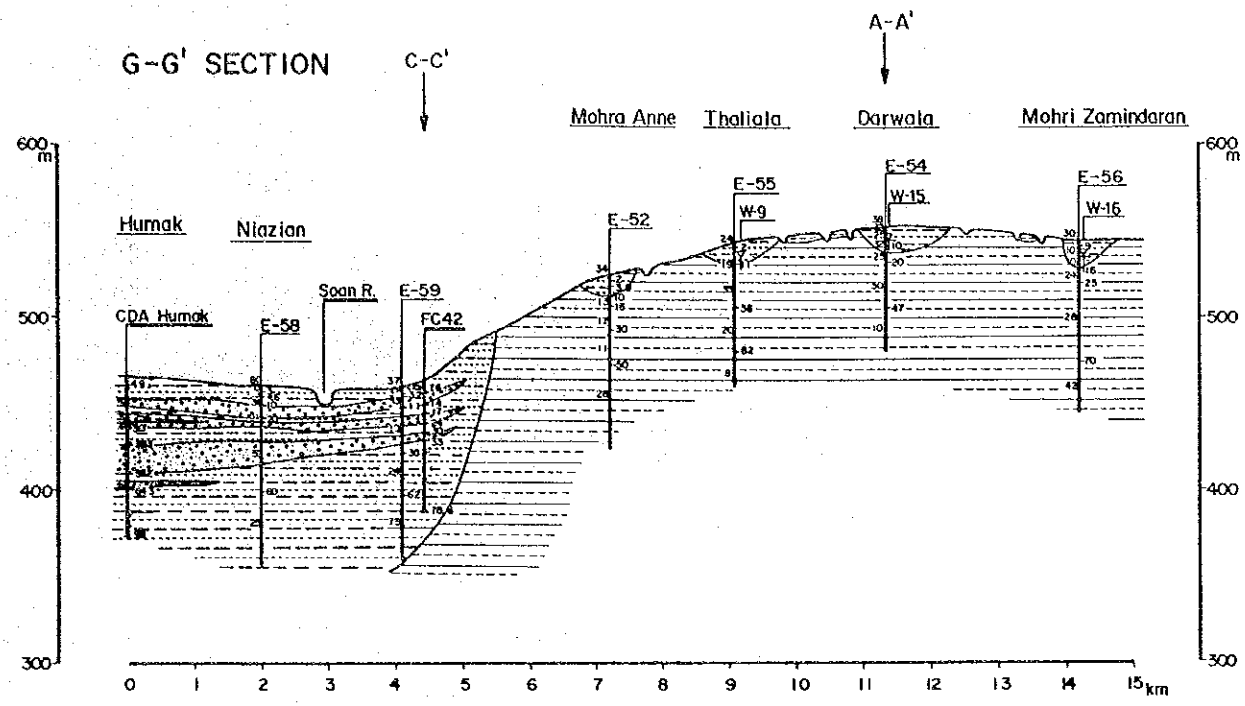


FIG. IV-15 G-G' CROSS SECTION

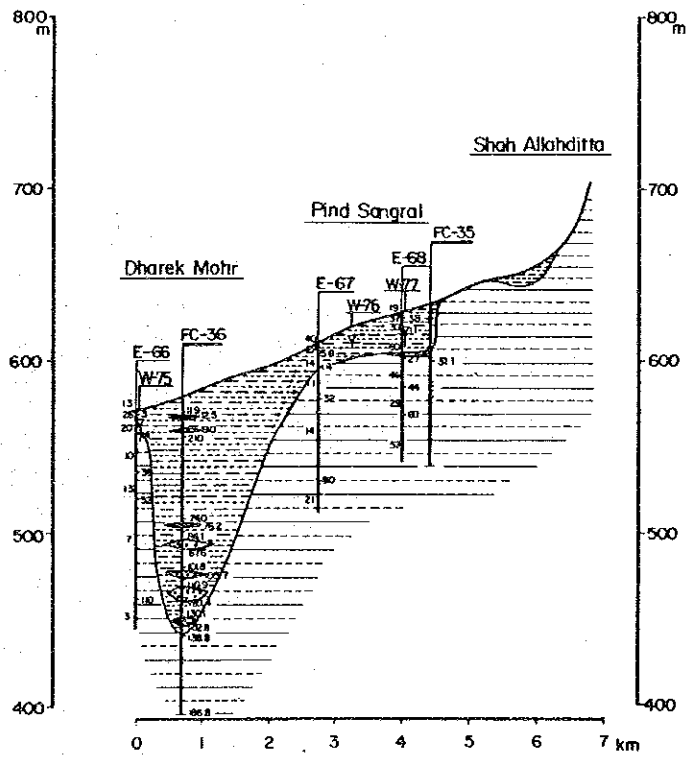


FIG. IV-16 H-H' CROSS SECTION

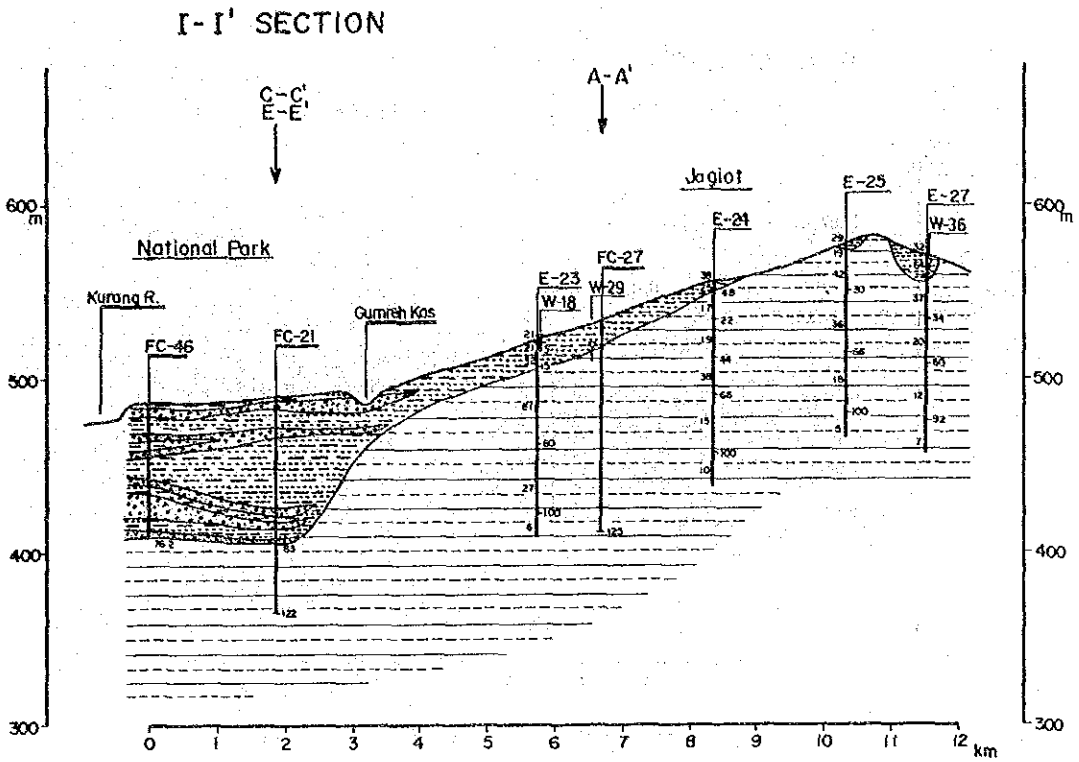


FIG. IV-17 I-I' CROSS SECTION

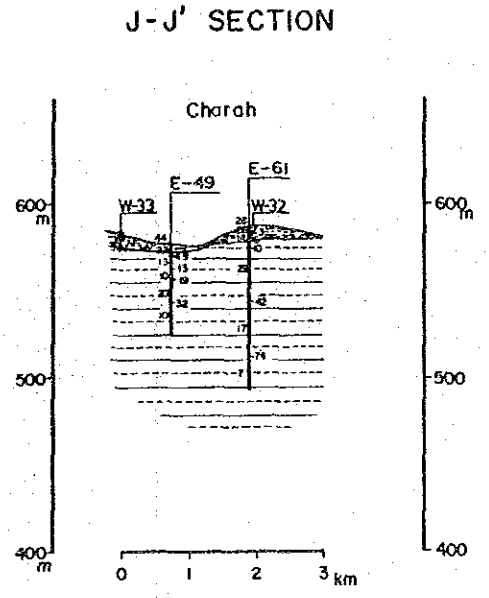


FIG. IV-18 J-J' CROSS SECTION

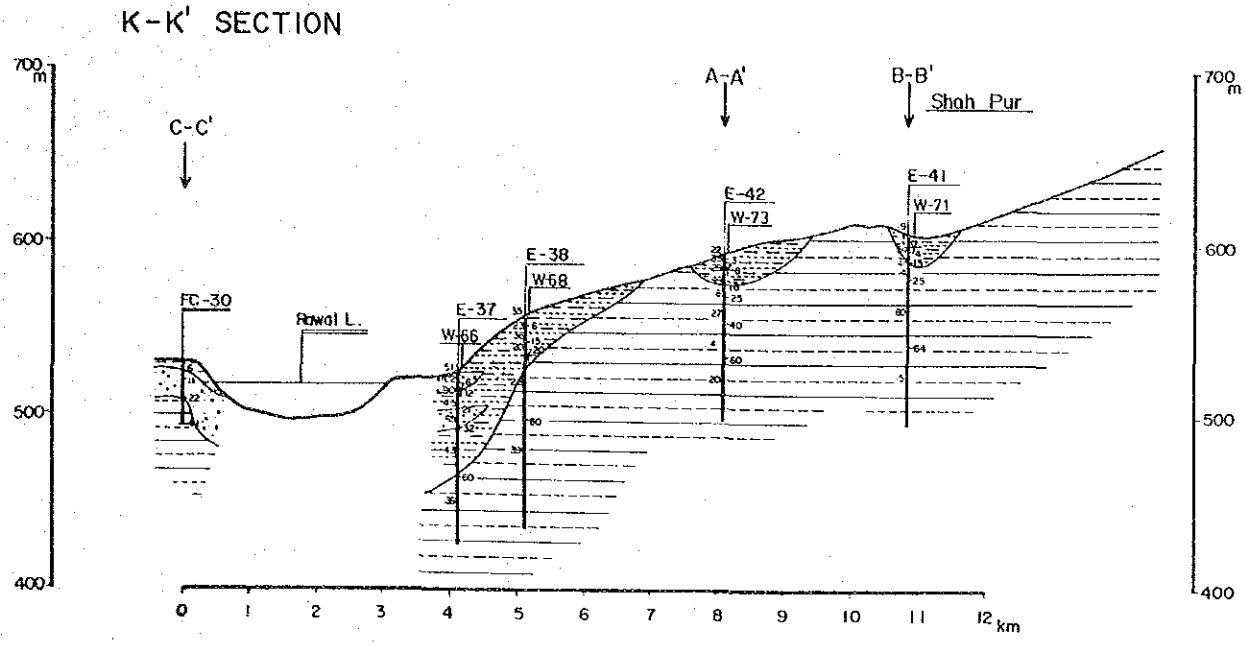


FIG. IV-19 K-K' CROSS SECTION

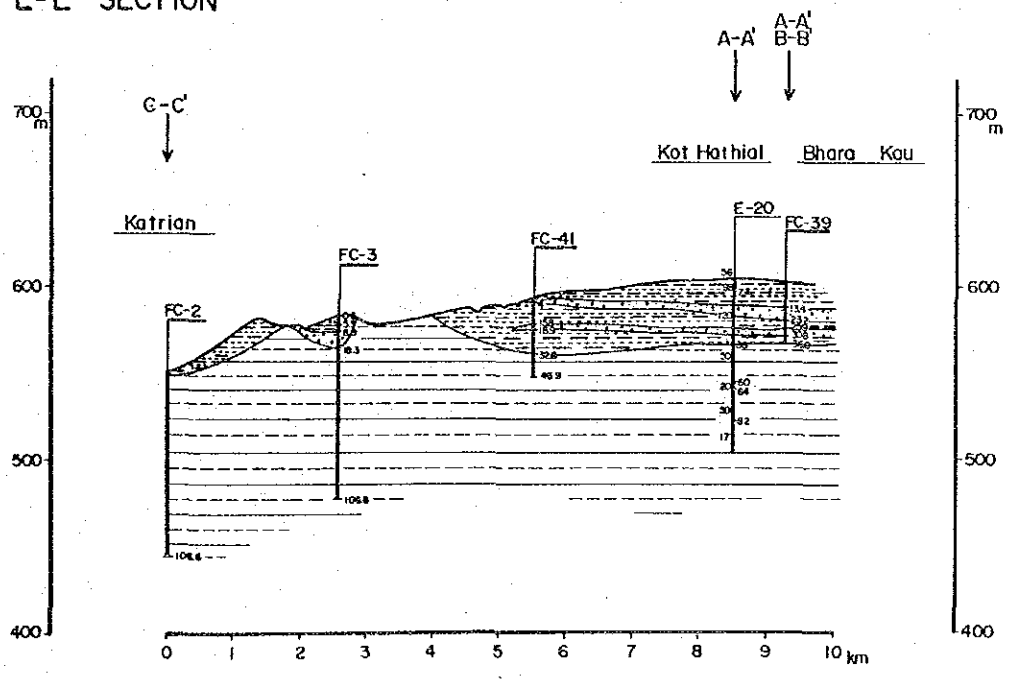


FIG. IV-20 L-L' CROSS SECTION

V. ENGINEERING PLAN AND DESIGN

CONTENTS

LIST OF TABLES AND FIGURES

V-1 IRRIGATION SCHEME

1. Design Flood Discharge

The calculation of the design flood discharge was carried out analysing probable rainfall, rainfall intensities, time of flood concentration and runoff coefficients. Rational formula is expressed below.

$$Q = \frac{1}{3.6} \cdot f \cdot rt \cdot A$$

where
- Q : design flood discharge (m^3/s)
- f : runoff coefficient
- rt: rainfall intensity (mm/hr)
- A : catchment area (km^2)

. Runoff coefficient

The runoff coefficient "f" of the Study Area is given as 0.7 as classified below.

Land Category	Runoff coefficient
Steep mountain area	0.75 - 0.9
Tertiary hills	0.7 - 0.8
Undulating land and forest	0.5 - 0.75
Flat cultivated land	0.45 - 0.8

. Rainfall intensity

Rainfall intensity is estimated by use of the Mononobe formula as described below.

$$rt = \frac{R24}{24}\left(\frac{24}{T}\right)^{2/3}$$

where
- rt : rainfall intensity (mm/hr)
- R24: daily rainfall
- T : time of concentration (hr)

. Probable rainfall

The probable rainfall computed by the Iwai method is shown in the following table.

PROBABLE DAILY RAINFALL

Return period (year)	1/2	1/5	1/10	1/20	1/50	1/100
Probable daily rainfall (mm/day)	91	120	140	160	187	208

. Time of flood concentration

Time of flood concentration is given by the Kraven formula as described below.

$$T = L / W$$

where T: time of flood concentration (hr)
L: length of water course (m)
W: velocity (m/s)

The value of velocity used is shown in the following table.

Gradient of Water Course (H/L)	Velocity (m/s)
below 1/100	3.5
1/100 - 1/200	3.0
above 1/200	2.1

The result of the calculation is shown in TABLE V-2.

2. Dam Type

A concrete gravity dam which has a spillway in its body can direct the flow of flood safely and quickly making the most suitable dam.

3. Dam Features

Dam features are decided by the storage capacity, total head, the height of freeboard and the cut line of the foundation.

. Freeboard

Based on the empirical prediction method of SDO, the freeboard of the concrete gravity dam is estimated as described below.

$$F = 0.03 \times H + 2 \text{ feet}$$

where F: Freeboard (feet)
H: Height of dam (feet)

. Head and length of spillway

Head is related to the length as described below. The length is decided by the topographical condition of the river and stream.

$$H = \left(\frac{Q}{C \cdot L}\right)^{2/3}$$

where H: head (m)
Q: design flood discharge (m^3/s)
C: coefficient (2.0)
L: length (m)

The result of calculation is shown in TABLE V-3.

. Storage capacity

The storage capacity of dam sites are estimated by the planimeter on the topographical map of 1/50,000 or 1/21,120 and decided by the topographical condition or the possible runoff discharge in the catchment area.

The effective storage capacity except for the loss of storage such as sediment, evaporation and leakage of water are 80 % of total capacity.

The loss of storage by sediment is protected by making a sabo dam at the upper side of the reservoir.

. Foundation excavation

Weathered rock rock is excavated from ground surface for the dam foundation.

. Height of dam

Height of the dam is from the excavation line of the foundation to the top of the dam as shown in the following Figure.

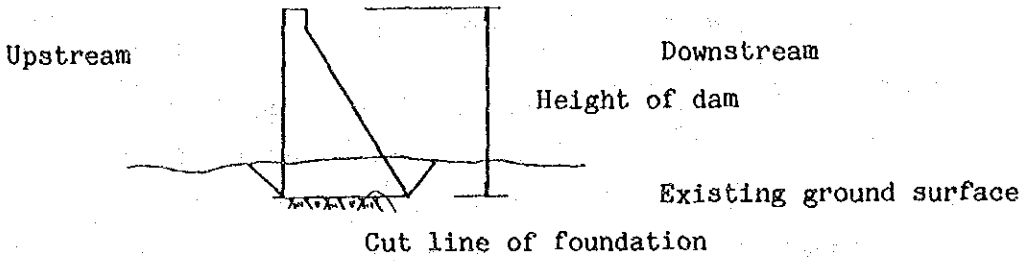


TABLE V-1 **DESIGN FLOOD DISCHARGE**

District	No.	Catchment Area(km^2)	Time (hrs)	Rainfall Intensity (mm/hour)	Design Flood Discharge Q (m^3/s)	Specific Discharge q ($m^3/s/km^2$)	Width of Spillway B (m)	Surcharge Head H (m)
Kurang R.	K-1	2.3	0.2≤1	116.1	51	22.6	26	1
	K-2	137	1.8	70.4	1,875	13.7	64	6
Gumreh kas	G-1	5.7	0.2≤1	116.1	129	22.6	23	2
	G-2	6.5	0.3≤1	116.1	147	22.6	26	2
	G-3	13.2	0.7≤1	116.1	298	22.6	53	2
	G-4	1.6	0.2≤1	116.1	36	22.6	18	1
	G-5	2.0	0.2≤1	116.1	45	22.6	23	1
Malal kas	M-1	10.9	0.6≤1	116.1	246	22.6	24	3
	M-2	55.0	1.6	77.9	833	15.1	53	4
Hills and Mountains	H-1	1.3	0.1≤1	116.1	29	22.6	15	1
	H-2	25.0	0.4≤1	116.1	564	22.6	36	4
	H-3	3.6	0.2≤1	116.1	81	22.6	15	2
	H-4	5.9	0.4≤1	116.1	133	22.6	24	2
Soan R.	S-1	175	2.6	51.5	1,752	10.0	60	6

$Q = \frac{1}{3.6} \cdot A \cdot F \cdot \gamma t$ (Rational formula)

where, Q : design flood discharge (m^3/s)
A : catchment area (km^2)
f : runoff coefficient
γt: rainfall intensity (mm/hour)

TABLE V-2 TIME OF CONCENTRATION

District	No.	Location	Elevation (feet) Top of river (H1)	Elevation (feet) Dam sites (H2)	Height H (m)	Length L (m)	H/L	Velocity (m/s)	Time (hr)
Kurang R.	K-1	Sakrila	2,800	2,110	210	2,000	1/10	3.5	0.2
	K-2	Sakrila	5,000	2,100	883	22,000	1/25	3.5	1.8
Gumreh..kas	G-1	Athal	2,400	1,850	168	3,000	1/18	3.5	0.2
	G-2	Athal	2,400	1,850	168	4,000	1/24	3.5	0.3
	G-3	Sihali	3,000	1,950	320	8,500	1/27	3.5	0.7
	G-4	Pind Begwal	1,850	1,750	30	2,800	1/93	3.5	0.2
	G-5	Muhrian	1,850	1,750	30	2,000	1/67	3.5	0.2
Malal kas	M-1	Tamail	2,100	1,850	76	7,000	1/92	3.5	0.6
	M-2	Jang Saiydan	2,200	1,750	137	17,000	1/124	3.0	1.6
Hills and Mountains	H-1	Shah Allahdita	2,700	2,200	152	1,000	1/7	3.5	0.1
	H-2	Shahdara	4,000	2,300	518	5,000	1/10	3.5	0.4
	H-3	Shahdara	4,400	2,400	610	3,000	1/5	3.5	0.2
	H-4	Subban	3,000	2,100	274	4,500	1/16	3.5	0.4
Soan R.	S-1	Cherah	4,000	2,000	610	32,500	1/53	3.5	2.6

TABLE V-3 **TOTAL HEAD AND LENGTH OF CREST**

District	No.	Design flood Discharge (m^3/s)	Length of Crest (Spillway)							Available length
			H=0.5m	H=1.0m	H=2.0m	H=3.0m	H=4.0m	H=5.0m	H=6.0m	
Kurang R.	K-1	51	72	26	9	5	-	-	-	30
	K-2	1,875	2,652	938	332	181	118	84	64	100
Gumreh kas	G-1	129	183	65	23	13	8	6	-	30
	G-2	147	208	74	26	15	10	7	-	50
	G-3	298	422	149	53	29	19	14	11	100
	G-4	36	51	18	7	4	-	-	-	50
	G-5	45	64	23	8	5	-	-	-	50
Malal kas	M-1	246	348	123	44	24	16	11	8	50
	M-2	833	1,178	417	148	80	53	38	29	50
Hills and Mountains	H-1	29	41	15	6	-	-	-	-	50
	H-2	564	798	282	100	55	36	26	20	50
	H-3	81	115	41	15	8	5	-	-	30
	H-4	133	188	67	24	13	9	6	-	50
Soan R.	S-1	1,752	2,478	876	310	169	110	79	60	100

* Discharge equation

$Q = CLH^{3/2}$ $L = Q/C.H^2$ where, Q : discharge (m^3/s)
L : length of crest (spillway) (m)
H : total head on the crest (m)
C : Coefficient 2.0

TABLE V-4 SEDIMENT

District	No.	Location	Catchment Area (km^2)	Total Sediment (m^3)	Total Storage Capacity (m^3)	Effective Storage Capacity (m^3)	Dead Storage (m^3)	Frequency of blow off
Kurang River	K - 1	Sakrila	2.3	115,000	2,500,000	2,000,000	500,000	-
	K - 2	Sakrila	137	6,850,000	11,000,000	8,800,000	2,200,000	1/16
Gumreh kas	G - 1	Athal	5.7	285,000	80,000	64,000	16,000	1/3
	G - 2	Athal	6.5	325,000	240,000	192,000	18,000	1/7
	G - 3	Sihali	13.2	660,000	1,200,000	960,000	240,000	1/18
	G - 4	Pind Begwal	1.6	80,000	240,000	192,000	48,000	1/30
	G - 5	Muhrian	2.0	100,000	135,000	108,000	27,000	1/14
Malal kas	M - 1	Tamail	10.9	545,000	300,000	240,000	60,000	1/11
	M - 2	Jang Saiydah	55.0	2,750,000	500,000	400,000	100,000	1/2
Hills and Mountains	H - 1	Shah Allahditta	1.3	65,000	286,000	228,000	58,000	1/45
	H - 2	Shahdara	25.0	1,250,000	1,750,000	1,400,000	350,000	1/15
	H - 3	Shahdara	3.6	180,000	620,000	496,000	124,000	1/34
	H - 4	Subban	5.9	295,000	950,000	760,000	190,000	1/32
Soan River	S - 1	Cherah	175	8,750,000	7,500,000	6,000,000	1,500,000	1/9

* 2 Acre.ft/sq.mile/year = 952 m^3/km^2/year
(by SDO) = 1,000 m^3/km^2/year

V-2 GROUND WATER MULTIPURPOSE DEVELOPMENT SCHEME

Site suitable for well drilling are determined based upon integrated decisions relating to natural and socioeconomic conditions. Wells are designed for domestic water supply, irrigation, and water supply for public facilities.

(1) Features of Production Wells

Tube wells are designed for confined groundwater to a depth of 60 to 100m by the rotary method with 0.35m diameter iron and stainless steel pipes selected for casing.

The optimum length of a screen for a productin well is determined upon the discharge of a production well, effective open area per length of a screen, and optimum screen entrance velocity.

Collector wells (shallow wells) are designed for unconfined ground water to a depth of 15 to 30m. Collector wells with a 3.5m diameter are constructed by lowering a cylindrical wavy iron caisson into unconsolidated deposits and jacking perforated pipes horizontally into the layer.

(2) Designed Yield of Ground Water

Dased on the results of pumping tests by WAPDA (1980), transmissibility ranges from 1×10^{-4} to 2×10^{-3} m^2/sec for confined aquifers and permeability ranges from 2×10^{-3} to 2×10^{-1} cm/sec for unconfined aquifers. Therefore, transmissibility of confined aquifers in alluvial terraces is calculated at 2×10^{-3} m^2/sec with Pleistocene terraces at 2×10^{-4} m^2/sec. Permeability of unconfined aquifers in alluvial terraces is calculated at 2×10^{-1} cm/sec with pleistocene terraces at 2×10^{-3} cm/sec.

As storage coefficients of confined aquifers obtained from pumping tests by WAPDA (1979) are calculated at 2.74×10^{-5}, 1.42×10^{-4} and 2.23×10^{-4}, the storage coefficient in Pleistocene terraces is assumed to equal 2.5×10^{-4}. The storage coefficient in alluvial terraces is higher than that in Pleistocene terraces. The storage coefficient in alluvial terraces is assumed to be 2.5×10^{-3}. The effective porosity of

unconfined aquifers, equivalent to a storage coefficient of confined aquifers, is assumed to be a value of 0.15 in alluvial terraces and 0.1 in Pleistocene terraces.

(3) Pumping and Distribution Facilities

Ground water pumped up by a submersible motor pump is supplied to a gravity (elevated) tanks (Fig.V-1A). If the distribution area is isolated from a pumping station (e.g. 1.5 to 5 km), ground-type distribution tanks are constructed (Fig.V-1B).

The capacity of these tanks approximates one-fourth of the water supply rate required during an 8-hour period. The elevated tanks range from 5 to 8m in height.

In areas where present springs occur a water catchment system is constructed capable of maintaining spring mechanism. The water capacity required during a 24-hour period is stored in distribution tanks.

(4) Water Supply

1) Water for Domestic use

Present comsumption of ground water is estimated at 5 gallons (20ℓ)/man-day. If consumption of water at the end of the year 2001 is assumed to be 80ℓ/man-day, 4,930 m^3 of water/day is lacking throughout the whole area. New wells are to be constructed in the 32 villages that are expected to suffer water shortages by the end of 2001. New wells proposed for domestic use in each UC are shown in TABLE 1 and 2.

Five (5) tubewells will be constructed to produce an average of about 1,800 m^3/day and twenty-six (26) shallow wells to produce about 2,900 m^3/day. A water catchment system will be constructed in Shah Allah Ditta village.

2) Irrigation Water

As mentioned in capter 14.1 of the main report, the total requirement of water for vegetables is about 14,000 m^3/ha.

In order to ensure irrigation water for intensive vegetable forming, twenty-one (21) new wells are proposed for construction in fields located near the villages facilitating farm management. New

wells are classified into the two following groups: two (2) tubewells and nineteen (19) shallow wells as shown in TABLE 3.

About 123 ha will be irrigated by new wells.

3) Water for Public Facilities

The wells constructed for domestic and irrigation use in association with public facilities consist of thirteen (13) rural development stations, one (1) vocational training station, one (1) agricultural machinery station, two (2) agricultural machinery substations, ten (10) agricultural machinery branches (tractor sheds), four (4) nursery stations, five (5) intensive horticulture pilot farms, one (1) livestock development station, three (3) livestock pilot farms, four (4) veterinary hospitals, five (5) veterinary dispensaries, one (1) fish hatchery, three (3) small-scale industries, and three (3) maternity stations.

For these public facilities, the allocation of water for domestic use is assumed at 40ℓ/man-day, water for tractor at 100 ℓ/unit-day, water for car at 50ℓ/unit-day, water for irrigating vegetable fields at 0.53ℓ/ha-sec, and water for cows at 150 ℓ/head-day.

TABLE V-5 NEW WELLS AND WATER CATCHMENT FACILITY FOR DOMESTIC USE

U.C.	TUBE WELLS	SHALLOW WELLS	WATER CATCHMENT FACILITY	TOTAL
KORAL	2 (769)			2 (769)
RAWAT	1 (410)			1 (410)
KIRPA		4 (281)		4 (281)
CHARAH		6 (425)		6 (425)
TARLAI KALAN		2 (689)		2 (689)
SOHAN		3 (751)		3 (751)
PHULGRAN		2 (141)		2 (141)
SHAH ALLAH DITTA		2 (141)	1 (45)	3 (186)
SIHALA	2 (640)	1 (72)		3 (712)
BHARA KAU		2 (139)		2 (139)
TAMAIR		4 (282)		4 (282)
TOTAL	5 (1819)	26 (2921)	1 (45)	32 (4785)

cf. Numbers in brackets indicate yield of groundwater (m^3/day)

TABLE V-6

MULTIPURPOSE SCHEMES FOR DOMESTIC USE

NUMBER OF WELLS	UNION COUNCIL	NAME OF VILLAGE	* TYPE OF WELLS	USAGE	STRUCTURAL OF WELLS									WATER REQUIREMENT																			
					WELL DEPTH	WELL DIAMETER	DESIGN PUMPAGE	ACTUAL PUMP HEAD	TOTAL PUMP HEAD	DROP PIPE DIAMETER	MOTOR OUTPUT	ELEVATED TANK CAPACITY	DELIVERY TANK CAPACITY																				
														LIVING WATER	RURAL DEVELOPMENT STATION	VOCATIONAL TRAINING STATION	AGRICULTURAL MACHINERY STATION(AMS)	AMS. SUBSTATION	AMS. TRACTER SHED	NURSERY STATION	INTENSIVE HORTICULTURE PILOT FARM	LIVESTOCK DEVELOPMENT STATION	VETERINARY HOSPITAL	VETERINARY DISPENSARY	LIVESTOCK PILOT FARM	FISH HATCHERY	SMALL SCALE INDUSTRY	MATERNITY STATION		TOTAL WATER REQUIREMENT
L-1	SHAH ALLAH DITTA	SHAH ALLAH DITTA	(Spring)	Living Water Common Facilities	m	m	m^3/min 0.10	m	m	m	kW		m^3 40	m^3/min 0.0937	○				○				○									m^3/min 0.100
L-2	"	TALHAR	S	Living Water	15	3.5	0.149	15	65	40	3.7		25	0.149																		0.149
L-3	"	GOKINA	S	Living Water Common Facilities	15	3.5	0.149	15	65	40	3.7		25	0.1457	○						○											0.149
L-4	BHARA KAU	KOT HATHIAL	S	Living Water	25	3.5	0.149	25	35	40	2.2	15		0.149																		0.149
L-5	"	"	S	Living Water Common Facilities	30	3.5	0.149	30	45	40	3.7	15		0.1415	○			○					○						○			0.149
L-6	PHULGRAN	SHAH PUR	S	"	25	3.5	0.149	25	45	40	3.7	15		0.1457	○																	0.149
L-7	"	KURI	S	Living Water	35	3.5	0.149	35	45	40	3.7	15		0.149																		0.149
L-8	TAMAIR	MAIRA BEGWAL	S	"	25	3.5	0.149	25	35	40	2.2	15		0.149																		0.149
L-9	"	PIND BEGWAL	S	Living Water Common Facilities	25	3.5	0.149	25	35	40	2.2	15		0.1437	○				○						○							0.149
L-10	"	SIALI	S	Living Water	20	3.5	0.149	20	30	40	2.2	15		0.149																		0.149
L-11	"	TAMAIR	S	Living Water Common Facilities	25		0.149	25	45	40	3.7	15		0.1457	○																	0.149
L-12	SOHAN	CHAK SHADAD	S	"	20	3.5	0.149	20	30	40	2.2	15		0.1457	○																	0.149
L-13	"	SHAK RIAL	S	Living Water	20	3.5	1.39	20	30	100	15	80		1.39																		1.39
L-14	TARLAI KALAN	TARLAI KALAN	S	Living Water Common Facilities	20	3.5	0.149	20	30	40	2.2	15		0.046	○			○				○		○					○			0.149
L-15	"	KHANA DAK	S	Living Water	20	3.5	1.39	20	30	100	15	80		1.39																		1.39
L-16	CHARAH	DARKALA	S	"	35	3.5	0.149	25	35	40	2.2	15		0.149																		0.149
L-17	"	CHARH	S	Living Water Common Facilities	20	3.5	0.149	20	30	40	2.2	15		0.1457	○																	0.149
L-18	"	"	S	Living Water	20	3.5	0.149	20	30	40	2.2	15		0.1457																		0.149
L-19	"	"	S	"	20	3.5	0.149	20	30	40	2.2	15		0.149																		0.149
L-20	"	"	S	Living Water Common Facilities	20	3.5	0.149	20	30	40	2.2	15		0.148													○			○		0.149
L-21	"	"	S	"	20	3.5	0.149	20	30	40	2.2	15		0.148					○													0.149

NOTE * TYPE OF WELLS : S = Shallow well, T = Tube well

TABLE V-6

MULTIPURPOSE SCHEMES FOR DOMESTIC USE

NUMBER OF WELLS	UNION COUNCIL	NAME OF VILLAGE	* TYPE OF WELLS	USAGE	STRUCTURAL OF WELLS									WATER REQUIREMENT																	
					WELL DEPTH	WELL DIAMETER	DESIGN PUMPAGE	ACTUAL PUMP HEAD	TOTAL PUMP HEAD	DROP PIPE DIAMETER	MOTOR OUTPUT	ELEVATED TANK CAPACITY	DELIVERY TANK CAPACITY		LIVING WATER	RURAL DEVELOPMENT STATION	VOCATIONAL TRAINING STATION	AGRICULTURAL MACHINERY STATION(AMS)	AMS. SUBSTATION	AMS. TRACTER SHED	NURSERY STATION	INTENSIVE HORTICULTURE PILOT FARM	LIVESTOCK DEVELOPMENT STATION	VETERINARY HOSPITAL	VETERINARY DISPENSARY	LIVESTOCK PILOT FARM	FISH HATCHERY	SMALL SCALE INDUSTRY	MATERNITY STATION		TOTAL WATER REQUIREMENT
					m	m	m^3/min	m	m	m	kW	m^3	m^3		m^3/min																
L-22	KIRPA	TAMMA	S	Living Water	20	3.5	0.149	20	30	40	2.2	15			0.149																0.149
L-23	"	KIRPA	S	Living Water Common Facilities	25	3.5	0.149	25	35	40	2.2	15			0.1457	○															0.149
L-24	"	KHATRIL	S	"	20	3.5	0.149	20	30	40	2.2	15			0.1457					○											0.149
L-25	"	BHIMBAR TARAR	S	"	20	3.5	0.149	20	30	40	2.2	15			0.1457									○							0.149
L-26	KORAL	KORAL	J	"	100	0.35	0.86	50	80	100	18.5		80		0.7784											○					0.86
L-27	"	LOI BHER	T	"	100	0.35	0.86	50	110	100	30		150		0.8247	○				○	○			○							0.86
L-28	SIHALA	GAGRI	T	"	100	0.35	0.86	50	60	100	15	50			0.859																0.86
L-29	"	HON DHAMIAL	S	Living Water	20	3.5	0.149	20	30	40	2.2	15			0.149																0.149
L-30	"	SIHALA	T	Living Water Common Facilities	100	0.35	0.86	50	70	100	15	50			0.475								○						○		0.86
L-31	RAWAT	RAWAT	T	"	60	0.35	0.86	50	110	100	30		150		0.8547	○				○				○				○			0.86
L-32	SOHAN	RAWAL	S	"	20	3.5	0.149	20	30	40	2.2	15			0.029												○				0.149

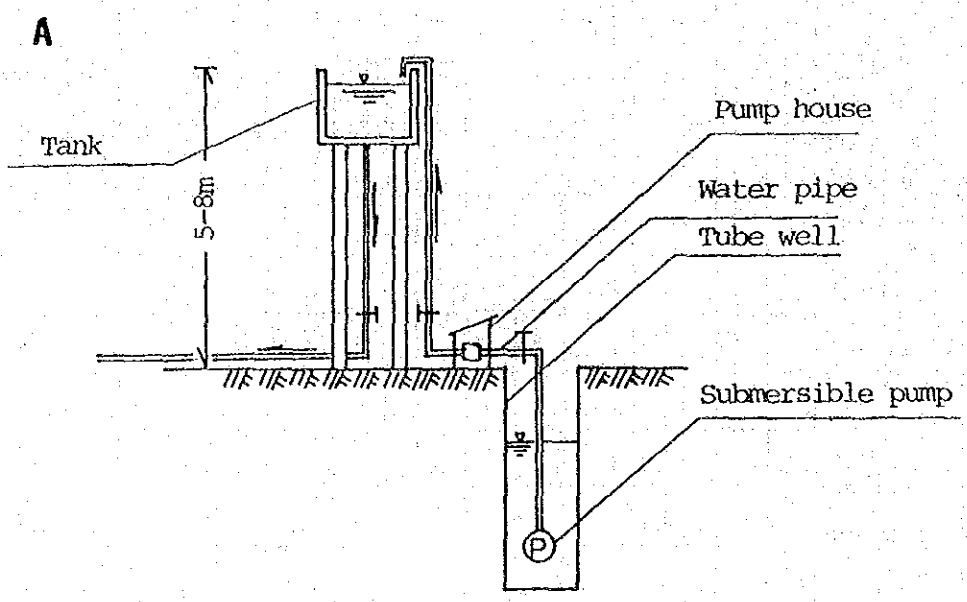
NOTE * TYPE OF WELLS : S = Shallow well, T = Tube well

TABLE V-7

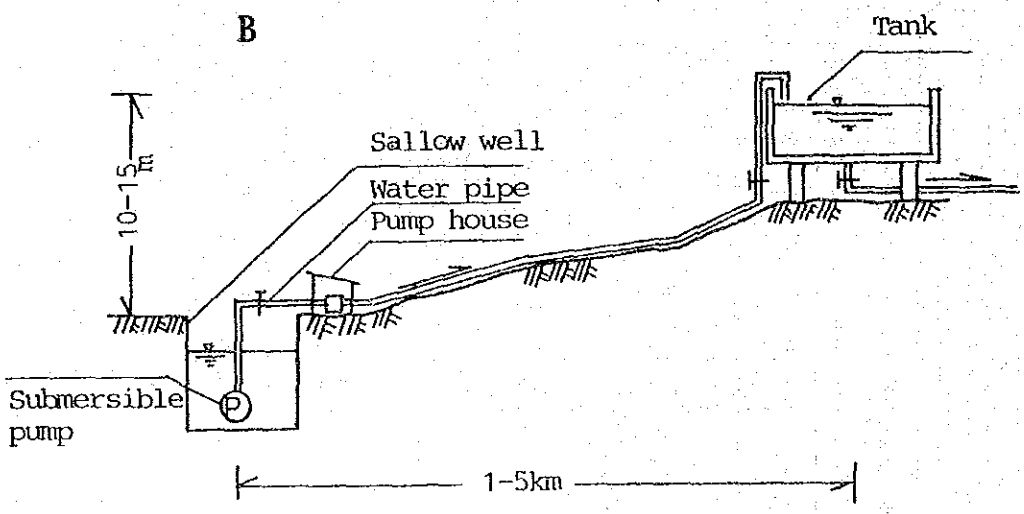
MULTIPURPOSE SCHEMES FOR IRRIGATION

NUMBER OF WELLS	UNION COUNCIL	NAME OF VILLAGE	* TYPE OF WELLS	USAGE	STRUCTURAL OF WELLS										WATER REQUIREMENT																			
					WELL DEPTH	WELL DIAMETER	DESIGN PUMPAGE	ACTUAL PUMP HEAD	TOTAL PUMP HEAD	DROP PIPE DIAMETER	MOTOR OUTPUT	ELEVATED TANK CAPACITY	DELIVERY TANK CAPACITY		IRRIGATION WATER	RURAL DEVELOPMENT STATION	VOCATIONAL TRAINING STATION	AGRICULTURAL MACHINERY STATION(AMS)	AMS. SUBSTATION	AMS. TRACTER SHED	NURSERY STATION	INTENSIVE HORTICULTURE PILOT FARM	LIVESTOCK DEVELOPMENT STATION	VETERINARY HOSPITAL	VETERINARY DISPENSARY	LIVESTOCK	PILOT FARM	FISH HATCHERY	SMALL SCALE INDUSTRY	MATERNITY STATION		TOTAL WATER REQUIREMENT
					m	m	m³/min	m	mm	mm	kW																						
I-1	BHARA KAU	KOT HATHIAL	S	Irrigation Water	30	3.5	0.149	30	40	40	2.2				0.149m³/min (1.0ha)																			0.149
I-2	"	MOHRA NOOR	S	"	20	3.5	1.39	20	40	125	15				1.39 (10ha)																			1.39
I-3	"	"	T	Irrigation Water Common Facilities	100	0.35	0.86	50	70	100	15				0.827 (6ha)						○													0.86
I-4	TAMAIR	MAIHA BEGWAL	S	Irrigation Water	25	3.5	0.149	25	40	40	2.2				0.149 (1.0ha)																			0.147
I-5	"	PIND BEGWAL	S	"	25	3.5	0.149	25	40	40	2.2				0.149 (1.0ha)																			0.149
I-6	"	"	S	"	20	3.5	0.149	20	40	40	2.2				0.149 (1.0ha)																			0.149
I-7	"	TAMAIR	S	"	30	3.5	0.149	30	40	40	2.2				0.149 (1.0ha)																			0.149
I-8	"	"	S	Irrigation Water Common Facilities	30	3.5	0.149	30	50	40	3.7				0.067 (0.5ha)																			0.149
I-9	PHULGRAN	KURI	S	Irrigation Water	25	3.5	0.39	25	40	125	15				1.39 (10ha)																			1.39
I-10	"	"	S	"	20	3.5	1.39	20	30	100	15				1.39 (10ha)					○													1.39
I-11	KIRPA	JHANG SAYADDAN	S	Irrigation Water Common Facilities	25	3.5	0.149	25	35	40	2.2				0.117 (1.0ha)					○	○													0.149
I-12	"	KIRPA	S	Irrigation Water	30	3.5	0.149	30	40	40	2.2				0.149 (1.0ha)					○														0.149
I-13	"	KANGOTA SAYADDAN	S	Irrigation Water Common Facilities	25	3.5	1.39	25	45	125	18.5				1.358 (10ha)						○													1.39
I-14	CHARAH	GHORA BAZ	T	"	60	0.35	0.086	50	70	32	2.2				-												○							0.086
I-15	SOHAN	SOHAN	S	"	20	3.5	1.39	20	25	100	11				1.379 (10ha)																			1.39
I-16	TARLAI KALAN	TARLAI KALAN	S	"	20	3.5	1.39	20	30	100	15				1.389 (10ha)																			1.39
I-17	"	KHANA DAK	S	Irrigation Water	20	3.5	1.39	20	25	100	11				1.39 (10ha)																			1.39
I-18	SIHALA	GAGRI	S	"	20	3.5	1.39	20	40	125	15				1.39 (10ha)																			1.39
I-19	"	"	S	Irrigation Water Common Facilities	25	3.5	1.39	25	35	100	15				1.295 (9ha)							○												1.39
I-20	"	SIHALA	S	"	20	3.5	1.39	20	25	100	11				1.383 (10ha)	○			○					○										1.39
I-21	"	MUGHAL	S	Irrigation Water	20	3.5	1.39	20	25	100	11				1.39 (10ha)																			1.39

NOTE * TYPE OF WELLS: S = Shallow well, T = Tube well



Gravity (elevated) Tank System



Distribution Tank System

FIG. V-1 PUMPING AND DISTRIBUTION FACILITIES

V-3 AGRICULTURAL MACHINERY STATION (AMS) SCHEME

1. Estimation for Required Number of Tractors at AMS

Plowing, harrowing and sowing system for kharif crop (corn)

Operation period 30 days

Plowing ..... one time

Harrowing ..... two times

Sowing ..... with fertilizing

Required implement for 30HP class and 40-50HP class tractor and working rate of each implement.

	Plowing	Harrowing	Sowing
30HP class	Mould board plow	Disk harrow	Corn planter
Size	14" x 1	18" x 16	2 rows
Working rate (h/ha)	10.6	4.3 (two times)	8.7
40-50HP class	Mould board plow	Disc harrow	Corn planter
Size	14" x 2	18" x 20	4 rows
Working rate (h/ha)	5.3	3.9 (two times)	3.7

Working area of each tractor;

Working hour per day ..... 8 hours

30HP class

$$\frac{8 \times 30}{10.6 + 4.3 + 8.7} = 10.2 \text{ (ha/unit)}$$

40-50HP class

$$\frac{8 \times 30}{5.3 + 3.9 + 3.7} = 18.6 \text{ (ha/unit)}$$

Required number of tractors in ICT rural area;

Corn area 10,900ha

10,900/18.6 = 586 Units

Existing number of tractors: 225 units (For agricultural use)

Registered number of tractors in ICT area from 1981 to 1984:

106 units (for agricultural use)

27 units/year

Estimated increasing number of tractor in ICT area from 1986 to 1995:

27 x 10 = 270 units

Required number of tractors at AMS

586 - (225 + 270) = 91 units

2. Estimation for Required Number of Bulldozers at AMS

Bulldozer	120HP
Required land leveling area	23,000ha
Working period	10 years
Working days per year	300 days

Land leveling area per day

$$\frac{23000}{10 \times 300} = 7.67 \text{ha/day}$$

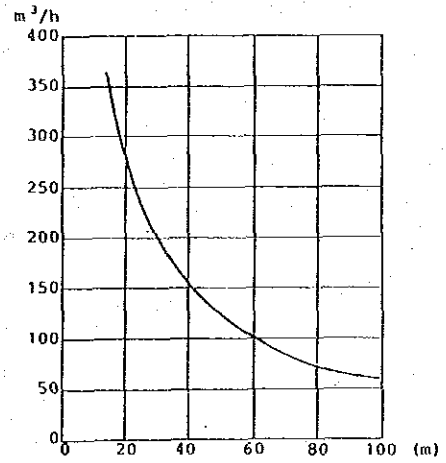
Average working depth	0.1m

Required production per day

$7.67 \times 10000 \times 0.1 = 7670 m^3/day$

Haul distance	80m
Production per hour	$80 m^3/h$

120HP Standard Production



Production per day

$80 \times 8 = 640 m^3/day$

Required number of bulldozers for land leveling

$$\frac{7670}{640} = 12 \text{ units}$$

Required number of bulldozers for road construction and maintenance

13 units (1 unit for each AMS and tractor shed, management is under each AMS)

Total required number	25 units
Stand-by	5 units
	30 units

TABLE V-8 **WORKSHOP MACHINES AND TOOLS**

Items	Tarlai AMS	Sihala Bhara Kau AMS	Tractor Shed
1. Compression gauge for gasoline engine	*	*	-
2. Compression gauge for diesel engine	*	-	-
3. Vacuum fuel pump gauge	*	-	-
4. Nozzle tester	*	*	-
5. Valve lifter and compressor	*	*	-
6. Cylinder gauge	*	-	-
7. Thermometer	*	*	-
8. Cylinder linner puller	*	-	-
9. Piston ring tool	*	*	-
10. Radiation cap & cooling system tester	*	-	-
11. Tire pressure gauge	*	*	-
12. Garage jack	*	-	-
13. Battery hydrometer	*	*	*
14. Volt-ampere meter	*	*	-
15. Battery charger	*	*	-
16. Straight edge	*	-	-
17. Torque wrench	*	-	-
18. Dial indicator with stand	*	-	-
19. Tachometer	*	*	*
20. Outside micrometer set	*	-	-
21. V-black	*	-	-
22. Hot water high pressure washer	*	*	-
23. Chain block	*	-	-
24. Hydraulic press	*	-	-
25. Air compressor	*	*	*
26. Parts cleaner (pouring type)	*	*	*
27. Electirc drill	*	*	*
28. Bench drill press	*	-	-
29. Lathe machine	*	-	-
30. Bench electirc grinder	*	*	*

- Continued -

Items	Tarlai AMS	Sihala Bhara Kau AMS	Tractor Shed
31. Disk sander	*	-	-
32. Spray gun	*	*	-
33. Arc welder	*	-	-
34. Gas welder set with stand	*	-	-
35. Surface plate	*	*	-
36. Dye penetrant-metal crack detector	*	-	-
37. Mighty puller set	*	*	*
38. Stud remover	*	*	-
39. Screw plate set	*	*	*
40. Hand saw	*	*	*
41. Steel cutting scissors	*	*	*
42. Electric soldering iron	*	*	-
43. Grease gun	*	*	*
44. Machinists vise	*	*	*
45. Cutting nipper	*	*	*
46. Test hammer	*	*	*
47. Engine cleaning gun	*	*	-
48. Rigid rack	*	*	-
49. Tool stand	*	*	*
50. Tool tray	*	*	*
51. Surface gauge	*	*	-
52. Square	*	*	-
53. Screw pitch gauge	*	*	-
54. Mechanic tool set	*	*	*
several kinds of wrench, plier, driver, hammer and others			

V-4 SMALL-SCALE INDUSTRY SCHEME

V.4.1 Cabion Factory

1. Introduction

Gabion has long been used as a transition method of construction and engineering for protecting river banks from erosion. In the beginning tubular shapped wire netting was silled with boulder of broken rock. Later the bed mattress type wire netting (rectangualr cube) was developed, and this has been used not only for river but also for supporting the shoulder of roads and the face of slopes to prevent landslide.

In many cases, both the tubular type wire netting and the bed mattress type wire netting are also used for woodland paths, in afforestation districts or buried beneath the ground of golf courses for drainage.

Also, gabions have been used as a foundation for a water reservoir serving housing complexes. More recently, gabions have been used for oceanic development and ocean "fortress" for fish farming.

The method itself is a simple one. The most important thing is power to drive the machinery for the wire mesh lubrication plant. Although a small amount of water is necessary, so called industrial water is not required. The raw materials, too, are simple, and so the establishment of the plant would not be so difficult. However, when production of the gabion is completed, they are filled with rock for which civil engineering knowledge is necessary.

The foundation of an agricultural country is built upon afforestation and flood control, and the development of sturdy and safe roads would lead to the development of various industries. Herein lies the importance of this product.

2. Process Description

A general description of the method of manufacturing will follow. Galvanized iron wire is set on an automatic wire netting machine and knitted into diamond shaped wire netting. In order to shape the wire netting into the designated tubular form or reactangular bone form, the

backbone framework is made. This backbone framework is inserted in the central portion and outer edge of the wire netting to produce the desired tubular or rectangular cube form.

There are two types of automatic machine, the fully automatic type chain-line wire netting machine and the semi-automatic type wire netting machine. The latter type requires considerable skill, and so there will be quite a loss in the beginning. Therefore, the fully automatic type is recommended. The automatic type is desirable also because of low cost and mass production. The automatic type will also enable knitting of big or small mesh fence netting and rockslide (landslide) prevention netting of various lengths.

The following is a general summary of the use of gabion:

(1) Rivers
(2) Harbours
(3) Roads
(4) Housing projects
(5) Sand retension
(6) Dams
(7) Prevention of landslide
(8) Preparation of golf course
(9) Railway consturtion work

EXAMPLE OF GABION MAKING PLANT

(1) PRODUCT: TUBULAR GABION

Wire used	Mesh	Diameter	Length
(#10) 3.2 mmϕ	10cm	45cm	3m
	•	•	•
	•	•	•
	•	•	•
	15cm	90cm	8m
(# 8) 4 mmϕ	10cm	45cm	3m
	•	•	•
	•	•	•
	•	•	•
	21cm	120cm	8m
(# 6) 5 mmϕ	13cm	45cm	3m
	•	•	•
	•	•	•
	•	•	•
	21cm	120cm	8m

(2) PRODUCT: RECTANGULAR CUBE GABION (BED MATTRESS TYPE)

Wire used	Mesh	Height	Width	Length
(#10) 3.2 mmϕ	10cm	40cm	120cm	2m
	•	•	•	•
	•	•	•	•
	•	•	•	•
	15cm	64cm	200cm	4m
(# 8) 4 mmϕ	10cm	40cm	120cm	2m
	•	•	•	•
	•	•	•	•
	•	•	•	•
	15cm	64cm	200cm	4m
(# 6) 5 mmϕ	13cm	40cm	120cm	2m
	•	•	•	•
	•	•	•	•
	•	•	•	•
	15cm	60cm	200cm	4m

3. Required Machinery and Equipment

The machinery and equipment required will differ depending on the sorts of product and the total output. That shown in Table 1 is for one set of automatic machinery used in combination to knit tubular and rectangular cube gabions. A different combination is possible, depending on requirements.

4. Required Ancillary Machinery and Equipment

Electrical equipment sufficient to operate the machinery listed in Table 1 is necessary. However, only the motors and electric power receiving station is given below. The prices have been omitted.

Electric power receiving station: 50kW or more.

Motors for: automatic type wire netting machine (7.5 HP), rectangular cube frame manufacturing machine (5 HP), twisting machine (2 HP), straightening machine (7.5 HP) and reserve motor (several HP).

Transporting equipment: The weight may be heavy depending on the lot size of the wire material, and so an indoor crane and an outdoor crane (approximately 2.5 tons capacity respectively) are necessary to move the material and products in and out of the building. Trucks, too, are required depending on the volume of output and the distance of transport.

TABLE 1 **RQUIRED MACHINERY AND EQUIPMENT**

Item	No.
Fully automatic chain-link wire netting machine	1 set
3 tons/day (8hrs.) x 25 days - 75 tons	
Semi-automatic type wire netting machine	1 set
2 tons/day (8 hrs.) x 25 days = 50 tons	1 set
Rectangular cube frame manufacturing machine	1 set
Circular ring frame manufacturing machine	2 sets
Frame twisting machine	2 sets
Circular ring frame and rectangular frame fixing machine.	2 sets
Machine for straightening wire netting	1 set

EQUIRED RAW MATERIAL

GLAVANIZED IRON WIRE

Item	Description
(#10) 3.2 mmϕ	116,000 yen/ton
(# 8) 4 mmϕ	110,000 yen/tpn
(# 6) 5 mmϕ	118,000 yen/ton

Note: The raw material wire shoud be purchased directly from the maker via a business firm.

REQUIRED MANPOWER

Item	No.
Automatic type machine	2
Rectangular cube frame manufacturing machine	1
Twisting machine Winding machine	3
Circular ring frame manufacturing machine Wire netting strightening machine	1
Others	1
Total	8

Note: only the factory empolyees, not including mangerial officers and transporting workers.

REQUIRED PLAN SITE AREA

Item	
Building area	(approx.) 660m^2
Required land area	(approx.) 2,00m^2
(including a products and materials storehouse)	

V.4.2 Match Factory

1. Selection of Product Type

1.1 Matchwood

1.1.1 Shape and type of matchwood

Matches are divided into two types depending on the shape of matchwood as shown in Table below, and classified into three types according to the quality of matchwood as listed in Tablle 2. In this case, to use materials available in Pakistan effectively, the wooden stick splints will be used.

SHAPE OF MATCHWOOD

A	Wooden stick	Each mach is separated. Wood, paper or wax is used.
B	Comb sticks	A plywood plate whose top half is cut in the shape of match sticks. The bottom is not cut and remains as one plate. When used, each stick is separated from the bottom. Veneer-type wood or paper is used.

TYPE OF MATCHWOOD

A	Wooden splints	Wood is used
B	Paper splints	Paper board is used
C	Wax splints	Paper-strings to which paraffin is applied.

1.1.2 Length and Thickness

Length and thickness of matchwood can be adjusted freely by adjusting the match making machine. In this case, a length of 45mm and a thickness off 2.1mm, which are the most marketable in Pakistan, are chosen.

1.2 Match Boxes

1.2.1 Shape of match boxes

Generally used shapes of match boxes are listed in the table below:

Full size	56 x 37 x 18mm;	60 sticks
3/4 (Three-quarter size)	51 x 36 x 16mm;	50-40 sticks
Small size A	56 x 37 x 8mm;	18 sticks
Small size A	42 x 27 x 13mm;	25 sticks

The 3/4 size is selected because it it most suitable for the length of 45 mm indicated in 1-1-2 and also because it is for the target market.

1.2.2 Materials for match boxes

There are two materials for match boxes as shown in the table below:

Paper	Outer box	Manila paper of 310-420 g/sq.m. is used. Trademark, and other information are printed on the paper. Creasing and pasting are done mechanically.
	Inner box	Manila paper of about 240 g/sq.m. is used. Creasing, forming and pasting are done mechanically.
Wood	Outer box	Veneer is creased and cut and pasted using bobbin paper, then dried. Tradmark is printed separately and pasted.
	Inner box	Same as above.

Using the above two types of material, the following three combinations are possible.

	Outer box	Inner box
A	Wood	Wood
B	Wood	Paper
C	Paper	Paper

Wood resources are not very abundant in Pakistan in terms of match box suitability. Thus, paper materials will be used for both outer and inner boxes.

1.3 Packaging Form

1) Dozen packaging: 12 boxes are packed in a package.
2) Carton packaging: 100 dozen are packed in a carton.

2. Selection of Production Scale

The capacity output of a match making machine for the minimum economic production unit is 500 gross (72,000 boxes) per day (8-hours operation).

From a geographical standpoint, it is believed that the following is the scale market of the industries:

Rawalpindi	Population:	795,000
Peshawar		506,000
Islamabad		204,000
Total population:		1,505,000

Source: Population Census, 1981/82

Supposing that a match box contains 40 sticks, that production scale is 500 gross per day and 21,600,000 boxes per year (500 gross x 144 x 300 days), and that the average consumption per person per day is 3 sticks, the market population will become as follows:

21,600,000 boxes x 40 sticks ÷ 365 days ÷ 3 sticks
= 789,041 ≒ 800,000

The production scale of 500 gross per day thus meets about half of the need of the above market. But as it is impossible to remove all of imported matches from the above market when the proposed match making plant begins operation, it will be suitable to begin the operation at the production level of half of the existing demand.

Thus, initial level of production of the proposed plant is determined as 500 gross boxes per day and 150,000 gross (21,600,000) boxes. If there arises a need to meet the entire demand of the market, production scale can be expanded by adopting the double shift system or other strategies for extending the time of operation of the plant.

3. Selection of Manufacturing System

Match manufacturing systems are roughly classified into the following two types: (A) automatic system and (B) semi-automatic system.

A) Automatic system: Splint paraffining, head chemical dipping and drying processes are entirely automated. Box filling, side phospher coating and packaging processes are separated from one another.

B) Semi-automatic system: Each part is processed by different machines, but manual labor is used for transmission between processes.

The automatic system is suitable for a production scale of 1,000 gross boxes per day or more, and from the viewpoint of operational efficiency and economy, 1,000 gross boxes per day are the minimum possible manufacturing unit.

The semi-automatic system requires more labor than the automatic system. Therefore, it has to be adopted considering the planned scale of production of 500 gross boxes, and the need to provide employment opportunities.

The manufacturing process of the semi-automatic system is shsown in Attached Sheet.

4. Procurement of Rawmaterials and Utilites

4.1 Raw Materials

4.1.1 Matchwood

1) Quantity required

In the case of:

Stick size: 45mm L x 2.1mm sq.

500 gross boxes (40 sticks) per day

36 cft per day will be needed.

36 cft x 25 days x 12 months = 10,800 cft/year

The above figures include waste rates.

2) Quality

Quality consideration for suitable matchwood include the following.

a) Soft and tenacious.

b) Straight grain with few knots.

c) White in color.

d) Diameter of 30-50cm.

e) Vessel size is not too big, and vessels are moderately dispersed.

4.1.2 Chemicals

The following table summarizes chemicals used for manufacturing matches and the quantity needed per year:

Chemical	Q'ty required per year (m/ton)	Quality
Postassium chlorate	9.00	($KClO_3$) 99.7% up 250 mesh up
Sulphur powder	1.80	(S) 99.8% up 250 mesh up, ash: below 0.5%
Glass	3.30	White, 200 mesh moisture: below 0.2%

Chemical	Q'ty required per year (m/ton)	Quality
Potassium bichromate	0.14	($k_2Cr_2O_7$) 98% up
Glue (match quality)	3.20	Jerry strength: 220/250 grams pH: 6.4-6.8 moisture: below 13%
Red amorphous phosphorus	1.10	(P) 98% up, 350 mesh
Anitimony suplhide	1.10	(Sb_2S_3) 40%, 150 mesh up, moisture: below 03%
Paraffin	9.00	120°F, pH7 Oil: below 3%
Kissel (infusorial earth)	0.26	(SiO_2) 93% ig. loss 0.06, 300 mesh
Rosin powder	0.23	($C_{20}H_{30}O_2$) 150 mesh ash: below 2%
Fukusol	0.90	Polyvynil-acryl acetate emulsion, appearance: milky paste, viscosity: 8,000 + 500 CPS
Sodium silicate	0.36	
Talc	1.70	200 mesh, moisture: below 0.03%
Boric acid	0.20	(H_3BO_3) 200 mesh, moisture: below 0.03%
First red	0.05	Dye

4.1.3 Packaging materials

Packaging materials for matches and the quantity needed per year are as follows:

Material	Q'ty required per year	Price (¥)	Quality
Cardboard for outer boxes	550,000 sheets	4,900,000	310 GSM, 43 x 58cm (40 boxes/sheet), 2-color printed
Cardboard for inner boxes	610,000 sheets	4,148,000	240 GSM, 38 x57cm (36 boxes/sheet)
Wrapping paper for dozen packaging	1,840,000 sheets	1,104,00	41.7 GSM, 31cm x 2,000m, 2-color printing
Carton cases	18,300 sheets	1,738,500	JIS second class
Adhesive paper tape	280 rolls	89, 880	5cm x 50m

4.2 Utilities

4.2.1 Electric power

(1) Electric power required

44.40kW/h x 8 hours x 60% x 300 days = 63,936kW/year

(2) Type of electic power

400V/3ph/60Hz and 230V/1ph/60Hz

4.2.2 Fuel

Kerosene for gelatine melting and ignition composition mixing:

15 ℓ/hour x 8 hours x 20% x 300 days = 720 ℓ = 160 gallons/year

4.2.3 Water

Required Quantity:

2.5 cu.m./day x 300 days = 750 cu.m./year

750 cu.m. = 750,000 ℓ = 165,000 gallons

Attached Sheet I. Manufacturing Process

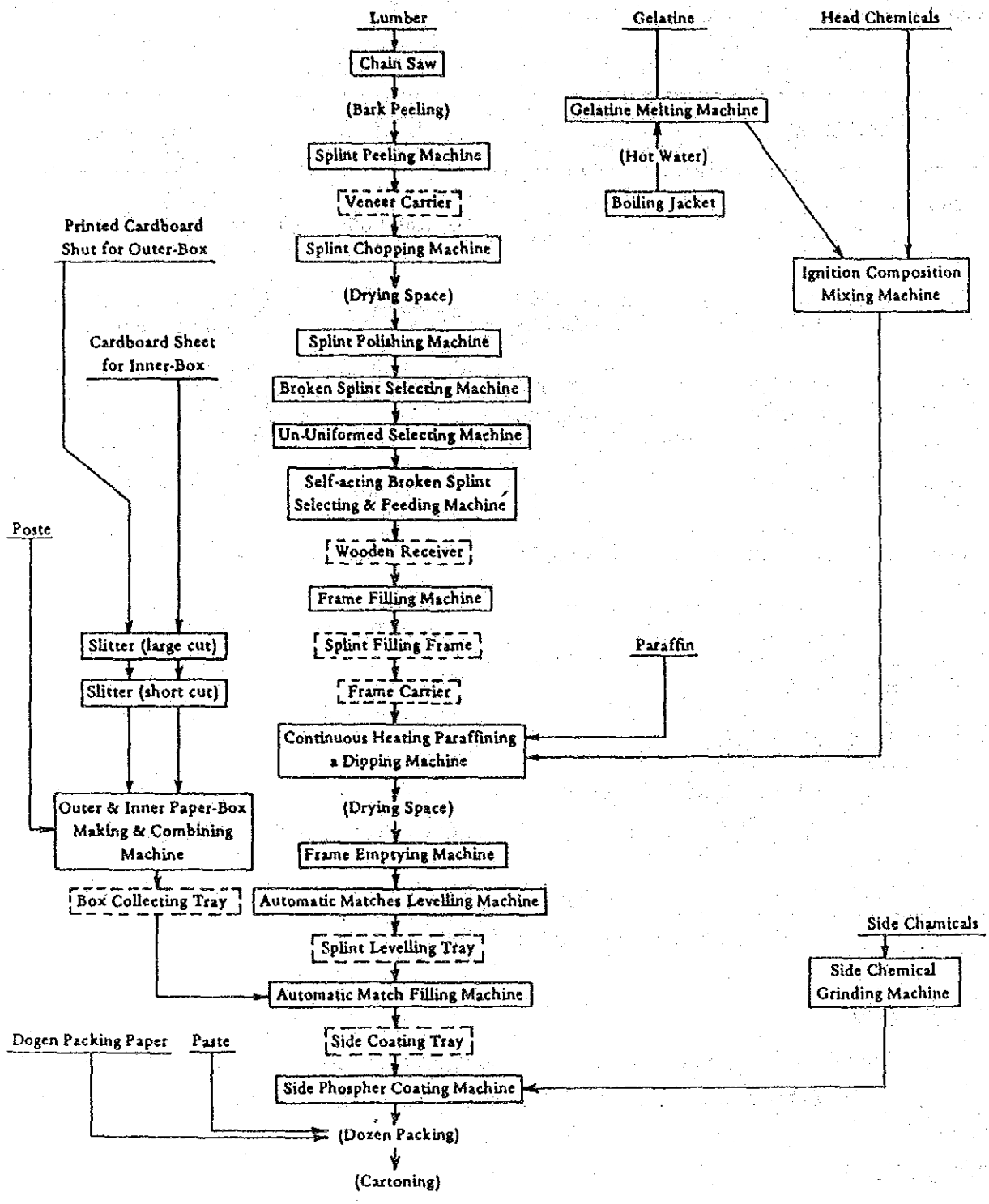


FIG. V-2 MANUFACTURING PROCESS

V-5 POWER SUPPLY PLAN

1. Transmission Line Scheme

The transmission line scheme to supply the electric power for future demand in the Study Area is shown in FIG. V-2. The length of power line (11 KV) is shown in the following table.

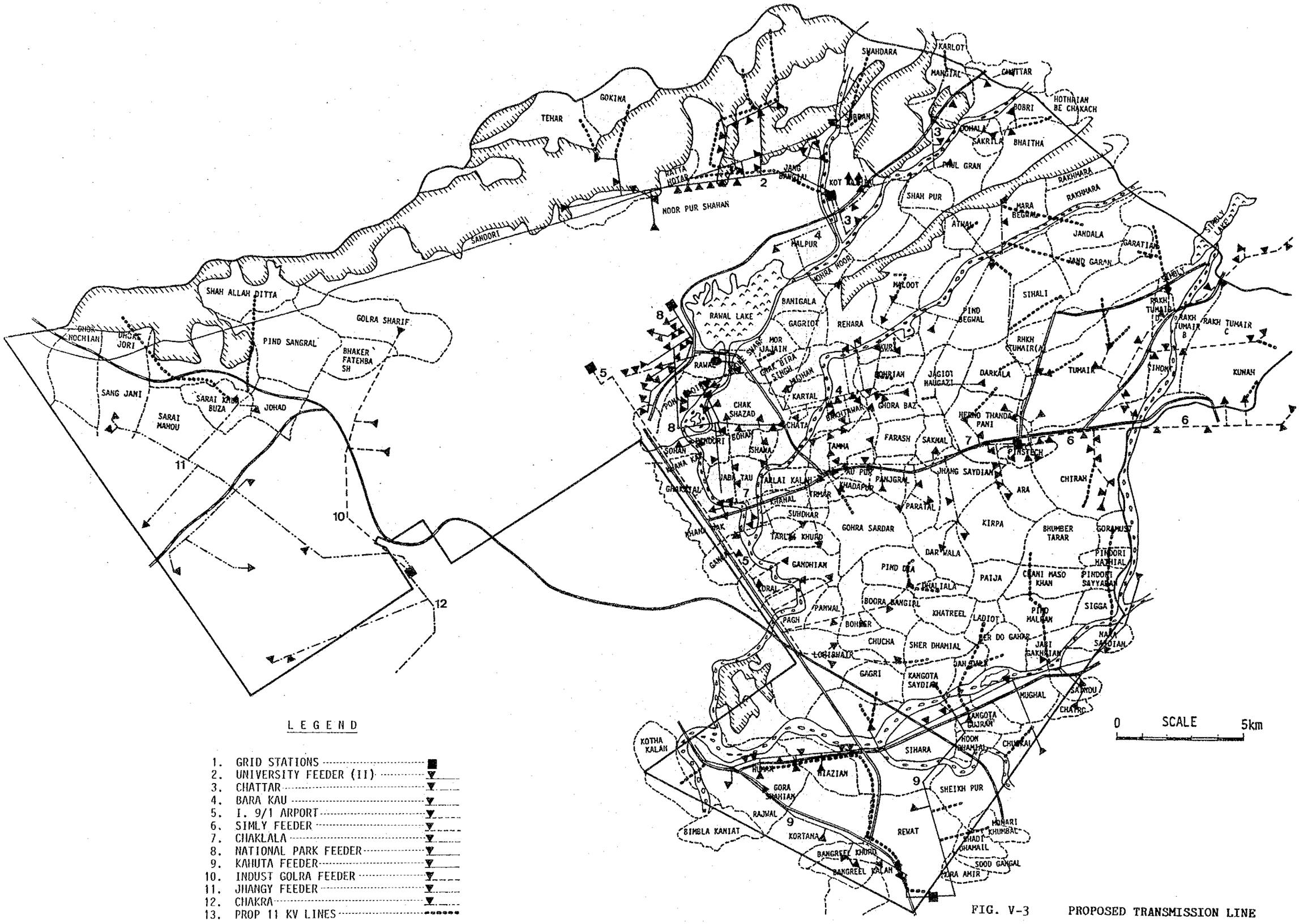
	Feeder Line	Length (km)
1.	University Feeder (II)	18.8
2.	Chattar Feeder	12.6
3.	Bhara Kau Feeder	1.8
4.	I 9/1 Airport Feeder	3.4
5.	Simly Feeder	9.6
6.	Chaklala Feeder	19.3
7.	National Park Feeder	-
8.	Kahuta Feeder	33.3
9.	Indust Golra Feeder	-
10.	Jhangy Feeder	9.1
11.	Chakra	-
	Total	107.9

2. Estimated Electric Demand

Future electric demand is estimated for each beneficial facility (TABLE V-9). The electirc demand is assumed as 1.5 kW per house and annual increase rate of the number of houses is assumed at 2.5%.

TABLE V-9 POWER DEMAND FORECAST

Facility	UC	Shah Allah Ditta	Bhara Kau	Phulgran	Tamair	Charah	Kirpa	Sihala	Rawat	Koral	Tarlai Kalan	Sohan	Total
(1) Residence	No.	1,211	2,020	1,833	2,195	2,434	2,981	1,869	1,538	890	1,524	2,526	21,021
	Power Consumption (kW)	1,817	3,030	2,750	3,293	3,651	4,472	2,804	2,307	1,335	2,286	3,789	31,534
(2) Pump Station	No.			1	2	1					1	2	7
	Power Consumption (kW)			230	5	5					9	6	255
(3) Tubewell	No.	2	5	4	9	7	7	7	1	2	4	4	52
	Power Consumption (kW)	8	39	38	23	16	32	85	30	49	44	31	395
(4) Rural Development Station	No.	2	1	1	2	1	1	1	1	1	1	1	13
	Power Consumption (kW)	70	35	35	70	35	35	35	35	35	35	35	455
(5) Livestock Development Station	No.							1					1
	Power Consumption (kW)							165					165
(6) Livestock PilotFarm	No.				1	1				1			3
	Power Consumption (kW)				35	35				35			105
(7) Veterinary Hospital	No.	1	1					1			1		4
	Power Consumption (kW)	10	10					10			10		40
(8) Veterinary Dispensary	No.				1	1	1		1	1			5
	Power Consumption (kW)				5	5	5		5	5			25
(9) Intensive Horiti-culture Pilot Farm	No.							1			1		2
	Power Consumption (kW)							100			100		200
(10) Fish Hatchery	No.											1	1
	Power Consumption (kW)											30	30
(11) Nursery Station	No.		1				2			1			4
	Power Consumption (kW)		15				30			15			60
(12) Small-scale Industries	No.								3				3
	Power Consumption (kW)								60				60
(13) AMS Station (Main)	No.										1		1
	Power Consumption (kW)										60		60
(14) AMS Sub-staiton	No.		1					1					2
	Power Consumption (kW)		20					20					40
(15) Vocational Training Station	No.											1	1
	Power Consumption (kW)											205	205
(16) Maternity Station	No.		1					1			1		3
	Power Consumption (kW)		35					35			35		105
Total	Power Consumption (kW)	1,905	3,184	3,053	3,431	3,747	4,574	3,254	2,437	1,474	2,579	4,096	33,734



LEGEND

1. GRID STATIONS
2. UNIVERSITY FEEDER (II)
3. CHATTAR
4. BARA KAU
5. I. 9/1 ARPORT
6. SIMLY FEEDER
7. CHAKLALA
8. NATIONAL PARK FEEDER
9. KAHUTA FEEDER
10. INDUST GOLRA FEEDER
11. JHANGY FEEDER
12. CHAKRA
13. PROP 11 KV LINES

FIG. V-3 PROPOSED TRANSMISSION LINE

V-6. SITE PLAN OF PROPOSED FACILITIES

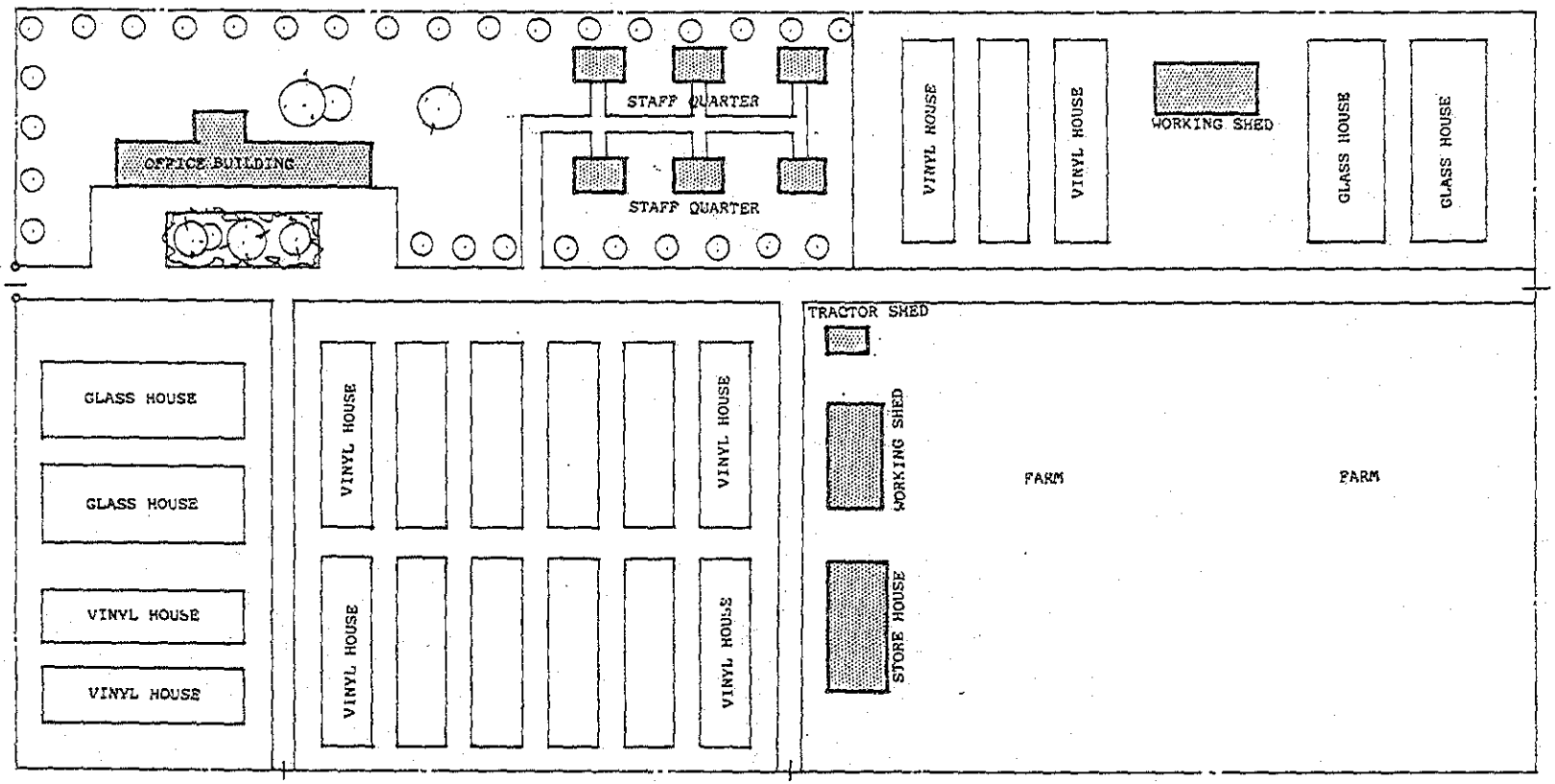


FIG. V-4 PROPOSED SITE PLAN OF INTENSIVE HORICULTURE PILOT FARM - INTENSIVE HORTICULTURE PROMOTION SCHEME

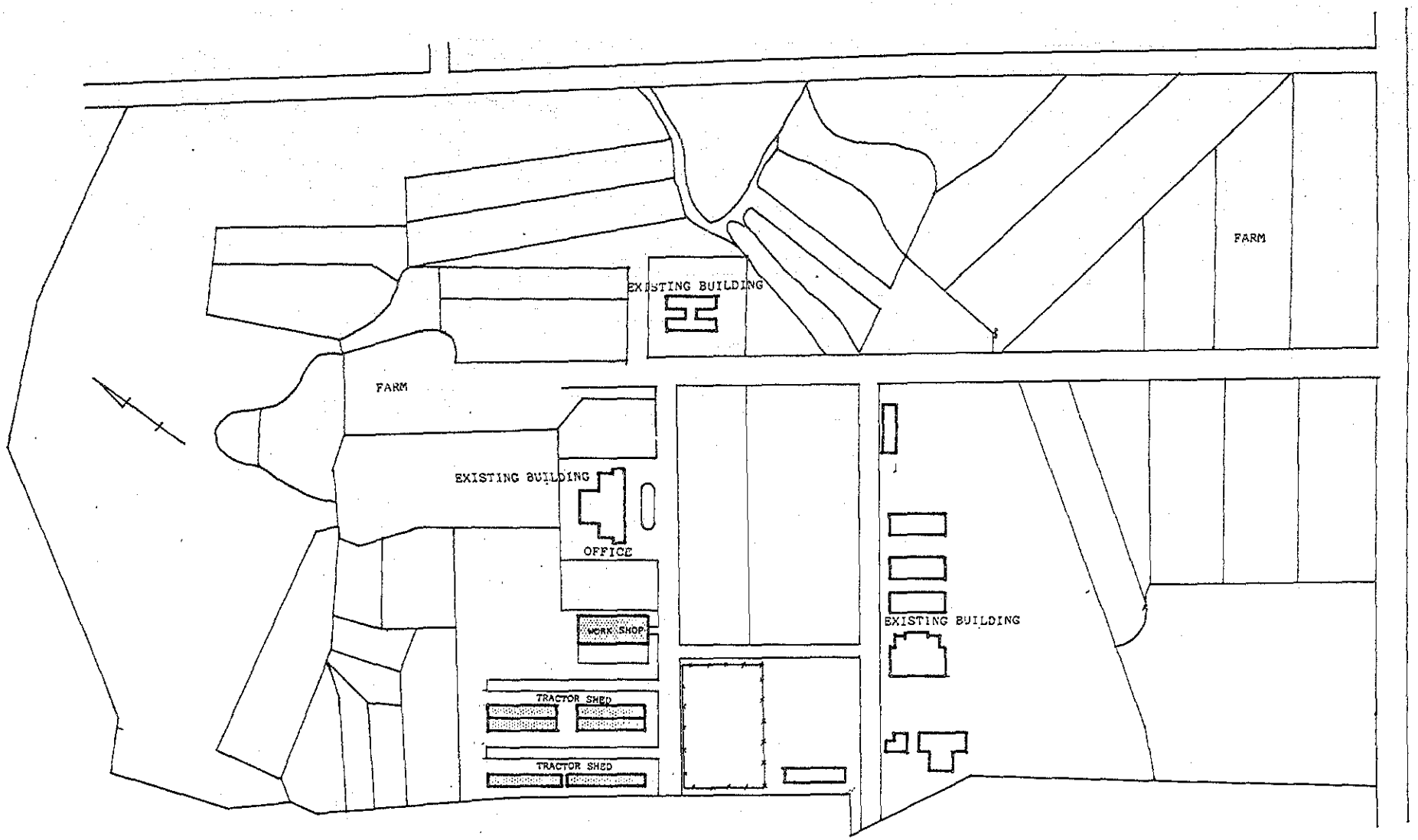


FIG. V-5 PROPOSED SITE PLAN OF AMS MAIN STATION (TARLAI MARKAZ)
- AGRICULTURAL MACHINERY STATION (AMS) SCHEME

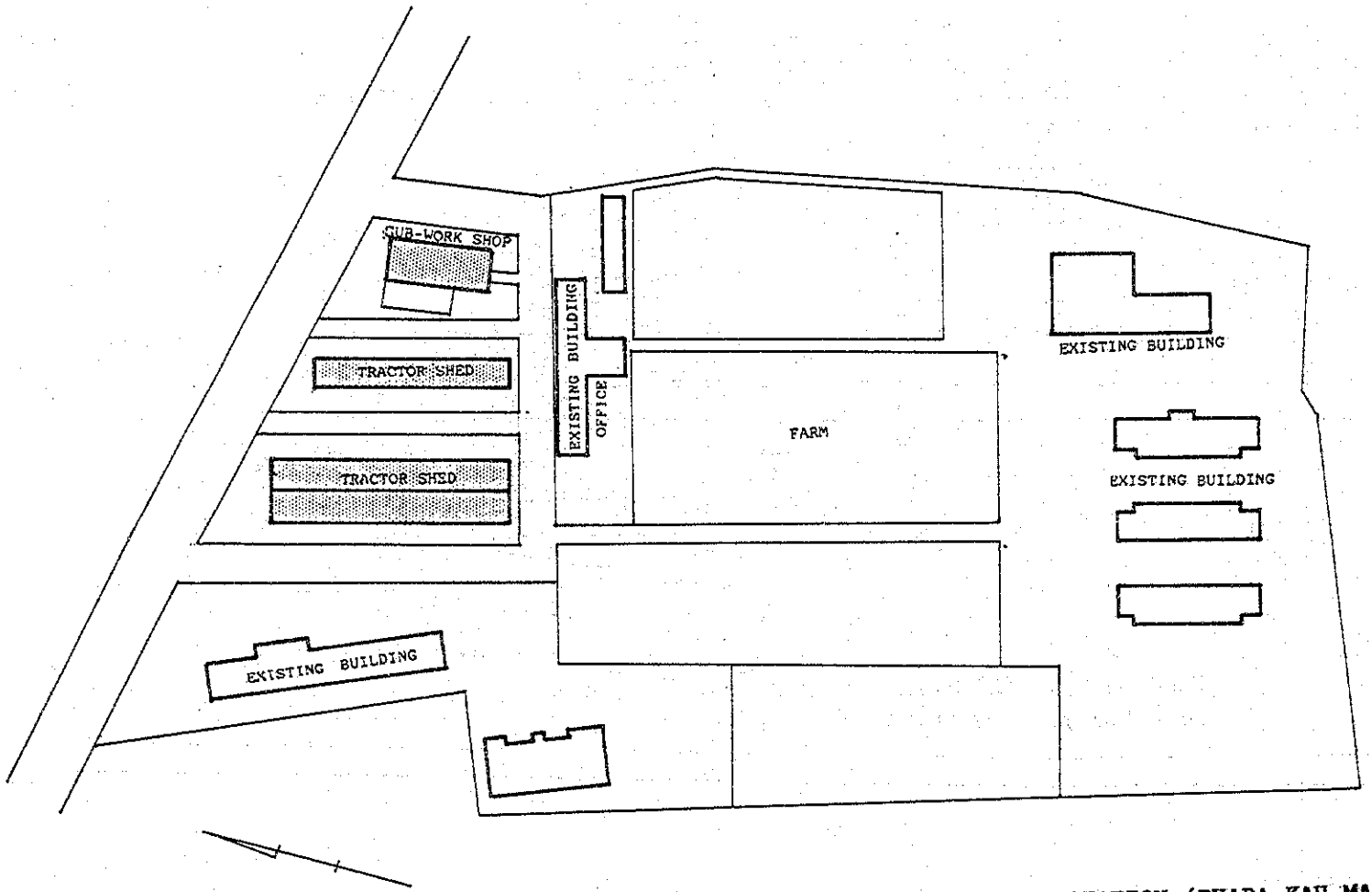


FIG. V-6 PROPOSED SITE PLAN OF AMS SUB STATION (BHARA KAU MARKAZ)

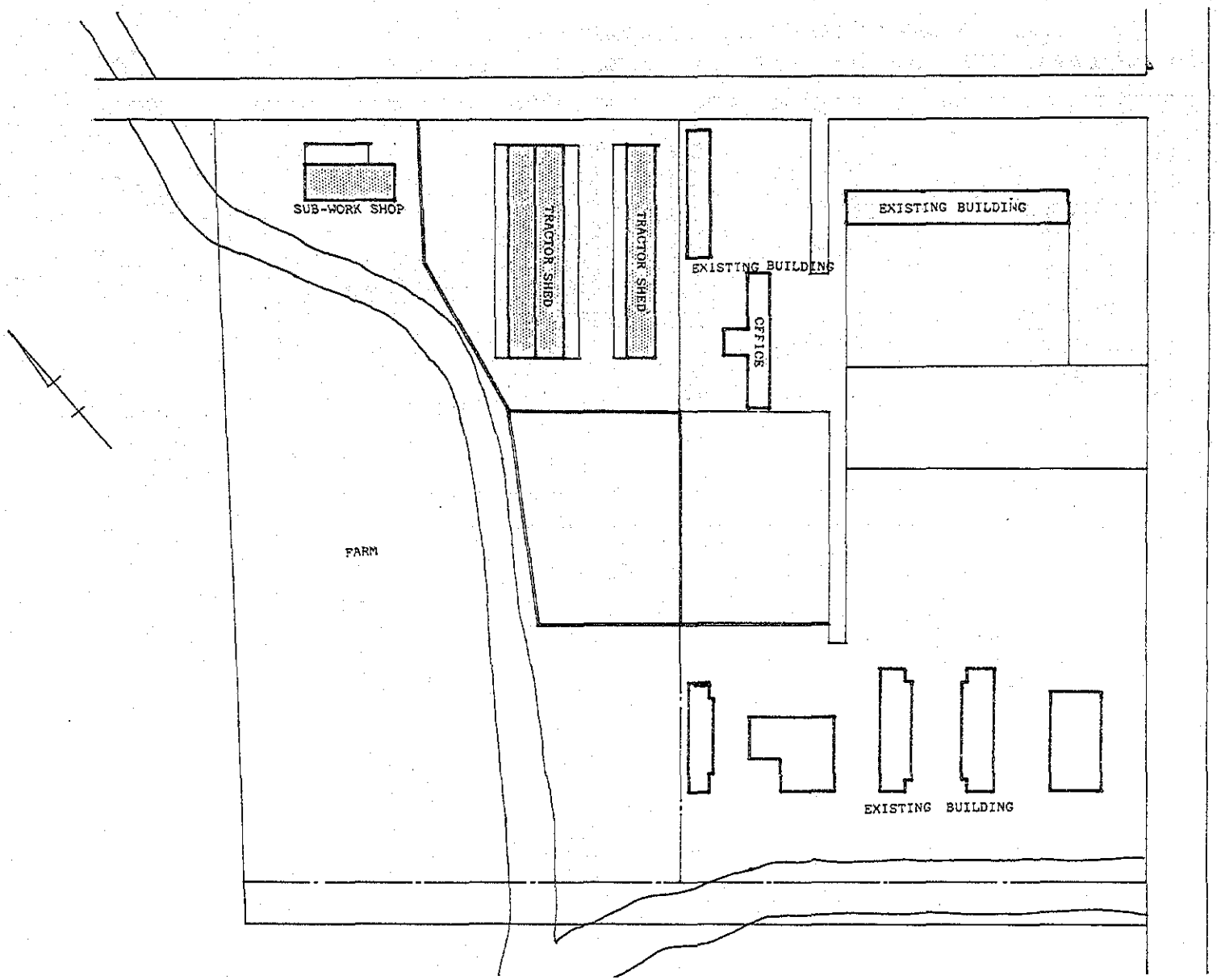


FIG. V-7 PROPOSED SITE PLAN OF AMS SUB STATION (SIHARA MARKAZ)

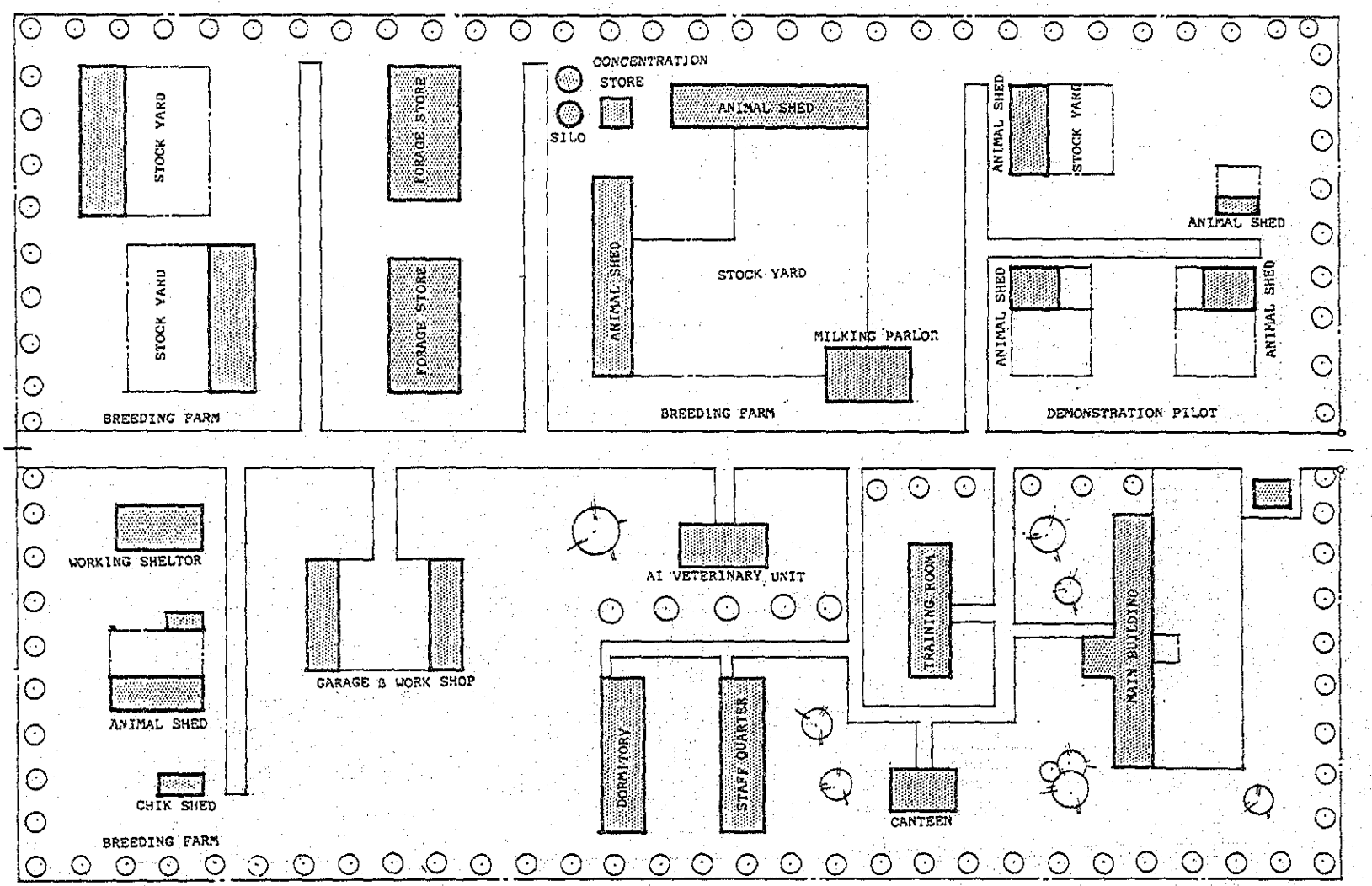
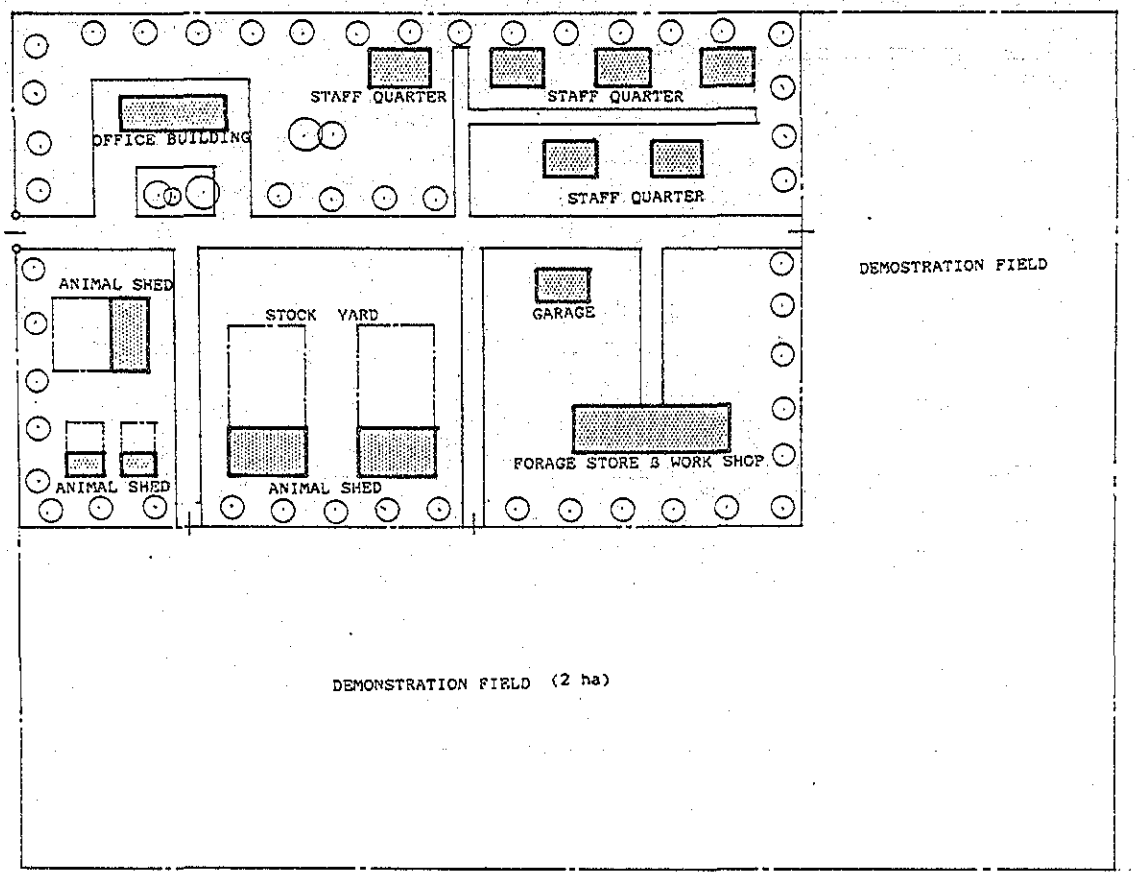
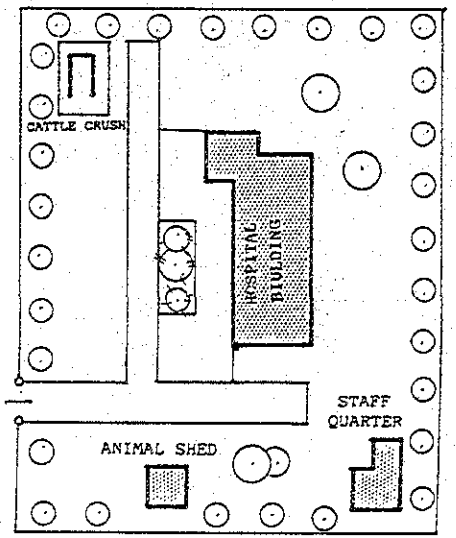


FIG. V-8 PROPOSED SITE PLAN OF LIVESTOCK DEVELOPMENT STATION - LIVESTOCK DEVELOPMENT PROMOTION SCHEME

LIVESTOCK PILOT FARM



VETERINARY HOSPITAL



VETERINARY DISPENSARY

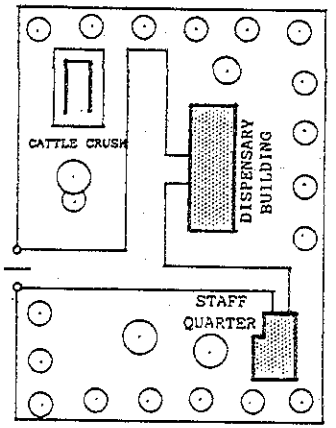


FIG. V-9 PROPOSED SITE PLANS OF LIVESTOCK PILOT FARM, VETERINARY HOSPITAL AND VETERINARY DISPENSARY

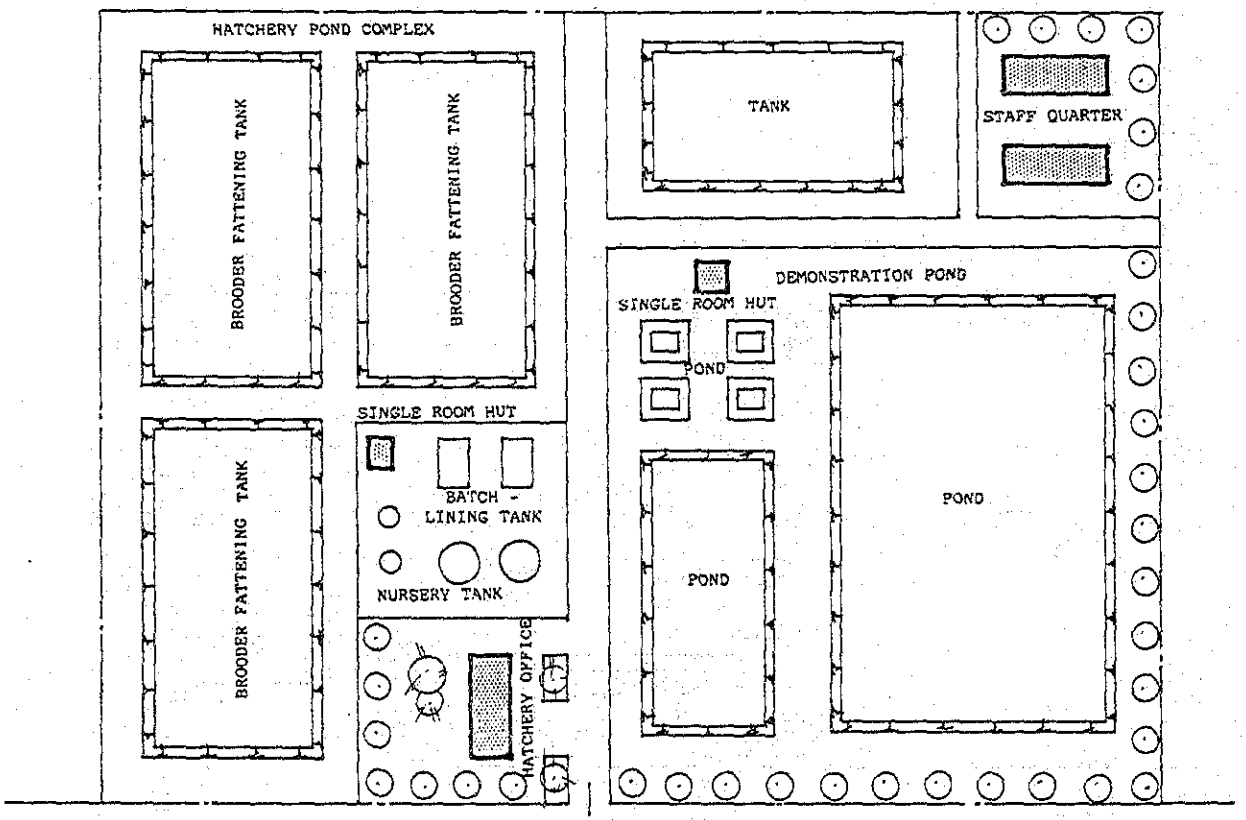
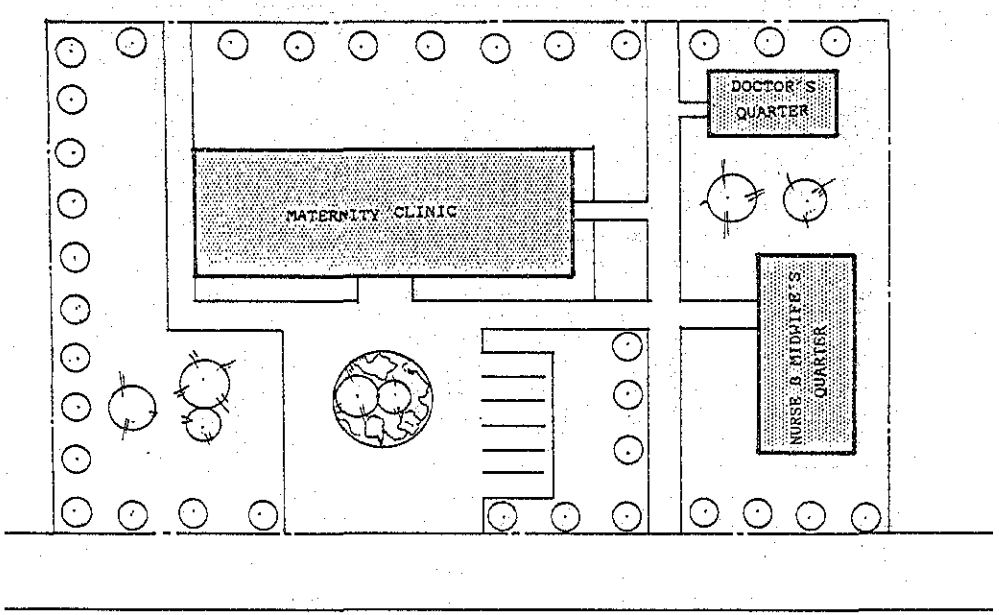


FIG. V-10 PROPOSED SITE PLAN OF FISH HATCHERY - INLAND FISHERY DEVELOPMENT SCHEME

MATERNITY STATION



Primary School

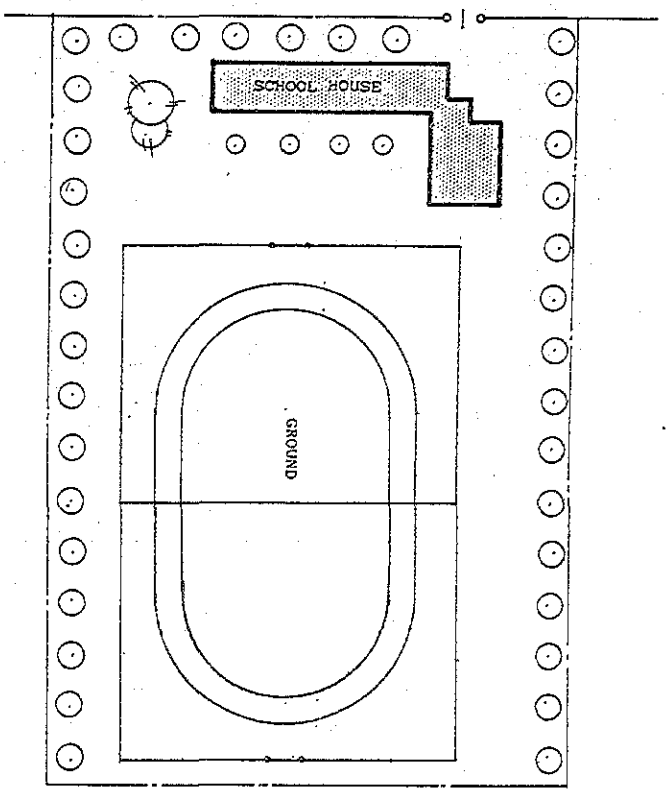


FIG. V-11 PROPOSED SITE PLANS OF MATERNITY STATION AND PRIMARY SCHOOL

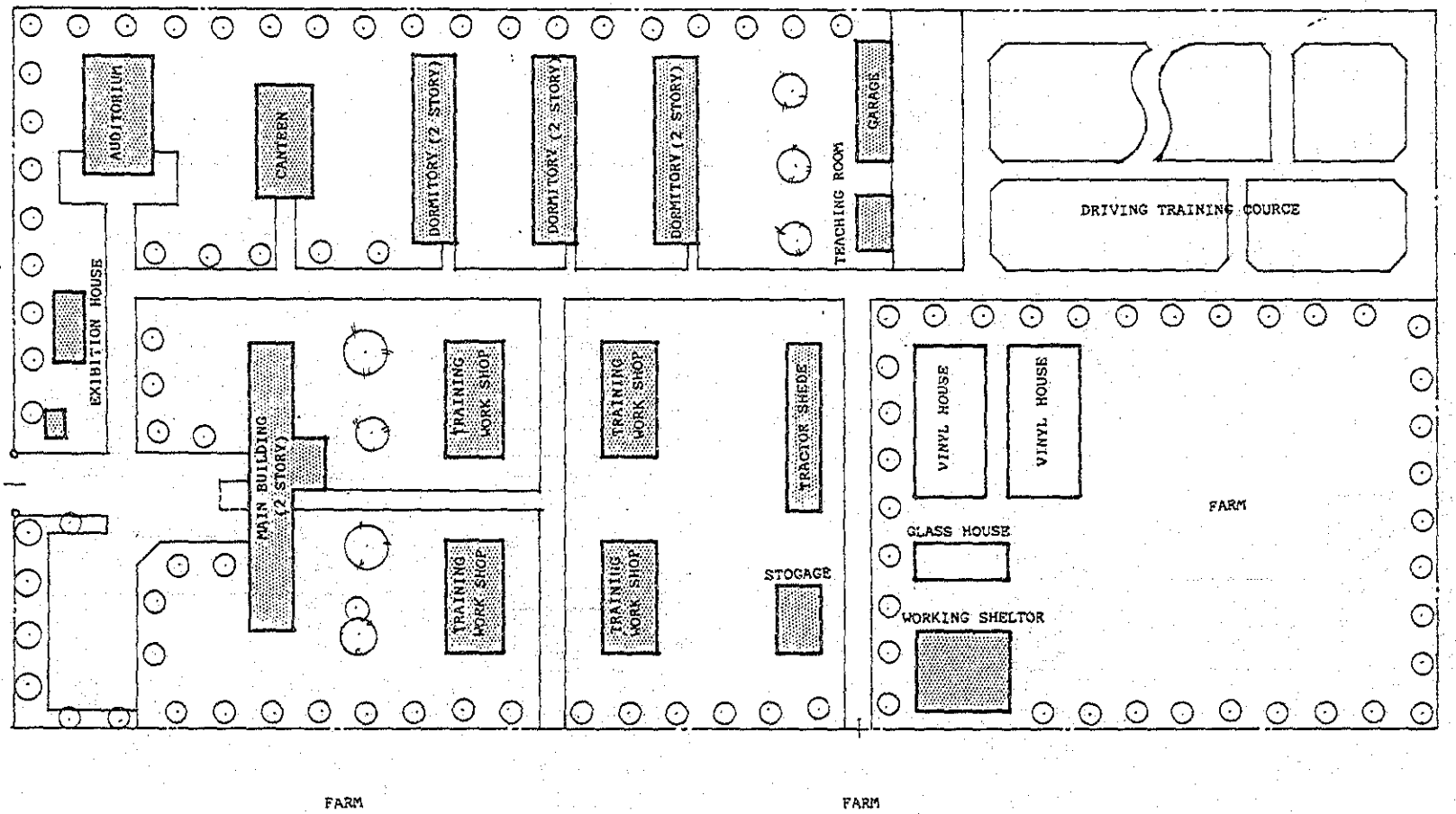


FIG. V-12 PROPOSED SITE PLAN OF VOCATIONAL TRAINING STATION - MANPOWER DEVELOPMENT SCHEME

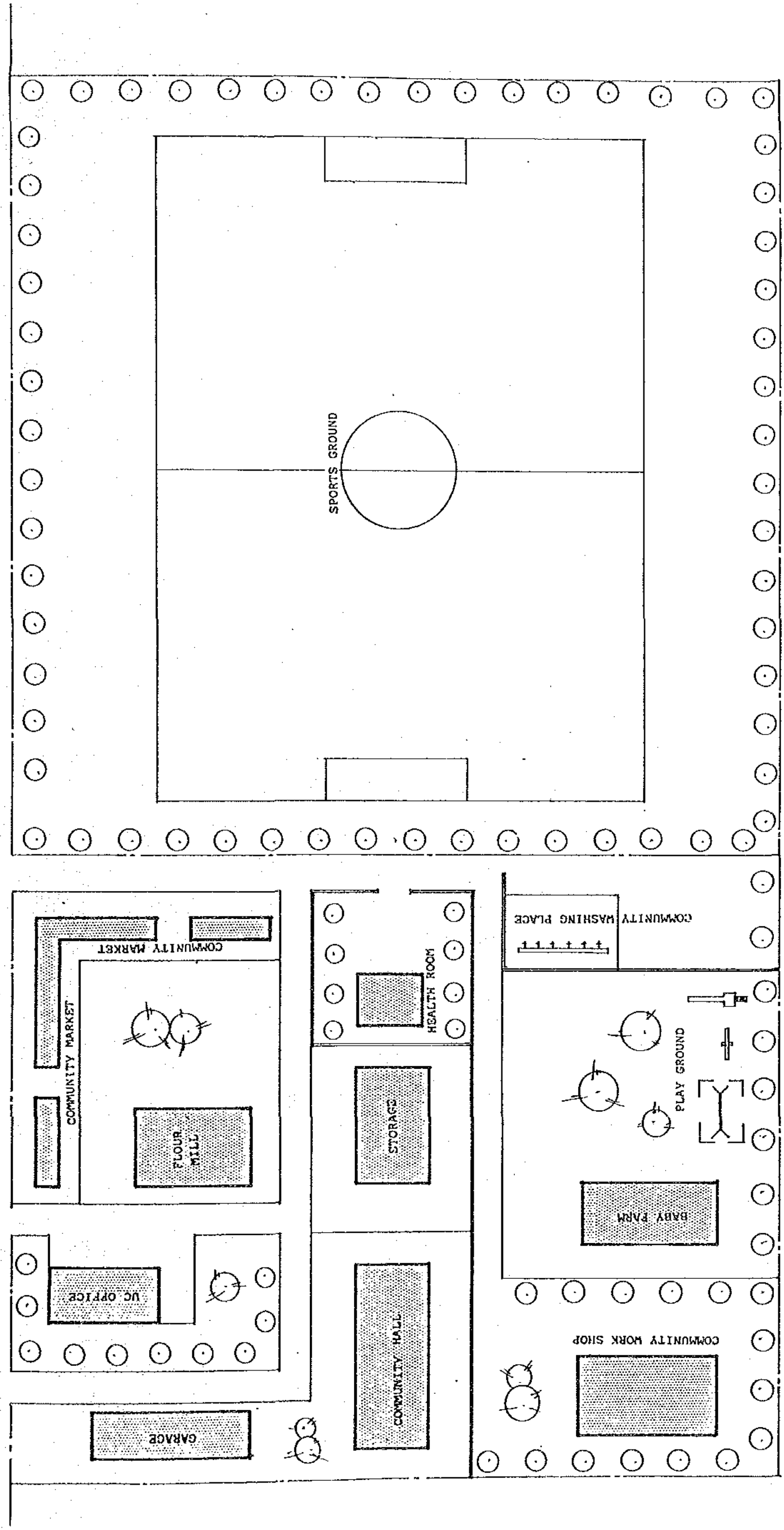


FIG. V-13 RPOPOSED SITE PLAN OF RURAL DEVELOPMENT STATION

VI. COST ESTIMATION OF PROPOSED SCHEMES

LIST OF TABLES

TABLE VI-1 COST ESTIMATES FOR 13 DEVELOPMENT SCHEMES

1. Irrigation Scheme

Item	Quantity	Amount mln.Rs.	Amount mln.Yen
1. Upper Kurang Irrigation Project	K-1: 481 ha	35.67	491.50
	K-2: 2118 ha	126.94	1749.30
	Kc-1: 2415 ha	17.58	242.30
	Kc-2: 1150 ha	8.19	112.90
	Gc-2: 200 ha	7.22	99.50
	(6364 ha)		
Direct costs total:		195.60	2695.50
Indirect costs (50%)		97.80	1347.75
Upper Kurang Irrigation Project total:		293.40	4043.25
2. Small irrigation schemes			
a) first priority schemes (component of MIRAD Project)	G-3: 231 ha	25.79	355.40
	G-5: 8 ha	7.18	99.00
	M-1: 17 ha	10.41	143.40
	M-2: 96 ha	22.54	310.60
	Gc-1: 100 ha	18.74	258.30
		(84.66)	(1166.70)
b) second priority schemes	G-1: 5 ha	3.77	51.90
	G-2: 46 ha	7.55	104.00
	H-1: 15 ha	7.98	110.00
	H-3: 32 ha	45.35	624.90
	Nc-1: 20 ha	2.00	27.50
	Nc-2: 20 ha	2.00	27.50
		(68.65)	(945.80)
c) other schemes	G-4: 14 ha	5.30	73.10
	H-2: 91 ha	40.46	557.50
	H-4: 49 ha	29.03	400.10
	S-1: 1444 ha	104.50	1440.00
		(179.29)	(2470.70)
Direct costs total:		332.60	4583.20
Indirect costs (50%):		166.30	2291.60
Small irrigation schemes total:		498.90	6874.80
Total project costs:		792.30	10918.05

Note: Quantities of each project component and detailed cost estimates are presented in the following tables.

TABLE VI-2

QUANTITY

District	No.	Location	Dam and Weir			Main Canal		Road		Irrigated area
			Height (m)	Length (m)	Volume(m^3)	Length (m)	Discharge (m^3/s)	Length (m)	Bridge (m)	
Kurang R.	K - 1	Sikrila	25	235	28,000	500	0.36	500	-	481
	K - 2	Sikrila	37	270	51,500	18,000	1.59	2,500	90	2,648
Gumreh Kas	G - 1	Athal	12	40	1,130	200	0.0066	-	-	6
	G - 2	Athal	17	50	4,860	2,000	0.035	-	-	46
	G - 3	Siali	22	153	18,000	1,500	0.173	2,000	-	231
	G - 4	Pind Begwal	12	40	1,680	-	-	3,000	20	14
	G - 5	Muhrian	10	180	4,080	-	-	1,000	25	18
Malal Kas	M - 1	Tamair	15	80	3,500	-	-	-	45	17
	M - 2	Jhang Sayaddan	15 (10.5)	60	6,020	-	-	1,000	55	96
Hills and Mountains	H - 1	Shah Allah Ditta	13	100	4,970	1,000	0.017	1,500	-	13
	H - 2	Shah Darah	27	150	31,490	1,000	0.107	-	40	82
	H - 3	Shah Darah	27	180	36,740	100	0.038	1,500	-	29
	H - 4	Subhan	26.5	100	21,910	-	-	2,000	25	45
Soan R.	S - 1	Charah	32	150	44,240	2,000	1.18	1,500	-	1,444
Kurang R.	Kc- 1	Khana Dak	2.5	100	1,050	-	-	-	-	2,415
	Kc- 2	Koral	5.0	50	1,690	-	-	1,000	50	1,150
Gumreh Kas	Gc- 1	Kuri	3.5	80	1,620	-	-	1,500	-	100
	Gc- 2	Tarlai Khurd	2.5	60	630	-	-	200	-	200
Nilan N.	Nc- 1	Gokina	4.0	30	720	-	-	-	25	20
	Nc- 2	Gokina	4.0	30	720	-	-	-	25	20

TABLE VI-3

PROJECT COSTS OF IRRIGATION SCHEMES

District	No.	Location	Direct Cost (Yen)	Indirect Cost (Yen) 50%	Total Cost		
					Yen	Rs	$
Kurang River	K - 1	Sikrila	491,520,000	245,760,000	737,280,000	53,500,000	3,430,000
	K - 2	Sikrila	1,749,250,000	874,630,000	2,623,880,000	190,300,000	12,200,000
Gumreh Kas	G - 1	Athal	51,880,000	25,940,000	77,820,000	5,600,000	360,000
	G - 2	Athal	103,960,000	51,980,000	155,940,000	11,400,000	730,000
	G - 3	Siali	355,400,000	177,700,000	533,100,000	38,700,000	2,480,000
	G - 4	Piind Begwal	73,140,000	36,570,000	109,710,000	8,000,000	510,000
	G - 5	Muhrian	98,980,000	49,490,000	148,470,000	10,800,000	690,000
Malal Kas	M - 1	Tamar	143,440,000	71,720,000	215,160,000	15,600,000	1,000,000
	M - 2	Jhang Sayaddan	310,600,000	155,300,000	465,900,000	33,900,000	2,170,000
Hills and Mountains	H - 1	Shah Allah Ditta	110,010,000	55,010,000	165,020,000	12,000,000	770,000
	H - 2	Shah Darah	557,500,000	278,750,000	836,250,000	60,700,000	3,890,000
	H - 3	Shah Darah	624,930,000	312,470,000	937,400,000	68,000,000	4,360,000
	H - 4	Subhan	400,100,000	200,050,000	600,150,000	43,500,000	2,790,000
Soan River	S - 1	Charah	1,440,050,000	720,030,000	2,160,080,000	156,800,000	10,050,000
Kurang River	Kc- 1	Khana Dak	242,310,000	121,160,000	363,470,000	26,400,000	1,690,000
	Kc- 2	Koral	112,860,000	56,430,000	169,290,000	12,285,000	790,000
Gumreh Kas	Gc- 1	Kuri	258,280,000	129,140,000	387,420,000	28,100,000	1,800,000
	Gc- 2	Tarlai Khurd	99,500,000	49,750,000	149,250,000	10,800,000	690,000
Nilan N.	Nc- 1	Gokina	27,500,000	13,750,000	41,250,000	3,000,000	190,000
	Nc- 2	Gokina	27,500,000	13,750,000	41,250,000	3,000,000	190,000
	Total		7,278,710,000	3,639,380,000	10,918,090,000	992,400,000	50,780,000

TABLE VI-4

CONSTRUCTION COST (DAMS AND WEIRS)

District	No.	Location	Dam and Weirs Cost (Yen)	Main Canal Cost (Yen)	Canal Cost in the Field (Yen)	Road Cost (Yen)	Gate Cost (Yen)	Others 10% (Yen)	Total (Yen)
Kurang River	K - 1	Sikrila	420,000,000	5,000,000	16,840,000	5,000,000	-	44,680,000	491,520,000
	K - 2	Sikrila	772,500,000	180,000,000	73,600,000	73,600,000	490,000,000	159,020,000	1,749,250,000
Gumreh Kas	G - 1	Athal	16,950,000	2,000,000	210,000	-	28,000,000	4,720,000	51,880,000
	G - 2	Athal	72,900,000	20,000,000	1,610,000	-	-	9,450,000	103,960,000
	G - 3	Siali	270,000,000	15,000,000	18,090,000	20,000,000	-	32,310,000	355,400,000
	G - 4	Pind Begwal	25,200,000	-	490,000	40,800,000	-	6,650,000	73,140,000
	G - 5	Muhrian	61,200,000	-	280,000	13,500,000	15,000,000	9,000,000	98,980,000
Malal Kas	M - 1	Tamar	52,500,000	-	600,000	24,300,000	53,000,000	13,040,000	143,440,000
	M - 2	Jhang Sayaddan	90,300,000	-	3,360,000	39,700,000	149,000,000	28,240,000	310,600,000
Hills and Mountains	H - 1	Shah Allah Ditta	74,550,000	10,000,000	460,000	15,000,000	-	10,000,000	110,010,000
	H - 2	Shah Darah	472,350,000	10,000,000	2,870,000	21,600,000	-	50,680,000	557,500,000
	H - 3	Shah Darah	551,100,000	1,000,000	1,020,000	15,000,000	-	56,810,000	624,930,000
	H - 4	Subhan	328,650,000	-	1,580,000	33,500,000	-	36,370,000	400,100,000
Soan River	S - 1	Charah	663,600,000	20,000,000	50,540,000	15,000,000	560,000,000	139,910,000	1,440,050,000
Kurang River	Kc- 1	Khana Dak	15,750,000	-	84,530,000	-	120,000,000	22,030,000	242,310,000
	Kc- 2	Koral	25,350,000	-	40,250,000	37,000,000	-	10,260,000	112,860,000
Gumreh Kas	Gc- 1	Kuri	24,300,000	-	3,500,000	15,000,000	192,000,000	23,480,000	258,280,000
	Gc- 2	Tarlai Khurd	9,450,000	-	7,000,000	2,000,000	72,000,000	9,050,000	112,860,000
Nilan N.	Nc- 1	Gokina	10,800,000	-	700,000	13,500,000	-	2,500,000	27,500,000
	Nc- 2	Gokina	10,800,000	-	700,000	13,500,000	-	2,500,000	27,500,000
	Total		3,968,250,000	263,000,000	186,960,000	398,000,000	1,679,000,000	649,520,000	7,144,730,000

TABLE VI-5 **COST ESTIMATES FOR 13 DEVELOPMENT SCHEMES**

2. Ground Water Multipurpose Development

	Item	Quantity	Amount	
			mln.Rs.	mln.Yen
1.	Preparatory works	Lump sum	3.32	45.80
2.	Materials and installation	7 deep tubewells, 45 shallow wells, tanks, pipes, etc.	98.40	1355.90
3.	Improvement of existing wells	200 hand pumps and distribution pipes	49.54	682.60
4.	Irrigation facilities	20 nos.	7.87	108.40
5.	Miscellaneous expenses	Lump sum	8.51	117.30
	Direct construction costs:		167.64	2310.00
	Indirect costs (50%):		83.82	1155.00
	Total project costs:		251.46	3465.00

TABLE VI-6 **COST ESTIMATES FOR 13 DEVELOPMENT SCHEMES**

3. Intensive Horticulture Promotion Scheme

	Item	Quantity	Amount	
			mln.Rs.	mln.Yen
1.	Building and facilities (5 units) Office, staff quarters, working shed, tractor shed, store house, glass house, vinyl house	13,160m^2 x 5	121.37	1672.50
2.	Site development	45,000m^2 x 5	32.66	450.00
3.	Machinery and equipment Farm machinery, solar pump, irrigation system, etc.	Lump sum	15.31	211.00
	Direct costs total:		169.34	2333.50
	Indirect costs (50%):		84.67	1166.75
	Total project costs:		254.01	3500.25

TABLE VI-7 COST ESTIMATES FOR 13 DEVELOPMENT SCHEMES

4. Transportation and Communication Improvement Scheme

Item	Quantity		Amount mln.Rs.	Amount mln.Yen
1. Rural Transportation				
1-1 Road works				
Construction	Type I:	100.5km	72.93	1005.00
	Type II:	18.5km	16.11	222.00
Improvement	Type I:	64.8km	32.92	453.60
	Type II:	16.2km	9.40	129.60
Others	Lump sum		13.13	181.00
Sub-total:			(144.49)	(1991.20)
1-2 Structure works				
Bridge	4 nos.		2.18	30.00
Causeway	63 nos.		4.57	63.00
Culvert	122 nos.		1.33	18.30
Retaining wall	2440 m		2.13	29.30
Side Gutter	200 km		29.03	400.00
Afforestation	40000 nos.		0.58	8.00
Others (20%)	Lump sum		7.96	109.70
Sub-total:			(47.78)	(658.30)
Direct costs for rural transportation:			192.27	2649.50
Indirect costs (50%):			96.14	1324.75
Rural transportation total:			288.41	3974.25
2. Rural Communication (Telephone Lines)				
2-1 Sihala station	about 30km		4.35	60.00
2-2 Humak Station	about 30km		4.35	60.00
2-3 Bhara Kau station	about 30km		4.35	60.00
2-4 Others	about 10km		1.45	20.00
Direct costs for rural communication:			14.50	200.00
Indirect costs (50%):			7.25	100.00
Rural communication total:			21.75	300.00
Total project costs:			310.16	4274.25

TABLE VI-8 **COST ESTIMATES FOR 13 DEVELOPMENT SCHEMES**

5. Agricultural Machinery Station Scheme

Item	Quantity	Amount mln.Rs.	Amount mln.yen
1. Main station (1 unit)		36.59	504.30
Building and facility	2020 m^2	(15.31)	(211.00)
Office, work shop, tractor shed			
Site development	25000 m^2	(4.97)	(68.50)
Machinery and equipment		(16.31)	(224.80)
Tractor, bulldozer, trailer for bulldozer, implement for tractor, workshop equipment.			
2. Substation (2 units)		44.79	617.20
Bulding & facility	1210 m^2 x 2	(13.72)	(189.00)
Site development	4000 m^2 x 2	(1.16)	(16.00)
Machinery & equipment	Lump sum	(29.91)	(412.20)
Tractor, bulldozer, trailer for bulldozer, implement for tractor, workshop equipment			
3. Tractor shed (10 units)		56.89	784.00
Building & facility	470 m^2 x 10	(28.30)	(390.00)
Site development	1500 m^2 x 10	(2.18)	(30.00)
Machinery & equipment	Lump sum	(26.41)	(364.00)
Tractor, implement for tractor, workshop equipment			
Direct construction costs:		138.27	1905.50
Indirect costs (50%):		69.14	952.75
Total project costs:		207.41	2858.25

TABLE VI-9 COST ESTIMATES FOR 13 DEVELOPMENT SCHEMES

6. Livestock Development Promotion Scheme

	Item	Quantity	Amount	
			mln.Rs.	mln.Yen
1.	Pilot farm	(3 units)	43.16	594.60
	Building & facility	1232 m^2 x 3	(29.50)	(406.50)
	Cattle shed, buffaloe shed, goat shed, young stock shed, office building, staff quarters, garage, forage store and workshop, water supply facility			
	Field development	22 ha x 3	(1.46)	(20.10)
	Reclamation of demonstration field (2ha) and range land development (20ha)			
	Site development	15000 m^2 x 3	(6.99)	(96.30)
	Machinery & equipment	7 units x 3	(3.53)	(48.60)
	Vehicle, tractor and implement, feed grinder-mixer, veterinary equipment, workshop equipment			
	Animal	44 nos. x 3	(1.68)	(23.10)
	Cow, bull buffaloe cow, buffaloe (male), goat (female), goat (male)			
2.	Station	(1 unit)	65.65	904.70
	Building & facility	5110 m^2	(47.11)	(649.20)
	Cattle shed, young cattle shed, goat shed, demonstration animal shed, main building, AI veterinary unit, training room, forage store, concentrate store, working shelter, garage and workshop, staff quarters, domitory, canteen, milking parlor building			

- cont'd -

Item	Quantity	Amount	
		mln.Rs.	mln.Yen
Field development	55 ha	(1.18)	(16.30)
Demonstration field (5ha) and range land development (50ha)			
Site development	60000 m^2	(9.32)	(128.40)
Machinery & equipment	23 nos.	(5.65)	(77.90)
Workshop equipment, veterinary equipment, AI equipment, feed graider-mixer, weighing facility, other equipment, vehicle (16), tractor and equipment			
Animal	249 nos.	(2.39)	(32.90)
Cow, bull, goat (female), goat (male), buffaloe cow, buffaloe			
3. Veterinary hospital	(4 units)	13.87	191.20
Building & facility	207 m^2 x 4	(8.85)	(122.00)
Hospital building, animal shed, staff quarter, water supply facility, cattle crash			
Site development	2000 m^2 x 4	(1.74)	(24.00)
Machinery & equipment	Lump sum	(3.28)	(45.20)
Veterinary equipment, AI equipment, other equipment, mobile veterinary unit, vehicle			
4. Veterinary dispensary	(5 units)	7.70	106.00
Building & facility	100 m^2 x 5	(5.66)	78.00
Site development	1200 m^2 x 5	(1,31)	18.00
Machinery & equipment	Lump sum	(0.73)	10.00
Veterinary equipment, vehicles, etc.			
Direct costs:		130.37	1796.50
Indirect costs (50%):		65.19	898.25
Total project costs:		195.56	2694.75

TABLE VI-10 COST ESTIMATES FOR 13 DEVELOPMENT SCHEMES

7. Inland Fishery Development Scheme

Item	Quantity	Amount	
		mln.Rs.	mln.Yen
1. Fish hatchery	(1 unit)		
1-1 Pond and tank			
Brroder fattening	3	0.21	2.90
Nursery tank	4	0.09	1.20
Batch-lining collecing tank	2	0.09	1.30
Raceway tank	1	0.55	7.60
Large size pond	1	0.13	1.80
Medium size pond	1	0.04	0.50
Mini size pond	4	0.003	0.04
1-2 Building & facility			
Hatchery office	150 m^2	1.63	22.50
Overtank shed	50 m^2	0.18	2.50
Single room hut	60 m^2	0.30	4.20
Staff quarter	300 m^2	3.27	45.00
Water supply	1	0.51	7.00
1-3 site development	30000 m^2	1.09	15.00
1-4 Machinery & equipment			
Fishing boat	5	0.73	10.00
Mobile pump	2	0.04	0.60
Hatchery equipment	1	0.15	2.00
Laboratory equipment	1	0.08	1.10
Other equipment	1	0.15	2.10
Vehicle	5	0.62	8.60
Direct costs for fish hatchery:		9.86	135.94
Indirect costs (50%):		4.93	67.97
Fish hatchery total:		14.79	203.91
2. Village community ponds	(11 units)		
1-1 Ponds		1.44	19.80
1-2 Facility		0.80	11.00
1-3 Equipment and tools		0.24	3.30
Direct costs for village community ponds:		2.48	34.10
Indirect costs (50%):		1.24	17.05
Village community ponds total:		3.72	51.15
Total project costs:		18.51	255.06

TABLE VI-11 **COST ESTIMATES FOR 13 DEVELOPMENT SCHEMES**

8. *Village Environmental Improvement Scheme*

Item	Quantity	Amount	
		mln.Rs.	mln.Yen
1. Development of Roads to Fuelwood Forest			
Road Improvement	60,500m	8.78	121.00
2. Access Road Improvement			
Road Improvement	24,200m	8.78	121.00
3. Inner-village Road Improvement			
Road Improvement	605,000m	131.71	1815.00
Resettlement of Housings	1,000 houses	217.71	3000.00
4. Fuel Wood afforestation			
Development of Fuelwood Forest	605ha	6.15	84.70
5. Pond & Tree Planting			
Pond Construction	605 ponds	7.02	96.80
Tree Planting	605 sites 100 trees/site	0.66	9.10
6. Recreation Park Development	605 sites		
Park Development	8 parks 2ha/park	41.80	576.00
Direct construction costs total:		422.61	5823.60
Indirect costs (50%):		211.31	2911.80
Total project costs:		633.92	8735.40

TABLE VI-12 **COST ESTIMATES FOR 13 DEVELOPMENT SCHEMES**

9. Land and Water Conservation Scheme

Item	Quantity	Amount	
		mln.Rs.	mln.Yen
1. Control of Soil Erosion from Cultivated Land		251.67	3468.00
Levelling, embankment & drainage works	23,120ha		
2. Prevention of Encroachment		70.78	975.30
Engineering works	292 sites		
Afforestation	292ha		
3. Conservation & utilization of culturable wasteland		105.90	1459.30
Land reclamation	3,630ha		
Rasture establishment	3,630ha		
4. Conservation & utilization of unculturable wasteland		25.40	350.00
Afforestation	5,000ha		
Reseeding	5,000ha		
5. Nursery station	4 stations	14.18	57.60
Direct construction costs:		457.93	6310.20
Indirect costs (50%):		228.97	3155.10
Total project costs:		686.90	9465.30

TABLE VI-13 **COST ESTIMATES FOR 13 DEVELOPMENT SCHEMES**

10. Medical and Health Services Improvement Scheme

Item	Quantity	Amount	
		mln.Rs.	mln.Yen
1. Building & facility	962 m^2 x 3	136.12	497.70
Meternity clinic	(432 m^2 x 3)		
Doctor's quarter	(150 m^2 x 3)		
Nurse and midwive's quarter with garage	(380 m^2 x 3)		
2. Site development	16000 m^2 x 3	6.97	96.00
3. Machinery & equipment	Lump sum	3.05	42.00
Ambulance and medical equipment			
Direct costs for 3 units of stations:		46.14	635.70
Indirect costs (50%):		23.07	317.85
Total project costs:		69.21	953.55

TABLE VI-14 **COST ESTIMATES FOR 13 DEVELOPMENT SCHEMES**

11. Manpower Development Scheme

Item	Quantity	Amount	
		mln.Rs.	mln.Yen
1. Vocational school			
Building and facility	6969 m^2	60.83	838.30
Site development		6.53	90.00
Machinery & equipment	Lump sum	8.20	113.00
Direct costs:		75.56	1041.30
Indirect costs (50%):		37.78	520.65
Vocational school total:		113.34	1561.95
2. Primary education facility improvement			
2-room school	46	155.22	2139.00
4-room school	68	347.90	4794.00
Educational eqipment	Lump sum	13.21	182.00
Direct costs:		516.33	7115.00
Indirect costs (50%):		258.17	3557.50
Primary education facility improvement total:		774.50	10672.50
Total project costs:		887.84	12234.45

TABLE VI-15 **COST ESTIMATES FOR 13 DEVELOPMENT SCHEMES**

12. Small-Scale Industry Development Scheme

Item	Quantity	Amount	
		mln.Rs.	mln.Yen
1. Gabion manufacturing			
Machinery & equipment	3 lines	7.47	103.00
Building	660 m^2	8.14	112.20
Direct costs:		15.61	215.20
Indirect costs (50%):		7.81	107.60
Gabion manufacturing total:		23.42	322.80
2. Enriched straw plants for cattle feeding			
Machinery & equipment	Lump sum	1.40	19.30
Building & facility		4.58	63.10
Direct costs:		5.98	82.40
Indirect costs (50%):		2.99	41.20
Enriched straw plants total:		8.97	123.60
3. Match manufacturing			
Building	583.4 m^2	7.40	102.00
Machinery & equipment	Lump sum	5.01	69.00
Direct costs:		12.41	171.00
Indirect costs (50%):		6.20	85.50
Match manufacturing total:		18.61	256.50
Total project costs:		51.00	702.90

TABLE VI-16 COST ESTIMATES FOR 13 DEVELOPMENT SCHEMES

13. Rural Development Supporting Service Scheme

Item	Quantity	Amount	
		mln.Rs.	mln.Yen
Rural development stations	(13 units)		
Building & facility	1264 m^2 x 13	101.70	1401.40
Community workshop, baby farm, health room, garage, flour mills, meeting and reading room, storage, community market, UC office			
Site development	8000 m^2 x 13	16.04	221.00
Direct costs for 13 units of stations:		117.74	1622.40
Indirect costs (50%):		58.87	811.20
Total project costs:		176.61	2433.60

VII. SCOPE OF WORK

SCOPE OF WORK

FOR

THE MASTER PLAN STUDY

FOR

THE INTEGRATED RURAL DEVELOPMENT PROJECT

IN

THE ISLAMIC REPUBLIC OF PAKISTAN

AGREED UPON BETWEEN

ECONOMIC AFFARIS DIVISION

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

ISLAMABAD NOVEMBER 21, 1984.

MOHAMMAD FAHEEM.
DEPUTY SECRETARY
ECONOMIC AFFAIRS DIVISION

JIRO NAKAJIMA
LEADER OF THE PRELIMINARY
SURVEY TEAM
THE JAPAN INTERNATIONAL
COOPERATION AGENCY.

1. INTRODUCTION

In response to the request of the Government of ISLAMIC REPUBLIC OF PAKISTAN (hereinafter referred to as "Pakistan"), the Government of Japan has decided to implement the Master Plan Study for the Integrated Rural Development Project (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force of Japan. Accordingly, 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 undertake the Study, in close cooperation with the authorities of Pakistan. The present document sets forth the Scope of Work with regard to the Study.

2. OBJECTIVE

The objective of the Study is to formulate a master plan for Integrated Rural Development Project in Islamabad Capital Territory in order to promote the development of rural area.

3. OUTLINE OF THE STUDY

The study will consist of field work in Pakistan and home office work in Japan.

1) Field Work

(1) Collection and review of the existing data and information

A. Natural condition
   a. Topography
   b. Meteorology
   c. Hydrology
   d. Geology
   e. Soil

B. Social Condition
   a. Population
   b. Land ownership
   c. Land disposal

C. Agriculture
   a. Farm management
   b. Land use
   c. Land holding
   d. Crop production
   e. Agricultural inputs
   f. Storage facilities

D. Agricultural infrastructure
   a. Irrigation and drainage system
   b. Farm land conservation
   c. Farm road

E. Agro-economy
   a. Marketing system
   b. Farmer's income and productivity
   c. Agricultural credit
   d. Farmers organization
   e. Extension service
   f. Agro-industry

F. Social infrastructure
   a. Rural electrification
   b. Communication
   c. Drinking water
   d. Welfare
   e. Village school

(2) Necessary field surveys for the formulation of the development plan

2) Home Office Work

(1) Formulation of the basic plan for the development

(2) Preliminary design of the major structures

(3) Approximate estimation of development cost

(4) Identification of development priority

4. WORK SCHEDULE

The Study will be executed in accordance with the attached tentative work schedule.

5. Reports

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

(1) Inspection 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 work.

(3) Interim report

Thirty (30) copies at the commencement of the second stage field work.

(4) Draft final report

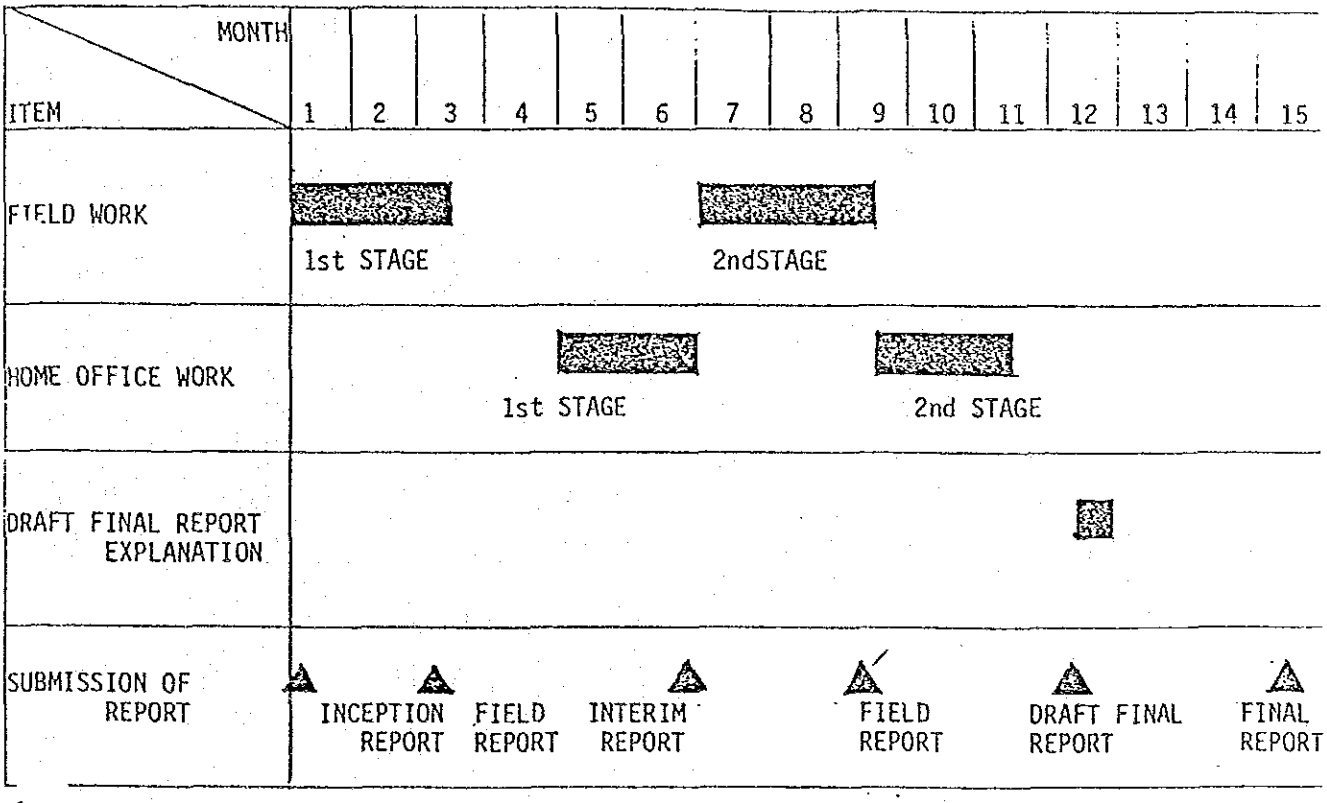
Thirty (30) copies within one (1) month after the end of the second stage home office work.

The Government of Pakistan is requested to provide its comments on the draft final report with 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.

TENTATIVE WORK SCHEDULE



VIII. PRIORITY CRITERIA OF MIRAD PROJECT COMPONENTS

VIII-1 PRIORITY CRITERIA OF MIRAD PROJECT COMPONENTS (TENTATIVE)

1. Ground Water Multipurpose Development

1) Rural Water Supply from Deep Well — 5 sites

(1) Koral village in UC Koral
(2) Loi Bher village in UC Koral
(3) Gagri village in UC Sihala
(4) Sihala village in UC Sihala
(5) Rawat village in UC Rawat

Priority Criteria

(a) Deep wells are present, but dry up in the dry season.
(b) Drafting of ground water from deep wells is possible within 1.5-5.0km of sites.
(c) Relative high population concerntration results in higher efficiency of investment on facilities.
(d) Sites are located near trunk roads, facilitating transport of construction materials from urban area.

2) Village Well Improvement — 20 sites

(1) UC Shah Allah Ditta	1 site
(2) UC Bhara Kau	2 sites
(3) UC Phulgran	2 sites
(4) UC Tamair	4 sites
(5) UC Tarlai Kalan	1 site
(6) UC Charah	6 sites
(7) UC Kirpa	3 sites
(8) UC Sihala	1 site

Priority Criteria

(a) Existing shallow wells are few, and ample ground water resources are not available for new well construction.
(b) Existing shallow wells are unlined, with danger of collapse. Liner plating need to be installed.
(c) Village residents strongly desire the envisaged improvement works.

3) Rehabilitation of Existing Wells 40 sites

(1) Kuri village in UC Phulgran
(2) Tarlai Kalan village in UC Tarlai Kalan
(3) Kirpa village in UC Kirpa
(4) Tamair village in UC Tamair
(5) Pind Begwal village in UC Tamair

Priority Criteria

(a) Population concentration is high and wells are relatively deep. Hand pump installation at the wells will substantially reduce physical effort necessary for water recovery from wells.
(b) Village residents strongly desire the envisages works.

2. Irrigation

1) Ground Water Irrigation 7 sites

(1) Kot Hathial village in UC Bhara Kau
(2) Kot Hathial village in UC Bhara Kau
(3) Maira Begwal village in UC Tamair
(4) Kuri village in UC Phulgran
(5) Jhang Sayaddan village in UC Kirpa
(6) Ghora Baz village in UC Charah
(7) Gagri village in UC Sihala

Priority Criteria

(a) Benefit area is situated close to well sites, with ample drafting of ground water possible.
(b) Sites are located close to trunk roads, facilitating transport of construction materials from the urban area.

2) Dam/Weir Irrigation 5 sites

(1) G-3 on Gumreh Kas
(2) G-5 on Gumreh Kas
(3) M-1 on Malal Kas
(4) M-2 on Malal Kas
(5) Gc-2 on Gumreh Kas

3) Village Pond 25 sites

2-3 sites per UC

Priority Criteria

(a) Scale of initial investment is small, but immediate impacts are expected.

(b) Multipurpose utilization of water resources is readily possible.

(c) Settlements and benefit are situated close to water resources, site vicinities offer ample potential for development.

(d) Sites are located near trunk roads, facilitating transport of construction materials from the urban area.

(e) Sites are centrally located in the rural area of ICT, with high effectivity as a model project to others.

(f) Area residents show strong desire for implementation of envisaged works.

3. Transportation and Communication

Total Road Length 35.0km

(1) Gagri-Ladhiot Road L = 8.9km B = 24ft

(2) Darwala- Kirpa-Charah Road L = 9.6km B = 24ft

(3) Tarlai-Panwal Road L = 5.3km B = 20ft

(4) Extension of Kuri Road L = 1.2km B = 20ft

(5) Kuri-Athal Road L = 7.5km B = 24ft

(6) Connecting Roads to the above Roads L = 2.5km

Priority Criteria

(a) Gagri - Ladhiot Road

Presently no satisfactory road is available on right bank of Soan River. Crossing of Soan River is impossible during periods of flood. New road construction is requisite.

(b) Darwal - Kirpa - Charah Road

This road would serve as a bypass of Lehtrar Road and as a farm road for the spreading cultivated land between Charah and Kirpa. It would also function as east-west trunk road through the area.

(c) Tarlai - Panwal Road

This road would serve as a bypass of Shahrah-i-Islamabad Road. By connecting with National Park Road, this would serve as a principal segment of the transportation network for the area.

(d) Extension of Kuri Raod

Despite the location of Kuri central to surrounding farmlands, passage of large vehicle is impossible. Construction of a bypass road would contribute significantly to development of the area.

(e) Kuri - Athal Road

Improvement of existing road connecting Simly Road with National Park Road would serve as bypass of Kurang River during flooding and connect the villages of Sohan, Tarlai and Simly to the north.

4. Agricultural Machinery Station

1) Agricultural Machinery Station (Main Station) 1 site

Tarlai Markaz

2) Agricultural Machinery Staion (Sub-staiton) 2 sites

(1) Bhara Kau Markaz

(2) Sihala Markaz

3) Tractor Shed 5 sites

(1) Charah village in UC Charah

(2) Kuri village in UC Phulgran

(3) Shah Darah village in UC Bhara Kau

(4) Shah Allah Ditta village in UC Shah Allah Ditta

(5) Pind Begwal village in UC Tamair

Priority Criteria

(a) Located far from Markaz with limited access to farm machinery hiring service.

(b) Area residents show keen interest in access to farm machinery.

(c) Centrally located in regards to envisaged beneficiaries for farm machinery hire services.

(d) Water for washing machinery is existing nearby.

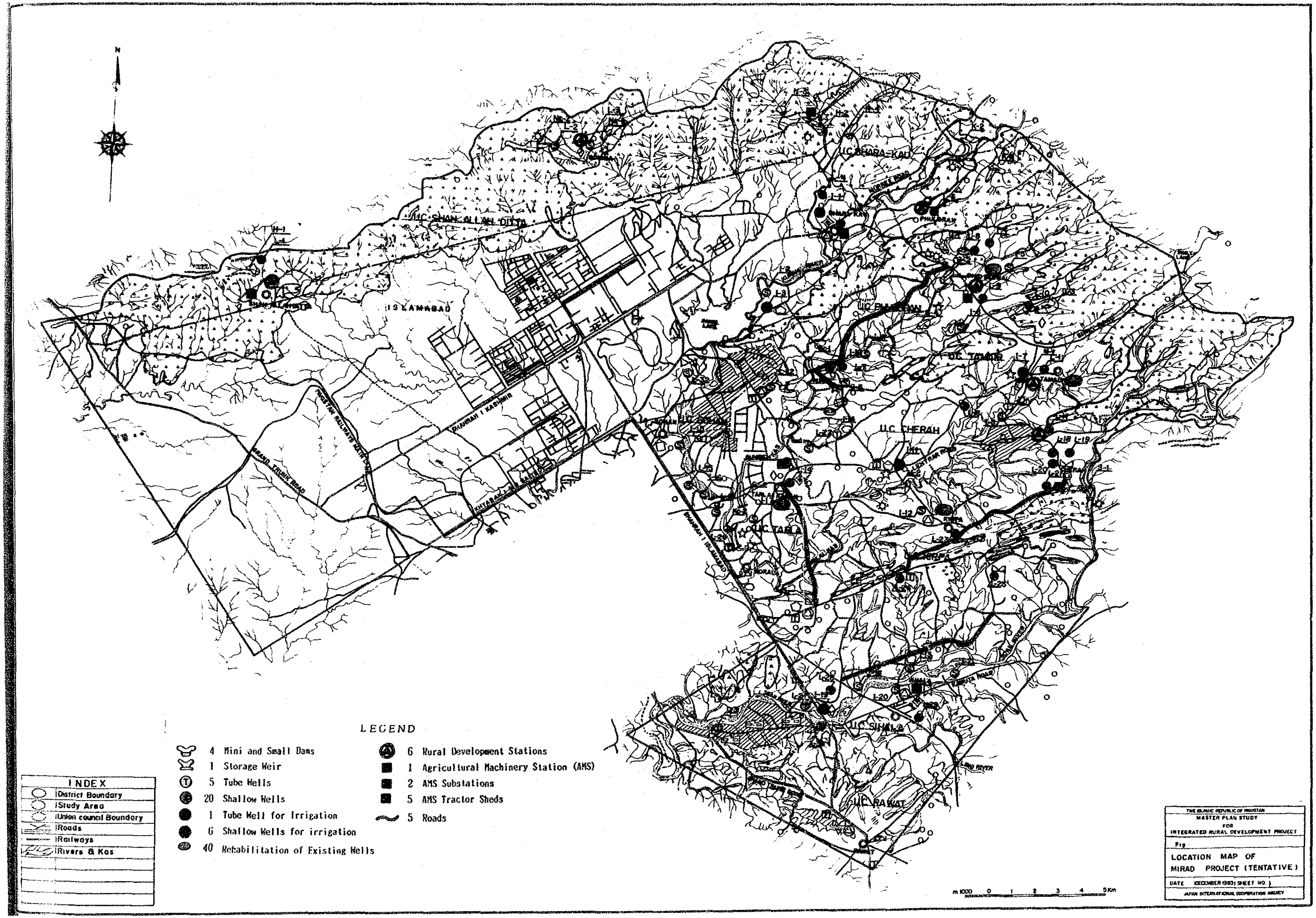
5. Rural Development Supporting Services

Rural Development Station 6 sites

(1) Shah Allah Ditta village in UC Shah Allah Ditta
(2) Gokina village in UC Shah Allah Ditta
(3) Phulgran village in UC Phulgran
(4) Pind Begwal village in UC Tamair
(5) Tamair village in UC Tamair
(6) Charah village in UC Charah

Priority Criteria

(a) Sites are remote from urban area and lack access to markets, employment opportunities, and various services.
(b) Sites are far from Markaz office and lack access to agricultural imputs such as farm machinery and equipment, fertilizers, seeds, etc.
(c) Sites are centrally located among settlements, facilitating access thereto by surrounding residents.
(d) Water is available from certain source for domestic use in the envisaged facility.
(e) Area residents exhibit a keen desire for envisaged facilities and services to be provided thereby.


N
U.C. SHAH ALLAH DITTA
ISLAMABAD
U.C. CHARA-KAU
U.C. CHERAH
U.C. TAMIR
U.C. SOHAN
U.C. TARLA
U.C. SIHALA
U.C. RAWAT
PAKISTAN RAILWAYS MAIN LINE
GRAND TRUNK ROAD
SHAHRAH-I-KASHMIR
KHYABAN-I-SIR SAYED
SHAHRAH-I-ISLAMABAD
MURREE ROAD
LING RIVER
LEGEND
4 Mini and Small Dams
1 Storage Weir
5 Tube Wells
20 Shallow Wells
1 Tube Well for Irrigation
6 Shallow Wells for irrigation
40 Rehabilitation of Existing Wells
6 Rural Development Stations
1 Agricultural Machinery Station (AMS)
2 AMS Substations
5 AMS Tractor Sheds
5 Roads
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District Boundary
Study Area
Union council Boundary
Roads
Railways
Rivers & Kas
m 1000 0 1 2 3 4 5 Km
THE ISLAMIC REPUBLIC OF PAKISTAN
MASTER PLAN STUDY
FOR
INTEGRATED RURAL DEVELOPMENT PROJECT
Fig.
LOCATION MAP OF
MIRAD PROJECT (TENTATIVE)
DATE
SHEET NO.
JAPAN INTERNATIONAL COOPERATION AGENCY

IX. ACKNOWLEDGEMENT

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IX-1 LIST OF DIRECT PARTICIPANTS AND SUPPORT PERSONNEL OF THE MASTER PLAN STUDY

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IX-2 LIST OF DATA COLLECTED

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Agency for Barani Areas Development (ABAD)	1. Punjab Barani Tract in Figures, 1984
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	2. Detail Specification of Pucca Qutleta Proposed for Cultivated Land
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Capital Development Authority (CDA)	1. Rehabilitation Policy, 1984
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	2. Islamabad and Rawalpindi Guide Map (1/30,000)
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	4. Punjab Map
	5. Index to Sheets of Pakistan
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	7. Lahore Guide Map

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WAPDA	1. Electrification Map of Project Area (1/50,000)
	2. Ground Water Investigators for Water Supply Scheme, Federal Capital Area Phase-I
	3. Availability of Ground Water in Selected Sectors/Areas of Islamabad
WP WAPDA	1. Geohydrology of the Federal Capital Area, West Pakistan
PMD	1. Station : Rawalpindi, Normals of Humidity, Maximum and Minimum Temperatures and Precipitation
East and West Publishing Company	1. Pakistan Year Book
Ferozsons Ltd.	1. Pakistan The Energy Sector
Vanguard Publication Ltd. (Lahore)	1. Pakistan, The political Economy of Rural Development
National Development Consultants	1. Flood Control Measures of Lai Nullah Rawalpindi Feasibility Report
Transport consultants and surveyors	1. Farm to Market Roads in Rawalpindi Shaikhpura and Mirpur Districts with Recommendations for Improvement up to 1995 (Volume I, II, III)
Indus Associated Consultants	1. Ten Years Masterplan of Rural Roads for Rawalpindi Civil Division
The World Bank	1. Monitoring Systems and Irrigation Management, An Experience from the Philippines
	2. Comparative Study of the Management and Organization of Irrigation Project
	3. Pakistan Recent Economic Developments and Structural Adjustment, 1985
	4. Price Prospects for Major Primary Commodities, Vol. I to V, 1984
	5. Pakistan Grain Storage Project, 1981

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	2. Report of the International Seminar on Integrated Rural Development, Lahore, November 3-10-1973
	3. Soil Survey Project, Pakistan