the farm inventory survey, yield testing, soil investigation, and intake rate test, and the purpose and methodology of investigations/surveys was explained to them by the Study Team.

4.11.4. Socio-economy Sector

(1) Technical Transfer through Collaboration with Counterparts

Basically, the transfer of technology from the socio-economic sector to UAE counterparts were made through collaboration both in the office and on the field.

(2) Workshop on Economic Evaluation

So that UAE nationals could learn to make economic evaluations by themselves, the workshop on the economic and financial evaluation of the development project was held by the Study Team in the presence of UAE personnel. At the workshop, the evaluation methods and technical terms such as present value, discount rate, internal rate of return and sensibility analysis were explained.

4.11.5. Environment and WID Sector

The transfer of technology to UAE personnel in the environmental and WID sectors was basically done on the job,

As the UAE does not possess any system for assessment, some studies at MAF were made in IEE and EIA. Emphasis was placed on the Initial Environmental Examination (IEE), and the main transfer of technology was made by means of the IEE study.

A joint field survey was also implemented with UAE nationals to examine environmental conservation.

The role of women in agricultural development was also discussed in accordance with government policy, which promotes the role of women in society.

Table 4.2.1. General Outline of Farms in the Study Area
by Farm Inventory Survey

	Khadra	Dhaid-1	Dhaid-2	Falaj al Mualla	Meleha	Total	Average
Number of Farms	14	50	49	24	59	196	
Farm Area							
Total Area (ha)	69	237	242	182	328	1,057	5.4
Cultivable Area (ha)	50	219	239	150	311	969	4.9
Cultivated Area (ha)	33	204	237	125	195	794	4.1
Farm Owner							
No. of interviewed	6.67%	4.16%	2.08%	26.09%	12.07%	17	8.85%
Having other main job	100.00%	98.00%	100.00%	95.65%	78.33%	182	92.39%
Living in							
Sharjah	0.00%	34.69%	22.00%	0.00%	71.67%	71	36.22%
Dubai	0.00%	34.69%	30.00%	0.00%	3.30%	34	17.26%
Abu Dhabi	0.00%	20.41%	32.00%	4.55%	8.33%	32	16.24%
Others	100.00%	10.21%	16.00%	95.45%	16.70%	59	29.95%
Family							
Total Family	11.2	8.5	7.7	7.9	9.5		8.8
Adult	5.6	6.9	6.2	5.1	5.1		5.9
Children	5.6	1.6	1.4	2.8	4.4		2.8
Farm Workers							
Total Numbers	3.43	3.38	3.17	4.39	3.38		3.46
Nationality							
Indian	0.00	0.08	0.33	1.52	0.38		0.40
Bangladeshi	2.71	1.08	0.78	1.09	0.86		0.91
Pakistani	0.64	1.70	1.41	1.09	1.64		1.61
Egyptian	0.07	0.32	0.61	0.04	0.22		0.31
Other Nationals	0.01	0.20	0.04	0.65	0.28		0.21
Working Hour	9.93	8.72	8.70	9.09	11.19		9.60
Wages (Dh/month)	818.36	783.72	882.92	807.78	786.53		813.90

Table 4.2.2. Crop Cultivation in the Study Area by Farm Inventory Survey

Crops	Area Cropped	Yield	Production	Unit Price	Gross Income	Production Cost		Net Income	Water Consumption		Net Income / W.C.	Growing Period
	(ha)	(ton/ha)	(ton)	(Dh/kg)	(Dh.)	(Dh/ha)	(Dh.)	(Dh)	(m³/ha)	(m³)	(Dh/m³)	in Main Field
[Vegetables]												
Squash	15.1	46.50	700.7	0.64	448,445	27,701	417,458	30,987	2,300	34,661	0.9	100(23/Sep-31/Dec)
Tomato	11.9	48.91	580.0	1.51	875,874	24,909	295,419	580,454	3,100	36,766	15.8	115(8/Oct-30/Jan)
Eggplant	7.6	24.43	186.2	0.89	165,700	40,764	310,625	-144,925	2,400	18,288	-7.9	85(30/Sep-23/Dec)
Sweet melon	3.2	14.89	47.2	0.88	41,540	39,693	125,826	-84,286	3,100	9,827	-8.6	90(16/Jan-15/Apr)
Cauliflower	3.1	20.22	61.7	1.90	117,186	20,279	61,850	55,336	1,800	5,490	10.1	55(10/Oct-3/Dec)
Bean	2.1	14.24	29.5	1.08	31,828	21,977	45,493	-13,665	2,400	4,968	-2.8	103(1/Nov-11/Feb)
Green beans	1.6	10.49	16.8	1.84	30,877	23,786	38,058	-7,181	2,400	3,840	-1.9	103(1/Nov-11/Feb)
Cucumber	1.3	91.98	117.7	0.99	116,558	23,711	30,350	86,208	2,500	3,200	26.9	100(23/Sep-31/Dec)
Cabbage	1.1	25.67	26.9	0.30	8,085	18,713	19,649	-11,564	1,600	1,680	-6.9	65(19/Oct-27/Dec)
Okra	1.0	12.67	12.7	6.02	76,255	20,119	20,119	56,136	3,600	3,600	15.6	75(1/Aug-14/Oct)
Onion	1.0	32.50	32.5	1.14	37,050	15,092	15,092	21,958	2,500	2,500	8.8	110(9/Nov-26/Feb)
Potato	0.9	20.09	17.1	1.33	22,715	21,362	18,157	4,558	2,500	2,125	2.1	100(21/Oct-28/Jan)
Bottle gourd	0.8	25.57	20.5	1.00	20,458	20,949	16,759	3,699	*4,500*	3,600	1.0	197(1/Oct-15/Apr)
Radish	0.7	26.00	19.0	1.15	21,827	22,351	16,316	5,511	1,900	1,387	4.0	60(16/Sep-14/Nov)
Courgette	0.7	25.50	17.9	1.00	17,850	33,802	23,661	-5,811	*1,700*	1,190	-4.9	76(16/Sep-30/Nov)
Pepper	0.5	15.00	7.5	2.27	17,025	9,621	4,811	12,215	2,000	1,000	12.2	110(5/Sep-23/Dec)
Water melon	0.4	13.91	6.0	0.80	4,786	26,541	11,413	-6,627	5,500	2,365	-2.8	150(16/Jan-14/June)
Parsley	0.3	15.67	4.7	2.09	9,823	18,095	5,428	4,395	1,900	570	7.7	70(16/Sep-24/Nov)
Carrot	0.2	24.00	4.8	2.06	9,888	9,807	1,961	7,927	2,300	460	17.2	90(1/Oct-29/Dec)
Jews mallow	0.1	*86.40*	4.3	2.50	10,800	35,112	1,756	9,044	1,800	90	100.5	50(16/Feb-6/Apr)
Subtotal	53.3	594.64	1,913.6	1.09	2,084,571	27,756	1,480,202	604,368	2,580	137,607	4.4	-
[Fruit Tree]												
Date Palm	191.0	6.23	1,189.9	3.30	3,926,507	21,470	4,099,639	-173,132	14,800	2,826,060	-0.1	365
Lemon	43.0	6.36	273.3	2.42	661,368	20,478	880,551	-219,183	10,200	438,600	-0.5	365
Mango	28.9	4.61	133.4	7.50	1,000,713	19,564	565,783	434,930	9,500	274,740	1.6	365
Orange	14.8	3.08	45.7	1.76	80,461	23,350	346,511	-266,050	10,200	151,368	-1.8	365
Lime	11.2	7.15	79.7	5.76	459,202	15,072	168,048	291,153	10,200	113,730	2.6	365
Guava	8.1	4.83	39.0	4.00	155,912	20,108	162,272	-6,359	9,500	76,665	-0.1	365
Other Citrus	5.5	12.85	70.9	2.02	143,258	18,525	102,257	41,001	10,200	56,304	0.7	365
Chico	4.6	1.98	9.1	4.00	36,590	20,350	94,017	-57,427	9,500	43,890	-1.3	365
Fig	2.4	4.26	10.1	5.00	50,269	17,746	41,880	8,389	9,500	22,420	0.4	365
Pomegranate	1.2	1.37	1.7	4.27	7,143	16,952	20,681	-13,538	9,500	11,590	-1.2	365
Grape fruit	0.4	2.56	0.9	2.50	2,306	26,773	9,638	-7,332	10,200	3,672	-2.0	365
Grapes	0.3	1.25	0.3	4.29	1,341	6,685	1,671	-331	9,400	2,350	-0.1	365
Subtotal	311.3	5.96	1,854.0	3.52	6,525,071	20,860	6,492,948	32,123	12,920	4,021,389	0.0	365
[Field Crops]												
Alfalfa	85.2	91.55	7,798.3	1.06	8,266,196	37,113	3,161,252	5,104,943	15,700	1,337,326	3.8	365
Methapleon (Missiblo)	20.4	154.03	3,137.5	0.48	1,508,842	42,964	875,173	633,669	15,000	305,550	2.1	365
Rhodes Grass	48.5	100.92	4,894.4	0.42	2,078,021	33,170	1,608,765	469,256	15,000	727,500	0.6	365
Subtotal	154.1	102.76	15,830.2	0.75	11,853,059	36,645	5,645,191	6,207,868	15,387	2,370,376	2.6	365
Total	518.6	37.79	19,597.8	1.04	20,462,701	26,258	13,618,342	6,844,360	12,589	6,529,372	1.0	-

Notes : 1) Production cost includes production material costs, labor cost and water cost(0.54 Dh/m³)
2) (Net) Water Consumption is calculated based on the FAO method
3) ***Number in bold Italic*** : Estimated from the average water consumption per day of Cucumber and Squash
4) *Number in Italic* : Uncertain data (the value is too big)

Table 4.2.3. Livestock in the Study Area by Farm Inventory Survey

Kind of Animal	No. of Farm Raised	Percentage of Raised Farm(%)	No. of Head Raised	No.of Head Raised per Raised Farm	No.of Head Born in the Last Year	Milk Produced (L)	Eggs Produced (pcs.)	No.of Head Consumed At Home
Goat	100	54.3	6,675	67	1,447	12,059		2,212
Sheep	83	45.1	5,720	69	1,094	0		2,829
Camel	33	17.9	757	23	26	0		48
Cattle	64	34.8	1,191	19	146	0		276
Chicken	37	20.1	2,144	58	126		215,898	574
Horse	3	1.6	21	7	5			
Geese	3	1.6	76	25	0			
Pigeon	3	1.6	315	105	65			480
Duck	2	1.1	24	12	0			
Falcons	2	1.1	6	3	0			
Antelopes	1	0.5	7	7	1			
Donkey	1	0.5	1	1	0			
Doves	1	0.5	40	40				
Peacock	1	0.5	6	6	0			6

Kind of Animal	No. of Heads Sold	Average Price Sold (Dh/Head)	Amount Sold (Dh)	Feed Cost Purchased (Dh)	Purchased Feed Cost Per Head	Health Cost (Dh)	Labor Cost (Dh)	Total Cost Paid (Dh)
Goat	142	249	35,300	635,104	95	11,288	178,296	624,935
Sheep	105	295	31,000	587,554	103	2,666	198,021	665,413
Camel	19	6,053	115,000	329,744	436	7,950	60,904	243,060
Cattle	76	1,067	81,100	239,904	201	988	310,556	472,347
Chicken	5	25	125	29,604	14	1,210	45,750	54,282
Horse				9,246	440		10,409	19,655
Geese	0			6,526	86		734	7,260
Pigeon				500	2	600	6,411	7,511
Duck				100	4		1,375	1,475
Falcons							200	200
Antelopes	4	1,000	4,000				200	200
Donkey				300	300		175	492
Doves				1,200	30			1,200
Peacock				0	0		33	33

Note: Number of farms surveyed: 184 Farms

Table 4.3.1 Aquifer Coefficient

Major Aquifer	Well	Area Name	SWL 1985(m)	S/P m3/hr/m	T m2/day	S/C %	EC mS/m2	TDS ppm
Upper Aquifer	GP-2	F'Al Mualla	26	1	3	-	19	-
	MF-1	Masfut	8	6	172	-	6	-
	GP-7	S.E.Mileiha	21	3	88	-	-	-
	B-1	N.Ikdedir	-	-	-	-	22-30	-
	B-2	N.E.Mileiha	-	-	-	-	11-20	-
	OW2	Khuderah	-	-	16	0.16	-	-
	PW2	Khuderah	-	0	3	-	-	1190
	GP-17	S.W.Dhaid	34	10	110	-	22.3	-
	GP-10	S.E.Dhaid	12	4	264	0.12	25	-
	GP-10A	S.E.Dhaid	12	4	264	0.12	18	-
	GWR4	Dhaid	-	-	-	-	-	-
	GP-1	Manamah	18	<1.8	8	0.60	7	-
	GP-1A	Manamah	18	<1.8	8	0.60	-	-
	GP-3	Manamah	19	1	6	0.60	12	-
	GP-3A	Manamah	19	1	6	0.60	15	-
	OW4	F'Al Mualla	-	-	-	-	-	-
	GP-13	N.Tawi Suhai	-	dry	-	-	-	-
	GWR2	F'Al Mualla	-	-	-	-	-	-
	GP-19	F'Al Mualla	24	dry	-	-	-	-
	GP-14	Siji	19	6	230	-	13	-
	PW3(municipality well)	Khuderah		1	12	-	-	-
			AVERAGE	3	85	0.40	14	1190
			MIN.	0	3	0.12	6	1190
			MAX.	10	264	0.60	25	1190
Lower Aquifer	PW5	Fah	-	0	5	-	-	1420
	OW3	Khuderah	-	-		-	-	
	PW3	Khuderah	-	-	1	0.33	-	970
	GP-15	S.E.Dhaid	14	5	-	-	24	
	PW1	Dhaid East	-	1	8	1000-2800		440
	GP-18	Dhaid	32	low	-	-	28	-
	GP-16	East Dhaid	23	2	120	0.25	-	-
	GP-16A	East Dhaid	23	2	120	0.25	6	-
			AVERAGE	2	51	0.28	19	943
			MIN.	0	1	0.25	6	440
			MAX.	5	120	0.33	28	1420
Fissure Water in Upper Aquifer	GP-11	E.Jabal Faivah	9	28	480	-	151	-
	GP-6	Mileiha	18	29	1166	2.40	-	-
	GP-6A	Mileiha	18	29	1166	2.40	24	-
	PW4b	Manamah	-	24	290	-	-	450
			AVERAGE	28	776	2.40	87	450
			MIN.	24	290	2.40	24	450
			MAX.	29	1166	2.40	151	450

Table 4.5.1 Catchment and Storage Capacity of Recharge Dam

Dam site	Catchment (km^2)	Capacity (Flood of 25-year return period) (MCM)	Sedimentation Volume (MCM)	Recharge Dam	
				Surface Area (km^2)	Full Water Level (m)
wadi gauge (Siji)	86.6	2.5700	0.8901		
Siji dam site	83.1	2.4658	0.8583	0.8559	16.5
wadi gauge (Khadrah)	215.6	3.2500			
Khadrah dam site	217.8	3.2836	2.0043	1.0406	13.5
Shokah Index Point	54.0	2.6600			
Shokah dam site	50.0	2.4630	0.5489	2.5072	16.5

Table 4.5.2 Spillway Dimension of Recharge Dam

Dam site	Catchment Area (km^2)	Flood Discharge 10,000-year return period (m^3/sec.)	Full Water Level (m)	Design Flood Level (m)	Crest Height (m)	Coefficient of velocity C	Spillway Width (m)	Spillway Crest Width (m)	Surface Area of Dam Storage (km^2)
wadi gauge (Siji)	86.6	584							
Siji dam site	83.1	560	16.50	18.00	20.50	1.81	169	0.20	1.02
wadi gauge (Khadrah)	215.6	713							
Khadrah dam site	217.8	720	12.50	14.00	16.50	1.81	217	0.20	1.25
Shokah Index Point	54.0	527							
Shokah dam site	50.0	488	23.50	25.00	27.50	1.81	147	0.20	0.80

Table 4.5.3 Estimated Construction Cost of Recharge Dam

Recharge Dam	Crest Height	Dam Length	Volume of Embankment	Excavation cost	Spreading and compaction cost	Construction cost ($)
Siji Dam (main)	25.5	380	423,091	125,601	4,436,927	$4,562,528
Saddle Dam (A)	15.5	160	70,591	37,744	739,841	$777,585
Spillway		169		12,731,942	207,362	$12,939,304
Conduit				9,475	3,574	$13,049
Subtotal			493,682	12,904,763	5,387,704	$18,292,467
Khadrah Dam (main)	20.5	700	520,014	198,252	5,463,361	$5,661,613
Saddle Dam (A)	10.5	280	61,785	52,803	649,143	$701,946
Saddle Dam (B)	10.5	580	129,310	109,377	1,364,555	$1,473,932
Saddle Dam (C)	5.5	120	8,840	16,950	92,855	$109,805
Spillway		217		216,639	266,587	$483,226
Conduit				8,058	3,220	$11,278
Subtotal			719,949	602,080	7,839,720	$8,441,800
Shokah Dam	25.5	580	646,734	191,707	6,786,602	$6,978,309
Saddle Dam (A)	10.5	180	39,576	33,945	415,169	$449,113
Saddle Dam (B)	10.5	140	30,736	26,401	322,226	$348,627
Saddle Dam (C)	10.5	280	61,785	52,803	649,143	$701,946
Spillway		147		1,426,714	180,581	$1,607,295
Conduit				6,633	9,620	$16,252
Subtotal			778,831	1,738,203	8,363,341	$10,101,543
					Subtotal	$36,835,810
					Survey	$1,841,791
					Supervision	$1,841,791
					Contingency	$3,683,581
					Total	$44,202,972

Figure 4.5.4 Estimated Construction Cost of Recharge Trench

Description	Unit	Price ($)	Quantity	Total cost ($)
1 Leveling	m^3	$1.82	70,000	$127,273
2 Excavation and remove	m^3	$4.55	9,000	$40,909
3 Gabion work	m^3	$45.45	12,000	$545,455
4 Back-fill	m^3	$13.64	35,250	$480,682
Subtotal				$1,194,318
5 Survey				$59,716
6 Supervision				$59,716
7 Contingency				$119,432
Total (1,000m Trench)				$1,433,182
1,000m Trench × 3				$4,299,545

Table 4.6.1 Hydrological Balance of the Study Area in the Current Condition (1977-1995)

Groundwater balance in Current Condition (1977-1994) Area: 1825.9 km2 Unit: mm

Year	Area Rainfall	Evapo-transpiration	Surface Runoff	Groundwater Recharge	Balance (Surface System)	Groundwater Runoff	Groundwater Draft	Balance (Sub-surface System)	Balance (Surface + Subsurface)
1977	219.3	214.1	0.0	7.1	-1.9	16.9	1.3	-11.1	-13.0
1978	124.3	124.4	0.0	4.2	-4.3	15.2	1.4	-12.4	-16.7
1979	177.6	140.0	0.0	3.3	34.3	14.3	1.6	-12.6	21.7
1980	106.7	135.9	0.0	5.2	-34.4	13.6	5.1	-13.5	-47.9
1981	87.1	86.1	0.0	1.5	-0.5	12.7	5.1	-16.3	-16.8
1982	385.4	338.0	0.1	42.6	4.7	13.2	5.9	23.5	28.2
1983	179.3	173.9	0.0	9.1	-3.7	12.9	7.9	-11.7	-15.4
1984	110.6	109.5	0.0	1.7	-0.6	11.8	8.6	-18.7	-19.3
1985	25.9	25.5	0.0	0.9	-0.5	10.7	13.2	-23.0	-23.5
1986	92.4	91.3	0.0	0.9	0.2	9.6	13.5	-22.2	-22.0
1987	153.1	143.6	0.0	6.0	3.5	8.7	15.4	-18.1	-14.6
1988	211.6	163.8	3.8	44.2	-0.2	9.7	16.9	17.6	17.4
1989	132.1	124.0	0.0	4.4	3.7	9.0	20.4	-25.0	-21.3
1990	219.8	187.7	0.1	36.4	-4.4	8.3	22.2	5.9	1.5
1991	71.7	71.4	0.0	2.8	-2.5	7.3	24.5	-29.0	-31.5
1992	143.3	139.7	0.0	2.1	1.5	6.2	26.6	-30.7	-29.2
1993	186.5	142.6	0.4	41.8	1.7	6.8	29.7	5.3	7.0
1994	61.9	61.5	0.0	3.6	-3.2	5.9	31.4	-33.7	-36.9
1995	259.0	249.4	0.0	7.8	1.8	4.5	29.6	-26.3	-24.5
Total	-	-	-	-	-4.8	-	-	-252.0	-256.8
Average	155.1	143.3	0.2	11.9	-0.3	10.4	14.8	-13.3	-13.5

Groundwater balance in Current Condition (1977-1994) Area:1825.9 km2 Unit: MCM

Year	Area Rainfall	Evapo-transpiration	Surface Runoff	Groundwater Recharge	Balance (Surface System)	Groundwater Runoff	Groundwater Draft	Balance (Sub-surface System)	Balance (Surface + Subsurface)
1977	400.4	390.9	0.0	13.0	-3.5	30.9	2.4	-20.3	-23.7
1978	227.0	227.1	0.0	7.7	-7.9	27.8	2.6	-22.6	-30.5
1979	324.3	255.6	0.0	6.0	62.6	26.1	2.9	-23.0	39.6
1980	194.8	248.1	0.0	9.5	-62.8	24.8	9.3	-24.6	-87.5
1981	159.0	157.2	0.0	2.7	-0.9	23.2	9.3	-29.8	-30.7
1982	703.7	617.2	0.2	77.8	8.6	24.1	10.8	42.9	51.5
1983	327.4	317.5	0.0	16.6	-6.8	23.6	14.4	-21.4	-28.1
1984	201.9	199.9	0.0	3.1	-1.1	21.5	15.7	-34.1	-35.2
1985	47.3	46.6	0.0	1.6	-0.9	19.5	24.1	-42.0	-42.9
1986	168.7	166.7	0.0	1.6	0.4	17.5	24.6	-40.5	-40.2
1987	279.5	262.2	0.0	11.0	6.4	15.9	28.1	-33.0	-26.7
1988	386.4	299.1	6.9	80.7	-0.4	17.7	30.9	32.1	31.8
1989	241.2	226.4	0.0	8.0	6.8	16.4	37.2	-45.6	-38.9
1990	401.3	342.7	0.2	66.5	-8.0	15.2	40.5	10.8	2.7
1991	130.9	130.4	0.0	5.1	-4.6	13.3	44.7	-53.0	-57.5
1992	261.7	255.1	0.0	3.8	2.7	11.3	48.6	-56.1	-53.3
1993	340.5	260.4	0.7	76.3	3.1	12.4	54.2	9.7	12.8
1994	113.0	112.3	0.0	6.6	-5.8	10.8	57.3	-61.5	-67.4
1995	472.9	455.4	0.0	14.2	3.3	8.2	54.0	-48.0	-44.7
Total	-	-	-	-	-8.8	-	-	-460.1	-468.9
Average	283.3	261.6	0.4	21.7	-0.5	19.0	26.9	-24.2	-24.7

Table 4.8.1. Agriculture in the Study Area, 1994 by MAF Statistic Data

Crops	Area Croppe (ha)	Yield (ton / ha)	Productio n (ton)	Unit Price (Dh/kg)	Gross Income (Dh)	Production Cost (Dh/ha)	Production Cost (Dh)	Net Income (Dh)	Water Consumption (m^3/ha)	Water Consumption (m^3)	Estimated Gross Water (m^3)	Net Income / W.C. (Dh.)	Growing Period and Date
[Vegetables]													
Squash	245.1	28.65	7,019.9	1.70	11,933,832	18,596	4,557,188	7,376,644	3,000	735,188	490,126	10.0	110(6/Sep-24/Dec)
Tomato	230.3	27.04	6,228.7	1.65	10,277,366	18,102	4,169,684	6,107,682	3,100	714,066	476,044	8.6	115(8/Oct-30/Jan)
Onion	108.1	7.90	854.3	1.15	982,429	12,802	1,383,947	-401,518	2,500	270,260	180,173	-1.5	110(9/Nov-26/Feb)
Sweet Pepper	82.9	1.54	127.5	1.90	242,197	20,032	1,659,746	-1,417,548	2,000	165,709	110,473	-8.6	50(15/Sep-3/Nov)
Parsley	76.4	1.80	137.6	1.50	206,420	16,050	1,225,861	-1,019,441	1,900	145,117	96,745	-7.0	70(16/Sep-24/Nov)
Eggplant	65.6	37.97	2,492.6	1.10	2,741,816	12,248	803,976	1,937,840	2,400	157,539	105,026	12.3	85(30/Sep-23/Dec)
Sweet melon	42.1	20.60	867.1	2.10	1,820,952	22,722	956,664	864,288	3,100	130,519	87,013	6.6	90(16/Jan-15/Apr)
Cabbage	32.8	26.40	866.3	1.10	952,929	11,840	388,588	564,341	1,600	52,512	35,008	10.7	65(19/Oct-27/Dec)
Okra	31.7	10.59	336.3	3.10	1,042,585	32,914	1,045,829	-3,243	3,600	114,284	76,190	-0.0	75(1/Aug-14/Oct)
Cauliflower	30.5	22.22	678.4	1.35	915,778	14,448	441,039	474,740	1,800	54,947	36,631	8.6	55(10/Oct-3/Dec)
Water melon	27.9	21.20	591.7	1.40	828,433	17,066	476,393	352,040	5,500	153,531	102,354	2.3	150(16/Jan-14/June)
Cucumber	22.2	28.62	636.7	3.35	2,132,944	34,604	769,857	1,363,088	2,000	44,495	29,663	30.6	60(1/Sep-30/Oct)
Bean	18.3	15.07	275.6	3.75	1,033,685	38,388	701,806	331,879	1,600	29,251	19,501	11.3	70(1/Nov-11/Feb)
Cowpea	14.0	22.09	308.7	2.80	864,459	28,720	401,423	463,036	2,400	33,545	22,363	13.8	70(16/Sep-24/Nov)
Radish	10.1	19.61	197.3	0.60	118,379	7,002	70,462	47,917	1,900	19,120	12,747	2.5	60(16/Sep-14/Nov)
Pepper	7.9	10.42	82.4	1.98	162,831	21,532	170,340	-7,509	2,000	15,822	10,548	-0.5	50(5/Sep-23/Dec)
Potato	6.7	23.61	157.6	2.15	338,737	1,156	7,714	331,023	2,500	16,684	11,123	19.8	100(21/Oct-28/Jan)
Jews mallow	4.9	27.10	133.9	1.70	227,583	17,942	88,640	138,944	1,700	8,399	5,599	16.5	50(16/Feb-6/Apr)
Carrot	4.6	25.07	115.6	1.40	161,797	15,218	70,165	91,632	2,300	10,605	7,070	8.6	90(1/Oct-29/Dec)
Turnip(Lafi)	4.0	30.44	122.2	1.45	177,258	15,418	61,909	115,348	1,700	6,826	4,551	16.9	50(1/Sep-20/Oct)
Lettuce	3.7	18.73	68.6	1.50	102,896	16,218	59,410	43,486	2,300	8,425	5,617	5.2	97(27/Oct-31/Jan)
Other	87.9	37.55	3,301.0	*1.84*	6,087,322	*18,417*	1,645,335	4,441,987	*2,424*	213,072	142,048	20.8	-
Subtotal	1,157.8	22.11	25,599.9	1.69	43,352,630		21,155,975	22,196,655		3,099,918	2,066,612	7.2	-
[Fruit Trees]													
Date Trees	1,095.4	19.23	21,061.6	3.50	73,715,546	42,992	47,095,338	26,620,208	14,800	6,212,574	10,132,859	1.6	365
Lemon	270.5	15.71	4,248.8	2.20	9,347,416	27,508	7,441,336	1,906,080	10,200	2,759,256	1,724,535	0.7	365
Mango	120.3	6.41	770.4	4.70	3,620,789	52,130	6,270,073	-2,649,285	9,500	1,142,638	714,148	-2.3	365
Other Citrus	105.7	11.82	1,249.1	2.50	3,122,818	30,508	3,223,225	-100,407	10,200	1,077,648	673,530	-0.1	365
Guava	62.9	11.86	746.0	3.05	2,275,153	35,630	2,241,058	34,095	9,500	597,532	373,457	0.1	365
Fig	39.0	4.78	186.3	1.65	307,414	21,630	843,752	-536,338	9,500	370,580	231,612	-1.4	365
Lime	23.1	12.75	294.2	2.50	735,563	30,508	704,087	31,476	10,200	235,403	147,127	0.1	365
Grape fruit	14.3	11.62	166.5	2.20	366,306	27,508	394,094	-27,789	10,200	146,131	91,332	-0.2	365
Pomegranate	12.7	20.91	265.0	3.80	1,007,130	43,130	546,598	460,532	9,500	120,396	75,248	3.8	365
Grapes	9.0	2.53	22.7	4.00	90,989	45,076	405,410	-314,421	9,400	84,543	52,839	-3.7	365
Almond	7.1	2.95	21.1	0.80	16,848	16,640	118,932	-102,084	16,000	114,357	71,473	-0.9	365
Banana	3.6	3.33	11.9	2.30	27,353	32,288	115,388	-88,025	17,200	61,468	38,417	-1.4	365
Others	61.7	*10.51*	636.9	*2.77*	1,761,885	*33,296*	2,084,818	-322,933	*11,350*	700,169	437,606	-0.5	365
Subtotal	1,825.3	16.26	29,680.6	3.25	96,395,218		71,484,109	24,911,109		3,622,695	14,764,185	1.1	-
[Field Crops]		10.32											
Alfalfa	972.5	90.86	88,363.3	1.40	123,708,613	14,000	1,272	123,707,341	15,700	5,268,681	22,266,827	8.1	365
Green fodder	625.7	76.97	48,162.9	1.10	52,979,160	11,000	6,883	52,972,277	15,000	9,385,987	13,687,898	5.6	365
Tobacco	1.9	8.70	16.9	1.80	30,483	17,634	34	30,449	5,000	9,732	14,193	3.1	-
Others	0.9	20.00	18.4	*1.43*	26,316	*14,211*	5	26,311	*11,900*	10,922	15,928	2.4	-
Subtotal	1,601.1	196.53	136,561.4	1.29	176,744,572		8,195	176,736,378		4,675,322	35,984,845	7.2	-
Total	4,584.2	234.90	191,842.0	1.65	316,492,421		92,648,278	223,844,142		1,397,936	52,815,642	4.4	-

1) Water Consumption is estimated at 80% of the net water requirement which is calculated based on the FAO method

2) Production cost : Statistic data, MAF + Water cost (0.54 Dhs/m^3 of water consumption)

3) Gross water is estimated based on the assumption of net irrigation ratios (0.4, 0.3 and 0.7 for vegetables tree crops and field crops respectively) and irrigation efficiencies (o.75, 0.60 and 0.6 for vegetable, tree crops and field crops respectively)

4) *number In Italic* : Average of crops in each sub-groups.

Table 4.8.2. Agriculture in the Study Area by Farm Inventory Survey and MAF Statistic Data

Source Of Data	Crop	Cultivated Area		Net Income		Water Consumption		N.I/W.C.
		(ha)	(%)	(1,000Dh.)	(%)	(m^3)	(%)	(Dhs/m^3)
JICA Inventory Survey (196 Farms)	Vegetables	53.3	10.3	604	8.8	137,607	2.1	4.4
	Tree Crops	311.3	60.0	32	0.5	4,021,389	61.6	0.0
	Field Crops	154.1	29.7	6,208	90.7	2,370,376	36.3	2.6
	Total	518.6	100.0	6,844	100.0	6,529,372	100.0	4.4
Statistic Data* (2,018 Farms)	Vegetables	1,157.8	25.3	22,197	9.9	3,099,918	6.0	7.2
	Tree Crops	1,825.3	39.8	24,911	11.1	23,622,695	46.0	1.1
	Field Crops	1,601.1	34.9	176,736	79.0	24,675,322	48.0	7.2
	Total	4,584.2	100.0	223,844	100.0	51,397,936	100.0	4.4

Note : * MAF Statistic Section 1994

Table 4.8.3. Vegetable Experimental Cultivation Results of UNDP/FAO 1982-1983, Open Field

Crop	Cultivation Method	Production (ton/ha)	Unit Price (Dh/kg)	Gross Income (Dh/ha)	Production Cost (Dh/ha)	Net Income (Dh/ha)	Water Consumption(m³/ha)	Net Income Per W.C. (Dh/m³)	Days in Main Field (Days)	Cropping Season in Main Field
Cabbage	T.P	32.40	2.17	70,308	11,798	58,510	1,500	39.0	62	27/Oct-28/Dec
	T.P	52.70	1.08	56,916	12,056	44,860	2,000	22.4	84	27/Oct-19/Jan
	T.P	46.23	2.17	100,308	12,434	87,874	2,700	32.5	89	18/Sep-16/Dec
	T.P	36.30	2.17	78,771	12,260	66,511	2,400	27.7	74	18/Sep-1/Dec
	T.P	31.60	1.08	34,128	12,920	21,208	3,600	5.9	123	18/Sep-19/Jan
	Average	39.85	1.73	68,086	12,294	55,793	2,440	25.5	86	
Cauliflower	T.P	14.60	3.17	46,282	14,256	32,026	1,400	22.9	57	29/Oct-25/Dec
	T.P	24.50	3.00	73,500	14,814	58,686	2,500	23.5	71	19/Sep-29/Nov
	T.P	16.10	3.17	51,037	14,730	36,307	2,300	15.8	78	1/Oct-18/Dec
	T.P	22.30	3.17	70,691	15,288	55,403	3,400	16.3	99	9/Sep-17/Dec
	Average	19.38	3.13	60,378	14,772	45,606	2,400	19.6	76	
Carrot	D.S	27.24	2.00	54,480	15,218	39,262	2,300	17.1	92	27/Nov-27/Feb
	D.S	26.81	2.00	53,618	15,248	38,370	2,400	16.0	104	15/Nov-27/Feb
	Average	27.02	2.00	54,049	15,233	38,816	2,350	16.5	98	
Musk melon	D.S	15.60	8.50 *	132,600	23,682	108,918	5,100	21.4	106	27/Mar-11/July
	D.S	21.18	9.00 *	190,575	25,710	164,865	8,900	18.5	172	15/Feb-6/Aug
	D.S	12.08	8.50 *	102,638	23,382	79,256	4,500	17.6	95	26/Mar-29/June
	D.S	5.55	10.73 *	59,552	24,384	35,168	6,400	5.5	119	15/Feb-14/June
	Average	13.60	9.18	121,341	24,290	97,052	6,225	15.7	123	
Water Melon	D.S	24.10	3.31	79,771	14,912	64,859	4,000	16.2	91	1/Mar-31/May
	D.S	18.58	3.00	55,740	15,152	40,588	5,100	8.0	103	1/Mar-12/June
	Average	21.34	3.16	67,756	15,032	52,724	4,550	12.1	97	
Tomato	T.P	142.59	1.07	152,571	20,142	132,429	7,100	18.7	200	23/Oct-11/May
	T.P	94.10	1.07	100,687	19,680	81,007	6,200	13.1	162	30/Nov-11/May
	T.P	104.55	1.07	111,869	19,902	91,967	6,300	14.6	197	23/Oct-8/Mar
	T.P	91.27	1.07	97,659	20,142	77,517	7,100	10.9	199	23/Oct-10/May
	T.P	107.37	1.15	123,471	20,184	103,287	6,200	16.7	160	2/Dec-11/May
Tomato(L.C)	T.P	19.61	1.07	20,983	20,874	109	8,500	0.0	223	13/Oct-24/May
	Average	93.25	1.08	101,207	20,154	81,053	6,900	12.3	190	
Spinach	D.S	45.47	2.75	125,032	16,312	108,720	3,400	32.0	136	3/Oct-16/Feb
	D.S	48.40	2.83	136,972	15,988	120,984	2,800	43.2	120	1/Nov-1/Mar
	D.S	16.90	2.75	46,475	15,364	31,111	1,600	19.4	79	30/Nov-17/Feb
	D.S	29.45	2.00	58,900	15,934	42,966	2,700	15.9	111	30/Nov-21/Mar
	Average	35.05	2.58	91,845	15,900	75,945	2,625	27.6	112	
Radish	D.S	14.50	1.37 **	19,865	6,456	13,409	800	16.8	31	27/Oct-27/Nov
	D.S	15.24	1.25 **	19,050	6,834	12,216	1,500	8.1	58	4/Oct-1/Dec
	D.S	1.83	1.37 **	2,511	6,618	-4,107	1,100	-3.7	42	4/Oct-15/Nov
	Average	10.52	1.33	13,808.74	6,636	7,173	1,133	7.1	44	
Pepper(L.C)	T.P	52.60	2.29	120,454	24,760	95,694	8,200	11.7	231	20/Sep-9/May
	T.P	20.47	2.29	46,876	24,760	22,116	8,200	2.7	231	20/Sep-9/May
	Average	36.54	2.29	83,665	24,760	58,905	8,200	7.2	231	
Okra	D.S	11.70	4.25	49,725	34,942	14,783	7,300	2.0	123	15/Mar-16/July
	D.S	15.90	3.88	61,692	36,346	25,346	9,900	2.6	172	15/Feb-6/Aug
	D.S	11.10	4.25	47,175	35,104	12,071	7,600	1.6	136	1/Mar-16/July
	D.S	11.50	4.25	48,875	35,482	13,393	8,300	1.6	143	23/Feb-16/July
	D.S	12.20	3.88	47,336	35,860	11,476	9,000	1.3	144	15/Mar-6/Aug
	D.S	11.90	3.88	46,172	35,968	10,204	9,200	1.1	158	1/Mar-6/Aug
	D.S	10.35	3.88	40,158	35,482	4,676	8,300	0.6	143	23/Feb-16/July
	Average	12.09	4.04	48,733	35,598	13,136	8,514	1.5	146	
Onion	T.P	25.70	0.66	16,962	13,372	3,590	3,600	1.0	106	3/Jan-19/Apr
	T.P	34.43	0.65	22,376	14,350	8,026	5,500	1.5	135	3/Jan-18/May
	T.P	24.88	0.90	22,392	15,868	6,524	8,400	0.8	178	3/Jan-30/June
	T.P	18.76	0.90	16,884	15,868	1,016	8,400	0.1	177	4/Jan-30/June
Onion(L.C)	T.P	29.30	0.65	19,045	15,190	3,855	7,100	0.5	195	3/Nov-17/May
	Average	26.61	0.75	19,532	14,930	4,602	6,600	0.8	158	

Notes :
1) Unit price was adopted the average price of Dubai Wholesale Market's during the harvesting months of each vegetables in 1993
2) Production cost was adopted those of statistic data, MAF except water cost
3) Water cost was estimated as Dh. 0.54/m³ of irrigation water
4) D.S : Direct sowing. T.P : Transplanting. L.C : Long cycle crop
5) * : Adopted melon data. ** : Adopted turnip data

Table 4.8.4. Vegetable Experimental Cultivation Results of UNDP/FAO, 1982-1983, Greenhouse Cultivation

Crop	Cultivation Method	Production (ton/ha)	Unit Price (Dh./kg)	Gross Income (Dh./ha)	Production Cost (Dh./ha)	Net Income (Dh./ha)	Water Consumption (m³/ha)	Net Income Per W.C. (Dh./m³)	Days in Main Field (Days)	Cropping Season
Musk Melon	D.S	22.00	18.12	398,640	72,330	326,310	2,300	141.9	113	15/Oct-5/Feb
	D.S	11.65	20.00	233,000	72,060	160,940	1,800	89.4	92	15/Oct-15/Jan
	Average	16.83	19.06	315,820	72,195	243,625	2,050	115.6	103	
Cucumber	D.S	46.72	2.15	100,448	86,181	14,267	1,800	7.9	92	19/Oct-19/Jan
	D.S	53.32	2.15	114,629	86,343	28,286	2,100	13.5	96	4/Oct-8/Jan
	D.S	84.83	2.05	173,908	87,069	86,839	3,400	25.5	136	12/Sep-26/Jan
	D.S	70.40	1.95	137,280	86,853	50,427	3,000	16.8	115	14/Sep-7/Jan
	D.S	102.60	1.79	183,654	87,501	96,153	4,200	22.9	111	6/Feb-19/May
	T.P	109.00	1.79	195,110	87,717	107,393	4,600	23.3	109	12/Jan-28/May
	T.P	87.20	1.79	156,088	87,231	68,857	3,700	18.6	96	12/Jan-19/May
	D.S	82.60	1.79	147,854	87,285	60,569	3,800	15.9	99	9/Feb-19/May
	D.S	32.28	2.15	69,402	86,229	-16,827	1,800	-9.3	84	27/Oct-19/Jan
	D.S	48.30	1.97	95,151	86,853	8,298	3,000	2.8	118	12/Sep-8/Jan
	T.P	101.20	1.94	202,148	88,065	114,083	5,200	21.9	119	12/Jan-11/June
	Average	74.68	1.96	143,243	87,030	56,213	3,327	14.5	107	
Dwarf Bean	D.S	34.20	4.73	161,766	59,779	101,987	5,300	19.2	177	16/Nov-12/May
	D.S	20.40	4.64	94,656	58,729	35,927	3,400	10.6	146	15/Oct-10/Mar
	D.S	23.60	5.15	121,540	59,185	62,355	4,200	14.8	155	15/Nov-19/Apr
	D.S	22.20	5.15	114,330	59,239	55,091	4,300	12.8	130	4/Jan-14/May
	D.S	24.00	4.75	114,000	59,401	54,599	4,600	11.9	147	16/Dec-12/May
	D.S	20.80	4.85	100,880	59,671	41,209	5,100	8.1	187	16/Oct-21/April
	Average	24.20	4.88	117,862	59,334	58,528	4,483	12.9	157	
Sweet Pepper	T.P	153.95	2.62	403,349	50,924	352,425	7,500	47.0	207	12/Oct-11/June
	T.P	77.90	2.77	215,783	50,276	165,507	6,300	26.3	114	15/Feb-27/July
	T.P	105.50	2.29	241,595	51,218	190,377	8,000	23.8	232	3/Sep-1/June
	T.P	90.10	2.29	206,329	50,978	155,351	7,600	20.4	217	16/Sep-5/June
	T.P	85.40	2.29	195,566	51,218	144,348	8,000	18.0	232	3/Sep-1/June
	T.P	24.80	1.80	44,640	48,230	-3,590	2,600	-1.4	123	3/Sep-9/Feb
	T.P	24.80	2.02	50,096	48,824	1,272	3,700	0.3	146	16/Aug-9/Feb
	T.P*	23.70	2.02	47,874	48,824	-950	3,700	-0.3	146	16/Aug-9/Feb
	Average	73.27	2.26	175,654	50,062	125,593	5,925	16.8	177	
Tomato	T.P	96.70	1.31	126,677	51,656	75,021	7,400	10.1	129	14/Feb-27/July
	T.P	63.88	1.31	83,676	51,146	32,530	6,500	5.0	114	17/Jan-1/July
	Average	80.29	1.31	105,177	51,401	53,776	6,950	7.6	122	

Notes :
1) Unit price was adopted the average unit price in Dubai wholesale market during the harvesting months of each vegetables in 1993
2) Production cost was estimated as the total of open field costs(statistic data) and greenhouse material cost
3) Unit price and production cost of musk melon were adopted those of sweet melon
4) *: Cooling system
5) D. S : Direct sowing, T.P : Transplanting

Table 4.8.5. Balance Sheet of Livestock in the Study Area by Farm Inventory Survey

Kind of Animal	No. of Head Raised	Products in 1994		Unit Price (Dh.)		Value of Products (Dh.)			Raising Cost Paid (Dh.)	Net Income (Dh.)
		Livestock Born(Head)	Milk/Egg (Lit./pcs.)	Livestock Per Head	Milk/Egg per Lit./pcs.	Livestock Born	Milk & Egg	Total		
Goat	6,675	1,447	12,059	249	3.76	360,303	45,342	405,645	624,935	-219,290
Sheep	5,720	1,094		295		322,730	0	322,730	665,413	-342,683
Camel	757	26		6,053		157,368	0	157,368	243,060	-85,692
Cattle	1,191	146		1,067		155,797	0	155,797	472,347	-316,550
Chicken	2,144	126	215,898	25	6.68	3,150	1,442,195	1,445,345	54,282	1,391,063
Horse	21	5							19,655	
Geese	76	0							7,260	
Pigeon	315	65							7,511	
Duck	24	0							1,475	
Falcons	6	0							200	
Antelopes	7	1		1,000		1,000	0	1,000	200	800
Donkey	1	0							492	
Doves	40								1,200	
Peacock	6	0							33	

Note: 1) Number of farms surveyed: 184 Farms
2) Production Cost consists of feed cost purchased, health cost and labor cost

Table 4.9.1. Groundwater Quality in the Study Area by Existing Well Inventory Survey

Item		Extension Unit					Survey Total
		Kadrah	Dhaid-1	Dhaid-2	Falaj Al Mualla	Meleiha	
Electric Conductivity (µS/cm)	Sample No.	33	104	100	72	152	461
	Average	2,620	3,494	1,919	2,535	2,886	2,739
	Maximum	7,860	37,700	6,480	15,370	9,170	37,700
	Minimum	1,220	200	619	933	414	200
Water Temperature (°C)	Sample No.	34	112	100	79	190	515
	Average	33.5	37.0	36.6	35.1	33.1	35.0
	Maximum	36.3	56.0	43.5	42.5	45.4	56.0
	Minimum	30.5	29.5	31.2	30.6	27.6	27.6
pH	Sample No.	32	112	84	71	185	484
	Average	7.7	7.8	8.2	7.7	7.4	7.7
	Maximum	9.8	8.8	8.9	8.2	8.0	9.8
	Minimum	6.6	6.3	6.6	7.2	4.0	4.0
Irrigation Water Salinity Class No.	Class 1	0	1	0	0	0	1
	Class 2	0	2	7	0	1	10
	Class 3	22	81	77	61	94	335
	Class 4	7	3	6	4	42	62
	Class 5	4	17	10	7	15	53
Irrigation Water Salinity Class in %	Class 1	0.00%	0.96%	0.00%	0.00%	0.00%	0.22%
	Class 2	0.00%	1.92%	7.00%	0.00%	0.66%	2.17%
	Class 3	66.67%	77.88%	77.00%	84.72%	61.84%	72.67%
	Class 4	21.21%	2.88%	6.00%	5.56%	27.63%	13.45%
	Class 5	12.12%	16.35%	10.00%	9.72%	9.87%	11.50%

Source : Farm and Existing Wells Inventory Survey, JICA Study Team, 1995

Notes: irrigation salinity class is estimated by electric conductivity by following criteria:

Class 1: EC < 250 µS/cm Class 2: 250 < EC < 750 µS/cm

Class 3: 750 < EC < 2,250 µS/cm Class 4: 2,250 < EC < 5,000 µS/cm

Table 4.9.2. Results of Groundwater Extraction Survey in 1978

Farm No.	Gross Area	Irrigated Area	Total Groundwater Extraction	Extracted Water per ha		Ratio Eto (= 2,200 mm)	Remarks
	ha	ha	m³/annum	m³/ha/annum	mm/ha		
1	2.52	1.51	82,026	54,322	5,432	247%	
2	2.18	1.53	89,435	58,454	5,845	266%	
3	2.23	1.78	106,141	59,630	5,963	271%	
4	3.31	2.58	156,600	60,698	6,070	276%	
5	2.27	1.82	107,730	59,192	5,919	269%	
6	9.05	3.62	76,006	20,996	2,100	95%	Drip Irrigation applied (70% area)
7	8.68	3.47	178,360	51,401	5,140	234%	
8	8.76	3.50	147,911	42,260	4,226	192%	
9	9.13	4.70	155,740	33,136	3,314	151%	G.I. pipe distribution
10	4.00	2.08	106,054	50,988	5,099	232%	
11	2.86	2.00	110,185	55,093	5,509	250%	
12	8.92	3.57	122,271	34,250	3,425	156%	G.I. pipe distribution
13	2.23	1.34	79,757	59,520	5,952	271%	
14	6.41	2.56	108,113	42,232	4,223	192%	
15	2.16	1.44	81,613	56,676	5,668	258%	
Average	4.98	2.50	113,863	49,256	4,926	224%	

Source : UNDP/FAO/MAF. "Cropping Pattern and Irrigation Requirements, Central Region. UAE". Technical Report 3, May 1978

Table 4.9.3. Results of Groundwater Extraction Quantity Survey in the Study Area

Farm	Location	Falaj Al Mualla	Dhaid West	Dhaid East	Mileiha East	Wisha	Khuderah	Jabal Mileiha	Mileiha	Ikedir	Filli	Average
Total Farm Area		2.65	3.39	2.06	2.23	4.15	6.20	7.00	4.67	6.20	3.36	4.19
Cultivation Area in ha	Date Palm	0.60	0.88	0.92	0.08	2.82	2.24	1.90	0.78	1.17	0.56	1.20
	Forage Crops	0.32	0.00	0.00	1.11	0.34	1.94	0.30	1.30	2.52	1.57	0.94
	Others	0.00	0.48	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.08
	Total	0.92	1.36	1.23	1.19	3.16	4.18	2.20	2.08	3.69	2.16	2.22
Extraction	Avg. m³/day	289	104	15	160	157	250	100	298	825	498	269.60
	Unit Water m³/ha	314	76	12	134	50	60	45	143	224	231	128.96
	Unit Water m³/ha	109	31	7	72	38	40	14	64	133	148	65.63
	Est. Annual (m³/ha)	86,386	21,029	3,354	36,975	13,663	16,447	12,500	39,399	61,484	63,403	35,464
Net Irrigation Requirement	ETo in July (mm/day)	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	
	Kc Date Palm	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
	Kc Fodder	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
	Date Palm (mm/day)	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	
	Forage Crop (mm/day)	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	
	Total Net Requirement (m³)*	32			63	86	161	62	91	168	100	
	Irrigation Efficiency	10%			47%	173%	269%	136%	63%	75%	44%	102%
Annual Water Requirement	Date Palm (m³)	3,726			497	17,512	13,910	11,799	4,844	7,266	3,478	
	Forage Crops (m³)	4,637			16,084	4,927	28,111	4,347	18,837	36,515	22,749	
	Total (m³)**	4,364			11,408	8,702	23,851	6,583	14,639	27,740	16,968	
	Irrigation Efficiency	5%			31%	64%	145%	53%	37%	45%	27%	51%

Note : * net irrigation area assumed 0.3 and 0.8 for date palm and forage crops, respectively
Source : JICA Study Team 1995

Table 4.10.1. Endemic Spices of Fauna in the Study Area

Gechoes :	Hemidactylus turcicus, Hemidactylus flaviviridis, Teratoscincus scincus, Pristurus rupestris, Stenodactylus doriae, Stenodactylus arabicus, Stenodactylus leptocosymbotes
Agamid lizards :	Uromastyx microlepis, Agama jayakari, Agama sinaita, Phrynocephalus arabicus, Phrynocephalus maculatus
Lacertid lizards :	Acanthodactylus boskianus, Acanthodactylus opheodurus, Acanthodactylus schmidti, Mesalina adramitana
Shinks :	Mabuya tesellata
Worm lizards :	Diplometopon zarudnyi
Monitor lizards :	Varanus griseus
Toads :	Bufo arabicus, Bufo dhufarensis
Cobras :	Walterinnesia aegyptia
Vipers :	Cerastes gasperettii, Echis carinatus sochureki
Colubrid snakes :	Psammophis schokari (Venomous), Spalerosophis diadema (Non-venomous), Lytorhynchus gaddi , Coluber rhosorachis, Malopon moilensis
Boas :	Eryx jayakari
Gerbillus nanus :	Gerbillus nanus, Meriones libycus, Meriones crassus
Jerboas :	Jaculus jaculus
Rat :	Acomys dimidiatus, Acomys russatus
Hedgehogs :	Paraechinus aethiopicus dorsalis, Lepus capensis cheesmani
Mongooses :	Ichneumia albicauda albicauda
Bodgers :	Mellivora capensis
Antelope :	Gazella dorcas saudiya (Very rare), Gazella gazella arabica (Rare)
Dogs :	Vulpes vulpes arabica, Vulpes rueppelli sabaea (Rare)
Cats :	Felis margarita (Endangered)
Birds :	Alaemon alaudipes, Ammomanes deserti, Coracias benghalensis, Corvus ruficolis, Eremopterix nigriceps, Francolinus pondicerianus, Galerida cristata, Lanius excubitor, Merope orientalis, Nectarinia asiatica, Passer domesticus, Prinia gracillis, Pterocles ex

Source : The National Atlas of the United Arab Emirates

Table 4.10.2. Endemic Spices of Flora in the Study Area

Very common	
Grasses :	Stipagrostis plumosa
Shrubs :	Hammada elegans, Leptadenia pyrotechnica, Ochradenus arabicus, Ochradenus aucheri,
Trees :	Acacia tortillis
Other annuals :	Asphodelus fenuifolius, Savignya parviflora, Schweinfurthia papilionacea
Common	
Grasses :	Astenatherum forskalii
Shrubs :	Tephrosia persica
Trees :	Prosopis cineraria
Other perennials :	Cyperus conglomeratus
Uncommon	
Grasses :	Cenchrus pennisetiformis, Tragus berteronianus
Shrubs :	Capparis cartilaginea, Rhazya stricta, Salvadora persica
Trees :	Calotropis procera
Other perenials :	Morettia parviflora, Polycarpea spp.

Source : The National Atlas of the United Arab Emirates

Table 4.10.3. Banned Pesticide by the Ministry of Agriculture (Decree No. 97, 1993)

Insecticide:	Parthion, Aldrin, HHDH, Dieldrin, HEOD, Chlordane Heptachlor, PCP, BHC, HCH, Heachlorocyclohexane, Ethylenedibromide, DDT, Chlordimeform, Chloropicrin, Disulfoton, Methoxychlor, Demeton, Sodium Fluoride, Fluoroacetmide, Endrin, Camphechlor, Chlordecone, Mirex, Strobane, Schradan, Leptophos, Telodrine, Kelevan, Aldicarb, Parathion, Phosphamidon, Lindane, Gamma-BHC Aluminium phosphid, Zinc phosphide, Dicofol, Methamidophos, Methyl bromide, Monocrotophos, Carbofuran, Dichlorvos, TEPP, Ethyl Pyrophosphate, Chlorobenzilate, Cyhexa
Rodenticide:	Arsenic compounds, Sodium Fluoracetate, Thallium sulphate
Fungicide	HCB, Hexachlorobenzene, Mercury compounds, Captafol,
Herbicide:	2,4,5-T, mitrole, Nitrophen, Mercury compounds, Dinoseb, Paraquat
Nematocide :	DBCP, Dibromo-Chloropropane

Source : The National Atlas of the United Arab Emirates

Table 4.10.4. Number of Student at the UAE University by Sex

	1991/92	1992/93	1993/94
Male	2,611	2,401	2,611
Female	6,706	7,245	8,777
Total	9,317	9,646	11,388

Source: UAE Census 95

Table 4.10.5. Distribution of National Administrative, Technical and Teaching Staff According to Jobs and Sex in 1993/94

Jobs	Male	Female	Total
Administrative Staff			
Principal	105	280	385
Vice Principal	102	294	396
Supervisor	74	193	267
Secretary	96	411	507
Storekeeper	3	84	87
Total	380	1,262	1,642
Technical Staff			
Social Service Specialist	135	439	574
Librarian	5		131
Laboratory Technician	2	148	150
Total	142	587	855
Teaching Staff			
K.G.	0	542	542
Primary	255	2,418	2,673
Prep+Secondary	169	1,539	1,708
Religious Ed.	9	0	9
Technical Ed.	4	0	4
Total	437	4,499	4,936
Grand Total	959	6,348	7,433

Source: Summary of Educational Statistics 1993 - 1994, Ministry of Education

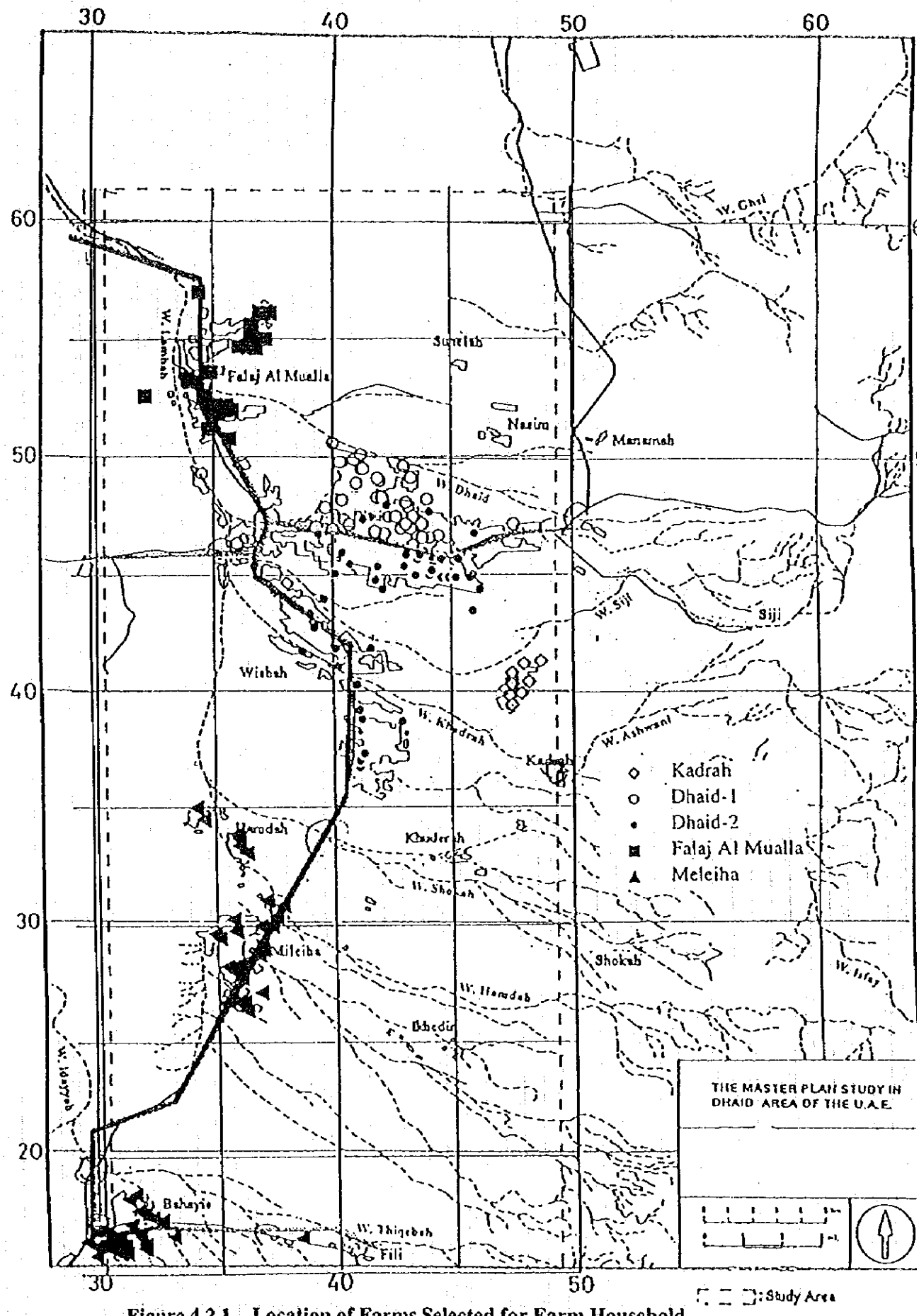
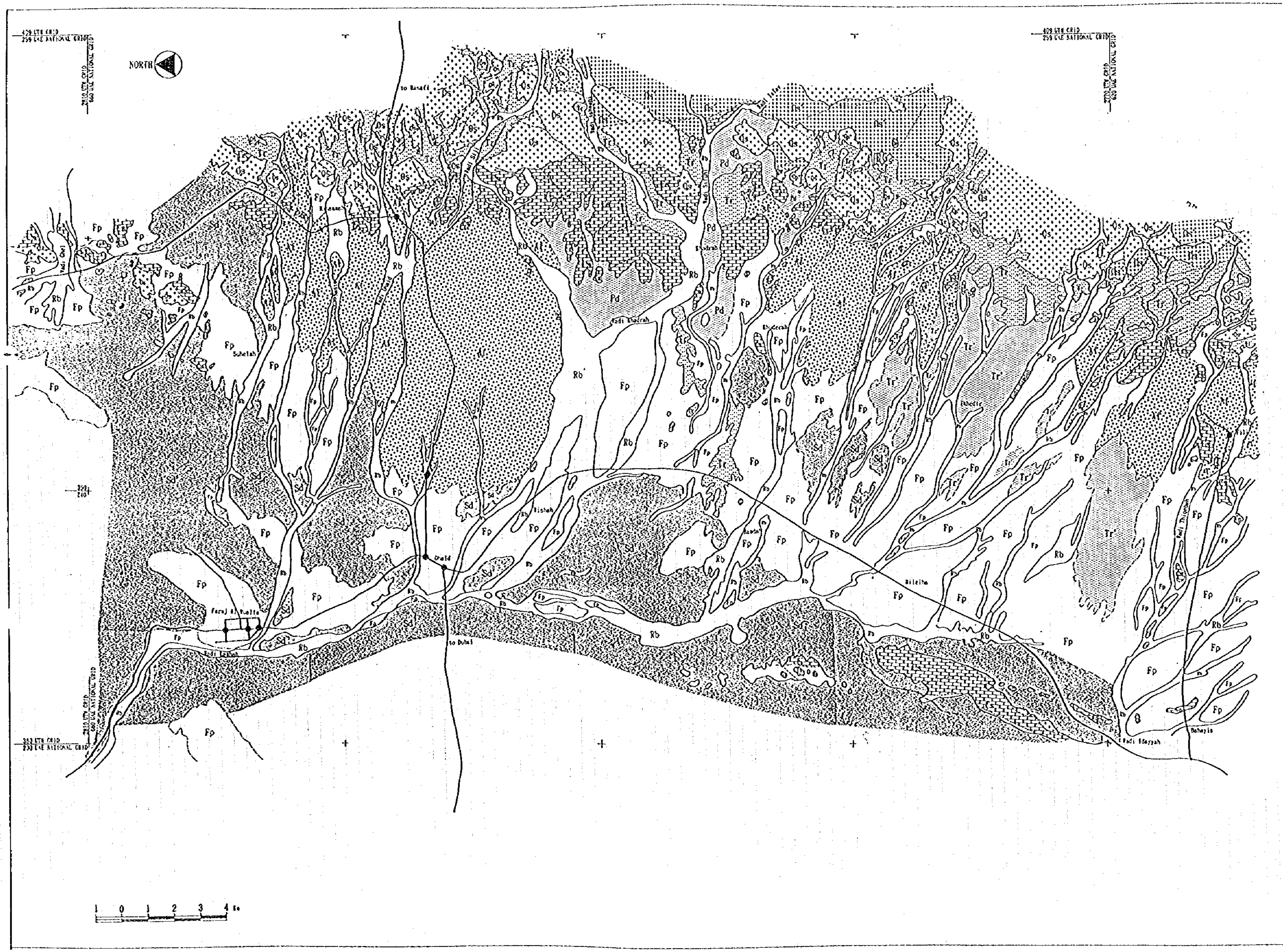
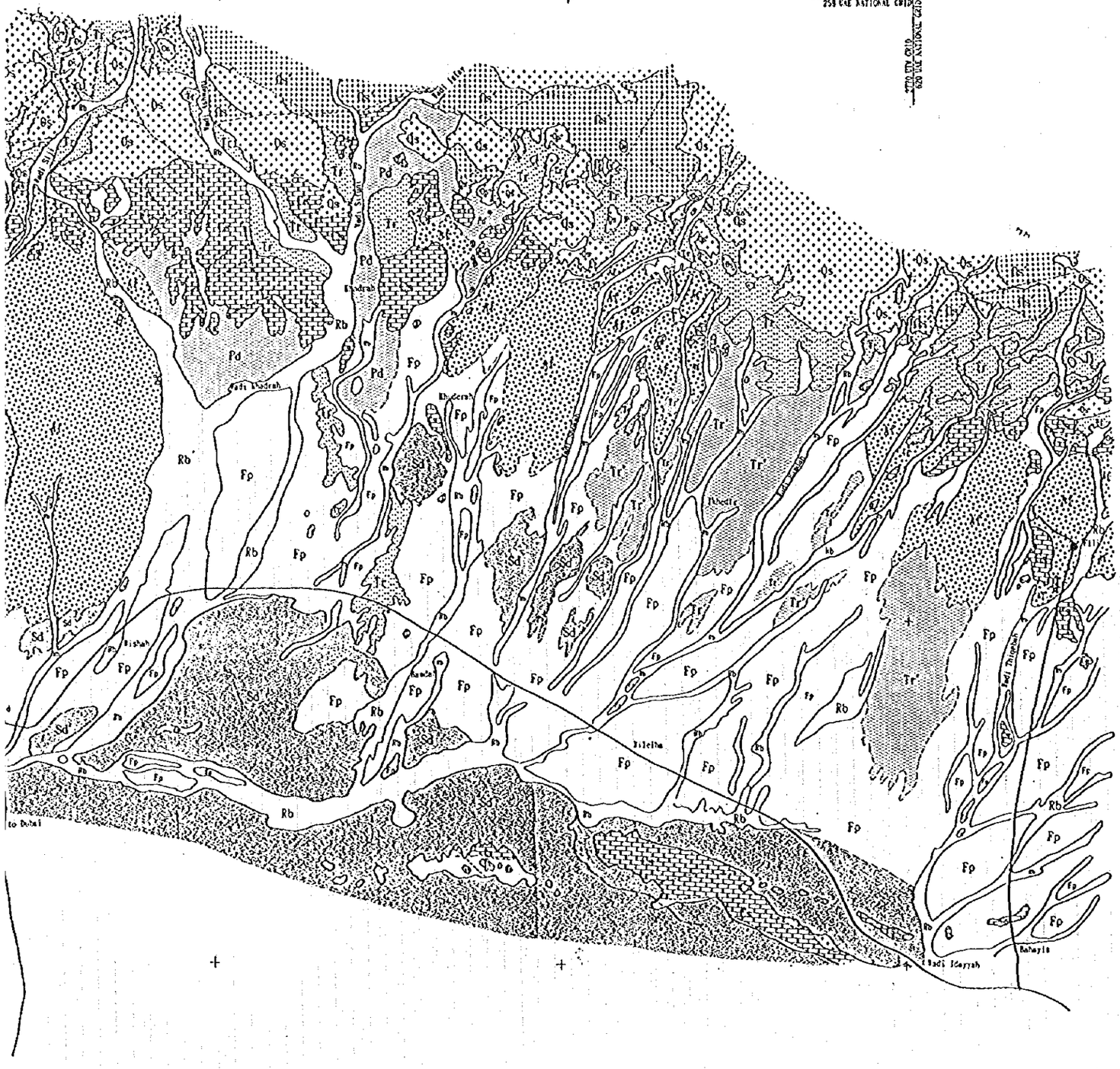


Figure 4.2.1. Location of Farms Selected for Farm Household and Existing Well Inventory Survey



NORTH
429 UTM GRID
259 UAE NATIONAL GRID
Fp
Rb
Sd
Tr
Pd
Fp
Rb
Sd
Dhaid
to Dubai
1 0 1 2 3 4



Topographical Division	Geomorphologic Symbols	Land Form Type	Geologic Symbols	Geological Unit
Inland Plain and Sand Dune	Af	[Af]Alluvial Fan(old/dissected)		[Af]Superficial Deposit(Recent alluvial gravel, sands and screen)
	Af	[Af]Alluvial Fan(new/active)		
	Fp	[Fp]Flood Plain,		
	Rd	[Rd]River Bed(active wadi)		
	Sd	[Sd]sand dune and trough		
Foot-Hill Highland and Gravel Plain	Tr	[Tr]Trace(or Dissected) Limestone and carbonates	Qs	Neoautochthonous Unit (Maastrichtian-Tertiary Sediment):
	Pd	[Pd]Pediment Plain		[Jw]Juweiza Formation
				[Qh]Qahlah Formation and/or
				[Uar] Umm al Radhuma Formation and/or
				[Esh] Eocene shale and/or
				[Fa] Far Formation
				[UFa] Terrace Deposites(Cemented ravel)/Upper Far Formation
Oman Mountain Range		Erosional Slope	Qs	[Os]Semail Ophiolite Sequence
			Qs	Allochthonous Unit(Batinah Complex) :Hayabi Complex and/or Hawasina Assemblages

Figure 4.3.1 Geomorphologic Map of the Study Area

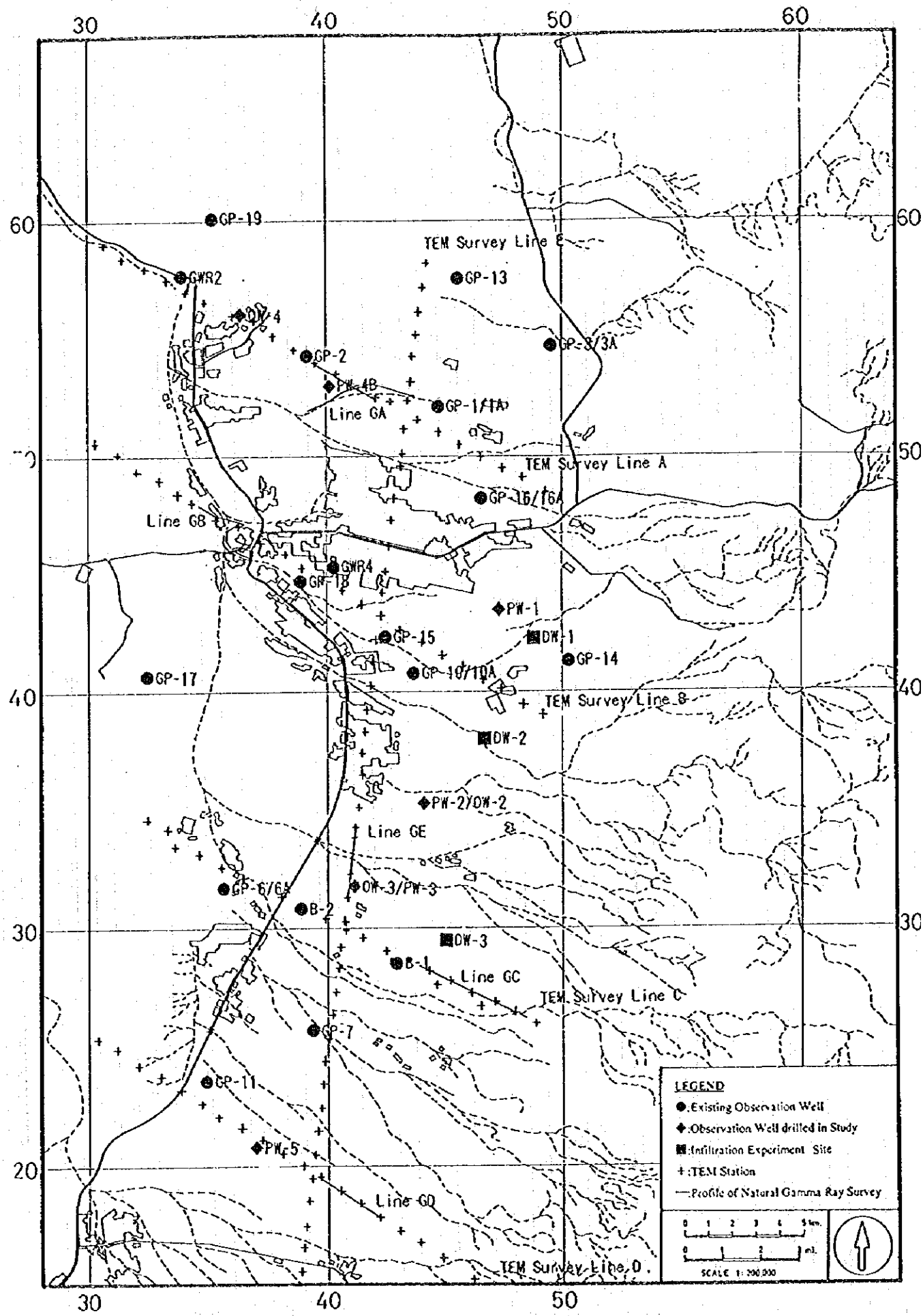
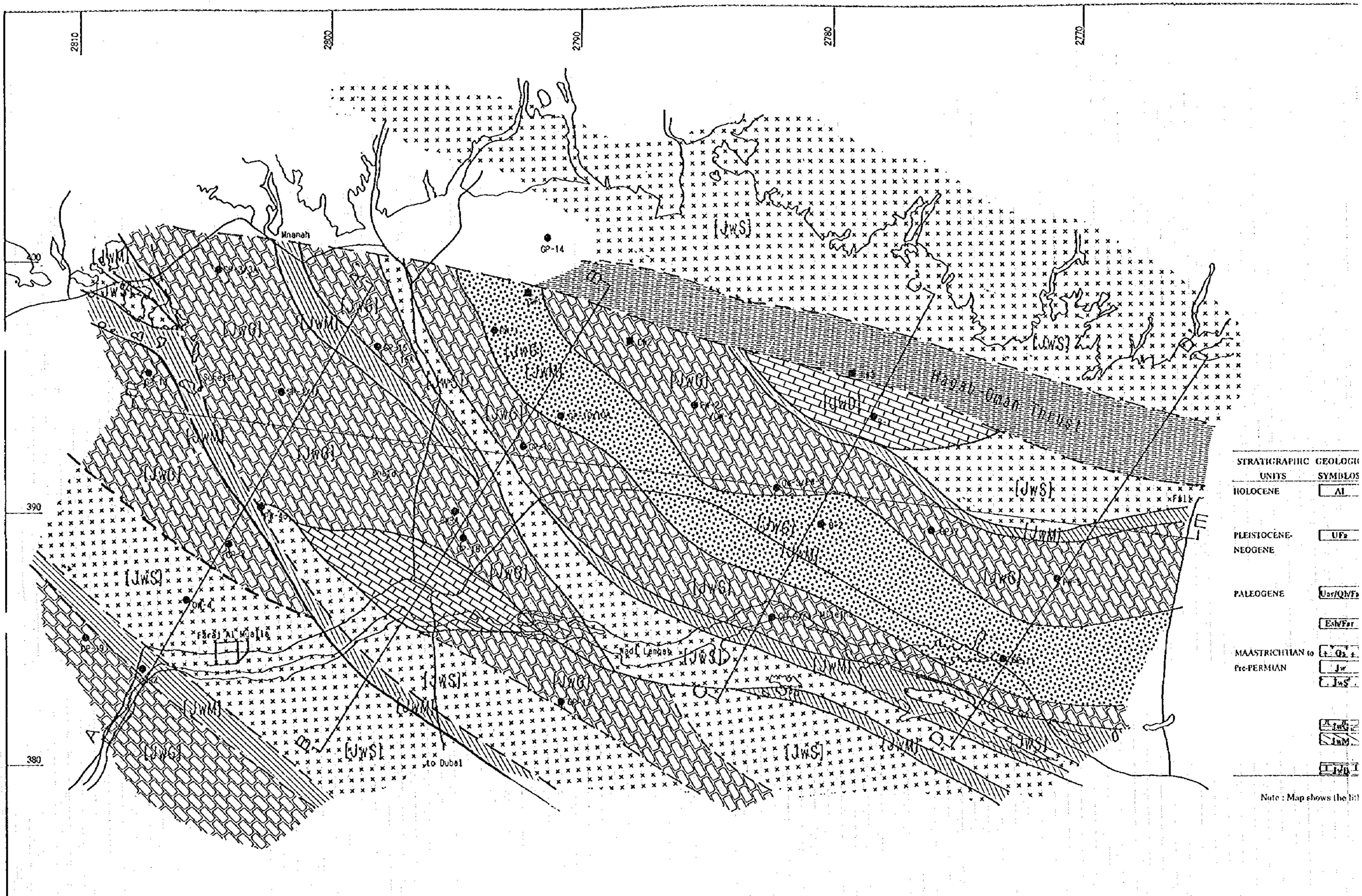
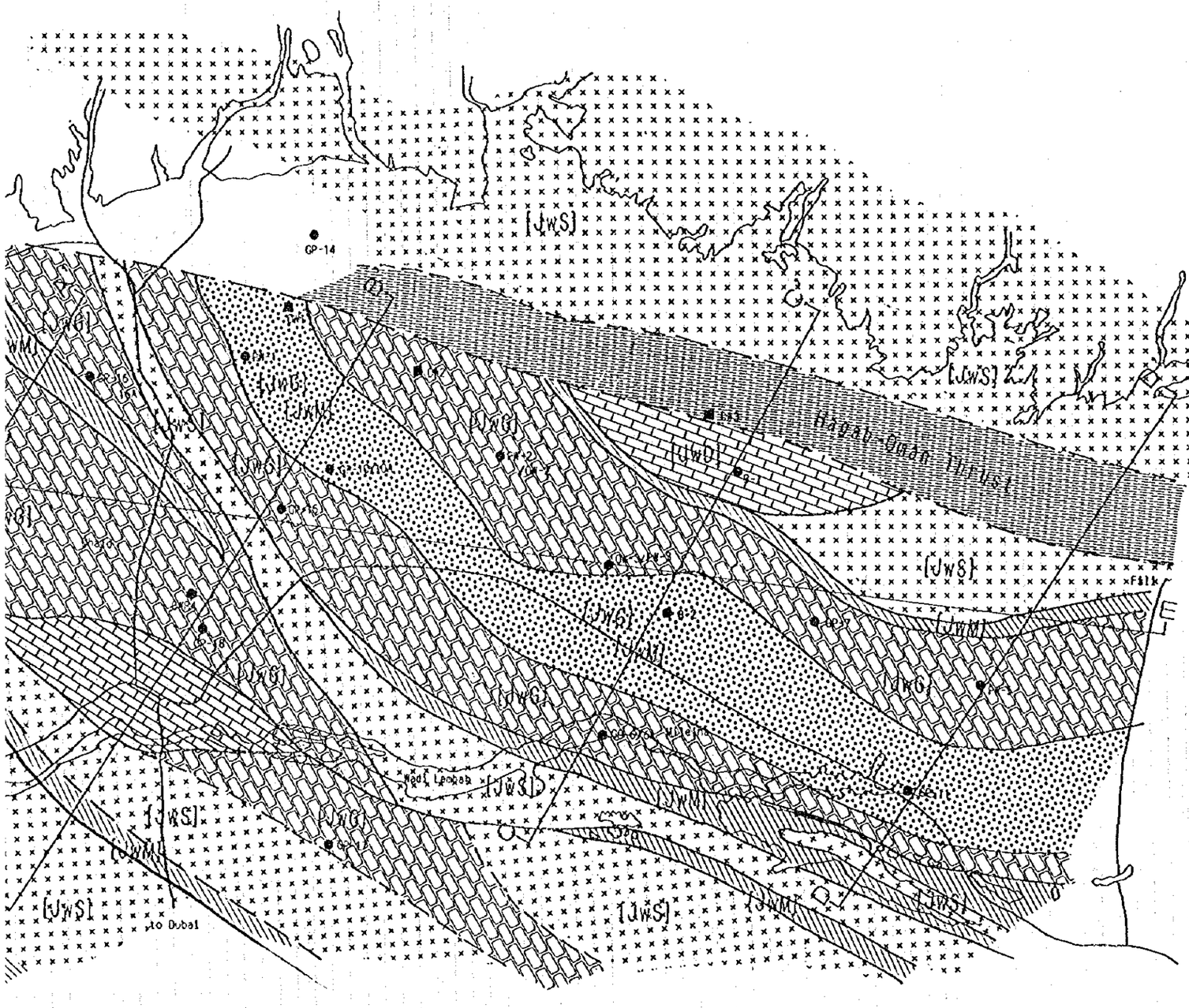


Figure 4.3.2 Observation Lines and Stations in the Study Area



2810
2800
2790
2780
2770
400
390
380
Mnamah
GP-14
[JwS]
[JwM]
[JwG]
Hagab-Oman Thrust
to Dubai
0
5km
STRATIGRAPHIC UNITS
HOLOCENE
PLEISTOCENE-NEOGENE
PALEOGENE
MAASTRICHTIAN to Pre-PERMIAN

Figure 4.3.3

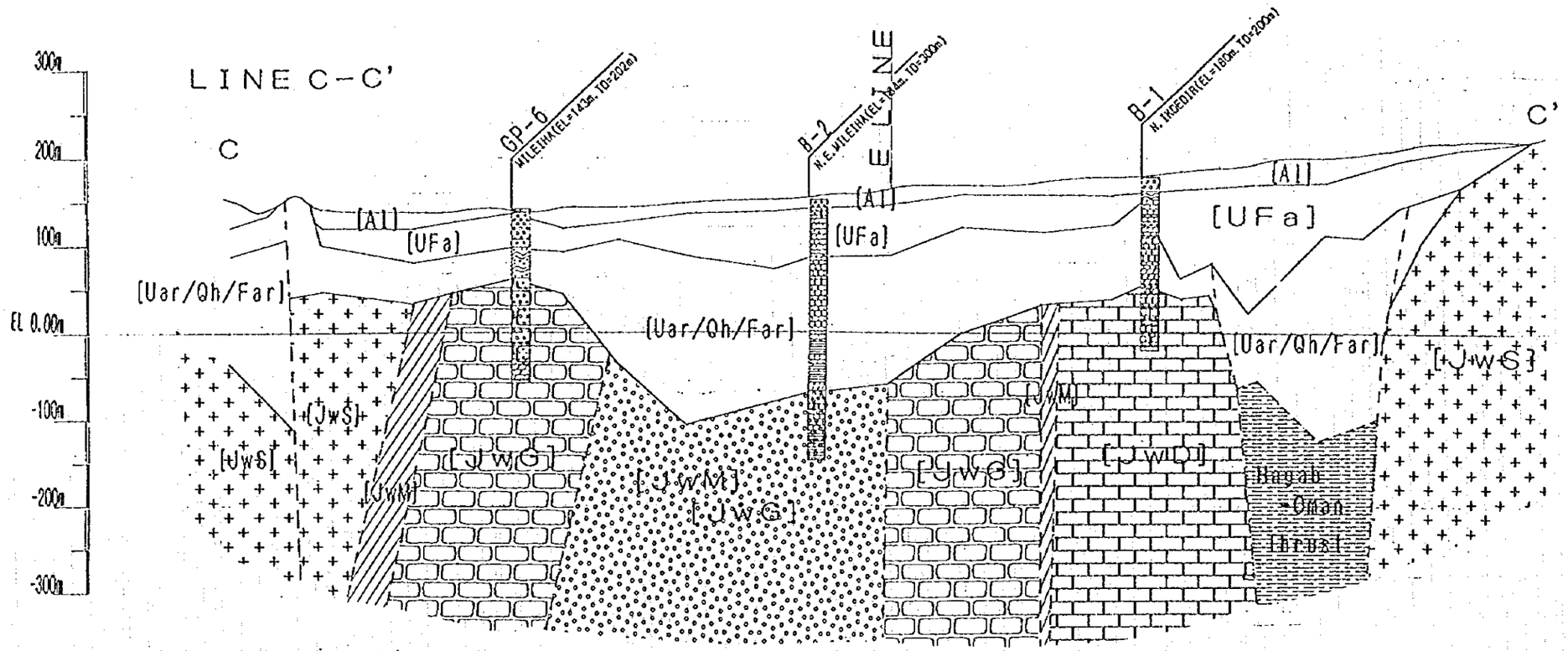


STRATIGRAPHIC UNITS	GEOLOGIC SYMBLOS	FORMATION CORRELATED	LITHOLOGY	RESISTIVE LAYER CORRELATED
HOLOCENE	Al	[Al]Superficial Deposit(Recent alluvial gravel, sands and screes)	Gravel, Gravel with sand and silt, partly cemented.	LAYER I (AVG. 100 ohm-m)
PLEISTOCENE-NEOGENE	UFa	[UFa]Post-Upper Far or Razzak Formation (Cemented sand and gravel)	Clay hard, Limestone,Marl, Gravel, Limestone Gravely and Sandy.	LAYER II (AVG. 50 ohm-m)
PALEOGENE	Uar/QN/Fac	[Uar/QN/Far] Umm al Radhuma, Qahlah , Far Formation	Shale, Limestone, Marl, Sandstone, Dolomite, Magnesite.	LAYER III (AVG. < 10 ohm-m)
	Esh/Far	[Esh/Far]Eocene shale, Far Formation		
MAASTRICHTIAN to Pre-PERMIAN	Os	[Os]Semail Ophiolite Sequence	Semail Ophiolite,	LAYER IV (AVG. 20 ohm-m)
	Jw	[Jw]Juwaiza Formation		
	JwS		[JwS]Limestone with Melange Serpentinite, [JwG]Gravely Facies, [JwM]Marly & shalely Facies, [JwD]Dolomitic Facies.	
	JwG			
	JwM			
	JwD			

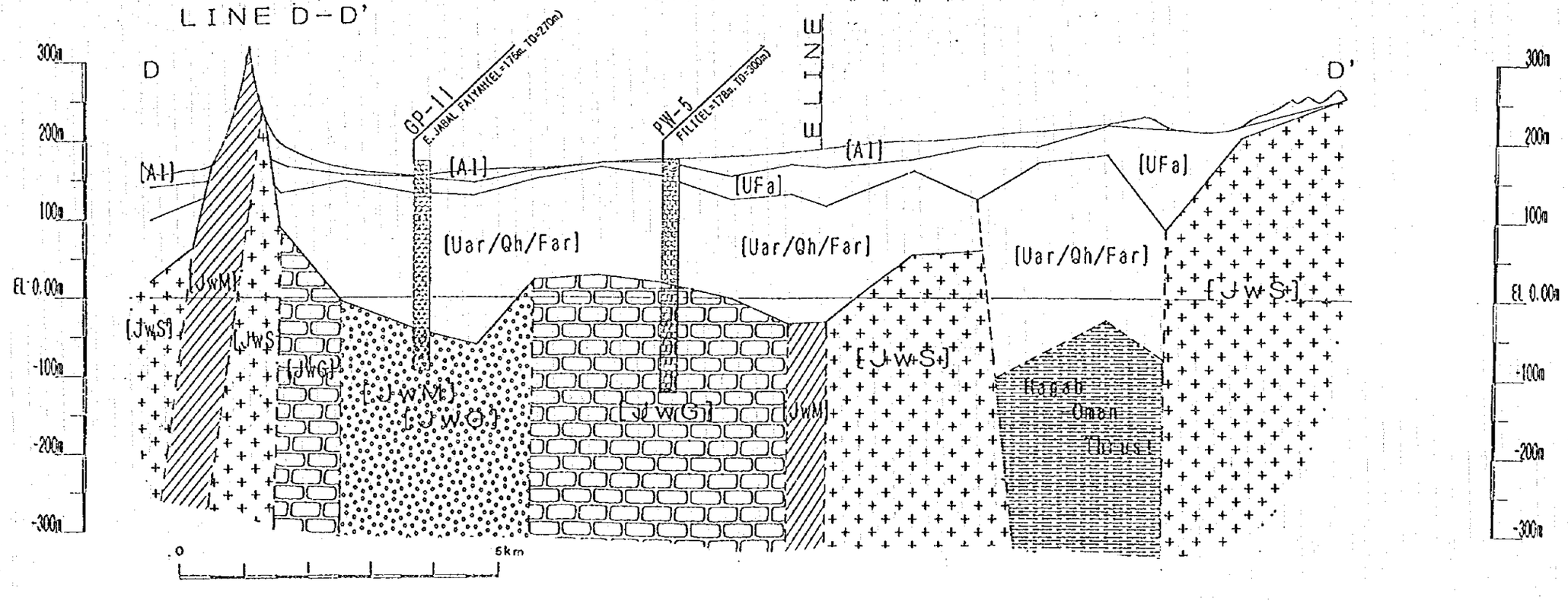
Note : Map shows the litho-facies of the surface of Lower Aquifer

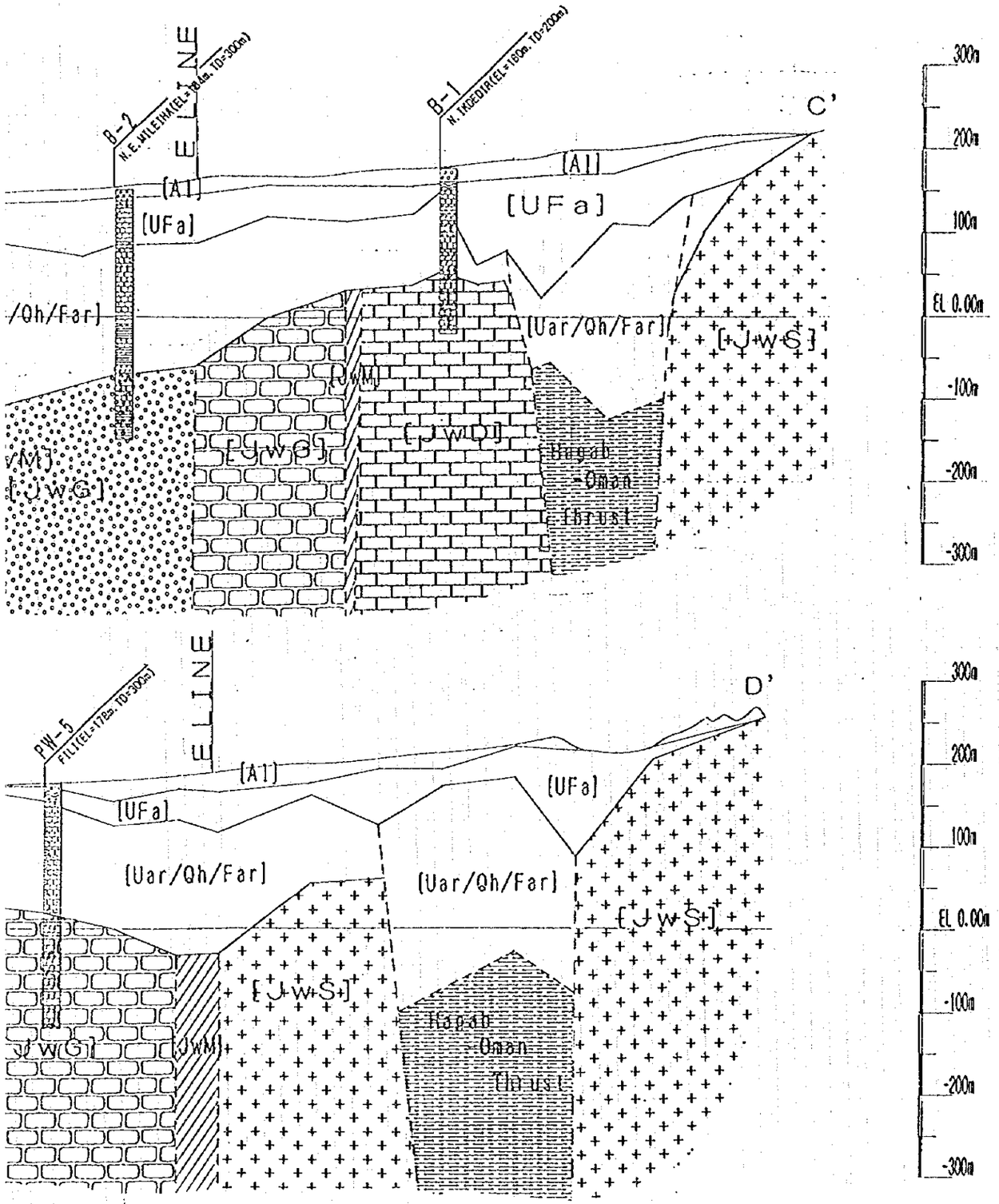
Figure 4.3.3 Sub-surface Geologic Map of the Study Area

LINE C-C'



LINE D-D'





Geologic Member in the Study Area

STRATIGRAPHIC UNITS	GEOLOGIC SYMBLOS	FORMATION CORRELATED	LITHOLOGY	RESISTIVE LAYER CORRELATED
HOLOCENE	Al	[Al]Superficial Deposit(Recent alluvial gravel, sands and screen)	Gravel, Gravel with sand and silt, partly cemented.	LAYER I (AVG. 100 ohm-m)
PLEISTOCENE-NEOGENE	UFa	[UFa]Post-Upper Far or Razzak Formation (Cemented sand and gravel)	Clay hard, Limestone,Marl, Gravel, Limestone Gravely and Sandy.	LAYER II (AVG. 50 ohm-m)
PALEOGENE	Uar/Qh/Far	[Uar/Qh/Far] Umm al Radhuma, Qahlah , Far Formation	Shale, Limestone, Marl, Sandstone, Dolomite, Magnesite.	LAYER III (AVG. < 10 ohm-m)
	Esh/Far	[Esh/Far]Eocene shale, Far Formation		
MAASTRICHTIAN to Pre-PERMIAN	Os	[Os]Semail Ophiolite Sequence	Semail Ophiolite,	LAYER IV (AVG. 20 ohm-m)
	Jw	[Jw]Juweiza Formation	[JwS]Limestone with Melange Serpentinite, [JwG]Gravely Facies, [JwM]Marly & shalely Facies, [JwD]Dolomitic Facies.	
	JwS			
	JwG			
	JwM			
	JwD			

Note : Map shows the litho-facies of the surface of Lower Aquifer

Figure 4.3.4 Geologic Cross-section along C-C' and D-D' Line

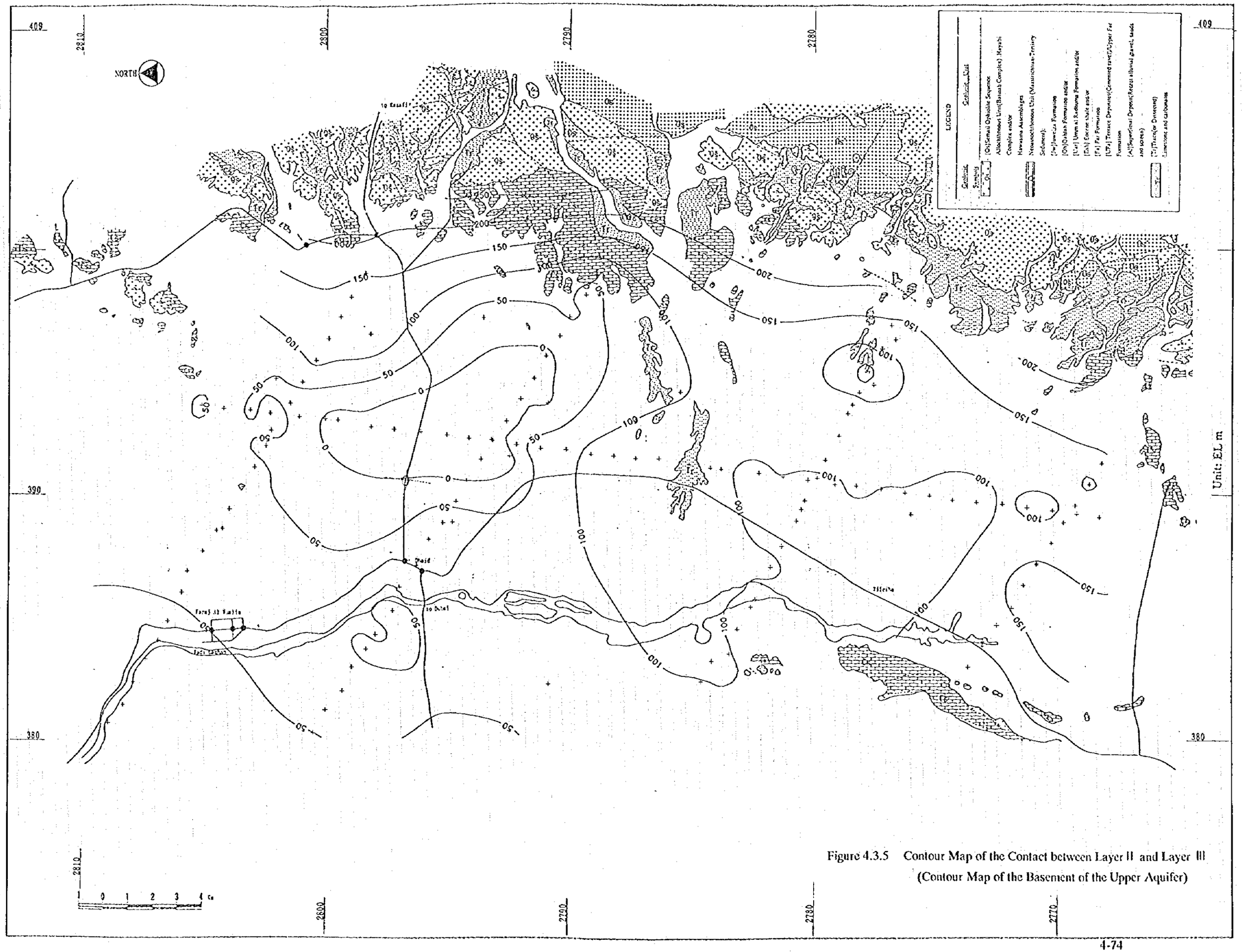


Figure 4.3.5 Contour Map of the Contact between Layer II and Layer III
(Contour Map of the Basement of the Upper Aquifer)

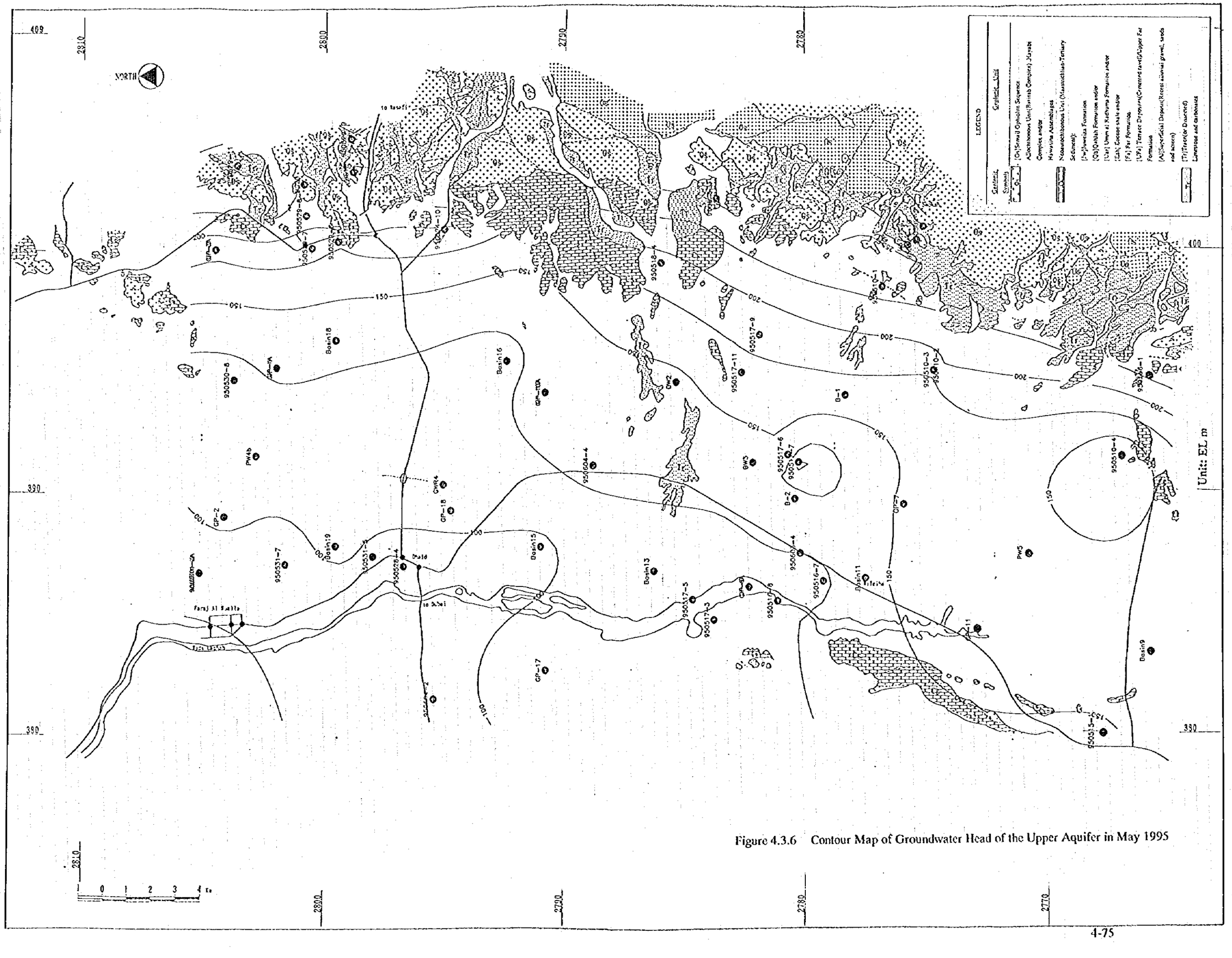


Figure 4.3.6 Contour Map of Groundwater Head of the Upper Aquifer in May 1995

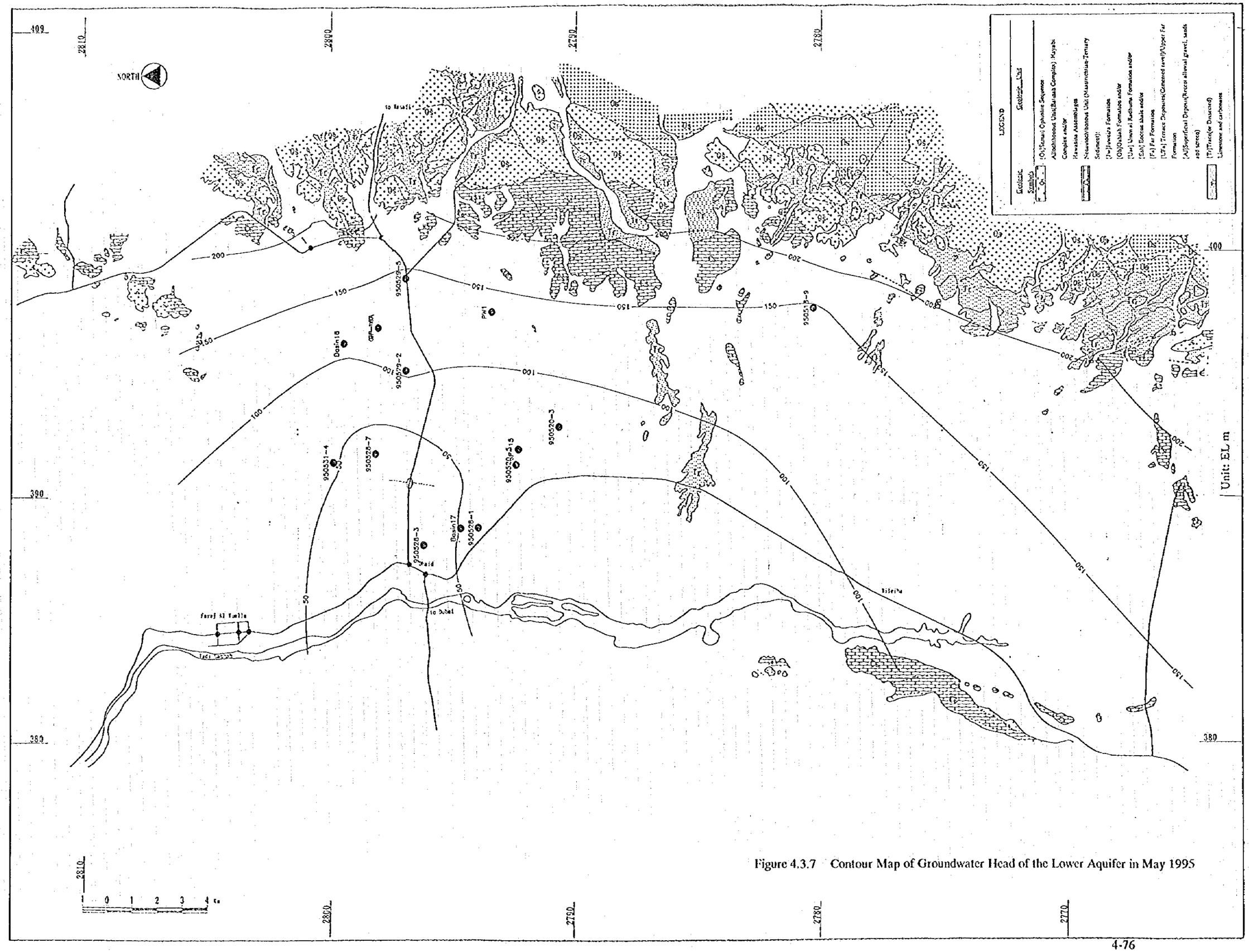
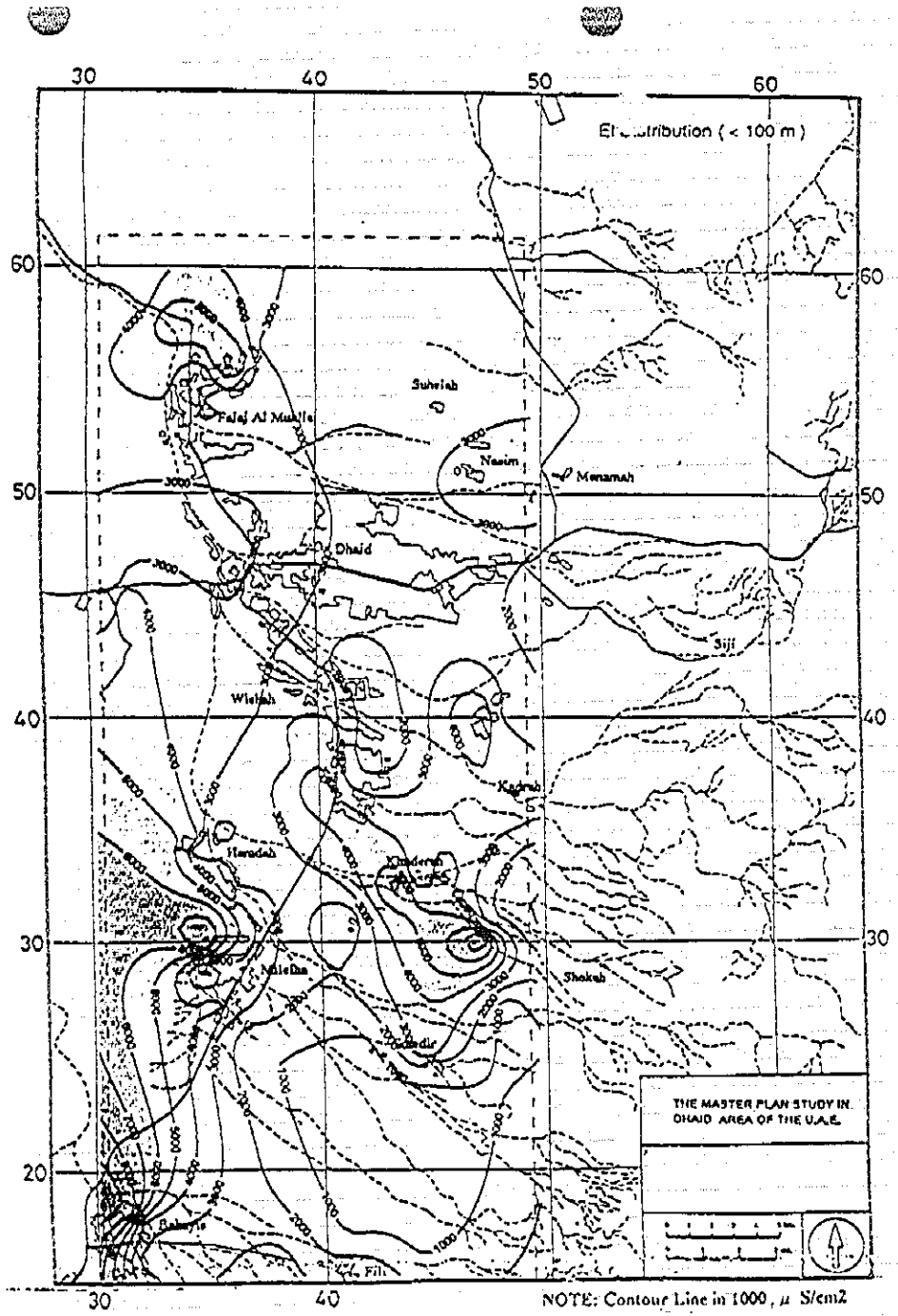
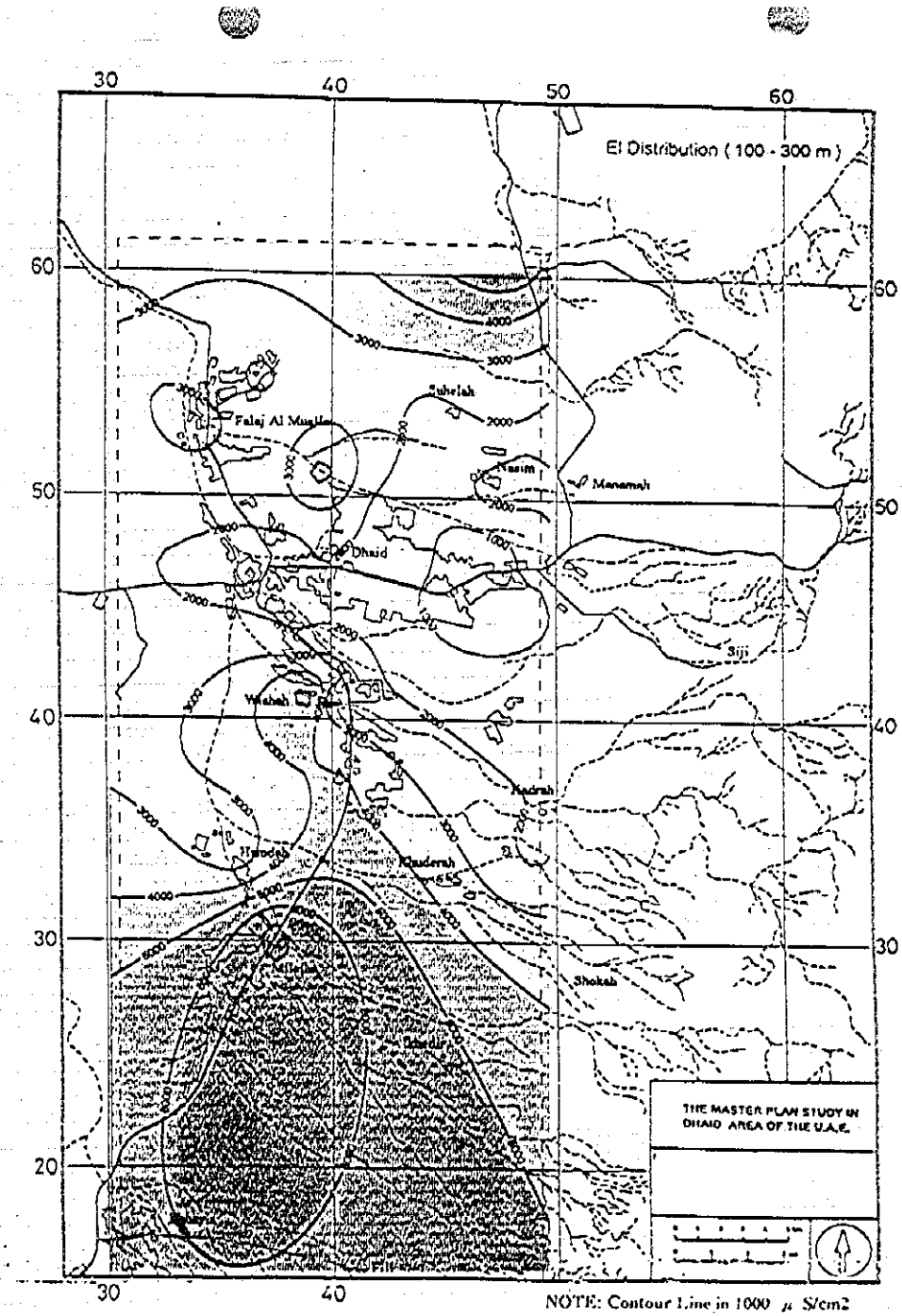
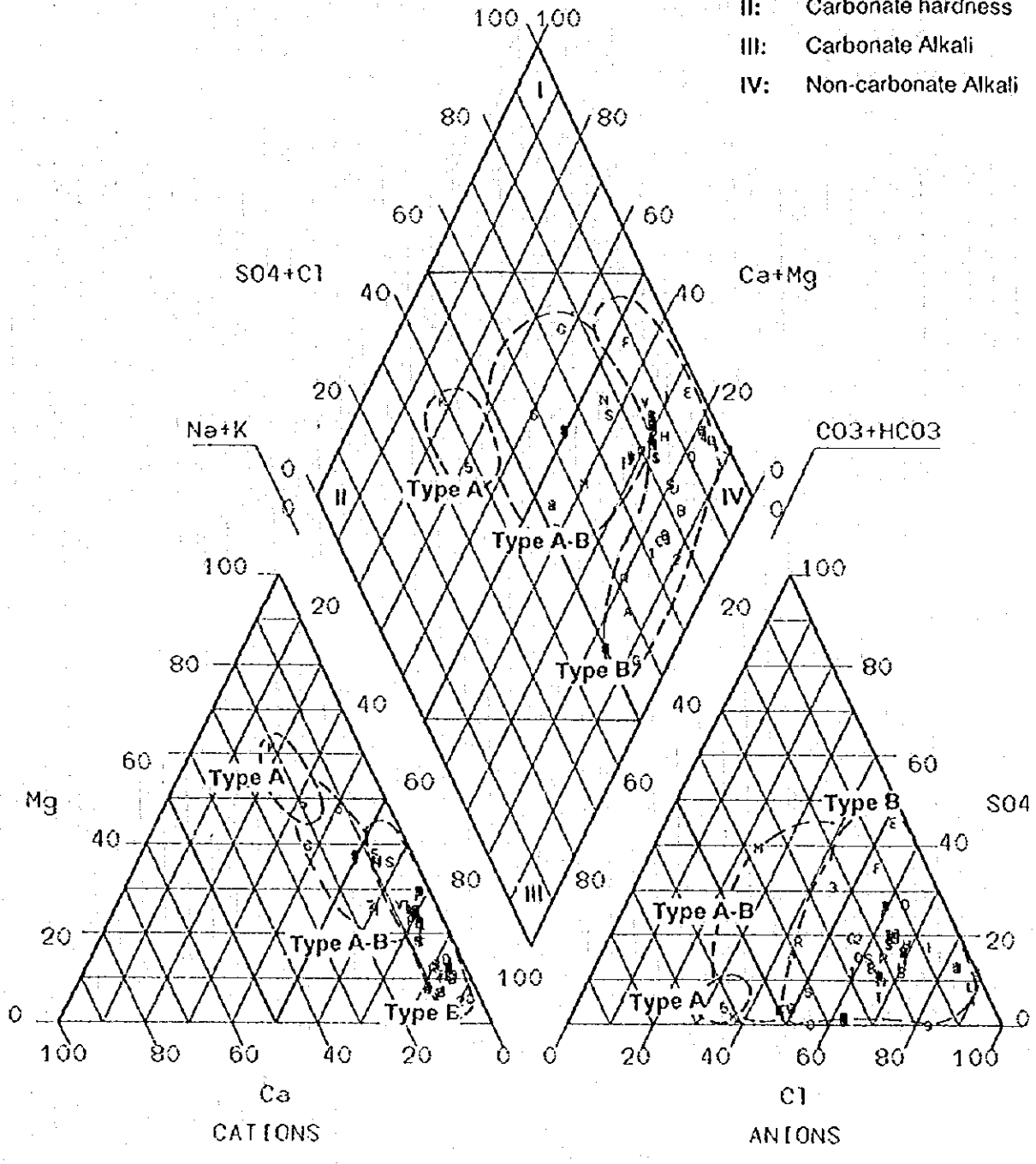


Figure 4.3.7 Contour Map of Groundwater Head of the Lower Aquifer in May 1995


El Distribution (< 100 m)
Falaj Al Mualla
Suhrlah
Nasim
Manamah
Dhaid
Sijji
Wasbah
Kadrah
Hamdah
Khaderah
Shokah
Mileiha
Fili
THE MASTER PLAN STUDY IN DHAID AREA OF THE U.A.E.
NOTE: Contour Line in 1000 , μ S/cm2


El Distribution (100 - 300 m)
Falaj Al Mualla
Suhrlah
Nasim
Manamah
Dhaid
Sijji
Wasbah
Kadrah
Hamdah
Khaderah
Shokah
Mileiha
Fili
THE MASTER PLAN STUDY IN DHAID AREA OF THE U.A.E.
NOTE: Contour Line in 1000 μ S/cm2



PIPER DIAGRAM

Type A: Aquifer in Oman Mountain

Type B: Aquifer in Bahada Plain

Type A-B: Contamination of type A with type B

Figure 4.3.9 Groundwater Quality (PIPER DIAGRAM)

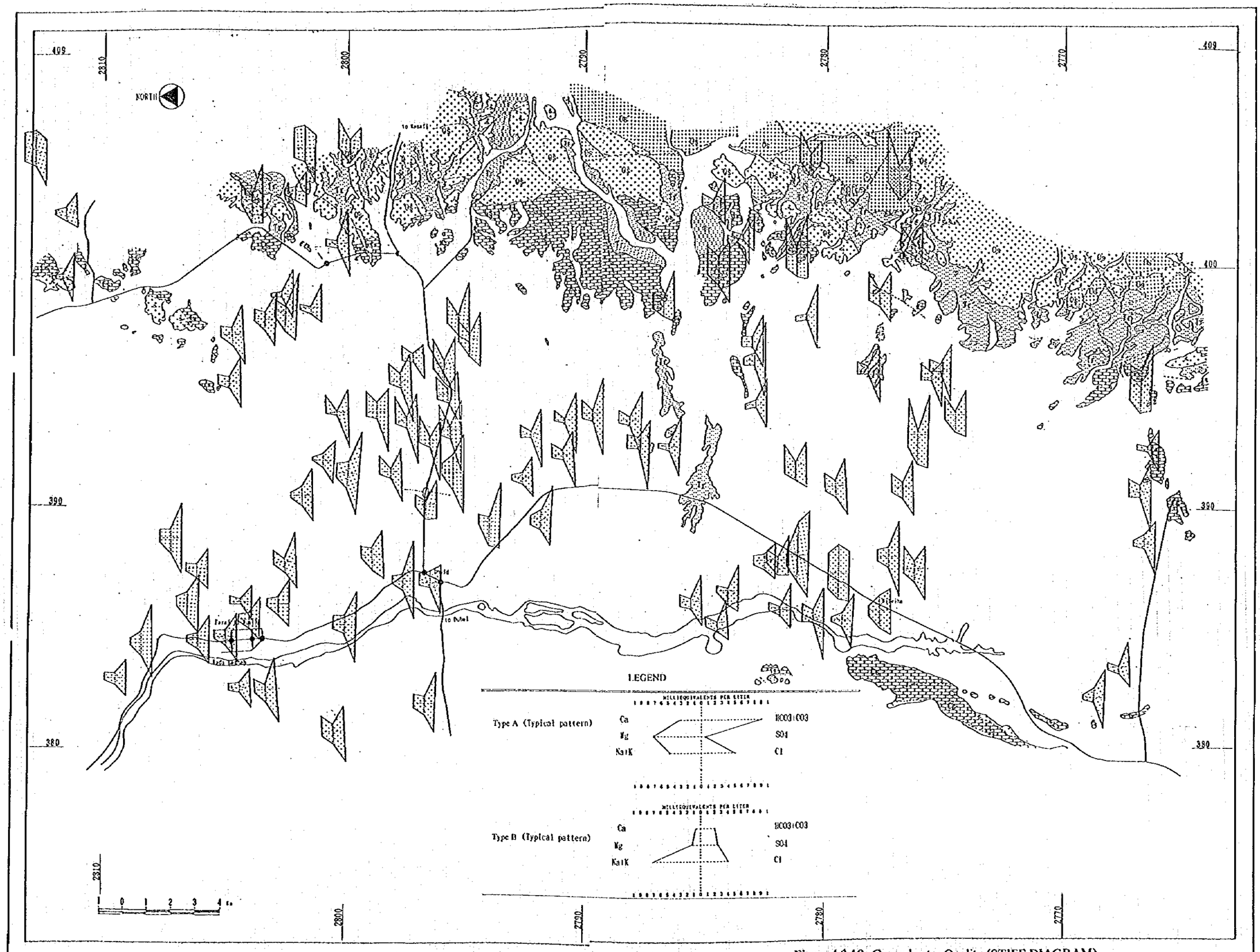


Figure 4.3.10 Groundwater Quality (STIFF DIAGRAM)

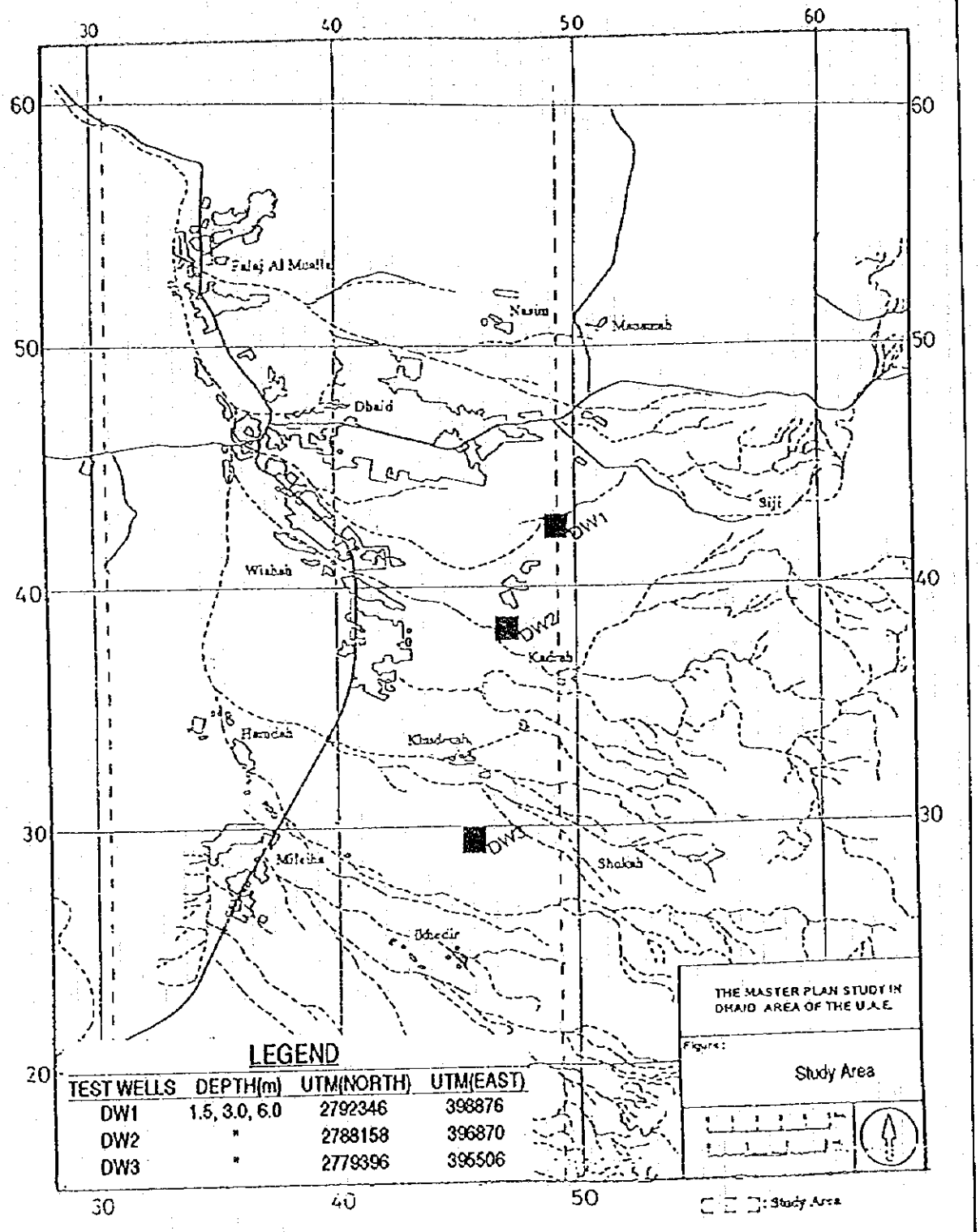


Figure 4.4.1

INFILTRATION EXPERIMENTS LOCATION PLAN

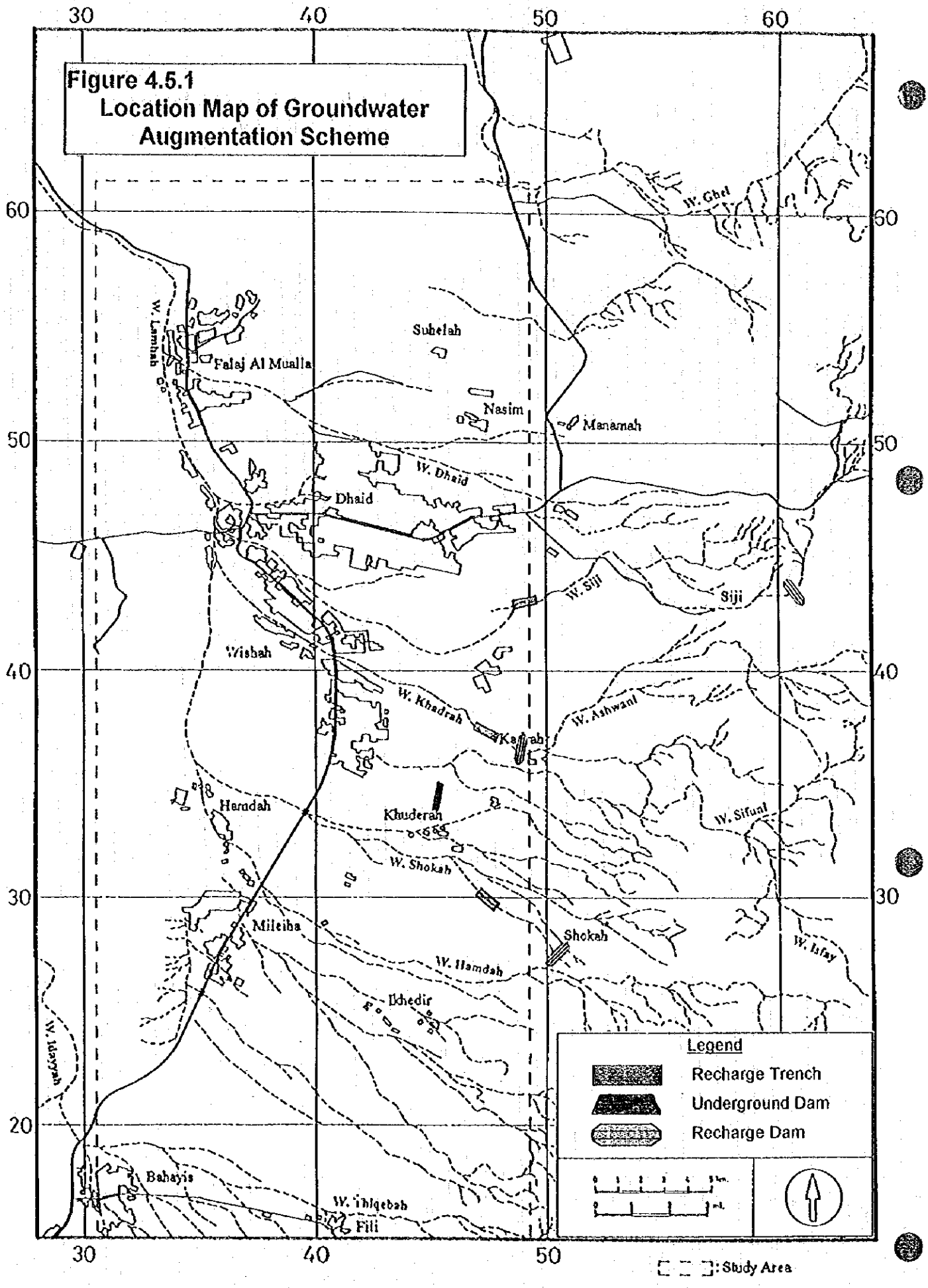


Figure 4.5.1
Location Map of Groundwater Augmentation Scheme
30
40
50
60
W. Ghel
W. Lambah
Falaj Al Mualla
Suhelah
Nasim
Manamah
W. Dhaid
Dhaid
W. Siji
Siji
Wishah
W. Khadrah
Kasrah
W. Ashwani
Hamdah
Khuderah
W. Sifuni
W. Shokah
Mileiha
Shokah
W. Isfay
W. Hamdah
Idhedir
W. Idayrah
Bahayis
W. Thiqebah
Fili
Legend
Recharge Trench
Underground Dam
Recharge Dam
: Study Area

Figure 4.5.2 Typical Dam Cross-Section

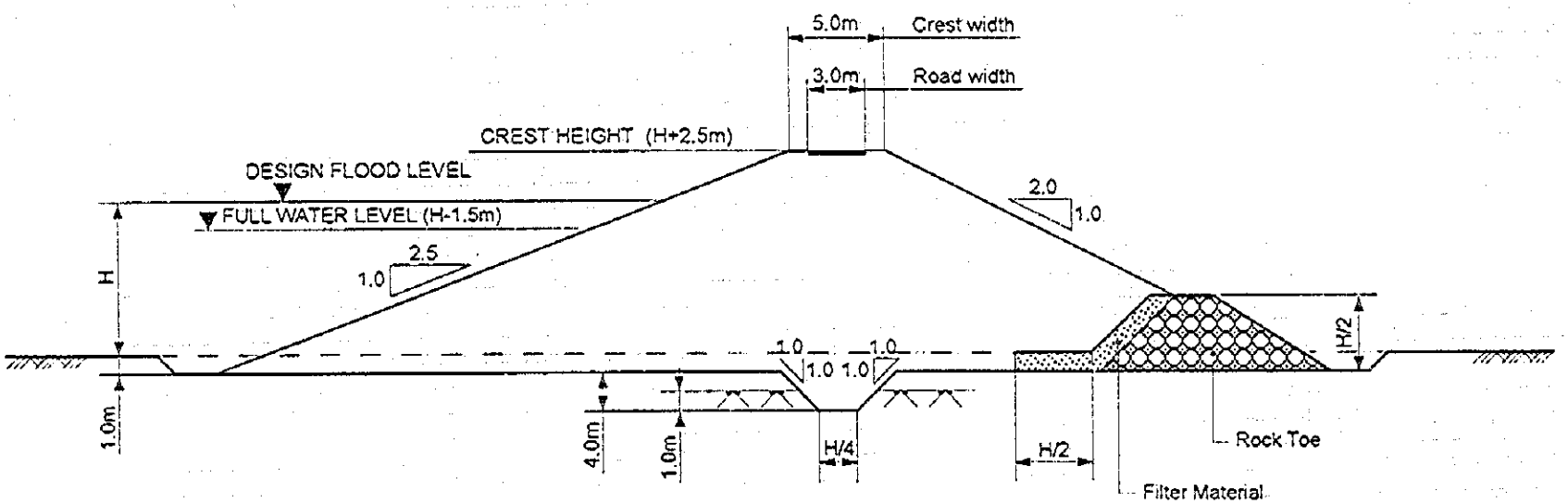
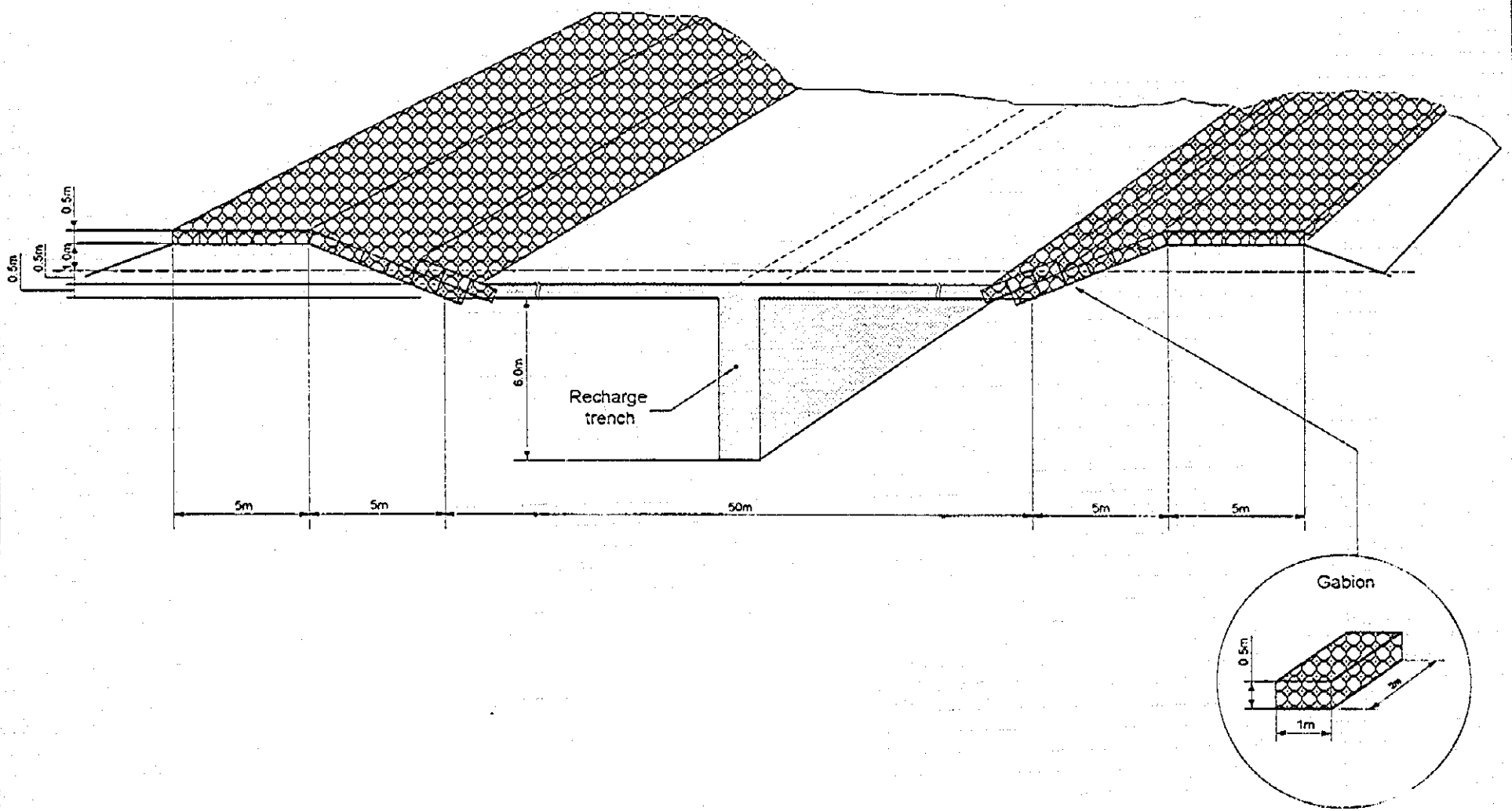
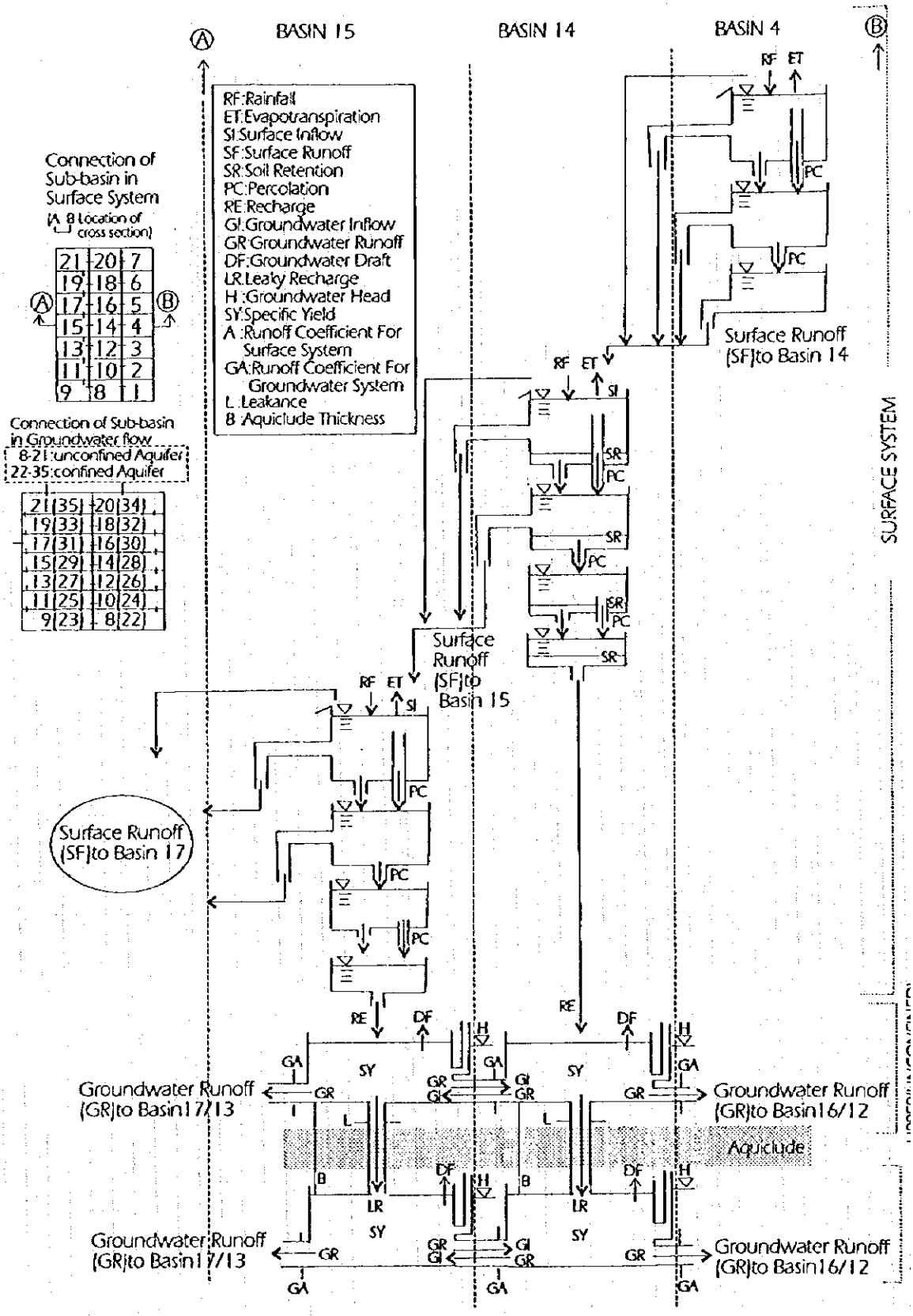
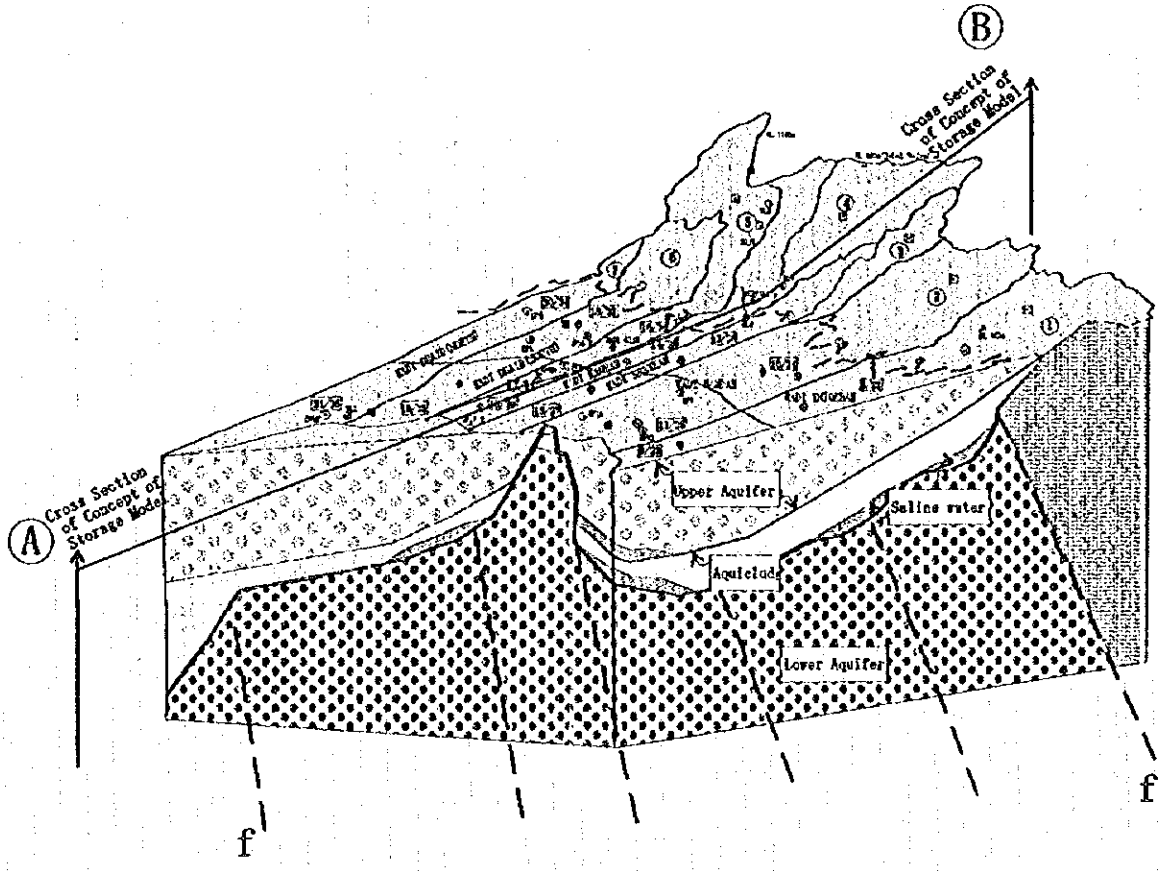


Figure 4.5.3. Cross Section of Recharge Trench





Concept of Storage Model



Conceptual Model for Hydrogeologic Structure of Study Area

Figure 4.6.1 Concept of Storage Model

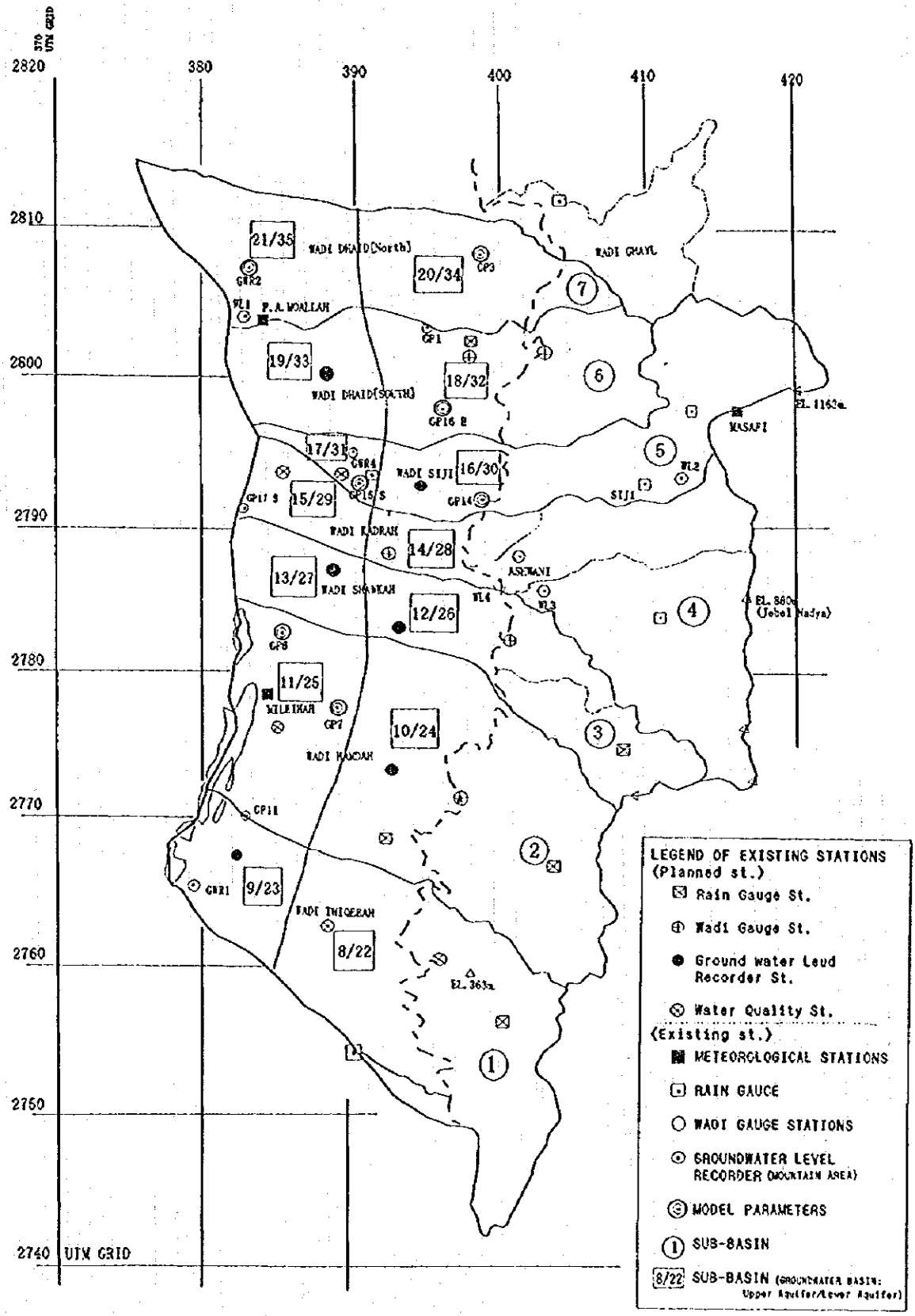


Figure 4.6.2 Sub-basin Division of the Study Area

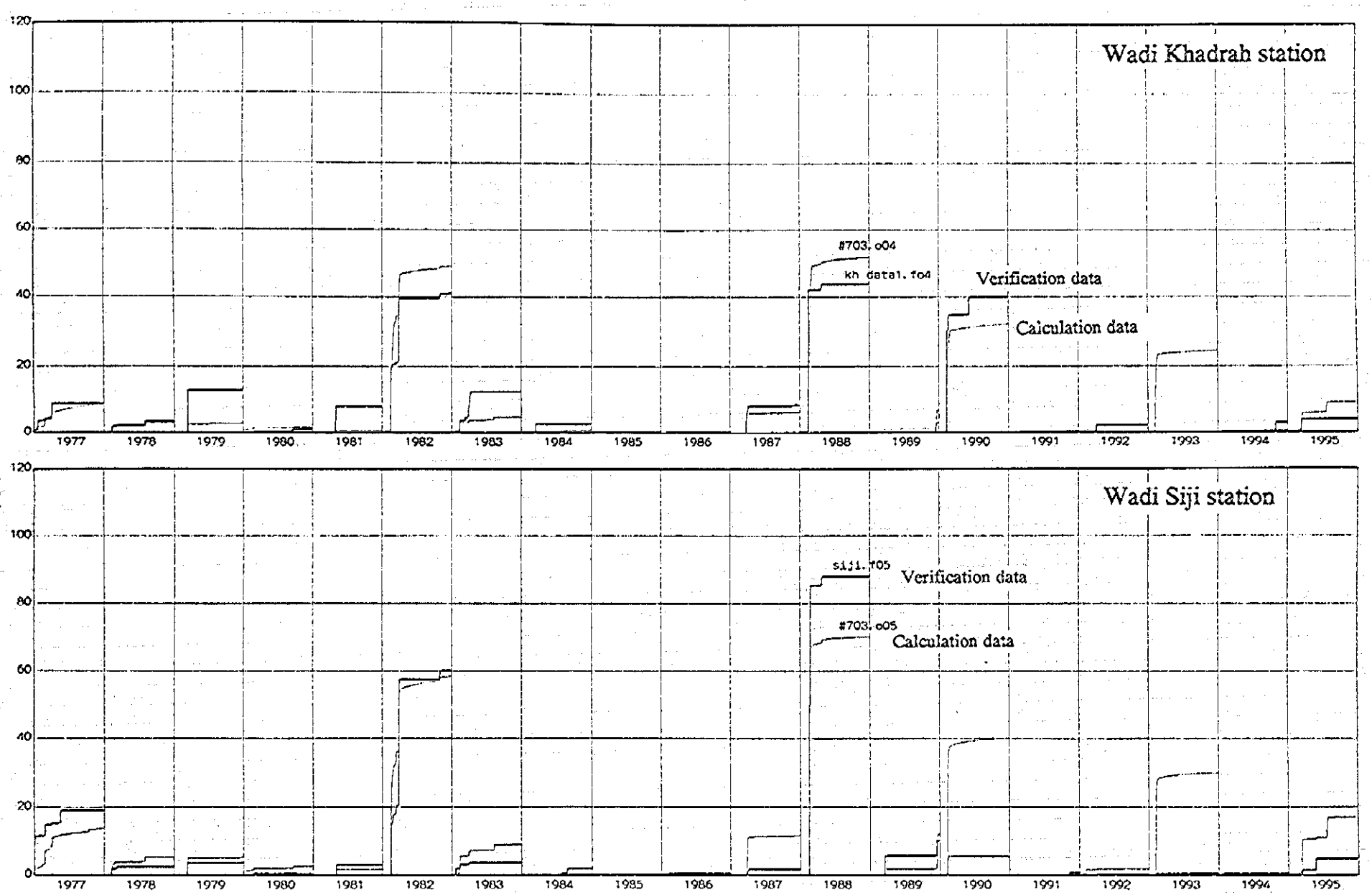


Figure 4.6.3 Result of the Verification of Surface Runoff

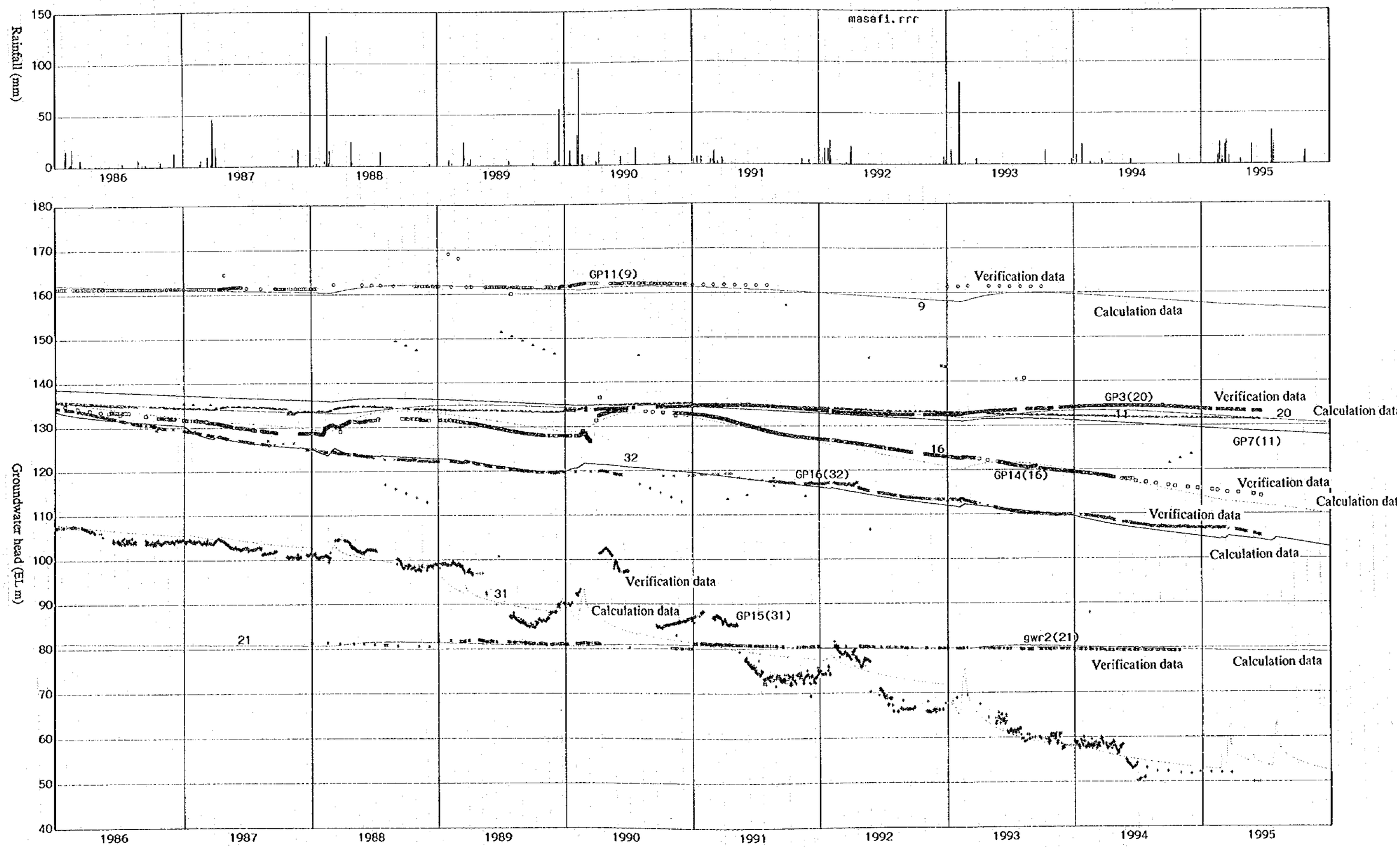


Figure 4.6.4 Result of the Verification of Groundwater Head

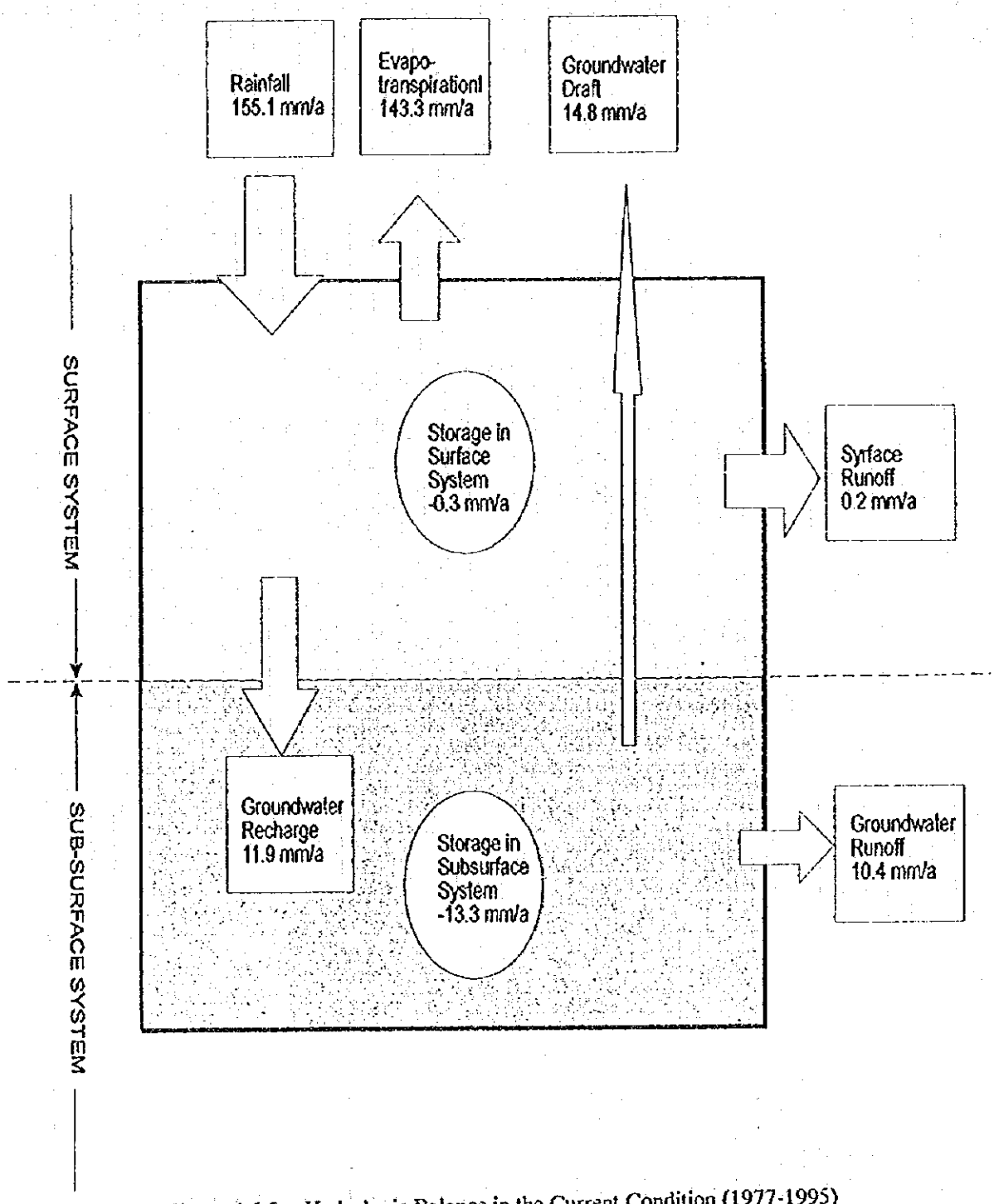


Figure 4.6.5 Hydrologic Balance in the Current Condition (1977-1995)

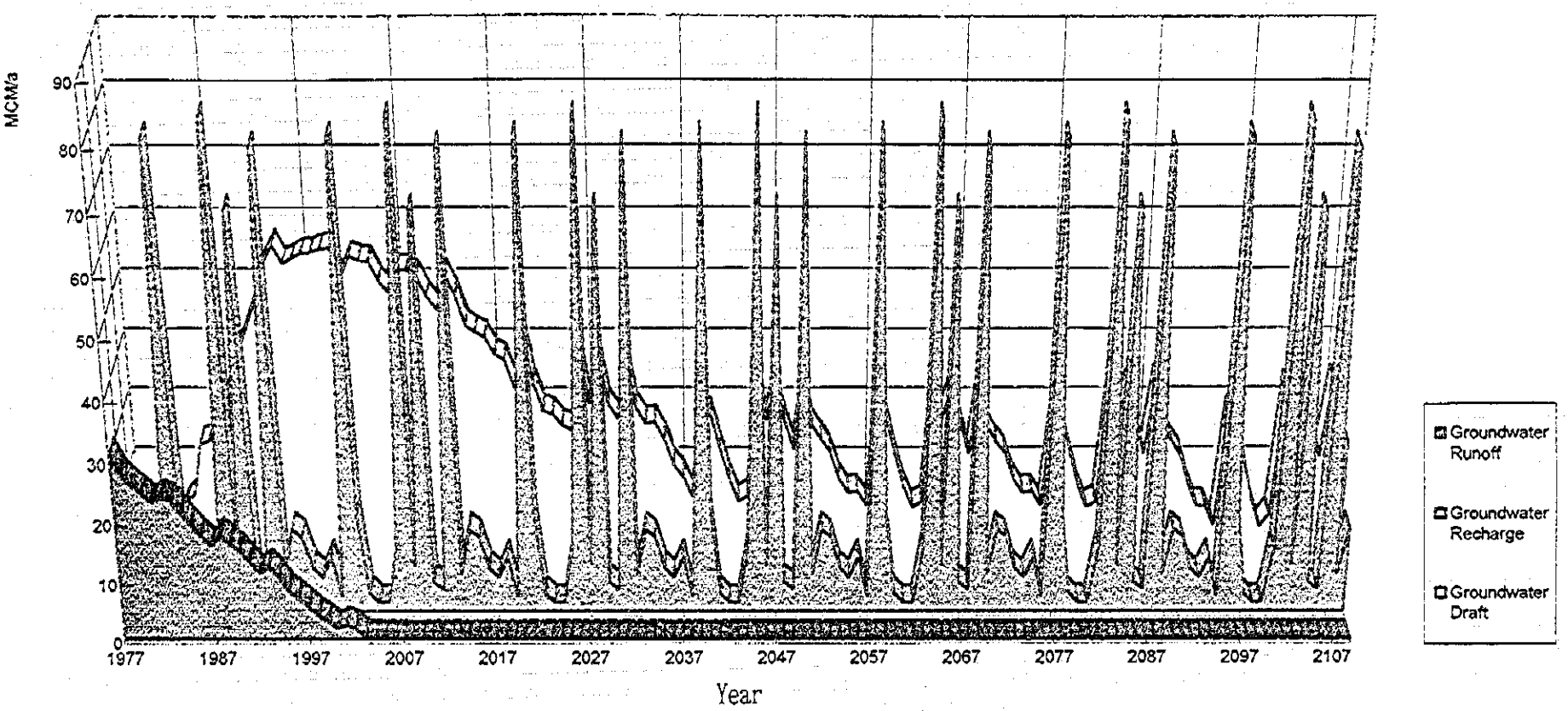


Figure 4.6.6 Result of Case 1 (Groundwater Balance of the Study Area)

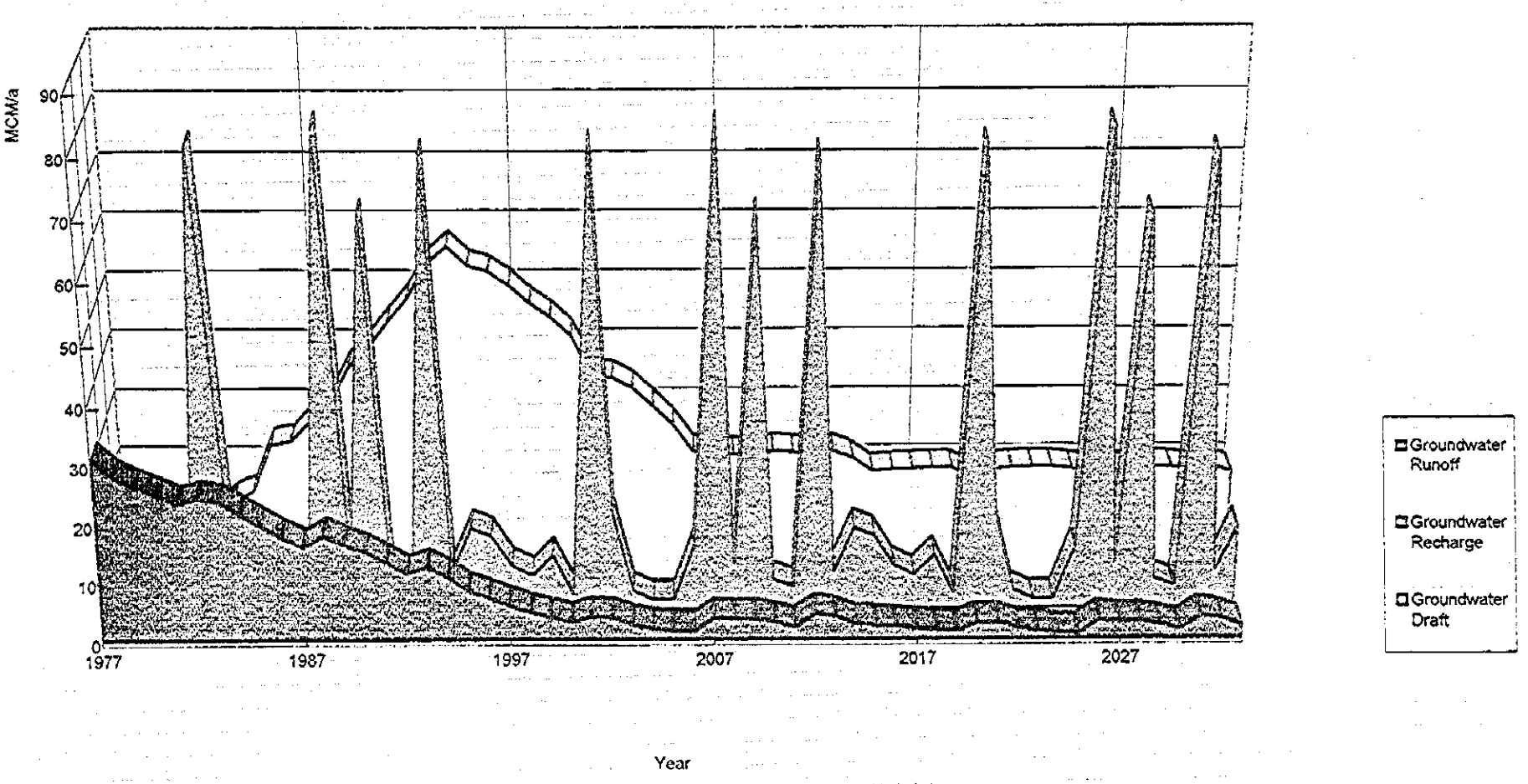


Figure 4.6.7 Result of Case 2 (Groundwater Balance of the Study Area)

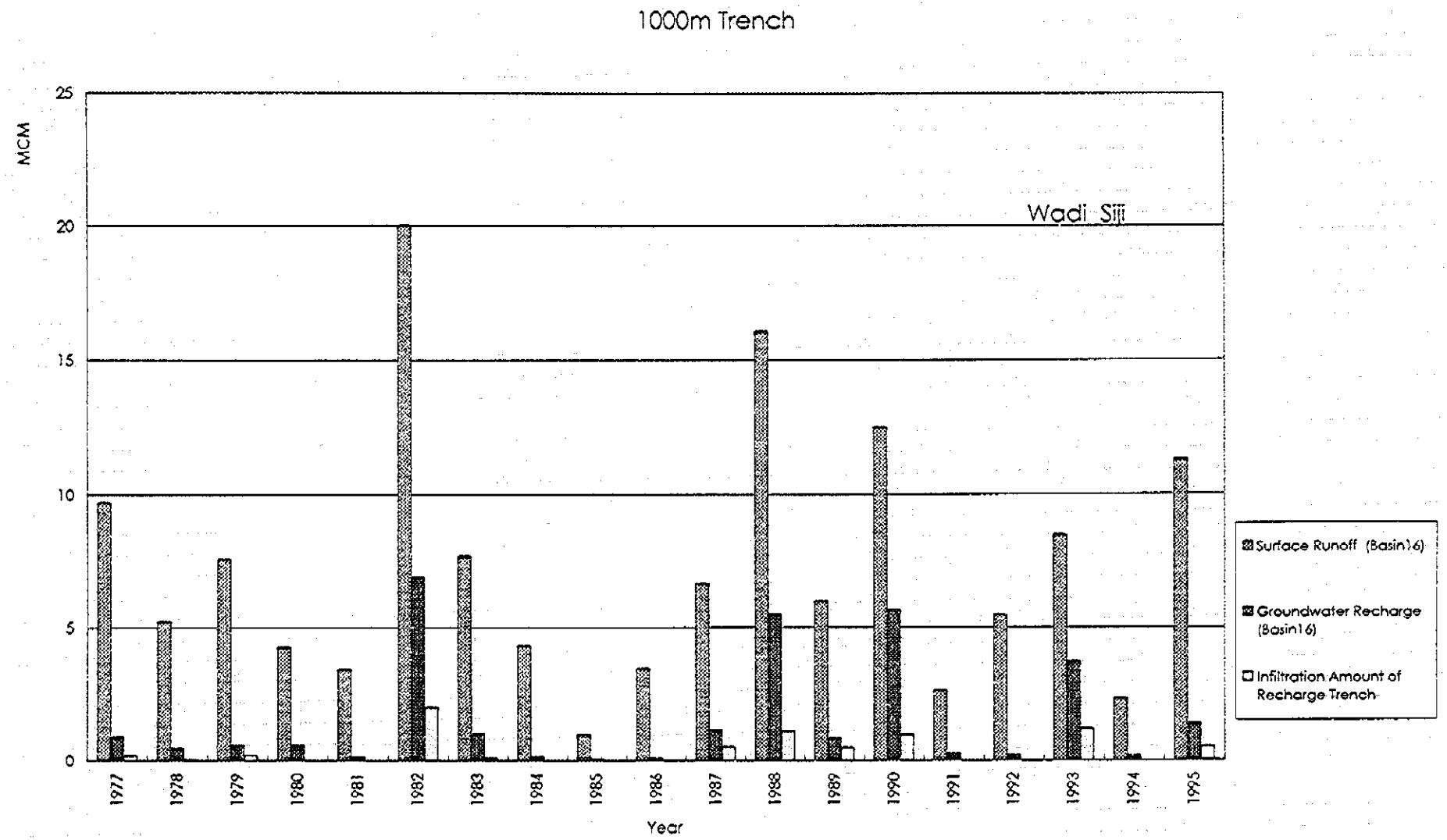


Figure 4.6.8 Result of Case 3 (Groundwater Balance of the Study Area)

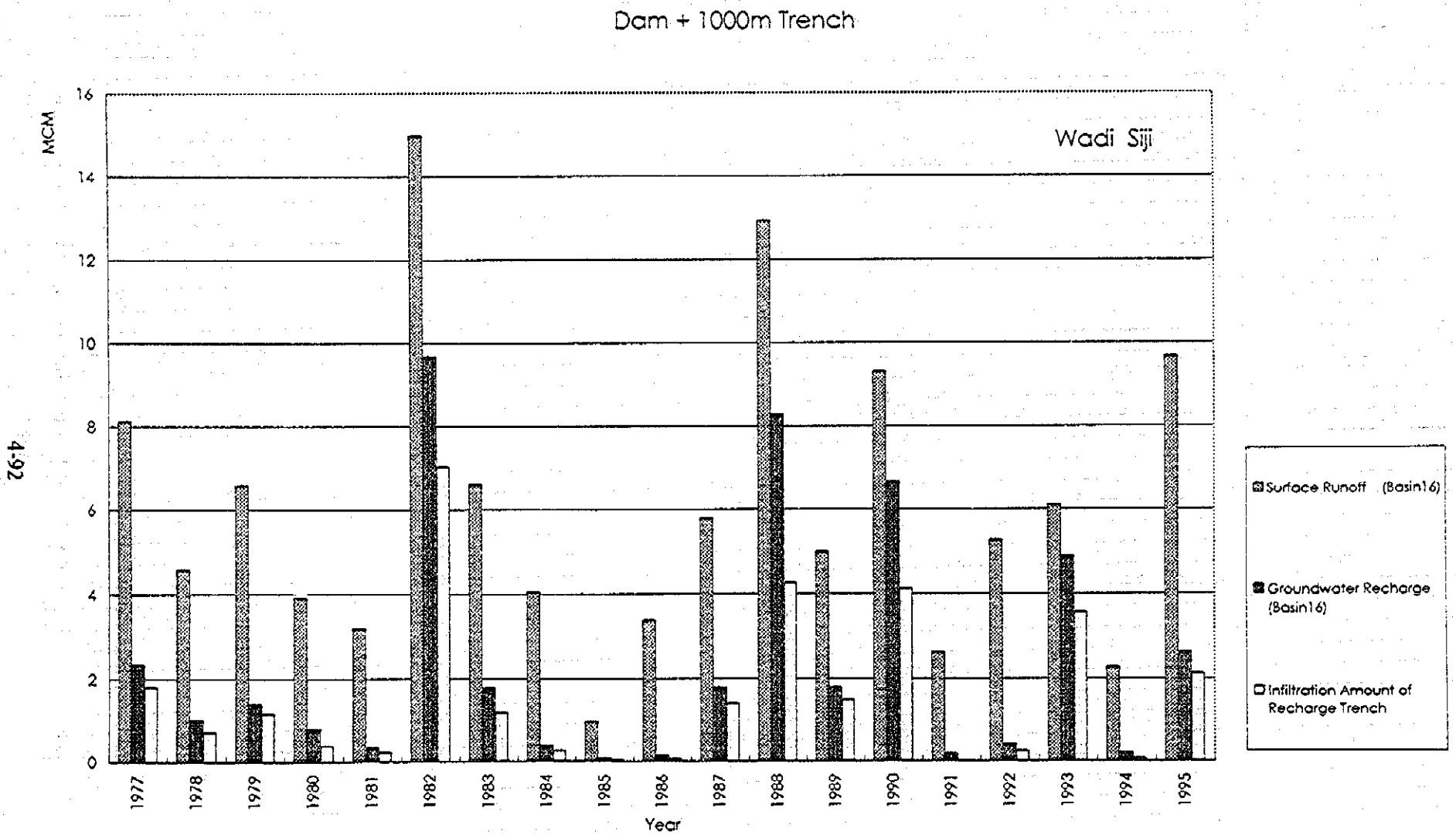


Figure 4.6.9 Result of Case 4 (Groundwater Balance of the Study Area)

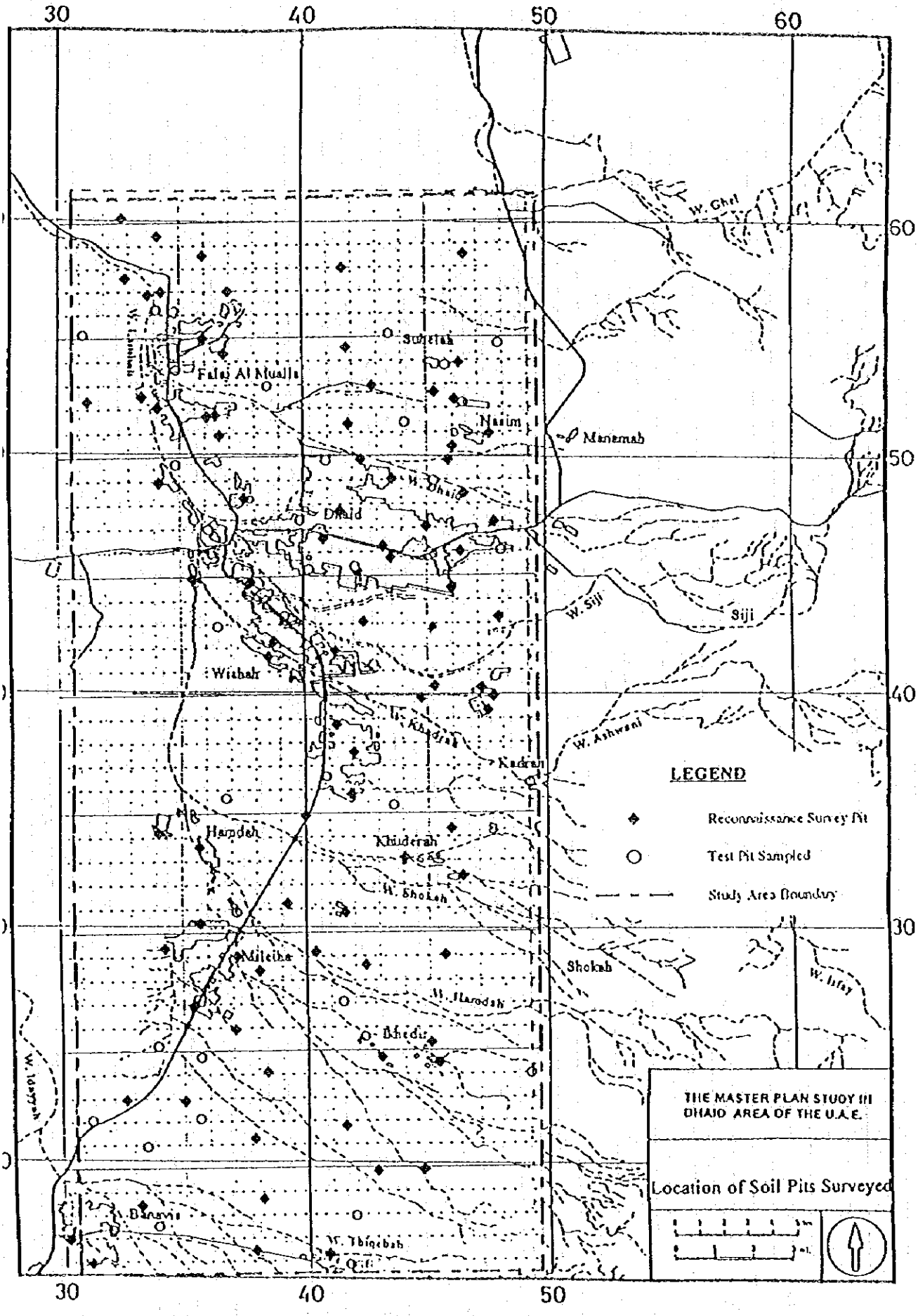


Figure 4.7.1. Location of Test Pits for the Soil Survey

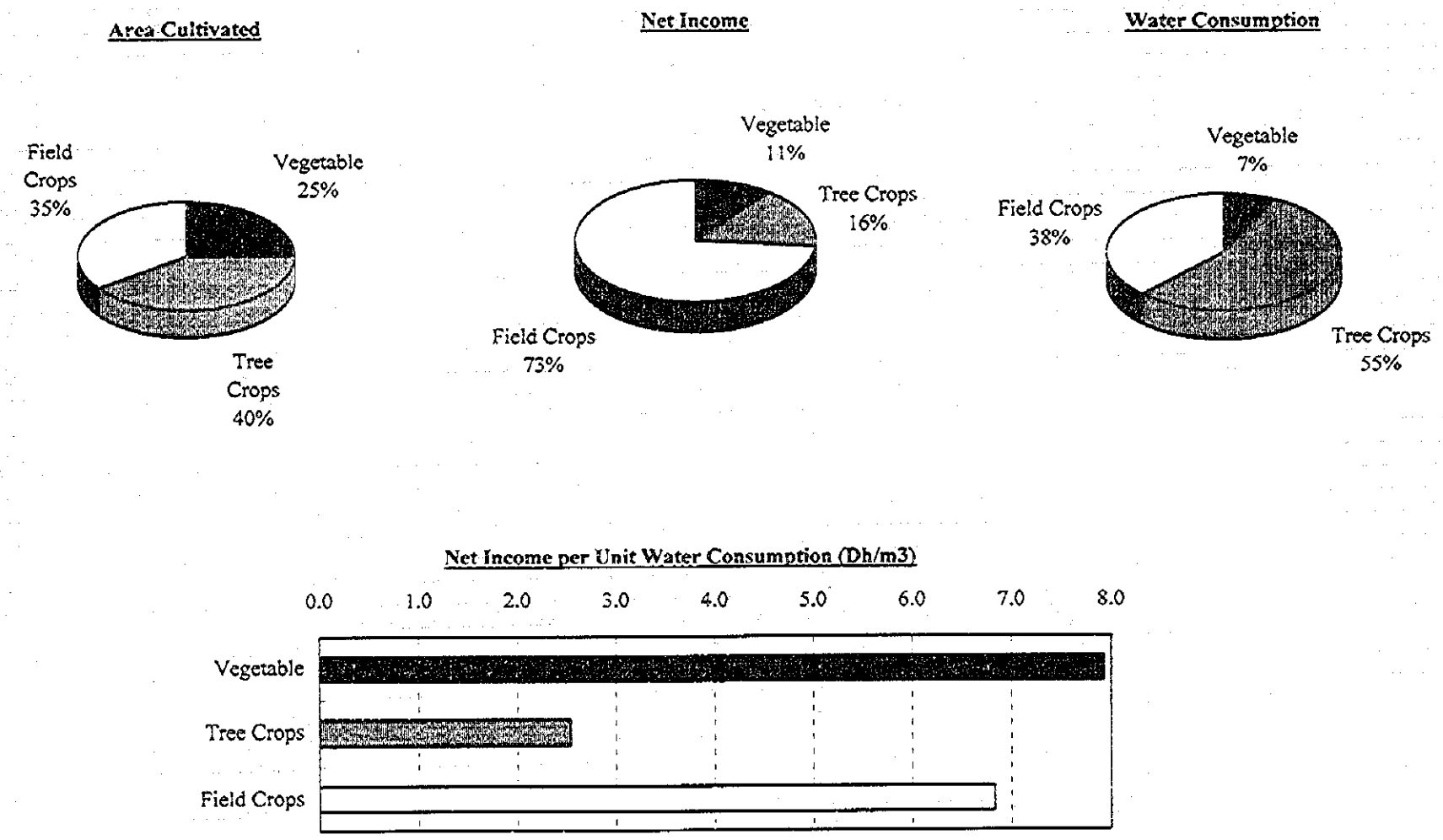
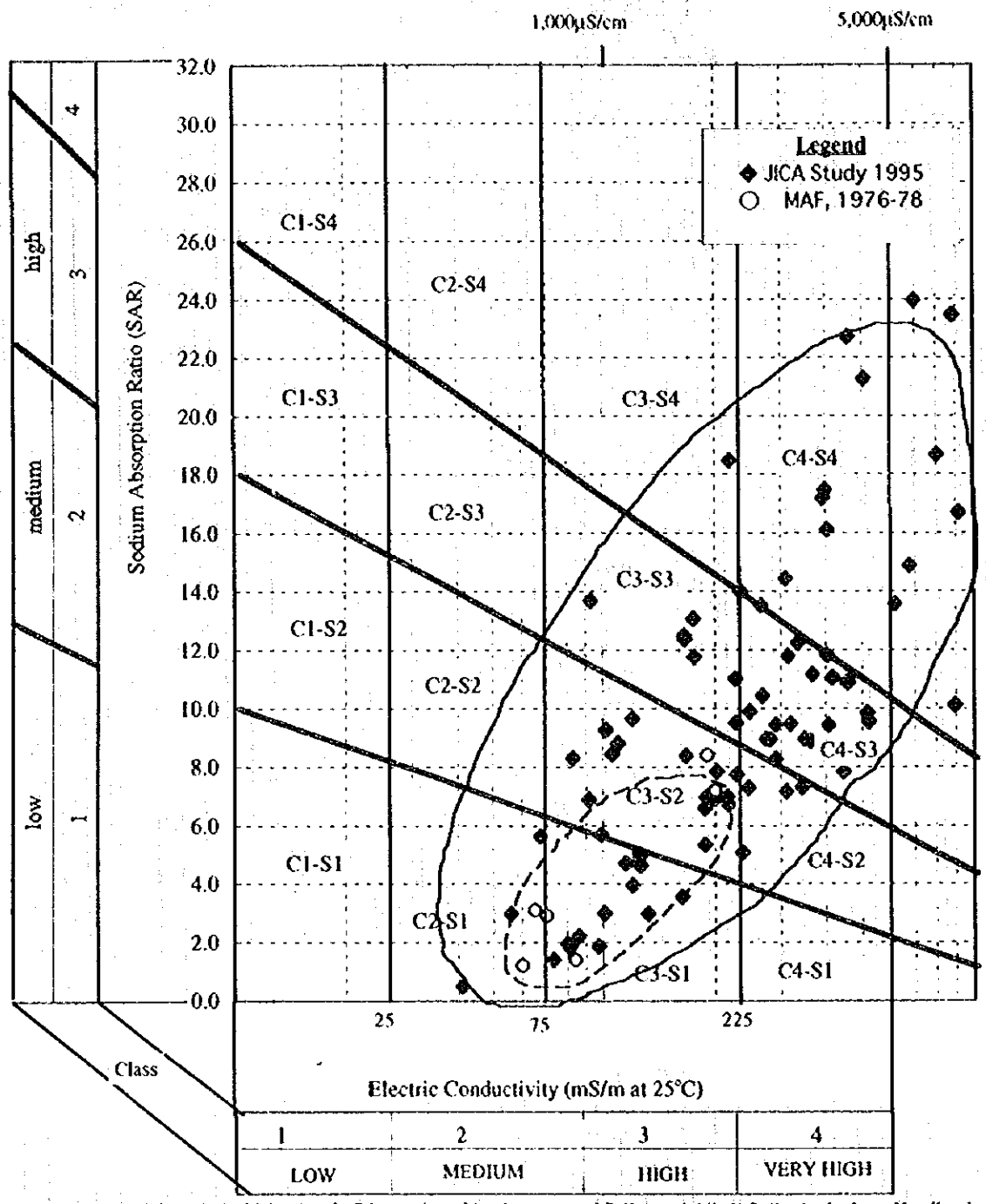


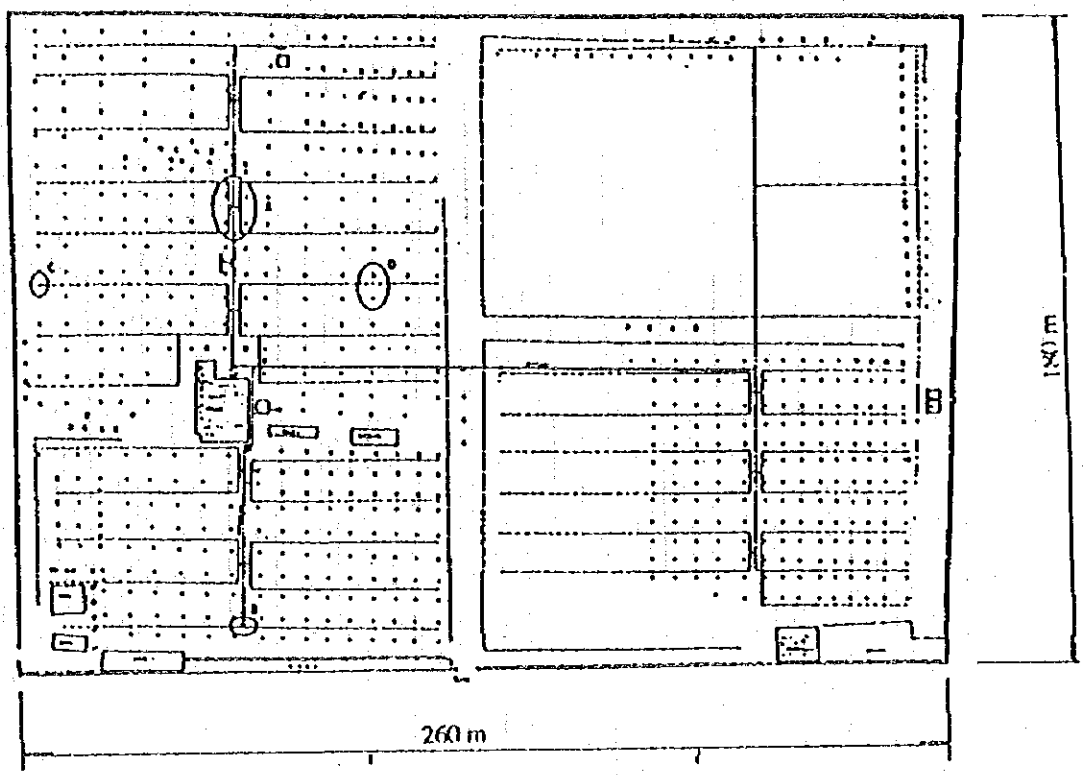
Figure 4.8.1. Present Agriculture Conditions in the Study Area



Source : modified from L.A. Richards(ed), Diagnosis and improvement of Saline and Alkali Soils, Agriculture Handbook 60, USAD, Washington, D.C., 1954,p 80.

Figure 4.9.1. Groundwater Quality Classification in the Study Area

FARM A

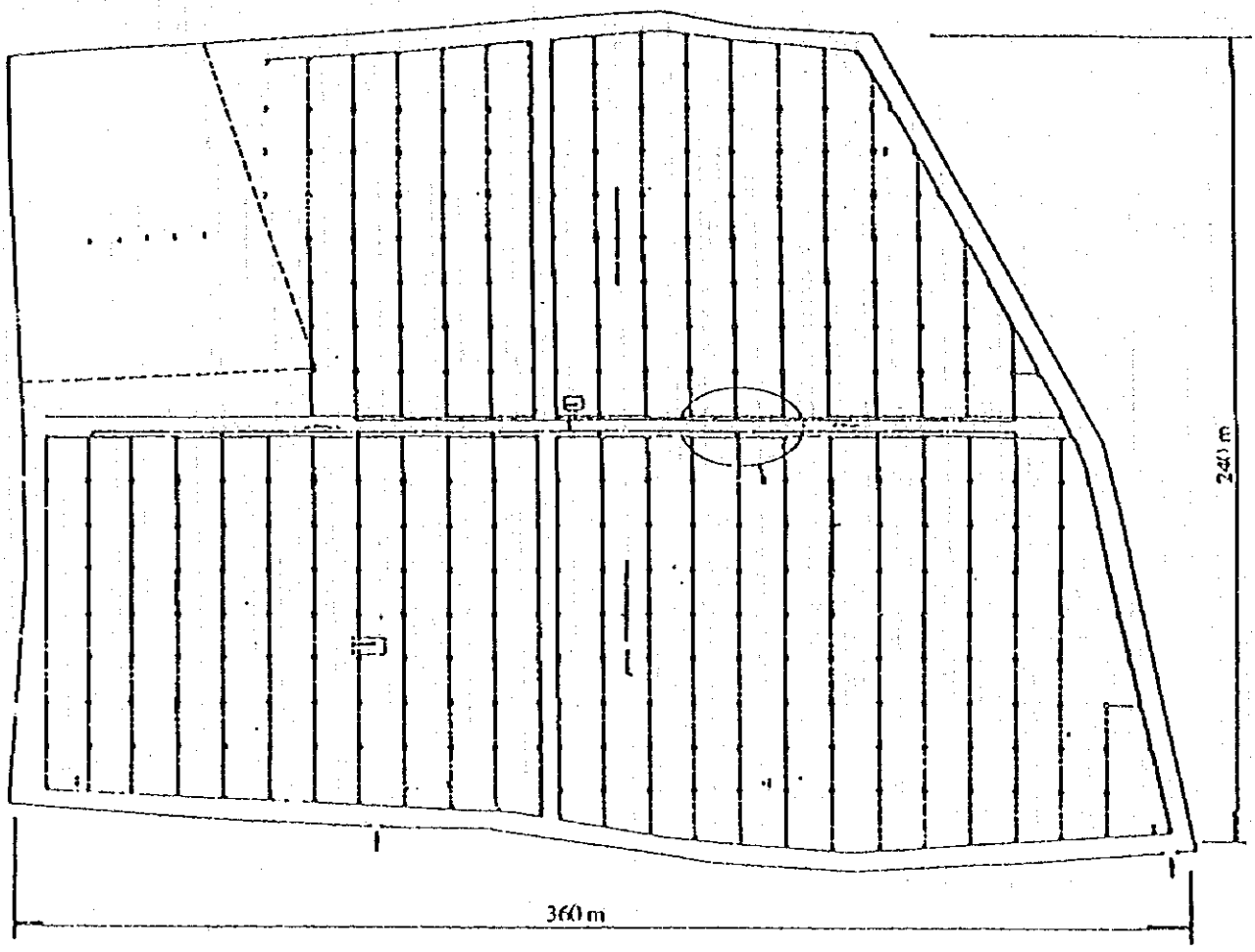


SPECIFICATION of FARM A

FARM A		
AREA	4.68	ha
SHAPE	Rectangular	260m x 180m
TANK	2	
WELL	2	
IRRIGATION TYPE	Bubbler	2.88ha; Dates and Fruits
	Basin	0.96ha: Others
PIPE LENGTH	140	m, Dia. 110mm
	340	m, Dia. 90mm
	1240	m, Dia. 63mm
	1060	m, Dia. 50mm
BUBBLER TUBE	1	roll, 400m
FERTILIZER TANK	2	
SCREEN FILTER	2	
ESTIMATED COST	122000	Dh./ha

Figure 4.9.2. General Layout of Farm in the Study Area (Model A)

FARM B



SPECIFICATION of FARM B

FARM B		
AREA	7.68	ha
SHAPE	Trapezoid	0.5 x (360m + 280m) x 240
TANK	1	
WELL	4	
IRRIGATION TYPE	Sprinkler	6.84ha; Feed Crop
	Basin	0.9ha; Dates
PIPE LENGTH	480	m, Dia. 110mm
	2640	m, Dia. 63mm
	2300	m, Dia. 50mm
LOW PRS. SPRINKLER	450	
FERTILIZER TANK	1	
SCREEN FILTER	1	
ESTIMATED COST	148000	Dh /ha

Figure 4.9.3. General Layout of Farm in the Study Area (Model B)

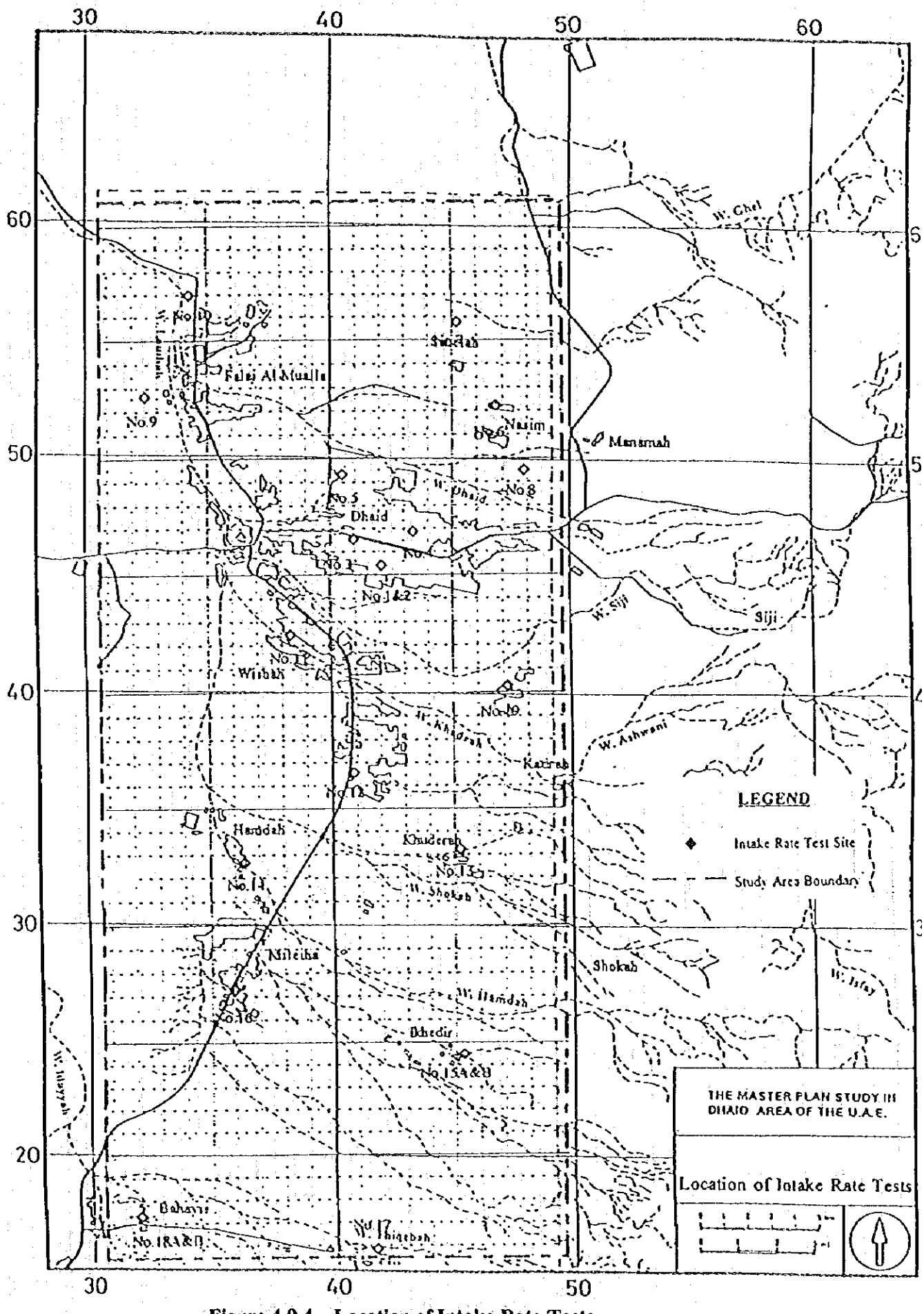
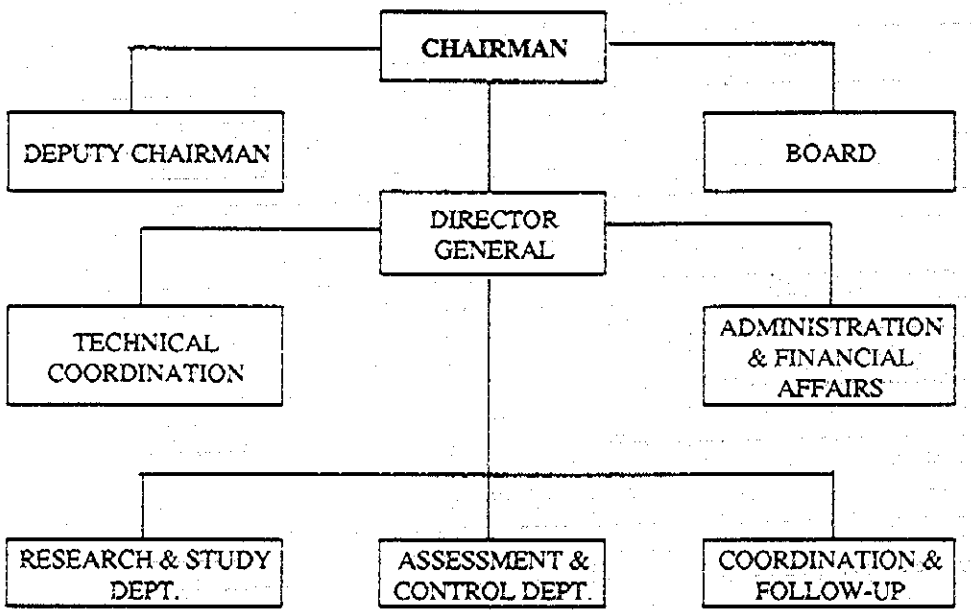


Figure 4.9.4. Location of Intake Rate Tests



Source : The National Atlas of the United Arab Emirates

Figure 4.10.1. Proposed Organization of Federal Environmental Agency (Draft)

CHAPTER FIVE : THE MASTER PLAN

5.1. Basic Strategy

5.1.1. Constraints on Agricultural Development

Agricultural development is one of the most important targets of the government of UAE. It is supported by several governmental subsidies. UAE has an arid climate and is covered by desert; Consequently potential water resources for agriculture are limited. There is a shortage of experts, technicians and also the labor force needed for agriculture. Under these natural and socio-economic conditions, the progress of agricultural development in UAE cannot be achieved smoothly.

The constraints and problems in agricultural development in the Study Area are summarized as follows:

(1) Deterioration of Groundwater

The main source of water in UAE is traditionally groundwater. Even though desalinated water production for the municipal water supply has increased rapidly, the importance of groundwater resources has never changed. Agriculture in UAE cannot be implemented without irrigation because of the prevailing natural conditions. The major water source for irrigation is always groundwater.

Based on the agricultural development policy pursued by the government, the groundwater consumption for agriculture and greening increased remarkably recently, while deterioration of the groundwater is drastic and rapid all over the nation. In the Study Area, the cause of groundwater deterioration is over-extraction, over-irrigation and the over-development of farmland, even in areas unsuitable for agriculture. As a result, the deterioration in both quantity and quality of the groundwater, together with the attendant drop in the water table has become a significant problem in the Study Area. Due to the drawdown of groundwater levels, farmers must either re-drill their existing wells more deeply or drill new wells, at greater cost, or in some cases are forced to abandon their farms due to lack of finance.

(2) Absentee Owners

Most farm owners in the Study Area live in major cities and have occupations other than farming. They do not depend on the income generated from agricultural activities. The actual work is performed by hired foreign laborers. These absentee owners use their farms as their weekend villas. The products from their farms do not flow onto the market as they are consumed at home.