crossing points with farm roads, cross drain structures consisting of concrete conduits and riprap inlet and outlet transitions.

(H) Farm road

Embankment of farm road is designed about 0.2 m in height above original ground surface and all width of road is 5.0 m. Gravel metalling of 3.0 m in width is provided in central portion of road.

3.3.6 On-farm Development

Land grading for the both scheme areas is not necessary because topographical slopes range less than 1% in the Dab'ah-Hammam scheme area and less than 10% in the Qatrana scheme area, in particular, majority of the Qatrana scheme area have topographical slopes of around 5%. Moreover, proposed crops are horticultural crops for which drip irrigation method is most suitable in the arid regions in view point of efficient water use, and in this study, drip irrigation method is adopted for the both schemes.

In typical layout for on-farm development of 8 ha, the layout is composed of tertiary pipe line of 300 m, farm turnout of one (1) set, farm road of 400 m, field drain of 1,600 m and drip tube irrigation facilities as shown in Fig. G-3.8.

3.3.7 Compensation Water for the Existing Wala Irrigation Area

In the study on water allocation of base flow of the Wadi Wala, if construction of the Wala dam is proposed, compensation of irrigation water for existing farms in the downstream area shall be made by using the stored water of the dam.

Present conditions in the existing farm areas are as follows:

(i) Registered irrigation area - - - - - - - - - - - - About 600 ha
(ii) Present planted area - - - - - - - - - - - - - - - About 340 ha
(iii) Planted crops - - - - - - - - - - - - - - - - - Vegetables and Fruit trees
(iv) Irrigation method - - - - - - - - - - - - Year-round irrigation by drip tube facilities and furrow ditches.

Irrigation water to be compensated for the areas is estimated to

irrigate all registered irrigation area including somewhat upgrading on agricultural techniques. Referring to the estimated irrigation water requirement of cropping patterns concerning with highlands irrigation development area, gross irrigation water requirement of vegetables type with cropping intensity 200% in the open field is estimated at about 1,300 mm/year. However, present cropping intensity in the area to be compensated is foreseen about 100% to 130% and irrigation efficiency is estimated at less than 60%. If cropping intensity and irrigation efficiency will be respectively upgraded to 180% and 70% in the future, gross irrigation water requirement will be expected at about 1,000 mm. Therefore, irrigation water for compensation is assumed 1,000 mm on the safe side. Annual compensated irrigation water for the downstream area of the Wala dam will reach 6 MCM.

4. ORGANIZATION AND MANAGEMENT

4.1 Proposed Organization

Before and during construction of both schemes, the Irrigation Department of WAJ will have all the responsibility for the works and execution of the both schemes. After accomplishment of the both schemes, a new scheme office, namely the Hammam-Qatrana Scheme Office will be organized under the Deputy Director of the Irrigation Department, WAJ. The head of the Scheme Office will have direct responsibility for all management of both scheme areas and reporting to the Deputy Director of the Irrigation Department. The Scheme Office is composed of two (2) Sub-Divisions, namely, The Extension and Research Sub-Division and the Operation and Maintenance Sub-Division as shown in Fig. G-4.1. The Extension and Research Sub-Division deals with technical study and research on agriculture specially, horticulture aspects and irrigation in arid region and technical extension for existing horticultural farms extending in and around scheme areas. This Sub-Division is consists of three (3) sections and office staff of about 16 persons will work.

The Operation and Maintenance Sub-Division is composed of three (3) sections, namely, the Maintenance Section, the Hamman Operation Section and the Qatrana Operation Section. This Sub-Division deals with maintenance works of the Hammam dam and irrigation facilities including pump and booster pump equipments for the both scheme areas and technical guidance and execution on irrigation water operation. For these execution works, approximately 10 persons will work.

On the other hand, the Scheme Office keeps closely cooperation with the Agricultural Research and Extension Department and the Agricultural Production and Service Department of the Ministry of Agriculture for upgrading technical knowledge of agricultural estension and strengthening agricultural research activities. The both departments and the Scheme Office will hold a periodical meeting to strengthen their activities.

4.2 Required Staff

Conforming with the proposed organization for the Hamman-Qatrana Scheme Office, 29 staff members consisting of 10 engineers, 14 technicians including gate masters and 5 assistant office clerks will be necessary for office operation as shown in Fig. G-4.1.

5. BENEFIT AND COST

5.1 Agricultural Benefit

5.1.1 Agricultural Benefit Without the Scheme

For the estimate of agricultural benefit without the Scheme condition, present conditions in the Scheme areas such as planted areas and crops are assumed as follows.

(a) Arable areas in the Scheme areas:

In the Dab'ah-Hammam Scheme area, total area of the Scheme is designed to reach 175 ha. Present arable lands are assumed to compose of rainfed farms of 75 ha, irrigated field farms of 70 ha and plastic house farms of 30 ha. In case of "Without the Scheme Condition", existing groundwater irrigation area of 100 ha is assumed not to increase more, because present groundwater use in existing irrigated areas is estimated to reach the maximum use.

In the Qatrana Scheme area, the all Scheme area of 75 ha is assumed non arable land, based on the results of field investigation.

(b) Planted crops and unit crop yield:

Present conditions on planted crops, planted areas and unit crop yield in the Dab'ah-Hammam Scheme area are assumed as shown in Table G-5.1, referring to present agricultural conditions in the Study Area.

(c) Anticipated crop yield without the Scheme conditions

In case of "Without the Scheme Conditions", unit yields of crops planted only in irrigated farms are assumed to increase in the Dab'ah-Hammam Scheme area, because unit yield of crops planted in rainfed farms are absolutely impaired from insufficient rainfall and more increase in crop productions will not be expected, however, crop yields in irrigated farms will be expected to increase by improvement of present farming techniques and introduction of new farming techniques.

The anticipated crop yield without the Scheme conditions is estimated to refer to average crop yields in cases of drip irrigation and furrow irrigation methods in the Jordan which are mentioned in the Manual on Vegetables and Fruits published by the MOA, taking into account present farming techniques of farmers in the Study Area. The anticipated crop yields are shown in Table G-5.1.

(d) Net income on farm without the Scheme condition:

In the Dab'ah-Hammam Scheme area, net income on farm is estimated at about JD199 x 10^3 equivalent to JD1,125/ha as shown in Table G-5.1.

That in the Qatrana Scheme Area will not be born because of non arable area, at present.

5.1.2 Incremental Benefit

On the basis of the estimated net income with and without the Scheme conditions mentioned in Chapter three (3) and preceding Chapter, incremental benefits are respectively estimated at about JD405 x 10^3 equivalent to JD2,316/ha for the Dab'ah-Hammam Scheme and at about JD142 x 10^3 equivalent to JD1,890/ha for the Qatrana Scheme as shown in Table G-5.2. Total incremental benefit for the both Schemes are about JD547 x 10^3 equivalent to JD2,118/ha.

5.2 Unit Construction Cost

Construction material costs, labour cost, and purchase and rental costs of construction equipments are surveyed in the field investigation. Construction materials and labour costs are adopted as shown in Table G-5.3, referring to collected data. As for allocation of foreign and JD currencies on materials and labour costs, foreign currency portion is assumed to cover 100% costs of steel bar, cement, timber, gates and valves, plywood and reinforced concrete pipes. Unit cost for the scheme is primarily estimated by using the material and labour costs and finally examined by referring to unit bidding prices and/or unit contract prices of similar dam and irrigation development projects of the Jordan such as the Pressure Pipe Network Project, the Middle Jordan Valley (May, 1986), the Mujib and Southern Ghor Irrigation Project, Contract for the Stage I (October,1981) and the Wadi Arab Dam and Irrigation Project (September, 1980).

Unit construction cost is updated on the October, 1986, taking into account price escalation rates of materials and labour costs and overhead and profit of the contractors. Unit construction costs for the schemes are adopted as shown in Table G-5.4.

In addition, construction cost of terminal irrigation system is estimated at JD1,180/ha as shown in Table G-5.5, based on typical canal layout shown in Fig. G-3.8.

5.3 Construction Cost and Disbursement Schedule

For the estimate of construction cost, three (3) cases of construction schedule are assumed. The first and second cases are single construction schedule for the each Scheme and the third is an overall construction schedule for the both Schemes. Construction period and disbursement construction works of three (3) cases as shown in Table G-5.6 to Table G-5.8. Total construction cost of the third case is estimated at JD9,488 x 10^3 equivalent to JD37,952/ha as shown in Table G-5.6.

Construction cost for the both schemes are respectively estimated at JD9,002 x 10^3 for the Dab'ah-Hammam scheme and at JD527.5 x 10^3 for the Qatrana scheme as shown in Table G-5.7 to Table G-5.8. Total construction costs are composed of direct construction costs, physical and price contingency, administration cost and engineering service cost. Direct construction costs for the both schemes are JD6,385 x 10^3 for the Dab'ah-Hammam scheme and JD389.2 x 10^3 for the Qatrana scheme. Physical contingency, administration cost and engineering service cost are respectively assumed 10%, 5% and 10% of direct construction cost. Price contingencies for local currency portion and for foreign currency portion are respectively estimated by using overall wholesale price index for Amman from 1981 to 1985 and forecast of world manufacturing unit value index, IBRD, 1983.

Unit construction costs per one (1) hectare for the both schemes are respectively estimated at JD51,440/ha for the Dab'ah-Hammam scheme and at JD7,033/ha for the Qatrana scheme. Proportion of foreign currency portion on construction costs are respectively 59% for the Dab'ah-Hammam scheme and 78% for the Qatrana scheme, and proportion of foreign currency is high. Detailed cost estimate for the each Scheme is shown in SUPPLEMENT C.

5.4 O & M Cost

Operation and maintenance cost for the both schemes are assumed to compose of running costs for the scheme office, electric cost of pumps, maintenance costs of pump stations, dams and irrigation facilities. Running cost for the scheme office are mainly composed of labour costs for office workers and field staff, consummable and expenditure costs of office and vehicles, and maintenance cost for building. For the estimate of O & M cost for the Dab'ah-Hammam scheme, the scheme office and necessary field staff for the Qatrana scheme area are assumed to belong to the Dab'ah-Hammam scheme.

O & M costs for the both schemes are estimated at about JD225,000/year for the Dab'ah-Hammam scheme and at about JD6,500/year for the Qatrana scheme as shown in Table G-5.9.

* Refer to "The Irrigation and Drainage Paper No.29 Rev.1, Water Quality for Agriculture", FAO.

Table G-1.1 EXPORT/IMPORT BALANCE OF MAIN AGRICULTURAL PRODUCTS

	1985					1984
	Import		Export		Quantity Balance	Quantity Balance
	Quantity t	Value 1000JD	Quantity t	Value 1000JD	t	t
Cereals	708,276	49,796	1,278	106	*706,998	*817,176
Meat	55,922	33,370	251	175	* 55,671	* 28,803
Dairy Products						
Birds & Eggs	50,530	18,051	132,293	3,438	81,763	1,689
Fruits & Nuts	69,712	13,821	146,020	7,535	76,308	51,032
Animals & Vegetable						
Fats & Oil	28,182	10,156	414	203	* 27,768	* 24,542
Residues & Waste						
for Feed	115,612	14,109	41,808	6,822	* 73,804	*102,550
Vegetables	54,243	7,755	309,366	15,790	255,123	275,924
Coffee & Tea	6,332	6,572	780	458	* 5,552	* 6,472
Sugar	44,483	5,762	274	151	* 44,209	* 53,193
Tobacco	774	2,668	523	1,728	* 251	* 1,691
Live Animals	245	8,607	217	3,755	* 28	* 4,417
Oil Seeds	15,268	5,848	315	56	* 15,212	* 16,857

Note : * Indicates net imported quantity

Source : Statistical Yearbook 1984, 1985

Table G-1.2 AVERAGE PRODUCTION OF MAIN AGRICULTURE PRODUCTS

Unit : (x 10^3 ton)

Items	The 2nd 5-yr Program (1981-85)			Plan for	Increase	Ratio of Self-Sufficiency (%)	
	Plan	Actual Prod.	Balance	The 3rd 5-yr	the 2nd to the 3rd	1981 - '85	1986 - '90
1. Wheat		61		143	82	14	26
2. Grains	142	9		12	3	57	61
3. Barley		20		26	6	18	20
4. Other Field Crops (including Corn & Soya Beans)		6		18	12	6	15
5. Dried Green Fodder		3		120	117	-	-
6. Vegetables	600	628	+28	970	342	182	227
7. Olives	32	40	+ 8	57	17	89	102
8. Fruits & Grapes	65	41	-24	50	9	55	55
9. Citrus	50	60	+10	120	60	101	158
10. Dairy Products	45	49	+ 4	67	18	69	77
11. Red Meat	15	9.5	- 5.5	16	6.5	29.5	40
12. Poultry Meat	36	37	+ 1	50	13	83	91
13. Fish		0.02		1	0.98	0.5	21.7
14. Eggs (Million)	450	402	-48	445	43	111	100

Data Source : The 3rd 5-year National Economic Development Plan, Agriculture Sector (draft report) 1986.

Table G-2.1 Soil Classification in the Study Area

Order	Entisols				Aridisols												
Suborder	Orthent		Fluvent		Orthids												
Greatgroup	Torriorthents		Torrifluvents		Paleorthid				Calciorthid								
Subgroup	-		-		-				Typic Calciorthid						Xerrolic Calciorthid		
Family	fragmental		loamy		fragmental		fragm./loamy		fragm./lithic		fragm./loamy		loamy		loamy		
Symbol	TOf		TF(		Pf		Pf(		Cf		Cf(		C(		Cx(		Total
Area	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
Hamman											605	12.8	4,114	87.2			4,719	100
Jiza													4,323	100			4,323	100
Zainab	642	8.5							3,351	44.2	3,343	44.1	245	3.2			7,581	100
Rumeil & Wala	1,838	37.5	377	7.7					850	17.3	455	9.3	266	5.4	1,115	22.8	4,901	100
Halq	447	16.1	158	5.7					322	11.6	1,420	51.2	429	15.5			2,776	100
Shabik											1,696	74.6	577	25.6			2,273	100
Siwaqa	1,180	28.7					336	8.2			1,508	36.7	1,086	26.4			4,110	100
Qatrana	536	9.3			1,331	23.0	1,593	27.6	439	7.6	1,647	28.5	229	4.0			5,775	100
Sultani	500	12.7			1,039	26.3	1,837	46.6			237	6.0	333	8.4			3,946	100
Total	5,143	12.7	535	1.3	2,370	5.9	3,766	9.3	4,962	12.3	10,911	27.0	11,602	28.7	1,115	2.8	40,404	100

Table G-2.2 Land Classification in the Study Area

Area	Class I Arable		Class II Arable		Class III Arable		Class IV Limited arable		Class V Non-arable		Class VI Non-arable		Total Area Portion	
	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
Hamman	4,114	87.2	605	12.8									4,719	100
Jiza	4,323	100.0											4,323	100
Zainab	245	3.2	3,343	44.1					3,351	44.2	642	8.5	7,581	100
Rumeil & Wala	1,381	28.2	832	17.0					850	17.3	1,838	37.5	4,901	100
Halq	429	15.5	1,578	56.8					322	11.6	447	16.1	2,776	100
Shabik	577	25.4	1,696	74.6									2,273	100
Siwaqa	1,086	26.4	1,508	36.7	336	8.2					1,180	28.7	4,110	100
Qatrana	1,876	32.5			1,593	27.6			1,770	30.6	536	9.3	5,775	100
Sultani	333	8.4							1,276	32.3	2,337	59.2	3,946	100
Total	14,364	35.6	9,562	23.7	1,929	4.8			7,569	18.7	6,980	17.3	40,404	100

Table G-2.3 Monthly Climate Data
7 years (1976-1982)

Factor	Station/Elevation (m)		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.
1. Mean Temperature (C°)	Na'our	910	18.9	13.0	9.2	7.0	8.1	10.3	14.2	18.1	21.3	22.7	22.4	21.1
	Madaba	785	19.7	14.1	9.7	7.7	9.0	11.3	15.2	19.1	22.2	24.1	23.5	22.3
	Wadi Wala	450	21.8	16.5	11.7	10.5	11.1	13.5	18.1	21.3	24.1	25.8	25.3	24.2
	Rabbah	920	19.6	14.0	9.6	7.6	8.9	11.2	15.3	19.5	22.0	23.3	22.9	21.5
	Hassan	1200	18.6	12.7	8.5	6.3	7.6	10.4	14.8	18.9	21.6	23.3	23.2	21.6
	Al Jiza	715	18.4	13.0	9.0	7.4	9.0	11.1	15.4	18.9	21.6	23.0	22.2	21.0
	Qatrana	730	20.0	13.9	9.8	8.1	9.2	12.2	16.6	18.1	21.9	23.7	21.3	20.0
2. Mean Relative Humidity (%)	Na'our	910	51	55	75	77	74	70	55	46	40	46	48	51
	Madaba	785	49	51	72	71	74	66	54	42	47	44	47	45
	Wadi Wala	450	50	44	67	67	69	63	51	38	42	42	46	48
	Rabbah	920	52	57	70	73	61	65	54	46	44	49	51	57
	Hassan	1200	46	55	63	64	65	59	44	41	45	42	43	47
	Al Jiza	715	55	59	74	73	74	71	57	50	50	53	56	59
	Qatrana	730	62	65	71	77	71	70	63	57	57	55	59	61
3. Mean Wind Sun (*m/sec*)	Na'our	910	2.2	2.8	2.2	3.0	3.2	3.1	3.6	3.2	3.3	3.7	3.7	3.1
	Madaba	785	2.4	3.9	3.2	3.0	3.4	3.1	3.3	2.7	2.5	3.1	3.2	2.6
	Wadi Wala	450	2.2	2.9	2.8	2.0	2.7	2.5	2.0	2.7	2.5	2.7	2.9	3.3
	Rabbah	920	2.1	2.6	2.4	2.6	2.9	3.1	2.9	2.5	2.4	2.9	2.4	2.3
	Hassan	1200	2.6	3.2	3.2	3.8	4.2	4.2	4.1	3.4	3.4	3.5	3.1	2.6
	Al Jiza	715	2.2	2.5	2.7	2.6	3.3	3.7	3.5	3.2	3.1	3.8	2.8	2.2
	Qatrana	730	1.8	2.5	2.3	2.4	3.2	2.8	3.5	3.2	3.6	3.4	3.3	2.4
4. Mean Cloudness (Octas)	Na'our	910	1.9	3.7	4.2	4.1	3.8	3.8	3.6	2.2	0.4	0.6	0.2	0.4
	Madaba	785	2.2	4.5	5.4	4.3	5.5	4.8	4.4	3.0	0.5	0.7	0.2	0.3
	Wadi Wala	450	1.6	2.9	3.4	3.2	4.0	3.7	2.8	2.2	0.4	0.6	0.5	0.2
	Al Jiza	715	1.3	2.3	3.7	3.6	3.7	3.8	3.2	2.3	0.4	0.4	0.2	0.4
5. Mean Sunshine Hour (hr/day)	Rabbah	920	8.5	7.6	5.9	7.3	6.4	7.3	8.8	9.9	11.7	11.3	10.9	10.1
	Hassan	1200	9.0	8.1	6.9	7.0	7.3	8.5	8.9	10.9	12.3	12.3	11.5	10.4
	Al Jiza	715	8.6	7.5	5.6	6.0	6.4	7.4	7.8	10.2	12.0	12.0	11.7	10.3
	Qatrana	730	9.7	7.5	6.5	6.1	6.3	7.7	9.6	10.6	11.9	12.5	11.9	10.8

Table G-2.4 Surface Water Quality

Name of Wadi	Sultani	Qatrana	Mujib/1	
	(Waste Water)		D/S/2	U/S/3
Sampling Date	10/12/86	9/26/86	6/29/77	6/29/77
Laboratory Measurements				
Conductivity (mm hos/cm)	4.5 (24°C)	0.57 (25°C)	1.7	2.0
T.D.S. (meq/ℓ)	-	365	1,088	1,280
PH	-	8.49	7.8	8.00
Ca^{++} (meq/ℓ)	2.70	0.92	4.30	4.90
Mg^{++} (meq/ℓ)	2.45	0.84	2.99	3.90
Na^{+} (meq/ℓ)	3.18	3.70	8.50	10.25
K^{+} (meq/ℓ)	0.10	0.32	0.39	0.41
Cl^{-} (meq/ℓ)	3.40	1.14	9.74	11.08
SO_4^{--} (meq/ℓ)	2.95	0.06	3.27	5.14
CO_3^{--} (meq/ℓ)	-	0.40	0	0.21
HCO_3^{-} (meq/ℓ)	2.00	3.64	3.05	3.04
SAR (meq/ℓ)	1.98	3.94	4.45	4.90
Classification	C5S1	C2S1	C3S1	C3S2

Note: /1 Data Source: Feasibility Study Report on the Southern Ghor Irrigation

/2 D/S : Downstream of Confluence

/3 U/S : Upperstream of Confluence

Table G-2.5 LAND USE

Administrative Territories	Total Area (ha)	Forest Area (ha)	Cultivated Area (ha)	Irrigation Area* (ha)	Rainfed Area** (ha)	Irrigation Area/ Cultivated Area (%)
Amman Governorate						
1. Amman Sub-District	31,792	1,460	8,119	720	7,399	8.8
2. Na'our Nahia	22,987	2,479	4,552	260	4,292	5.6
3. Sahad Nahia	11,095	986	3,470	50	3,420	1.4
4. Mowaqqar Nahia	36,218	0	8,002	1,030	6,972	12.9
5. Jiza Nahia	81,656	850	22,892	6,361	16,531	27.8
6. Ma'daba Sub-District	48,446	11,511	9,498	106	9,392	1.1
7. Dieban Nahia	54,275	4,082	4,172	339	3,833	8.1
Sub-Total	286,469	21,368	60,705	8,866	51,839	15.5
Karak Governorate						
1. Karak Sub-District	35,334	4,951	6,978	505	6,473	7.2
2. Al-Qasr Sub-District	31,728	4,515	7,012	64	6,948	0.9
3. Mazar S. Sub-District	42,647	146	8,722	106	8,616	1.2
Sub-Total	109,709	9,612	22,712	675	22,037	2.9
Total	396,178	30,980	83,417	9,541	73,876	11.9
Proportion (%)	100	7.8	21	2.4	18.6	

Data Source : National Village Survey 1984, Ministry of Agriculture.

* ** : Estimated figures

* : Maximum ha of cereal crop or vegetables + ha of fruit tree.
** : Cultivated area - Irrigated area.

Table G-2.6 Planted Area in the East Bank, the Ghors and the Study Area in 1985

(Unit: Ha)

Crops	East Bank	Ghors	Governorates concerned			Study Area/1			
			Amman Gov.	Karak Gov.	Sub total	Amman area	Kanak area	Sub total	Proportion (%)
1. Field Crops									
Wheat	94,355.6	708.6	20,305	12,220	32,525	19,316	12,131	31,447	60.2
Barley	39,920.2	994.4	10,315	3,560	13,875	9,620	4,624	14,244	27.2
Lentils	5,784.7	-	1,745	182	1,927				
Vetch	3,572.7	-	880.7	56	936.7				
Chick Peas	2,890.0	-	778.8	487.5	1,266.3				
Local Tabacco	832.0	-	78.6	25.2	103.8				
Maize	875.1	-	7.1	567.5	574.6				
Dry Broadbeans	725.8	-	-	-	-				
Sesame	167.2	-	-	-	-				
Others	551.8	-	480	-	480	3,833	2,752	6,585	12.6
Total	149,675.1	1,703			51,688.4			52,276	
2. Vegetables									
Tomato	4,929.6	8,777.1				1,115	289	1,404	25.7
Eggplant	450.0	2,266.2	- No data -			165	6	171	3.1
Potato	444.8	1,105.6				59	0	59	1.1
Pepper	391.4	703.8				246	0	246	4.5
Summer Squash	1,234.4	2,471.5				344	13	357	6.5
Cucumber	1,178.2	5,303.5				282	22	304	5.6
Snake Cucumber	1,278.7	-				-	-	-	
Water Melon	3,577.9	223.3				514	16	530	9.7
Sweet Melon	2,154.5	1,369.3				360	3	363	6.6
Broad Beans	394.0	594.5							
String Beans	258.2	1,636.4							
Peas	142.2	-							
Cowpeas	264.8	-							
Okra	1,365.3	-							
Cabbage	663.7	484.5							
Spinach	223.5	-							
Jew Mallow	-	83.7							
Lettuce	492.4	502.8				310	0	310	5.7
Cauliflower	1,425.1	240.4							
Garlic	106.0	-							
Radish	184.2	-							
Carrot	58.0	-							
Onion	785.4	506.0							
Others	527.9	290.2				1,666	50	1,716	31.5
Total	22,530.2	26,558.7						5,460	100.0
3. Fruit Trees									
Olives	29,774.9	46.0	3,656.6	773.3	4,429.9	3,657	773	4,430	42.8
Grapes	12,615.6	117.3	2,754.4	1,247.7	4,002.1	2,754	1,248	4,002	38.7
Figs	1,095.5	-	319.4	30.4	349.8	319	30	349	3.4
Pomegranate	734.8	-	137.4	30.3	167.7	137	30	167	1.6
Almond	895.6	-	314.3	27.6	341.9	314	28	342	3.3
Apple	1,181.6	-	250.2	4.8	255.0	250	5	255	2.5
Apricot	389.2	-	33.8	25.4	59.2	34	25	59	0.6
Peaches	779.9	-	300.3	8.5	308.8	300	9	309	3.0
Plums/Prunes	945.3	-	280.2	18.2	298.4	280	18	298	2.9
Citrus	5,303.1	4,951.5	19.3	16.4	35.7	19	16	35	0.3
Pears	174.9	-	12.4	0.9	13.3	12	1	13	0.1
Quince	24.5	-	0.8	1.6	2.4	8	2	10	0.1
Bananas	1,066.8	1,046.8	-	-	-	-	-	-	-
Cherry	22.2	-	9.8	0.3	10.1	10	3	13	0.1
Guava	399.5	367.3	10.0	-	10.0	10	-	10	0.1
Date Palm & Others	25.7	-	5.0	-	5.0	50	5	55	0.5
Total	55,429.1	6,528.9			10,289.3			10,347	100.0

Note /1 : Amman, Madaba, Karak, Al-Qasr and Mazar subdistricts

Data Source: Statistical Year Book 1985, The Department of Statistics & Field Crops & Vegetables, Village Survey (1981 - 1985), the Ministry of Agriculture

Table G-2.7 Annual Planted Area
(Study Area/1)

(Unit: Ha)

Hydrologic Year	1980 (Oct'80-Sep'81)	1981 (Oct'81-Sep'82)	1982 (Oct'82-Sep'83)	1983 (Oct'83-Sep'84)	1984 (Oct'84-Sep'85)
Annual Areal Rainfall (mm)					
1. Wala basin	168	134	198	105	176
2. Mujib basin	147	20	147	53	109
1. Field Crops					
Wheat	24,470	34,362	49,310	17,310	31,692
Barley	9,419	20,652	20,703	6,530	13,317
Other winter field crops	-	-	5,326	2,348	3,281
Summer field crops	1,409	1,467	1,724	835	2,261
Sub total	-	-	75,339	26,188	48,290
2. Vegetables					
Tomato	1,223	1,005	1,717	1,649	1,426
Egg plant	11	24	379	216	206
Cauliflower	68	97	432	350	605
Potato	15	119	-	62	40
Squash	203	247	517	574	246
Cucumber	136	132	506	480	284
Pepper	41	43	537	510	101
Spring bean	38	46	25	50	50
Water melon	340	237	501	751	823
Sweet melon	334	230	516	381	353
Others	1,098	1,211	1,503	1,996	2,881
Sub total	3,507	3,391	6,633	7,019	7,015

Ncte /1: Amman area (Amman and Madaba subdistricts) and Karak area (Karak, Al-Qasr and Mazar subdistricts)
Source : Field Crops & Vegetables, Village Survey (1981-1985), the Ministry of Agriculture

Table G-2.8 Rainfed and Irrigated Farms of the Study Area in 1983

(Unit: %)

Area	Study Area		
	Amman area/1	Karak area/2	Total
I. Rainfed Area			
1.1 Field crops	68.5	87.4	74.0
1.2 Vegetables			
a) Autumn & Winter	0	0	0
b) Spring & Summer	2.5	0.6	2.0
1.3 Fruit	16.6	0.4	11.8
Sub total	87.6	88.4	87.8
II. Irrigation Area			
2.1 Field crops	0.4	0.6	0.1
2.2 Vegetables			
a) Autumn & Winter	3.8	1.2	3.2
b) Spring & Summer	7.2	0.6	4.8
2.3 Fruit	1.0	9.5	4.1
Sub total	12.4	11.6	12.2
Total	100	100	100

Note /1 : Amman and Madaba subdistricts
/2 : Karak, Al-Qasr and Mazar subdistricts

Data Source : Agricultural Census 1983, The Department of Statistical

Table G-2.9 Crops in the Study Area in 1983

Farm Type & Crops	Amman/1 Spring & Summer Crops %	Amman/1 Autumn & Winter Crops %	Amman/1 Total/1 %	Kanak/2 Spring & Summer Crops %	Kanak/2 Autumn & Winter Crops %	Kanak/2 Total/1 %
(I) Rainfed Farm						
(I-1) Field Crops						
Wheats	0	38.5	38.5	0	51.3	51.3
Barley	0	25.0	25.0	0	31.4	31.4
Lentils	0	2.9	2.9	0	2.8	2.8
Chick Pea	0	2.1	2.1	0	1.9	1.9
(I-2) Vegetables	2.5	0	2.5	0.6	0	0.6
Sub total	2.5	68.5	71.0	0.6	87.4	88.0
(II) Irrigated Field Farm						
(II-1) Vegetables						
Tomatoes	1.42	2.06	3.48	0.18	0.89	1.07
Eggplants	0.53	0.49	1.02	0.02	0.05	0.07
Squashes	0.71	0	0.71	0.02	0	0.02
Cucumbers	0.90	0.72	1.62	0.03	0.01	0.04
Hot & sweet peppers	0.41	0	0.41	0.01	0	0.01
Water & sweet melons	1.39	0	1.39	0.19	0	0.19
Cauliflowers and others	0.83	0	0.83	0.08	0.12	0.20
Sub total	6.19	3.27	9.46	0.53	1.07	1.60
(III) Plastic House Farm						
(III-1) Vegetables						
Tomatoes	0.35	0.34	0.69	0.034	0.117	0.151
Eggplants	0.12	0.07	0.19	0.003	0.01	0.013
Squashes	0.15	0	0.15	0.003	0	0.003
Cucumbers	0.23	0.12	0.35	0.005	0.003	0.008
Hot & sweet peppers	0.12	0	0.12	0.001	0	0.001
Green beans and others	0.04	0	0.04	0.024	0	0.024
Sub total	1.01	0.53	1.54	0.07	0.13	0.20

Note /1 : Amman and Madaba subdistricts
/2 : Karak, Al-Qasr and Mazar subdistricts

Source : Agricultural Census 1983, The Department of Statistical

Table G-2.10 Use and Source of Power on Agricultural Holdings

(Unit: Family)

	Amman Governarate	Karak Governarate	Total No. Holdings	%
Total No. of holdings	10,885	8,174	19,059	100
No. of holdings,				
Use of;				
1. Mechanical power only	3,318	3,649	6,965	36.5
2. Animal power only	1,415	1,142	2,257	11.8
3. Mechanical and animal	3,360	2,486	5,846	30.7
4. Human power only	1,597	766	2,363	12.4
5. Electric power;				
5.1 Purchased	342	45	387	2.0
5.2 Produced on the holding	853	58	911	4.8

Source: Agricultural Census 1983

Table G-2.11 Number of Machinery Owned by the Holder

	Amman Governarate	Karak Governarate	Total	Machinery holder
Total No. of holding	10,885	8,174	19,059	
Mechanical movers	352	125	477	0.025
Electric generators	541	47	588	0.031
Electric moters	148	25	173	0.009
Track laying tractors	16	11	27	0.001
Wheel tractors	901	394	1,295	0.068
Levelers	26	12	38	0.002
Harvestor only	21	9	30	0.001
Harvestor & thresher	885	271	1,156	0.061
Thresher only	909	403	1,312	0.069
Water pumps	268	46	314	0.016
Plowes	46	42	88	0.005
Weeds, insects & dis. control machine	15	0	15	0.001
Other machines	19	2	21	0.001

Source: Agricultural Census, 1983

Table G-2.12 Present Use of Fertilizer and Agricultural Chemicals

Area	Amman Governorate			Karak Governorate			Manual
Items	Farms (Ha)	Q'ty (ton)	Use Q'ty (ton/ha)	Farms (Ha)	Q'ty (ton)	Use Q'ty (ton/ha)	Use Q'ty (ton/ha)
(I) Agricultural Chemicals							
Insecticides & Pesticides	8,075	0	0	4,291	0	0	
(II) Fertilizer							
(A) Inorganic, Fer.							
1. Nitrogenous Fer. (N)	1,535	826	0.54	144	26	0.18	0.12-0.16
2. Patasic Fer. (K_2O)	97	24	0.25	10	5	0.50	0.5-1.0
3. Phosphate Fer. (P_2O_5)	423	270	0.64	92	72	0.78	0.2-1.0
4. Compound Fer.	3,188	1,962	0.62	842	677	0.80	
5. Other Fer.	719	585	0.81	1,494	925	0.62	
(B) Organic Fer.	3,309	41,654	12.59	1,181	902	0.76	20-30
Total	9,270	45,320	4.89	3,763	10,721	2.85	

Data Source : Agricultural Census 1983
Manual of Vegetable Production, the M.O.A., 1979
Manual of Vegetable Production in Plastic House, the M.O.A., 1984

Table G-2.13 Unit Yield and Production in the East Bank, the Ghors and the Study Area in 1985

Crops	East Bank			Ghors			Governorates Concerned						Study Area/1								
							Amman Gov.			Karak Gov.			Amman Area			Karak Area			Sub total		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1. Field Crops																					
Wheat	94,355.6	0.7	64,516	708.6	1.2	871	20,305.0	0.6	13,050	12,220.0	0.8	9,825	19,472	0.41	7,913	12,220	0.80	9,826	31,692	0.56	17,739
Barley	39,920.2	0.5	19,681	994.4	1.8	1,761	10,315.0	0.3	2,883	3,560.0	0.7	2,451	9,776	0.2	1,928	3,560	0.69	2,451	13,316	0.33	4,379
Lentils	5,784.7	0.7	4,063	-	-	-	1,745.0	0.7	1,286	182.0	0.8	151									
Vetch	3,572.7	0.6	2,309	-	-	-	880.7	0.7	611	56.0	0.7	37									
Chick Peas	2,890.0	0.5	1,589	-	-	-	778.8	0.4	313	487.5	0.6	294									
Local Tobacco	812.0	0.2	162	-	-	-	78.6	0.5	36	25.2	0.1	3									
Maize	875.1	0.4	353	-	-	-	7.1	0.0	0	567.5	0.3	169									
Dry Broad Beans	725.8	0.7	505	-	-	-	-	-	-	-	-	-									
Sesame	167.2	0.7	121	-	-	-	-	-	-	-	-	-									
Others	551.8	0.4	212	-	-	-	480.0	0.4	212	-	-	-									
Total	149,675.1			1,703																	
2. Vegetables																					
Tomato	4,929.6	24.1	118,779	8,777.1	33.4	293,489							1,120	13.1	14,718	306	15.9	4,850	1,426	13.7	19,568
Eggplant	450.0	18.9	8,499	2,266.2	29.9	67,733							200	4.1	818	6	8.5	51	206	4.2	869
Potato	444.8	21.6	9,614	1,105.6	15.0	16,585							40	12.3	492	0	-	0	40	12.3	492
Pepper	391.4	10.6	4,150	703.8	19.0	13,384							99	19.5	1,934	1	3.0	3	100	19.4	1,937
Summer Squash	1,234.4	10.2	12,652	2,471.5	14.9	36,873							213	15.1	3,215	33	8.5	280	246	14.2	3,495
Cucumber	1,178.2	21.8	25,628	5,303.5	33.8	179,120							251	14.5	3,627	33	10.5	346	284	14.0	3,973
Snake Cucumber	1,278.7	2.9	3,694	-	-	-															
Water Melon	3,577.9	17.1	61,347	223.2	16.4	3,664							776	8.1	6,314	47	5.0	235	823	10.0	6,549
Sweet Melon	2,154.5	14.3	30,755	1,369.3	15.3	20,886							343	6.6	2,248	11	6.8	75	354	6.6	2,323
Broad Beans	394.0	10.2	4,006	594.5	10.0	5,948															
String Beans	258.2	8.6	2,233	1,636.4	11.2	18,261							50	8.8	440	0	-	0	50	8.8	440
Peas	142.2	4.0	562	-	-	-															
Cowpeas	264.8	1.5	397	-	-	-															
Okra	1,365.3	2.2	3,015	-	-	-															
Cabbage	663.7	18.2	12,067	484.5	34.8	16,847															
Spinach	223.5	17.3	3,867	-	-	-															
Jew Mallow	-	-	-	83.7	30.0	2,511															
Lettuce	492.4	17.6	8,654	502.8	19.6	9,872															
Cauliflower	1,425.1	18.9	27,003	240.4	35.0	8,405															
Garlic	106.0	6.9	735	-	-	-															
Radish	184.2	11.7	2,158	-	-	-															
Carrot	58.0	21.8	1,264	-	-	-															
Onion	785.4	5.9	4,605	506.0	17.9	9,051															
Others	527.9	8.2	4,315	290.2	9.2	2,684							1,666			50			1,716		
Total	22,530.2			26,558.7																	
3. Fruit Trees																					
Olives	29,774.9	0.8	22,613	46	7.6	350	3,656.6	0.9	3,229	773.3	1.1	889	3,657	0.9	3,229	773	1.2	889	4,430	0.9	4,118
Grapes	12,615.6	3.4	42,637	117.3	18.3	2,146	2,754.4	3.6	10,043	1,247.7	3.8	4,682	2,754	3.7	10,043	1,248	3.8	4,682	4,002	3.7	14,725
Figs	1,095.5	2.5	2,698	-	-	-	319.4	2.9	943	30.4	1.1	34	319	3.0	941	30	1.1	34	349	2.8	975
Pomegranate	734.8	2.5	1,854	-	-	-	137.4	4.5	621	30.3	1.1	32	137	4.5	621	30	1.0	32	167	3.9	653
Almond	895.6	1.6	1,465	-	-	-	314.3	2.7	864	27.6	0.8	21	314	2.8	864	28	0.8	21	342	2.6	885
Apple	1,181.6	2.6	3,035	-	-	-	250.2	3.7	922	4.8	1.0	5	250	0.4	92	5	1.0	5	255	0.4	97
Apricot	389.2	2.0	771	-	-	-	33.8	2.2	73	25.4	1.4	35	34	2.1	73	25	1.4	35	59	1.8	108
Peaches	779.9	1.6	1,223	-	-	-	300.3	2.6	782	8.5	1.1	9	300	2.6	782	9	1.0	9	309	2.6	791
Plums/Prunes	945.3	2.9	2,709	-	-	-	280.2	3.4	957	18.2	0.9	16	280	3.4	957	18	0.9	16	298	3.3	973
Citrus	5,303.1	29.8	158,270	4,951.5	31.0	153,605	19.3	6.9	134	16.4	6.4	105	19	6.9	134	16	6.6	105	35	6.8	239
Pears	174.9	1.7	299	-	-	-	12.4	0.2	3	0.9	1.1	1	12	0.3	3	1	1.0	1	13	0.3	4
Quince	24.5	1.1	28	-	-	-	0.8	0	0	1.6	1.3	2	8	-	-	2	1.0	0	10	0.2	2
Bananas	1,066.8	28.9	30,804	1,046.8	29.2	30,604	-	-	-	-	-	-									
Cherry	22.2	0.9	19	-	-	-	9.8	1.7	17	0.3	0	0	10	1.7	17	3	-	-	10	1.7	17
Guava	399.5	13.2	5,282	367.3	14.3	5,257	10.0	0	0	-	-	-	10	-	-	-	-	-	10	-	-
Date Palm & Others	25.7	4.2	108	-	-	-	5.0	0	0	-	-	-	50	-	-	5	1.0	5	55	-	-
Total	55,429.1			6,528.9															10,347		

Note /1 : Amman, Madaba, Karak, Al-Qasr and Mazar sub-districts

Data Source : Statistical Year Book 1985, The Department of Statistics & Field Crops & Vegetables, Village Survey (1981-1985), The Ministry of Agriculture

Table G-2.14 Annual Crop Yield

(Unit: ton/ha)

Crops	1981	1982	1983	1984	1985
Wheat	0.59	0.73	0.82	0.75	0.56
Barley	0.52	0.62	0.78	0.16	0.33
Tomato	9.67	7.69	8.38	17.54	13.72
Eggplant	10.00	9.17	10.00	22.26	4.22
Cucumber	12.25	9.25	10.17	25.42	13.99
Squash	12.62	6.06	7.37	13.23	14.22
Pepper	-	9.41	10.00	10.00	19.27
Spring Beans	-	4.07	6.00	8.10	8.87
Water Melon	-	10.86	13.49	21.12	7.96
Sweet Melon	-	9.50	9.69	20.13	6.57
Cauliflower	10.00	9.91	10.00	29.40	16.16
Potato	10.00	12.60	-	22.71	12.46

Source : Village Survey (M.O.A.)

Table G-2.15 Unit Yield and Crop Production in the Study Area

Crops	Amman Area/4 Area (ha)	Amman Area/4 Production (ton)	Amman Area/4 ton/ha	Karak Area/5 Area (ha)	Karak Area/5 Production (ton)	Karak Area/5 ton/ha	Total Area (ha)	Total Production (ton)	Total ton/ha
1. Field Crops/1									
Wheat	19,316	15,563	0.81	12,131	8,841	0.73	31,447	24,404	0.78
Barley	9,620	6,303	0.66	4,624	3,118	0.67	14,244	9,421	0.66
Other Winter Crop	3,045	-	-	1,197	-	-	4,242	-	-
Summer Crop	788	-	-	1,555	-	-	2,343	-	-
Sub total	32,769	-	-	19,507	-	-	52,276	-	-
2. Vegetables/2									
Tomato	1,115	14,144	12.69	289	3,696	12.79	1,404	17,840	12.71
Eggplant	165	1,950	11.82	6	49	8.09	171	1,999	11.69
Squash	344	3,984	11.58	13	95	7.35	439	4,079	9.29
Cucumber	282	5,417	19.21	22	217	10.09	304	5,634	18.53
Pepper	246	2,752	11.19	0	0	0	246	2,752	11.19
Green Beans	42	296	7.04	0	0	0	42	296	7.04
Water Melon	514	7,805	15.19	16	109	6.81	530	7,914	14.93
Sweet Melon	360	4,272	11.87	3	19	6.40	363	4,291	11.82
Cauliflower	310	5,206	16.79	0	0	0	310	5,206	16.79
Potato	59	589	9.98	0	0	0	59	589	9.98
Others	1,666	-	-	50	-	-	1,716	-	-
Sub total	5,054	-	-	399	-	-	5,453	-	-
3. Fruit/3									
Olives	3,657	3,229	0.88	773	889	1.15	4,430	4,118	0.93
Grape	2,754	10,043	3.65	1,248	4,682	3.75	4,002	14,725	3.68
Citrus	19	134	6.94	16	105	6.56	35	239	6.83
Apples	250	92	0.37	5	5	1.00	255	97	0.38
Figs	319	941	2.95	30	34	1.13	349	975	2.79
Pomegranate	137	621	4.53	30	32	1.06	167	653	3.91
Quince	8	-	-	2	2	1.00	10	2	0.20
Guava	10	-	-	-	-	-	10	-	-
Pears	12	3	0.25	1	1	1.00	13	4	0.30
Almond	314	864	2.75	28	21	0.75	342	885	2.59
Apricots	34	73	2.14	25	35	1.40	59	108	1.83
Plums/Prunes	280	957	3.42	18	16	0.89	298	973	3.27
Peaches	300	782	2.60	9	9	1.00	309	791	2.56
Cherries	10	17	1.70	3	-	-	10	17	1.70
Others	50	-	-	5	5	1.00	55	5	-
Sub total	8,103	18,586	2.29	2,185	5,831	2.67	10,288	24,417	2.37
Total	45,926			22,091			68,017		

Note /1, /2 : Field Crop & Vegetable; M.O.A. Village Survey (1981-85)

/3 : Fruit; Statistical Year Book 1985

/4 : Amman Area : Amman sub-district and Madaba sub-district

/5 : Karak Area : Karak, Al-Qasr and Mazar sub-districts

Table G-2.16 Unit Yield Variation of Vegetables by Area and by Cropping Season

(1984/85 Season)

	Irrigated Winter Vegetable				Irrigated Summer Vegetables				Rainfed Summer Veg.
	Highland	N.Ghor	M.Ghor	S.Ghor	Highland	N.Ghor	M.Ghor	S.Ghor	Highland
Tomato	19.1	48.7	35.0	10.0	41.1	28.2	27.4	-	4.3
Eggplant	11.5	30.0	30.0	11.1	19.5	35.0	30.0	-	-
Zucchini	27.7	15.0	15.0	-	13.4	15.0	14.7	-	1.7
Cucumber	13.4	-	-	-	23.6	-	-	-	
Green Pepper	9.2	20.0	20.0	11.4	10.6	43.7	42.0	-	
Cauliflower	17.8	-	20.0	2.4	19.9	20.0	20.0	-	
Cabbage	14.3	35.0	-	-	22.1	35.0	34.3	-	
Beans	12.0	35.0	20.0	-	7.9	35.0	35.0	-	
Onion	6.5	20.7	10.0	10.0	21.3	10.3	12.5	-	2.2
Potato	25.5	20.0	20.0	-	20.2	7.6	20.0	-	
Garlic	6.9	15.0	15.0	-	-	-	-	-	
Lettuce	17.9				12.7	20.0	20.0	10.7	
Radish	12.8				5.0	-	-	-	
Carrot	21.8				-	-	-	-	
Spinach	17.3				-	19.2	20.0	-	
Green Peas	5.0				-	-	-	-	2.0
Water Melon	-				39.9	15.0	15.0	-	4.8
Yellow Melon	-				29.7	20.0	20.0	12.0	4.8
Mushroom	-				7.7	-	-	-	
Okra	-				5.6	-	-	-	21.8
Cowpeas	-	-	-	-	-	-	-	-	1.8
Mallow	-	8.2	10.0	-					

Date Source : Annual Report 1985, The Ministry of Agriculture

Table G-2.17 AGRICULTURAL HOLDING AND FARM SIZE

(Amman and Karak Governorate)

Category	Number of Agricultural Holdings Amman	Karak	Total	Proportion (%)
Owner	9,222	1,837	11,059	78.7
Tenure	1,663	1,337	3,000	21.3
a)For fixed amount of money	520	96	616	4.4
b)For fixed amount of produce	1,039	1,151	2,190	15.6
c)For fixed amount of money & produce	32	45	77	0.5
d)Others	72	45	117	0.1
Total	10,885	3,174	14,059	100.0

Size of Group (dunum)	Area dunum	%	Holding number	%	Average Size dunum
0-10	15,253	1.0	5,372	38.2	2.8
10-20	31,387	2.1	2,382	16.9	13.2
20-30	42,043	2.8	1,845	13.1	22.8
30-40	49,945	3.3	1,551	11.0	32.2
40-50	46,594	3.1	1,101	7.8	42.3
50-100	204,902	13.5	3,136	22.3	67.5
100-200	249,231	16.4	1,965	14.0	126.8
200-500	346,055	22.8	1,236	8.8	280.0
500-1000	196,323	12.9	301	2.1	625.2
more than 1000	343,083	22.6	172	1.2	1,994.7
Total	1,516,111	100	14,059	100	107.8

Data Source : Agricultural Census 1984

Table G-2.18 HOLDING NUMBER OF DOMESTIC ANIMAL

Administrative Territories	Number of Sheep	Number of Goats	Number of Cows	Number of Poultries	Number of Farmers	Number of Own Farmer
Amman Governorate						
1. Amman Sub-District	58,680	31,475	1,241	415,345	1,007	656
2. Na'our Nahia	21,250	8,540	368	304,030	1,734	1,374
3. Sahab Nahia	22,800	9,380	151	466,180	1,218	444
4. Mowaqqar Nahia	51,600	17,960	152	278,940	2,470	1,970
5. Jiza Nahia	109,500	20,700	290	941,765	3,180	2,639
6. Ma'daba Sub-District	29,100	18,420	665	643,415	3,070	2,850
7. Dieban Nahia	23,535	13,830	384	31,165	4,017	3,716
Sub-Total	316,465	120,305	3,251	3,080,840	16,696	13,649
(Average holding No./Farmer*)	(23)	(9)	(0.2)	(228)		
Karak Governorate						
1. Karak Sub-District	30,173	27,894	124	446,000	3,458	3,518
2. Al-Qasr Sub-District	24,727	26,792	65	1,047,000	1,133	618
3. Mazar S. Sub-District	57,060	44,482	31	530,000	4,334	2,784
Sub-Total	111,960	99,168	220	2,023,000	8,925	6,920
Total	428,425	219,473	3,471	5,103,840	25,621	23,616
(Average holding No./Farmer*)	(16)	(14)	(0.03)	(292)		
(Average holding No./Farm)	(18)	(9)	(0.1)	(216)		

Data Source : National Village Survey 1984, Ministry of Agriculture.

* : Estimated figures

Table G-2.19 Projected Area and Production for 85/86 Crop Season (Area in Dunum, Production in 1,000 tons)

Croos	Valley		Highlands		Total	
	Area	Production	Area	Production	Area	Production
Tomato	57,046	170	22,587	72	79,633	241.9
Eggplant	39,246	109	7,046	11	46,292	119.8
Cucumber	-	-	16,771	35	-	-
Squash	40,700	58	3,638	5	44,338	63.8
Cauliflower	-	-	6,265	11	-	-
Watermelon	14,000	*	21,585	54	35,585	-
Melon	6,000	*	3,014	5	9,014	-
Potato	15,000	27	13,000	26	28,000	53
Onion	10,000	26	8,000	24	18,000	50
Pepper	-	-	9,223	8	-	-
Stringbeans	-	-	1,421	1	-	-
Broadbeans	-	-	5,544	3	-	-
Cabbage	-	-	4,928	7	-	-
Other vegetables	-		1,679	*	-	-
Gains	60,000	18	-	-	-	-

Remarks : *No Data

PLANTED AREA AND PRODUCTION IN 1985
(Statistical Yearbook 1985) (AREA IN DUNUM, Production in 10 tons)

Croos	Valley		Highlands		Total	
	Area	Production	Area	Production	Area	Production
Tomato	87,800	294	49,300	119	137,100	412.30
Eggplant	22,700	68	4,500	9	27,200	76.20
Cucumber	53,000	179	11,800	26	64,800	204.70
Squash	24,700	37	12,400	13	37,100	49.50
Cauloflower	2,400	8	14,300	8	16,700	35.40
Watermelon	2,200	4	35,800	61	38,000	65.00
Melon	13,700	21	21,500	31	35,200	51.60
Potato	11,100	17	4,400	10	15,900	13.70
Onion	5,100	9	7,800	5	12,900	13.70
Pepper	7,038	13	3,900	4	11,000	17.60
Stringbeans	16,400	18	2,500	2	18,900	20.50
Broadbeans	5,900	6	4,000	4	9,900	10.00
Cabbage	4,800	17	6,700	12	11,500	28.90

Remarks : *No Data

Table G-2.20 Consumption of the Major Crops in 1985

Crops	Production ton	Import ton	Export ton	Consumption ton	Consumption per Capita kg
Wheat	62,827	376,908	-	439,735	163
Barley	19,681	74,890	-	94,571	35
Lentils	4,063	585	-	4,648	2
Chick Peas	1,589	10,384	500	11,473	4
Tomato	412,268	-	108,237	304,031	113
Eggplant	76,232	-	31,692	44,540	17
Pepper	17,534	-	18,978		-
Potato	26,199	16,232	5,487	36,944	14
Cauliflower	35,408	33	12,353	23,088	9
String Beans	20,494	-	6,590	13,904	5
Carrot	1,264	3,876	378	4,762	2
Squash	49,525	-	23,928	25,597	10
Cucumber	204,748	-	58,519	146,229	54
Water Melon	65,011	470	5,734	59,747	22
Sweet Melon	51,641	408	13,416	38,633	14
Onion	13,656	8,644	4,071	18,229	7
Garlic	735	1,820	41	2,514	1
Okra	3,015	-	1,340	1,675	1
Cabbage	20,914	250	8,429	12,735	5
Bananas	30,804	-	6	30,798	11
Green Olives	22,610	155	-	22,765	8
Grapes	52,637	-	2,148	50,489	19
Apples & Pears	3,334	57,057	341	60,050	22
Cherries	19	848	71	796	0
Citrus	158,270	111,867	137,467	132,670	49
Peaches	1,223	1	124	1,100	0
Total					587

Note: Used population in 1985 is 2,694,000 estimated by Dep. of Statistics

Source: Statistic Year Book 1985

Table G-2.21 Number of Holdings by Source of Finance

(Unit: Family)

	Amman Governarate	Karak Governarate
Total Holdings	10,885	8,174
Holders financed by:		
The holders himself	10,512	7,874
The land load	780	380
The middle man	68	74
Agricultural Credit Corporation (ACC)	201	134
Cooperative Organization (JCO)	141	124
City and Village Development Bank	1	7
Farmers union	12	4
Other government source	26	15
Private source	53	35
Other non government source	68	31

Source: Agricultural Census 1983

Table G-2.22 Price of Materials and Labour (1985)

Item	Price (JD)	Item	Price (JD)
1. Seed/Seedling		3. Agro-chemicals	
Wheat	0.14/kg	Pesticide	5.0/ha/time
Barley	0.10/kg	Kalthane MF	3.7/kg
Lentil	0.20/kg	Malathione 57 liquid	1.75/〃
Chick Pea	0.26/kg	Mitac	4.5/〃
Tomato	35.5/kg	Danitol	9.5/〃
Cucumber	19.7/kg	Pirimor	10.0/〃
Pepper	25.0/kg	Cymbush	10.0/〃
Sweet Melon	20.0/kg	Fungicide	4.5/ha/time
Spinach	3.8/kg	Diathine M.45	2.5/kg
Celery	75.0/kg	Karathane LC	7.0/〃
Potato	0.27/kg	Benlate	10.0/kg
Lettuce	38.0/kg	Ronilan	7.5/kg
Water Melon	11.6/kg	Mematicide	
Squash	17.4/kg	Methyl bromide	1.15/kg
Green Bean	0.17/kg		
Radish	6.4/kg	4. Manual labour	0.4/mhr
Carrot	6.4/kg		
Okra	2.0/kg	5. Machinary labour	
Onion	9.7/kg	Plawing & hurrowing	
Cauliflower	50.0/kg	Plastic house	40/ha
Pepper	25.0/kg	Open field	20/ha
Strawberry	0.12/seedling		
Tomato	0.02/seedling	6. Drip system	300/ha/year
Sweet Pepper	0.01/seedling		
Peach	0.5/seedling	7. Plastic house	1,519/ha/year
Grape	0.5/seedling		
Apple	0.5/seedling		
Pear	0.5/seedling		
2. Fertilizer			
Ammonium sulfate	0.13/kg		
Super phosphate	0.07/kg		
Potasium sulfate	0.05/kg		

Source: Material Price 1985, The Department of Agricultural Economic, The Ministry of Agriculture.

National Center for Agricultural Research and Technology Transfer.

Table G-2.23 Present Material Use (1985)

Farm Type	Crop	Seeds kg/ha	Seedling No./ha	Manure ton/ha	Ammonium Sulfate ton/ha	Super Phosphate ton/ha	Potassium Sulfate ton/ha	Pesticide time/ha	Fungicide time/ha	Water m^3/ha
Rainfed Farm	Wheat	100			90	70				
	Barley	100			50	50				
	Lentils	50			60			1		
	Chick Peas	50			60			1		
	Tomatoes	0.5			300	200		1		
	Cucumbers	3			300	100		1	1	
	Water & Sweet Melons	3			200	100		1	1	
	Squashes	3			300	100		1	1	
Irrigated Field	Tomatoes	1.1			500	400	100	3	3	5,200
	Eggplants		5,000		500	400	100	3	3	6,000
	Squashes	5			300	150		2	2	3,600
	Cucumbers	3.7			500	400	100	3	3	2,800
	Hot & Sweet Peppers	1			500	400	100	3	3	5,200
	Water & Sweet Melons	5			600	300	100	2	2	7,000
	Cauliflowers	0.8			500	200		2	2	3,400
Plastic House	Tomatoes		8,000	10	1,000	600	200	3	3	5,200
	Eggplants		5,000	10	1,000	600	200	3	3	6,000
	Squashes		5	10	500	300	200	3	3	3,600
	Cucumbers		3.7	20	600	300	100	3	3	2,800
	Hot & Sweet Peppers		20,000	20	1,000	700	400	3	3	5,200
	Green Beans	65			400	300	100	3	3	5,000

Note : The Agricultural Research Center's Information, The Manual of Vegetable Production (M.O.A. 1979) and The Manual of Vegetable Production in Plastic House (M.O.A. 1985).

Table G-2.24 Present Labour Requirements and Labour Cost (1985)

(Unit: men-hours/ha)

	Land Preparation	Sowing	Planting	Weeding	Irrigation	Fertilizer	Pesticide	Other husbandry	Harbesting	Total	Unit Cost JD/mhr	Labour Costs JD/ha
(I) Rainfed Farm												
Wheat	1	4	-	-	-	5	10	-	25	45	0.4	18
Barley	1	4	-	-	-	5	-	-	10	20	0.4	8
Lentil	1	4	-	-	-	5	10	-	25	45	0.4	18
Chick Pea	1	4	-	-	-	5	10	-	25	45	0.4	18
Tomatoes	90	20	-	30	-	20	20	-	130	310	0.4	124
Cucumbers	90	20	-	30	-	20	20	-	240	420	0.4	168
Water & Sweet Melons	90	20	-	30	-	20	20	-	120	300	0.4	120
Squashes	90	20	-	30	-	20	20		200	380	0.4	152
(II) Irrigated Field												
Tomatoes	90	-	80	40	90	25	35	10	410	740	0.4	296
Eggplant	90		80	40	90	25	35	10	360	730	0.4	284
Squashes	90	40	-	40	90	25	35	10	350	680	0.4	272
Cucumbers	90	40	-	40	90	25	35	10	1,090	1,420	0.4	568
Hot & Sweet Peppers	90	20	80	40	90	25	35	10	820	1,150	0.4	460
Water & Sweet Melons	90	20		40	90	25	35	10	250	560	0.4	224
Cauliflowers	90	20	-	40	90	25	35	10	220	530	0.4	212
(III) Plastic House												
Tomatoes	90	-	80	40	90	30	50	30	1,640	2,050	0.4	822
Eggplants	90	20	80	40	90	30	50	30	1,150	1,580	0.4	632
Squashes	90	20	80	40	90	30	50	30	1,070	1,450	0.4	580
Cucumbers	90	20	80	40	90	30	50	30	1,660	2,090	0.4	836
Hot & Sweet Peppers	90	-	80	40	90	30	50	30	1,610	2,020	0.4	808
Green Beans	90	20		40	90	30	30	30	1,100	1,450	0.4	580

Data Source: Feasibility Study on Mujib and Southern Ghors Irrigation Project (Stage II) 1983

Table G-2.25 Present Production Cost (1985)

(Unit: JD/ha)

	Material Costs	Manual Labour Costs	Machinary Labour Costs	Capital Interests	Total Cost
(I) Rainfed Farms					
Wheat	36	18	10	3	67
Barley	12	8	10	1	31
Lentil	19	18	10	2	49
Chick Pea	22	18	10	2	52
Tomatoes	83	124	20	7	236
Cucumbers	114	168	20	9	311
Water & Sweet Melons	45	120	20	4	189
Squashes	107	152	20	9	288
(II) Irrigated Field					
Tomatoes	586	296	20	37	939
Eggplant	596	284	20	37	937
Squashes	387	272	20	36	715
Cucumbers	564	568	20	21	1,173
Hot & Sweet Peppers	572	460	20	36	1,088
Water & Sweet Melons	492	224	20	26	762
Cauliflowers	365	212	20	23	620
(III) Plastic House					
Tomatoes	1,581	820	40	113	2,554
Eggplants	1,380	632	40	99	2,151
Squashes	1,307	578	40	98	2,023
Cucumbers	1,475	836	40	111	2,462
Hot & Sweet Peppers	1,613	809	40	119	2,581
Green Beans	1,217	708	40	88	1,925

Table G-2.26 Farm Gate Price (1985)

	Crops	Farm Gate Price (JD/ton)		Crops	Farm Gate Price (JD/ton)
1.	Strawberry	975	14.	Carrot	71
2.	Tomato	75	15.	Okra	201
3.	Cucumber	109	16.	Onion	83
4.	Sweet Melon	149	17.	Cauliflower	56
5.	Spinach	175	18.	Eggplant	70
6.	Celery	175	19.	Peech	160
7.	Sweet Pepper	140	20.	Grapes	180
8.	Potato	100	21.	Apple	129
9.	Lettuce	56	22.	Pear	285
10.	Water Melon	70	23.	Wheat	120
11.	Squash	90	24.	Barley	89
12.	Green Bean	146	25.	Lentil	188
13.	Radish	65	26.	Chick Peas	253

Data Source: The Department of Agricultural Economic, The M.O.A.

Table G-2.27 Farm Receipt (1985) (Amman Area)

Farm Type and Crops	Yield ton/ha	Farm Gate Price JD/ton	Gross Income JD/ha	Production Cost JD/ha	Net Income JD/ha
(I) Rainfed Farm					
Wheats	0.78	120	94	67	27
Barleys	0.66	89	59	31	28
Lentils	0.41	188	77	49	28
Chick Peas	0.30	253	76	52	24
Tomatoes	4.3	75	323	236	87
Cucumbers	4.5	109	491	311	180
Water & Sweet Melons	4.8	75	360	189	171
Squashes	5.0	90	450	288	162
(II) Irrigated Field					
Tomatoes	30	75	2,250	939	1,311
Eggplants	15	70	1,050	939	111
Squashes	15	90	1,350	700	650
Cucumbers	20	109	2,180	1,173	1,007
Hot & Sweet Peppers	15	140	2,100	1,088	1,012
Water & Sweet Melons	30	70	2,100	764	1,336
Cauliflowers	20	56	1,120	620	500
(III) Plastic House Farm					
Tomatoes	55	75	4,125	2,554	1,571
Eggplants	40	70	2,800	2,151	649
Squashes	35	90	3,150	2,023	1,127
Cucumbers	57	109	6,213	2,462	3,751
Hot & Sweet Peppers	35	140	4,900	2,581	2,319
Green Beans	30	109	3,270	1,925	1,345

Source: Field crop and irrigated vegetable yield: Annual Report of Agriculture (1985)
Plastic house vegetable yield: Cost of agricultural production in Arab Country (1985)
Farm Gate Price: Dep. of Agricultural Economy (1985)

Table G-2.28 HIGH LAND IRRIGATION PROJECTS

Name of Project	Water Resource	Irrigation Area (ha)	Water Discharge (l/sec)	Number of Well	Planted Crops	Irrigation Method	Remarks
I) Pilot Irr.* Scheme (Public Sector)							
1. Dhulei Irr. Project 2/	Ground Water	630	220	6	Cereals, vegetable fruit tree (Olives, etc.)	Furrow for cereals, Drip for vegetables	Retention dam :1.0 MCM
2. Al-Samra Irr. Proj. 2/	Waste Water (Ground W.)	?	?	(High Salinity Water)	Olives popular, Eucaliptos Apple (463,500 NOS)	Furrow for olives & forest trees, Drip for olives	Research Center:6ha
3. Arja Irr. Proj.1/2/	Ground Water	?	97	3	Wheat, Barley, Maize Sorghum		
4. Woheda Irr. Proj.1/2/	Ground Water	171	76	2	Apples, Grapes		
5. Abu-Lisan Irr. Project 1/	Ground Water	117	92	2	Apples, Grapes, fruit,vegetables	Sprinkler & Contour Furrows	Farm Pond System
6. Tal-Burma Irr. Proj. 1/ 2/	Ground Water	120	69	2	Vegetables	Contour furrows	
7. Wadi Al-Abiad Irr. Proj. 1/ 2/	Ground Water	52.5	39	1	Vegetables		
8. North Qatranah Irr. Proj. 1/	Ground Water	100	75	3	Vegetables	Drip for vegetables, furrow for grain	
9. South Qatranah Irr. Proj. 1/	Ground Water	65	50	2	Vegetables	Drip for vegetables, furrow for grain	
Total		<1255.5		<21			

Note : 1/ Beduin Settlement Project
2/ Schemes are located outside of the Study Area

Table G-2.29 Existing Irrigation Schemes In The Study Area

Type of Irrigation Scheme	Water Resource	Irrigation Area (ha)	Water Discharge (l/sec)	Number of Well	Planted Crops	Irrigation Method	Remarks
A) Pilot Irr. Scheme (Public Sector)							
1. N. Qatranah Irr. Proj. 1/	Ground Water	100	75	3	Vegetables	Drip & furrow	
2. S. Qatranah Irr. Proj. 1/	Ground Water	65	50	2	Vegetables	Drip & furrow	
Sub Total		165		5			
B) Spring Water Devel. (Public/Private Sectors) Project							
1. Lajjun Area	Spring Water	40 *	12	-	Vegetables, Wheat	Drip	
C) Ground Water Irr. (Private Sector) Scheme							
1. Wadi Wala Area	Ground Water	3,000 *	2,000 *	170 *	Vegetable & fruit trees	Drip & furrow	
D) Surface Water Irr. (Private Sector) Scheme							
1. Wadi Wala Area	Basic flows of the Wadi	360 *	91 *	-	Vegetables	Furrows	Est. water require. 0.25 l/sec/ha
2. Wadi Majib Area	Basic flow of the Wadi	70	-	-	Vegetables & Field Crop	-	

Note: 1/ Beduin Settlement Project
2/ Schemes are located outside of the Study Area
* Estimated figures

Table G-3.1 Screening of Crops

Crops	Farm Type	Possibility of double cropping	Results of the 1st Sc.	Crop Budget (Net income) (JD/ha)	(Evaluation) /2	Results of the 2nd Sc.	Water Benefit (JD/m³)	(Evaluation) /3	Results of the 3rd Sc.	Final Results of Selection	Remarks
(I) Field Crops											
1. Wheat	OF	Possible	o	30			0.02				
2. Broadbeans	OF	Non		860			0.47				
(II) Vegetables											
1. Green Beans	OF	Possible	o	1,881	B	o	0.38	B	o	o	
	PH	"	o	1,782	B	o	0.36	B	o		Unsuitable crop for plastic houses
2. Tomato	OF	Non		1,611	B		0.31	B			
	PH	Possible	o	1,554	B	o	0.30	B	o	o	
3. Eggplant	OF	Non		1,086			0.18				
	PH	Possible	o	1,122			0.19				
4. Cucumber	OF	Non		1,937	B		0.69	A			
	PH	Possible	o	4,635	A	o	1.66	A	o	o	
5. Squash	OF	"	o	1,579	B	o	0.44	A	o	o	
	PH	"	o	1,731	B	o	0.48	A	o		Production control by Government
6. Sweet & hot Pepper	OF	Non		1,581	B	o	0.31	B			
	PH	Possible	o	3,749	A	o	0.72	A	o	o	
7. Water Melon	OF	"	o	1,839	B	o	0.26	B	o	o	
8. Sweet Melon	PH	"	o	4,602	A	o	0.87	A	o	o	
9. Strawberry	PH	Non	*	6,324	A	o	1.22	A	*	o	High net income
10. Okra	OF	Possible	o	1,865	B	o	0.23	B	o	o	
11. Lettuce	OF	"	o	870		*	0.36	B	*	o	Possibility of double cropping
12. Cauliflower	OF	"	o	1,360		*	0.40	A	*	o	"
13. Spinach	PH	"	o	1,235		*	0.69	A	*	o	"
14. Onion	OF	"	o	2,161	A	o	0.28	B	o	o	
15. Celery	PH	"	o	2,276	A	o	0.71	A	o	o	
16. Radish	OF	"	o	1,189		*	0.66	A	*	o	Possibility of double cropping
17. Carrot	OF	"	o	1,153		*	0.55	A	*	o	"
18. Potato	OF	"	o	2,419	A	o	0.37	B	*	o	"
(III) Fruit trees											
1. Peach	OF	Non		1,846	B		0.14				
2. Grapes	OF	Non		1,318			0.13				
3. Apples	OF	Non		1,148			0.08				
4. Pear	OF	Non		1,451			0.11				
(IV) Fodder Crops											
1. Alfalfa	OF	Non		869			0.06				
2. Berseem	OF	Non		195			0.04				

Note : Sc /1 : Screening
OF : Openfield farms
PH : Plastic houses farms
Evaluation /2 A: more than JD2,000/ha
B: JD2,000/ha to JD1,500/ha
Evaluation /3 A: more than JD0.4/m^3
B: JD0.4/m^3 to JD0.2/m^3

Table G-3.2 Labour Requirements and Labour Cost

Crops	Land Preparation (mh/ha)	Sowing (mh/ha)	Planting (mh/ha)	Weeding (mh/ha)	Irrigation (mh/ha)	Fertilizer (mh/ha)	Pesticide (mh/ha)	Other husbandry (mh/ha)	Harbesting (mh/ha)	Total (mh/ha)	Unit Cost (JD/mh)	Costs (JD/ha)
Strawberries	90	-	350	90	130	40	90	50	4,840	5,680	0.4	2,272
Tomatoes	90	-	90	40	90	40	90	50	1,500	1,990	0.4	796
Cucumbers	90	70	130	40	90	40	90	50	2,500	3,100	0.4	1,240
Sweet Melons	90	30	90	40	90	40	40	50	310	780	0.4	312
Spinaches	90	50	-	70	40	40	40	50	1,140	1,520	0.4	608
Celeries	90	70	260	90	90	40	40	50	1,670	2,400	0.4	960
Sweet Peppers	90	70	130	40	90	40	90	50	2,010	2,820	0.4	1,128
Potatoes	90	90	-	90	90	30	90	10	350	840	0.4	336
Lettuces	90	40	80	10	40	30	40	10	350	690	0.4	276
Water Melons	90	40	-	40	90	30	40	10	280	620	0.4	248
Squashes	90	30	-	40	90	30	40	10	650	980	0.4	392
Green Beans	90	30	-	40	90	20	40	10	840	1,160	0.4	464
Radishes	90	40	-	30	40	20	30	10	400	660	0.4	264
Carrots	90	40	-	30	50	20	30	10	540	810	0.4	324
Okras	90	40	-	40	90	30	40	10	690	1,030	0.4	412
Onions	90	30	80	90	90	30	90	10	330	840	0.4	336
Cauliflowers	90	40	80	10	40	30	40	10	390	730	0.4	292

Table G-3.3 Seasonal Labour Requirement

(I) Dab'ah-Hammam Scheme Area

(Unit: x10^3 man-day/ha)

Cropping Pattern	Area (Ha)	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.
Type-1	50	1.93	2.45	2.73	2.02	1.95	3.07	2.48	3.02	2.65	2.63	1.95	1.74
Type-2	50	1.16	1.10	0.61	0.38	0.64	0.86	0.44	0.83	1.46	1.25	0.86	1.08
Type-3	75	0.39	0.21	0.20	0.29	0.96	1.29	0.66	0.98	1.88	1.11	-	0.06
Total	175	3.48	3.76	3.54	2.69	3.55	5.22	3.58	4.83	5.99	4.99	2.81	2.88

(II) Qatrana Scheme Area

(Unit: x10^3 man-day/ha)

Cropping Pattern	Area (Ha)	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sep.
Type-3	75	0.39	0.21	0.20	0.29	0.96	1.29	0.66	0.98	1.88	1.11	-	0.66

Table G-3.4 Material Requirement for Crop

Crops	Seeds kg/ha	Seedlings No./ha	Manure ton/ha	Ammonium Sulfate ton/ha	Super Phosphate ton/ha	Potassium Sulfate ton/ha	Pesticide time/ha	Fungicide time/ha	Water m^3/ha
Strawberries	-	3,000	30	700	600	200	3	3	5,200
Tomatoes	1	13,000	30	1,500	600	200	5	5	5,200
Cucumbers	3.7	10,000	30	1,200	600	200	5	5	2,800
Sweet Melons	5	8,000	20	900	500	150	2	2	4,600
Spinaches	40	-	20	1,000	500	300	2	2	1,800
Celeries	2	40,000	30	2,000	1,000	1,000	2	2	3,200
Sweet Peppers	1	20,000	30	2,000	1,500	800	5	5	5,200
Potatoes	2,200	-	10	600	300	250	4	4	6,500
Lettuces	0.5	50,000	10	800	300	200	2	2	2,420
Water Melons	5	-	10	800	500	150	4	4	7,000
Squashes	5	-	20	600	300	100	4	4	3,600
Green Beans	65	-	10	300	500	300	5	4	3,400
Radishes	2.5	-	10	600	400	50	3	3	1,800
Carrots	2.5	-	20	800	500	150	3	3	2,100
Okras	8	-	10	1,000	500	300	5	5	8,000
Onions	9	25,000	20	500	200	100	4	4	7,800
Cauliflowers	0.8	25,000	10	800	300	200	3	3	3,400

Table G-3.5 Farm Imput for The Scheme Areas

Scheme / Cropping Pattern / Area (Ha)		Dab'ah Hamman Type-1 50	Dab'ah Hamman Type-2 50	Dab'ah Hamman Type-3 75	Dab'ah Hamman Total 175	Qatrana Type-3 75
1. Seed/Seedling (s)						
- Strawberries	(Seedling x 10^3)	37.5			37.5	
- Tomato	(")	162.5			162.5	
- Cucumber	(")	125			125	
- Sweet Melon	(")	100			100	
- Spinach	(kg)	500			500	
- Celery	(Seedling x 10^3)	500			500	
- Sweet Pepper	(")	250			250	
- Potato	(ton)		22	33	55	33
- Lettuce	(Seedling x 10^3)		500		500	
- Water Melon	(kg)		50	75	125	75
- Squash	(")		50		50	
- Green Bean	(")		650	975	1,625	975
- Radish	(")		25		25	
- Carrot	(")		25	37.5	62.5	37.5
- Okra	(")		80		80	
- Onion	(Seedling x 10^3)		90	135	225	135
- Cauliflower	(")		8		8	
2. Fertilizer (x 10^3 ton)						
- Manure		2.4	1.3	1.1	4.8	1.1
- Ammonium Sulfate		116.3	68	45	229.3	45
- Super Phosphate		60	38	30	128	30
- Potassium Sulfate		35.6	18	14.3	67.9	14.3
3. Agricultural Chemicals						
- Nematicides (ton)		2.6	3.0	2.3	7.9	2.3
- Insecticides (ℓ)		150	185	150	485	150
- Fungicides (kg)		390	468	371	1,229	371

Table G-3.6 Anticipated Unit Crop Yield

(Unit: ton/ha)

Crops	Anticipated Yield	Reference (drip irrigation)			U.S.A./5		Note
		Highland/1	Jordan/2,/3	Japan/4	Average Yield	Good Yield	
(I) Plastic House							
Strawberries	12	-	7*	25	-	-	*J.V.A. open field surface irrigation
Tomatoes	60	50	120	60	49	67	
Cucumbers	70	66	80-120	70	11	14	
Sweet Melons	40	-	10-20**	40	-	-	
Spinaches	20	-	30-50**	25**	16	22	**Open field, surface irrigation
Celeries	30	-	-	80	56	79	
Sweet Peppers	50	35	10-20**	70	-	-	
Potatoes	40	30	10-50**	40	28	39	
(II) Open Field							
Lettuces	30	-	15**	30	26	39	
Water Melons	40	35	20	60	13	22	
Squashes	30	26	20-40**	-	-	45	
Green Beans	20	20	6**	20	-	-	
Radishes	30	-	-	40	-	-	
Carrots	30	-	20**	30	31	39	
Okras	15	-	18*	18	-	11	
Onions	40	-	30-60	40	35	45	
Cauliflowers	40	35	40-50*	35	11	17	

Source: /1 : Leage of Arab State, Arab Organization for Agricultural Development; Costs of Agricultural Production in Arab Countries (1985)

/2 : Manual of Vegetable Production (M.O.A., 1979)

/3 : Manual of Vegetable Production in Plastic House (M.O.A. 1984)

/4 : Manual of Vegetable Production in Ibaraki Prefecture, Japan (1985)

/5 : Knott's Handbook for Vegetable Growers

Table G-3.7 Crop Production for the Scheme Area

(Unit: x 10^3 ton/ha)

Scheme / Cropping Pattern / Area (Ha) / Yield & Production	Unit Yield (ton/ha)	Dab'ah-Hammam Type-1 50	Dab'ah-Hammam Type-2 50	Dab'ah-Hammam Type-3 75	Dab'ah-Hammam Sub Total 175	Qatrana Type-1	Total
		Production					
Crops							
- Strawberry	12	0.6	-	-	0.6	-	0.6
- Tomato	60	3.0	-	-	3.0	-	3.0
- Cucumber	70	3.5	-	-	3.5	-	3.5
- Sweetmelon	40	2.0	-	-	2.0	-	2.0
- Spinach	20	1.0	-	-	1.0	-	1.0
- Celery	30	1.5	-	-	1.5	-	1.5
- Sweet pepper	50	2.5	-	-	2.5	-	2.5
- Potato	40	-	2.0	3.0	5.0	3.0	8.0
- Lettuce	30	-	1.5	-	1.5	-	1.5
- Watermelon	40	-	2.0	3.0	5.0	3.0	8.0
- Squash	30	-	1.5	-	1.5	-	1.5
- Greenbean	20	-	1.0	1.5	2.5	1.5	4.0
- Radish	30	-	1.5	-	1.5	-	1.5
- Carrot	30	-	1.5	1.5	3.0	1.5	4.5
- Okra	15	-	0.75	-	0.75	-	0.75
- Onion	40	-	2.0	3.0	5.0	3.0	8.0
- Cauliflower	40	-	2.0	-	2.0	-	2.0

Table G-3.8 Production Cost of Each Crop

(Unit: JD/ha)

Crop	Material Costs	Manual Labour Costs	Machinery Labour Costs	Capital Interests /1	Total Costs
Strawberries	2,846	2,272	40	218	5,376
Tomatoes	1,969	796	40	141	2,946
Cucumbers	1,593	1,240	40	122	2,995
Sweet Melons	1,495	312	40	111	1,958
Spinaches	1,500	608	40	117	2,265
Celeries	1,833	960	40	141	2,974
Sweet Peppers	1,938	1,128	40	145	3,251
Potatoes	1,136	336	20	91	1,583
Lettuces	480	276	20	34	810
Water Melons	654	248	20	39	961
Squashes	663	392	20	46	1,121
Green Beans	520	464	20	35	1,039
Radishes	445	264	20	32	761
Carrots	590	324	20	43	977
Okras	678	412	20	40	1,150
Onions	757	336	20	46	1,159
Cauliflowers	532	292	20	36	880

Note : /1 : Capital Interests = (Material costs exclude water cost) x 0.08

Table G-3.9 Farmgate Price

Crops	Farmgate Price JD/ton
Strawberries	975
Tomatoes	75
Cucumbers	109
Sweet Melons	149
Spinaches	175
Celery	175
Sweet Peppers	140
Potatoes	100
Lettuces	56
Water Melons	70
Squashes	90
Green Beans	146
Radishes	65
Carrots	71
Okras	201
Onions (dry)	83
Cauliflowers	56

Data Source : The Department of Agricultural Economic, the M.O.A.

Table G-3.10 Crop Budget on Farmgate

		Unit Crop Yield t/ha	Farmgate Price JD/ton	Gross Income JD/ha	Production Cost JD/ha	Net Income JD/ha
(I)	Plastic House Farms					
1.	Strawberries	12	975	11,700	5,376	6,324
2.	Tomatoes	60	75	4,500	2,946	1,554
3.	Cucumbers	70	109	7,630	2,995	4,635
4.	Sweet Melons	40	149	5,960	1,958	4,002
5.	Spinaches	20	175	3,500	2,265	1,235
6.	Celeries	30	175	5,250	2,974	2,276
7.	Sweet Peppers	50	140	7,000	3,251	3,749
(II)	Openfield Farms					
1.	Potatoes	40	100	4,000	1,583	2,417
2.	Lettuces	30	56	1,680	810	870
3.	Water Melons	40	70	2,800	961	1,839
4.	Squashes	30	90	2,700	1,121	1,579
5.	Green Beans	20	146	2,920	1,039	1,881
6.	Radishes	30	65	1,950	761	1,189
7.	Carrots	30	71	2,130	977	1,153
8.	Okras	15	201	3,015	1,150	1,865
9.	Onions	40	83	3,320	1,159	2,167
10.	Cauliflowers	40	56	2,240	880	1,360

Table G-3.11 Net Income of Each Cropping Pattern

Crops	Crop Intensity (%)	Unit Net Income (JD/Ha)	Net Income (JD/Ha)
(Type-1)			
1. Strawberry	0.25	6,324	1,581
2. Tomato	0.25	1,554	389
3. Cucumber	0.25	4,635	1,159
4. Sweet Melon	0.25	4,002	1,001
5. Spinach	0.25	1,235	309
6. Celery	0.25	2,276	569
7. Sweet Pepper	0.25	3,749	937
Total	1.75		5,945
(Type-2)			
1. Potato	0.2	2,417	483
2. Lettuce	0.2	870	174
3. Water Melon	0.2	1,839	368
4. Squash	0.2	1,579	316
5. Green Bean	0.2	1,881	376
6. Radish	0.2	1,189	238
7. Carrot	0.2	1,153	231
8. Okra	0.2	1,865	373
9. Onion	0.2	2,161	432
10. Cauliflower	0.2	1,360	272
Total	2.0		3,263
(Type-3)			
1. Potato	0.2	2,417	483
2. Water Melon	0.2	1,839	368
3. Green Bean	0.2	1,881	376
4. Carrot	0.2	1,153	231
5. Onion	0.2	2,161	432
Total	1.0		1,890

Table G-3.12 Calculated Potential Evapotranspiration (ETo)
(Modified Penman Method)

(Unit: mm/day)

Station	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.
1. Na'our	4.7	3.2	1.7	1.7	2.4	3.4	5.6	7.6	9.5	9.5	8.9	7.0
2. Madaba	5.0	4.0	2.0	2.0	2.3	3.5	5.4	7.3	8.4	9.3	8.7	7.2
3. Wadi Wala	5.3	4.3	2.4	2.2	2.8	4.0	5.8	8.3	9.2	9.6	8.8	8.1
4. Rabbah	4.7	3.4	2.0	2.0	3.0	3.8	5.8	7.2	8.2	8.5	7.4	6.0
5. Hassan	5.2	3.6	2.4	2.5	3.1	4.7	7.0	8.2	9.1	9.6	8.6	6.8
6. Jiza	4.5	3.1	1.8	1.9	2.5	3.7	5.6	7.5	8.5	9.0	7.5	5.8
7. Qatrana	4.5	3.0	2.0	1.8	2.7	3.7	6.0	7.1	8.4	8.9	8.0	6.1
(A) Adopted ETo for Design												
(I) Daba'h-Hamman Scheme Area	5.0	4.0	2.0	2.0	2.5	3.5	5.5	7.5	9.0	9.5	9.0	7.5
(II) Qatrana Scheme Area	5.0	3.5	2.0	2.0	3.0	4.0	7.0	8.0	8.5	9.5	8.0	7.0

Table G-3.13 Modified Monthly Climate Data
(for ETo of Plastic Houses of Years C1976-1982)

Factor/Station/ Elevation		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1. Mean Temperature (°C)													
Na'our	910m	24	18	14	12	13	15	19	23	26	28	27	26
Madaba	785m	25	19	15	13	14	16	20	24	27	29	28	27
Wadi Wala	450m	27	22	17	16	16	18	23	26	29	30	30	29
Al Jiza	715m	24	18	14	12	14	16	20	24	27	28	27	26
2. Relative Humidity (%)													
Na'our	910m	61	65	85	87	84	80	65	51	45	51	53	61
Madaba	785m	59	61	82	81	84	76	64	47	52	49	52	55
Wadi Wala	450m	60	54	77	77	79	73	61	43	47	47	51	58
Al Jiza	715m	65	69	84	83	84	81	67	55	55	58	51	69
3. Wind run (m/sec)													
Na'our	910m	0.5	0	0	0	0	0	0	0	0.5	0.5	0.5	0.5
Madaba	785m	0.5	0	0	0	0	0	0	0	0.5	0.5	0.5	0.5
Wadi Wala	450m	0.5	0	0	0	0	0	0	0	0.5	0.5	0.5	0.5
Al Jiza	715m	0.5	0	0	0	0	0	0	0	0.5	0.5	0.5	0.5
4. Cloudness (Octas)													
Na'our	910m	1.9	3.7	4.2	4.1	3.8	3.8	3.6	2.2	0.4	0.6	0.2	0.4
Madaba	785m	2.2	4.5	5.4	4.3	5.5	4.8	4.4	3.0	0.5	0.7	0.2	0.3
Wadi Wala	450m	1.6	2.9	3.4	3.2	4.0	3.7	2.8	2.2	0.4	0.6	0.5	0.2
Al Jiza	715m	1.3	2.3	3.7	3.6	3.7	3.8	3.2	2.3	0.4	0.4	0.2	0.4
5. Sunshine hour (hr/day)													
Al Jiza	715m	8.6	7.5	5.6	6.0	6.4	7.4	7.8	10.2	12.0	12.0	11.7	10.3

Table G-3.14 Average Crop Coefficient (Kca)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
(A) Conjunctive Use Area												
Plastic House (Type I)												
(1) Strawberry	0.86	0.86	0.86	0.86	0.86	0.86	0.86					0.86
	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86				0.43
	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.43			(Kca)	
(2) Celery (150 days)	0.45	0.70	0.92	0.99	0.92							
		0.45	0.70	0.92	0.99	0.92						
(Kca)	0.23	0.58	0.81	0.96	0.96	0.46						
(3) Peppers (120 days)						0.36	0.45	0.83	0.92	0.72	0.72	
							0.36	0.45	0.83	0.92	0.36	
				(Kca)		0.18	0.41	0.64	0.88	0.82		
(4) Cucumber (120 days)	0.85	0.74									0.32	0.63
	0.63	0.85	0.74									0.32
	0.74	0.80	0.37							(Kca)	0.16	0.48
(5) Tomato (120 days)						0.50	0.83	1.08	0.88			
							0.50	0.83	1.08	0.88		
					(Kca)	0.25	0.67	0.96	0.98	0.44		
(6) Spinach (90 days)	0.63	0.88										0.34
	0.34	0.63	0.88									
	0.49	0.76	0.44								(Kca)	0.17
(7) Sweetmelon (135 days)					0.39	0.59	0.87	0.88	0.67			
						0.39	0.59	0.87	0.88	0.67		
				(Kca)	0.20	0.49	0.73	0.88	0.78	0.34		
Open field (Type II)												
(8) Potato (120 days)					0.47	0.85	1.06	0.86				
						0.47	0.85	1.06	0.86			
				(Kca)	0.24	0.66	0.96	0.96	0.43			
(9) Onion (180 days)			0.55	0.81	0.95	0.92	0.88	0.73				
				0.55	0.81	0.95	0.92	0.88	0.73			
	(Kca)		0.28	0.68	0.88	0.94	0.90	0.81	0.39			
(10) Cauliflower (90 days)	0.92										0.32	0.79
	0.79	0.92										0.32
	0.86	0.46								(Kca)	0.16	0.56
(11) Carrot (90 days)			0.58	0.95	0.83							
				0.58	0.95	0.83						
	(Kca)		0.29	0.77	0.89	0.42						
(12) Okra							0.47	0.81	1.06	0.76		
								0.47	0.81	1.06	0.76	
						(Kca)	0.23	0.64	0.94	0.91	0.38	
(13) Squash (90 days)	0.77										0.32	0.74
	0.74	0.77										0.32
	0.76	0.39								(Kca)	0.16	0.62
(14) Radish	0.47	0.73	0.84									
		0.47	0.73	0.84								
(Kca)	0.24	0.60	0.79	0.42								
(15) Green bean (90 days)						0.37	0.63	0.88				
							0.37	0.63	0.88			
					(Kca)	0.19	0.50	0.76	0.44			
(16) Cherries & Apples	0.77	0.64			(Kca)	0.43	0.68	0.85	0.89	0.89	0.85	0.81
(17) Peaches & Pears	0.68	0.60			(Kca)	0.43	0.64	0.77	0.81	0.81	0.81	0.72
(18) Grapes	0.64						(Kca)	0.43	0.64	0.77	0.81	0.77
(19) Berseem		0.50	0.84	0.85	0.85	0.85	0.85	0.85				
			0.50	0.84	0.85	0.85	0.85	0.85	0.85			
	(Kca)	0.25	0.67	0.85	0.85	0.85	0.85	0.85	0.43			

Table G-3.15 Crop Irrigation Data Requirement

(Unit: mm/one season)

		Dab'ah-Hammam Scheme Area	Qatrana Scheme Area
Cropping Pattern (Type-1)			
1.	Strawberry	517	-
2.	Celery	220	-
3.	Peppers	523	-
4.	Cucumber	281	-
5.	Tomato	524	-
6.	Spinach	178	-
7.	Sweetmelon	457	-
Cropping Pattern (Type-2)			
1.	Lettuce	260	-
2.	Potato	580	-
3.	Onion	661	-
4.	Cauliflower	369	-
5.	Carrot	202	-
6.	Okra	803	-
7.	Watermelon	642	-
8.	Squash	363	-
9.	Radishes	213	-
10.	Greenbeans	389	-
Cropping Pattern (Type-3)			
1.	Potato	580	646
2.	Onion	662	738
3.	Carrot	202	218
4.	Watermelon	643	687
5.	Greenbeans	298	344

Table G-3.16 Leaching Water Requirement

(Yield decrement 0%)

Area/Crops	ECiw (mmhos/cm)	Max ECe (mmhos/cm)	L.F. (Loamy soils)	$LR = \frac{ECiw}{2(Max\ ECe)} \times \frac{1}{LF}$
A. Dab'ah-Hammam Scheme Area (Plastic Houses)/(Open field)				
Strawberry	1.0	4	0.7	0.18
Peppers	1.0	9	0.7	0.08
Cucumbers	1.0	10	0.7	0.07
Tomato	1.0	13	0.7	0.05
Lettuce	1.0	9	0.7	0.08
Potato	1.0	10	0.7	0.07
Onion	1.0	8	0.7	0.09
Cauliflower	1.0	14	0.7	0.05
Carrot	1.0	8	0.7	0.09
Radishes	1.0	9	0.7	0.08
Greenbeans	1.0	7	0.7	0.10
Peaches	1.0	8	0.7	0.09
Grapes	1.0	8	0.7	0.09
Apples	1.0	12	0.7	0.06
Pears	1.0	8	0.7	0.09
			Average	0.08 ≑ 0.1
B. Qatrana Scheme Area (Open field)				
Potato	1.0	10	0.7	0.07
Onion	1.0	8	0.7	0.09
Carrots	1.0	8	0.7	0.09
Watermelon	1.0		0.7	
Green beans	1.0	7	0.7	0.10
			Average	0.09 ≑ 0.1

Table G-3.17 Irrigation Water Requirement for Each Cropping Pattern

UNIT CROP IRRIGATION WATER REQUIREMENT (MM/MONTH)

CROP-TYPE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
TYPE-1	108.66	65.36	23.36	20.49	51.07	81.29	110.74	151.68	180.02	71.7	30.23	86.06	980.66
TYPE-2	117.84	62.22	58.18	29.9	75.32	92.91	171.05	273.53	175.88	81.48	63.22	100.11	1301.6
TYPE-3													
HAMMAM	0	0	39.55	25.83	93.64	87.68	158.8	192.12	83.97	3.6	0	0	685.19
QATRANA	0	0	39.55	25.83	102.03	99.75	202.11	204.48	79.3	3.6	0	0	756.65

CROP IRRIGATION WATER REQUIREMENT (MM/MONTH)

AREA / TYPE	RATIO	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
CONJUNCTIVE AREA														
TYPE-1	.5	54.33	32.68	11.68	10.25	25.54	40.65	55.37	75.84	90.01	35.85	15.12	43.03	490.33
TYPE-2	.5	58.92	31.11	29.09	14.95	37.66	46.46	85.53	136.77	87.94	40.74	31.61	50.06	650.82
TOTAL		113.25	63.79	40.77	25.20	63.20	87.10	140.90	212.61	177.95	76.59	46.73	93.09	1141.2
SURFACE WATER IRRIGATION AREA														
TYPE-3														
HAMMAM	1	0.00	0.00	39.55	25.83	93.64	87.68	158.80	192.12	83.97	3.60	0.00	0.00	685.19
QATRANA	1	0.00	0.00	39.55	25.83	102.03	99.75	202.11	204.48	79.30	3.60	0.00	0.00	756.65

Table G-3.18 Present Irrigation Water Use

UNIT CROP IRRIGATION WATER REQUIREMENT (MM/MONTH)

(PRESENT CONDITIONS)

CROP-TYPE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
TYPE-1	54.08	35.62	4.58	0	0	77.2	76.31	159.06	212.64	62.19	39.63	54.46	775.77
TYPE-2	50.45	22.67	2.23	0.00	0.00	47.90	103.87	199.69	269.92	195.77	62.46	52.76	1007.7

CROP IRRIGATION WATER REQUIREMENT (MM/MONTH)

AREA / TYPE	RATIO	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
CONJUNCTIVE AREA														
TYPE-1	.3	16.22	10.69	1.37	0.00	0.00	23.16	22.89	47.72	63.79	18.66	11.89	16.34	232.73
TYPE-2	.7	35.32	15.87	1.56	0.00	0.00	33.53	72.71	139.78	188.95	137.04	43.73	36.93	705.40
TOTAL		51.54	26.55	2.94	0.00	0.00	56.69	95.60	187.50	252.74	155.69	55.61	53.27	938.13

Table G-3.19 Irrigation Water Requirement for The Scheme

(A) Dab'ah - Hamman Scheme

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Total
(1) for existing ground water irrigation area (100 ha)(Cropping Pattern Type-1 & 2)													
(mm/month)	0	0	38	25	63	30	45	25	0	0	0	0	226
Monthly Amount ($x10^3m^3$/100 ha)	0	0	38	25	63	30	45	25	0	0	0	0	226
(2) for newly development area (75 ha)(Cropping Pattern Type-3)													
(mm/month)	0	0	40	26	94	88	159	192	84	4	0	0	685
Monthly Amount ($x10^3m^3$/75 ha)	0	0	30	19.5	70.5	66	119.3	144	63	3	0	0	515.3
Total Amount ($x10^3m^3$/175 ha)	0	0	68	44.5	133.5	96	164.3	169	63	3	0	0	741.3
(mm/day)	0	0	1.3	0.8	2.7	1.8	3.1	3.1	1.2	0.1	0	0	
(l/sec/ha)	0	0	0.15	0.09	0.31	0.21	0.36	0.36	0.14	0.01	0	0	

(B) Qatrana Scheme

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Total
(Cropping Pattern Type-3)													
(75 ha) (mm/month)	0	0	40	26	102	100	202	204	79	4	0	0	757
Monthly Amount ($x10^3m^3$/75 ha)	0	0	30	19.5	76.5	75	151.5	153	59.3	3	0	0	567.8
(mm/day)	0	0	1.3	0.8	3.3	3.2	6.5	6.6	2.5	0.1	0	0	
(l/sec/ha)	0	0	0.15	0.09	0.38	0.37	0.75	0.76	0.29	0.01	0	0	

Table G-5.1 Net Income Without the Scheme Condition

(Dab'ah - Hamman Scheme Area)

	Cropping Pattern %	Cropped Area ha	Farm gate Price JD/ton	Present Yield ton/ha	Without the Scheme					
					Yield ton/ha	Gross Income JD/ha	Production Costs JD/ha	Net Income JD/ha	Net income in cropped area JD	Average Net income JD/ha
(I) Rainfed Farm										
Wheats	54.6	40.9	120	0.78	0.78	95	66	28	1,145	
Barleies	35.3	26.5	89	0.66	0.66	59	31	28	742	
Lentils	5.6	4.2	188	0.41	0.41	77	49	28	118	
Chick Peas	4.5	3.4	253	0.30	0.30	76	52	24	82	
Sub total	100.0	75.0							2,037	27
(II) Irrigated Field Farm										
Tomatoes	33.4	23.4	75	30	40	3,000	1,014	1,986	46,472	
Eggplants	10.0	7.0	70	15	30	2,100	1,014	1,086	7,602	
Squashes	8.4	5.9	90	15	30	2,700	1,118	1,582	9,334	
Cucumbers	16.6	11.6	109	20	30	3,272	1,333	1,937	22,469	
Hot & Sweet Peppers	5.0	3.5	140	15	20	2,800	1,219	1,581	5,534	
Water & Sweet Melons	16.6	11.6	70	30	40	2,800	962	1,938	22,481	
Cauliflowers	10.0	7.0	56	20	40	2,240	879	1,361	9,527	
Sub total	100.0	70.0							123,419	1,763
(III) Plastic House Farm										
Tomatoes	45.0	13.4	75	55	60	4,500	2,946	1,554	20,824	
Eggplants	12.5	3.8	70	40	50	3,500	2,378	1,122	4,264	
Squashes	10.0	3.0	90	35	45	4,050	2,319	1,731	5,193	
Cucumbers	22.5	6.7	109	57	70	7,630	2,995	4,635	31,055	
Hot & Sweet Peppers	7.5	2.3	140	35	50	7,000	3,251	3,749	8,623	
Green Beans	2.5	0.8	146	22	35	5,110	3,328	1,782	1,426	
Sub total	100.0	30.0							71,385	2,380
Total		175.0							196,841	1,125

Table G-5.2 Incremental Benefit for the Scheme

Cropping Pattern	Scheme Net Income (JD/Ha)	Dab'ah-Hamman Area (Ha)	Dab'ah-Hamman Net Income (JD)	Qatrana Area (Ha)	Qatrana Net Income (JD)	Total (JD)
(A) With the Scheme Condition						
Type-1	5,945	50	297,250	0	0	
Type-2	3,263	50	163,150	0	0	
Type-3	1,890	75	141,750	75	141,750	
Sub total /1		175	602,150	75	141,750	743,900
(B) Without the Scheme Condition						
(1) Rainfed farms	27	75	2,037	0	0	
(2) Irrigated field farms	1,763	70	123,419	0	0	
(3) Plastic houses farms	2,380	30	71,841	0	0	
(4) Non arable land		0	-	75	-	
Sub total /2		175	196,841	75	0	196,841
(C) Incremental Benefit						
(Sub total /1 - Sub total /2)			405,309		141,750	547,059
(JD/Ha)			2,316		1,890	2,188

Table G-5.3 Construction Materials and Labour Cost

	Unit	F.C (JD)	D.C (JD)	Total (JD)
(A) Material Costs				
Cement	ton	35.0		35.0
Gravel	m^3	1.38	0.41	1.79
Sand	m^3	1.63	0.48	2.11
Timber wood	m^3	118	-	118
Plywood	m^2	3.65	-	3.65
Steel bar	ton	150	-	150
H beam	ton	310	-	310
Wire	kg	0.23	-	0.23
Reinforced Concrete				
Pipe Ø450	lin.m	9.3	-	9.3
Ø400	"	7.5	-	7.5
Ø300	"	5	-	5
Ø200	"	3.4	-	3.4
(B) Labour Cost				
Unskilled Local Labour	m-day	-	5.2	5.2
Unskilled Foreign Labour	"	5.2	-	6.9
Skilled Local Labour	"	-	6.9	-
Skilled Foreign Labour	"	6.9	-	6.9
Foreman		-	8.1	8.1

Table G-5.4 Unit Construction Cost

(JD)

DESCRIPTION	UNIT	F.C.	L.C	TOTAL
1.EARTH WORKS				
1.1.EXCAVATION	CUM	0.66	0.34	1.00
1.2.EMBANKMENT	CUM	0.83	0.28	1.10
1.3.BACKFILL	CUM	0.83	0.28	1.10
1.4.SANDFILL	CUM	1.83	1.17	3.00
2.STONE WORKS				
2.1.GRAVEL METAL	CUM	3.71	2.00	5.70
2.2.RIPRAP	CUM	9.54	5.14	14.68
2.3.STONE MASONRY	CUM	4.50	3.00	7.50
3.CONCRETE WORKS				
3.1.CONCRETE	CUM	34.34	8.06	42.40
3.2.R.C.PIPE				
ø1000	LIN.M	37.65	12.55	50.20
ø500	LIN.M	9.90	3.30	13.20
ø450	LIN.M	8.40	2.80	11.20
ø300	LIN.M	4.50	1.50	6.00
ø150	LIN.M	2.70	0.90	3.60
4.METAL WORKS				
4.1.SLIDE GATE				
ø500	SET	307.00	93.00	400.00
4.2.SCREEN	TON	314.53	38.87	353.40
4.3.I-BEAM	TON	336.58	41.60	378.18
4.4.REIN.BAR	TON	314.53	38.87	353.40
5.OTHERS				
5.1.VINYLE SHEET	SQ.M	1.60	0.40	2.00
5.2.PUMP HOUSE	SQ.M	240.00	80.00	320.00
5.3.PUMP	SET	8000.00	2000.00	10000.00
5.4.DISTRIBUTION LINE	LIN.KM	8000.00	2000.00	10000.00
5.5.TRANSFORMER	SET	1520.00	380.00	1900.00
5.6.AIR/TURNOUT VALVES	SET	967.50	107.50	1075.00
5.7.FARM DEVELOP.	HA	886.16	293.84	1180.00
5.8.SAND FILTER 30 LIT/SEC	SET	10975.70	2724.30	13700.00
6.DAM	CUM	4.92	3.71	8.63

Table G-5.5 Construction Cost of Terminal Irrigation System
(for 8 ha)

(Unit: JD)

Item	Unit	Q'ty	F.C. Unit Price	F.C.	L.C. Unit Price	L.C.	
1. Tertiary Pipe							
UPVC pipe Ø200	lin.m	300	5.913	1,773.9	1.387	416.1	
Turnout valves	Nos	4	LS	178	L.S.	42	
Earthwork							
Excavation	m^3	45	0.66	29.7	0.34	15.3	
Backfill	m^3	30	0.825	24.75	0.275	8.25	
Sandfill	m^3	9	1.830	16.47	1.170	10.53	
2. Farm turnout	set	1	967.5	9675.	107.5	107.5	
3. Farm road							
Embankment	m^3	280	0.825	231	0.275	77	
Stone pavement	m^3	120	3.705	444.6	1.995	239.4	
4. Field drain							
Excavation	m^3	96	0.66	63.36	0.34	32.64	
5. Drip irrigation* facility	ha	8	420	3,360	180	1,440	Total
Total				7,089.28		2,350.72	9,440
Unit cost/ha				886.16		293.84	1,180

* Note: Procurement and installation costs of drip irrigation facility are estimated at JD600/ha, referring to construction cost of similar highland irrigation schemes.

Table G-5.6 Construction Cost and Disbursement Schedule (1)

DISBURSEMENT SCHEDULE (DAB'AH - HAMMAM & QATRANA AREA)

	CALENDER YEAR	1	2	3	4	5	6	7
	ENGNEERING SERVICE							
	FEASIBILITY ST. ####							
	PROCESSING ::::::::::::::							
	DETAIL DESIGN ####							
	CONSRTUCTION							
CONSTRUCTION COST	DAM				##25%##	##50%##	##25%##	
	IRRIGATION				##100%##			
	INFLATION RATIO							
	FOREIGN PORTION	1.031	1.044	1.058	1.072	1.109	1.148	1.188
	LOCAL PROTION	1.03	1.061	1.091	1.126	1.159	1.194	1.23
1 DIRECT CONSTRUCTION COST								
F.C. JD 4044000								
DAM COST	3355440----------				838860	1677720	838860	
IRR COST	688560----------				688560			
L.C. JD 2730200								
DAM COST	2530000----------				632500	1265000	632500	
IRR COST	200200----------				200200			
SUBTOTAL 6774200								
2 PHYSICAL CONTINGENCY								
F.C. JD 404400								
DAM COST	335544----------				83886	167772	83886	
IRR COST	68856----------				68856			
L.C. JD 273020								
DAM COST	253000----------				63250	126500	63250	
IRR COST	20020----------				20020			
SUBTOTAL 677420								
3 E/S &ADOMINISTRATION COST								
F.C. JD 677420	----------	203226		135484	135484	135484	67742	
L.C. JD 338710	----------	33871	33871	67742	101613	67742	33871	
SUBTOTAL 1016130								
TOTAL								
F.C. JD 5125820	----------	203226	0	135484	1815646	1980976	990488	
L.C. JD 3341930	----------	33871	33871	67742	1017583	1459242	729621	
SUBTOTAL 8467750								
PRICE CONTINGENCY								
F.C. JD 508180	----------	6310	0	7870	130927	216257	146817	
L.C. JD 512070	----------	1018	2070	6177	128477	232492	141835	
SUBTOTAL 1020250		7328	2070	14047	259403	448749	288652	
CONSTRUCTION COST								
F.C. JD 5634000	----------	209536	0	143354	1946573	2197233	1137305	
L.C. JD 3854000	----------	34889	35941	73919	1146060	1691734	871456	
TOTAL 9488000	----------	244425	35941	217273	3092632	3888967	2008761	

Table G-5.7 Construction cost and Disbursement Schedule (2)

DISBURSEMENT SCHEDULE (DAB'AH - HAMMAN)

CONSTRUCTION COST	CALENDER YEAR	1	2	3	4	5	6	7
	ENGNEERING SERVICE							
	FEASIBILITY ST. ####							
	PROCESSING ##########							
	DETAIL DESIGN			####				
	CONSRTUCTION							
	DAM				##25%##	##50%##	##25%##	
	IRRIGATION				##100%##			
	INFLATION RATIO							
	FOREIGN PORTION	1.031	1.044	1.058	1.072	1.109	1.148	1.188
	LOCAL PROTION	1.03	1.061	1.091	1.126	1.159	1.194	1.23
1 DIRECT CONSTRUCTION COST								
F.C. JD 3740000								
DAM COST	3355440----------				838860	1677720	838860	
IRR COST	384560----------				384560			
L.C. JD 2645000								
DAM COST	2530000----------				632500	1265000	632500	
IRR COST	115000----------				115000			
SUBTOTAL 6385000								
2 PHYSICAL CONTINGENCY								
F.C. JD 374000								
DAM COST	335544----------				83886	167772	83886	
IRR COST	38456----------				38456			
L.C. JD 264500								
DAM COST	253000----------				63250	126500	63250	
IRR COST	11500----------				11500			
SUBTOTAL 638500								
3 E/S &ADDMINISTRATION COST								
F.C. JD 638500	----------	191550		127700	127700	127700	63850	
L.C. JD 319250	----------	31925	31925	63850	95775	63850	31925	
SUBTOTAL 957750								
TOTAL								
F.C. JD 4752500	----------	191550	0	127700	1473462	1973192	986596	
L.C. JD 3228750	----------	31925	31925	63850	918025	1455350	727675	
SUBTOTAL 7981250								
PRICE CONTINGENCY								
F.C. JD 508500	----------	6284	0	7838	112265	227598	154516	
L.C. JD 512250	----------	987	2007	5989	119231	238522	145513	
SUBTOTAL 1020750		7271	2007	13827	231496	466120	300029	
CONSTRUCTION COST								
F.C. JD 5261000	----------	197834	0	135538	1585727	2200790	1141112	
L.C. JD 3741000	----------	32912	33932	69839	1037256	1693872	873188	
TOTAL 9002000	----------	230746	33932	205377	2622983	3894662	2014300	

Table G-5.8 Construction Cost and Disbursement Schedule (3)

DISBURSEMENT SCHEDULE (OATRANA AREA)

CALENDER YEAR		1	2	3	4	5	6	7
ENGNEERING SERVICE								
FEASIBILITY ST.	####							
PROCESSING	::::::::::::::							
DETAIL DESIGN	####							
CONSRTUCTION								
IRRIGATION	##100%##							
INFLATION RATIO								
FOREIGN PORTION		1.031	1.044	1.058	1.072	1.109	1.148	1.188
LOCAL PROTION		1.03	1.061	1.091	1.126	1.159	1.194	1.23

CONSTRUCTION COST

1 DIRECT CONSTRUCTION COST								
F.C. JD	304000							
DAM COST	0----------				0	0	0	
IRR COST	304000----------				304000			
L.C. JD	85200							
DAM COST	0----------				0	0	0	
IRR COST	85200----------				85200			
SUBTOTAL	389200							
2 PHYSICAL CONTINGENCY								
F.C. JD	30400							
DAM COST	0----------				0	0	0	
IRR COST	30400----------				30400			
L.C. JD	8520							
DAM COST	0----------				0	0	0	
IRR COST	8520----------				8520			
SUBTOTAL	38920							
3 E/S &ADOMINISTRATION COST								
F.C. JD	38920	----------	11676		7784	7784	7784	3892
L.C. JD	19460	----------	1946	1946	3892	5838	3892	1946
SUBTOTAL	58380							
TOTAL								
F.C. JD	373320	----------	11676	0	7784	342184	7784	3892
L.C. JD	113180	----------	1946	1946	3892	99558	3892	1946
SUBTOTAL	486500							
PRICE CONTINGENCY								
F.C. JD	26900	----------	362	0	452	24660	849	577
L.C. JD	14100	----------	58	119	355	12569	620	378
SUBTOTAL	41000							
CONSTRUCTION COST								
F.C. JD	400220	----------	12038	0	8236	366844	8633	4469
L.C. JD	127280	----------	2004	2065	4247	112127	4512	2324
TOTAL	527500	----------	14043	2065	12483	478971	13145	6793

Table G-5.9 O & M Cost

(I) Dab'ah-Hammam Scheme Area

1. Running cost for the Scheme Office		
1.1	Labour cost ... 42 personnels (504 M/M)	JD120,000
1.2	Consumable and expenditure cost of the office	JD36,000
1.3	Fuel cost and other maintenance cost for vehicle	JD2,000
1.4	Maintenance cost for building	JD1,600
	Sub Total	JD159,600
2. Running cost for pump stations		
2.1	Electric cost for pumps	JD1,120
2.2	Maintenance cost for pump stations	JD490
	Sub Total	JD1,610
3. Maintenance costs for dam and irrigation facilities		
3.1	Dam	JD58,900
3.2	Irrigation	JD4,600
	Sub Total	JD63,500
	Total	JD224,710
	Say	JD225,000

(II) Qatrana Scheme Area

1. Running cost for pump stations		
1.1	Electric cost for pumps	JD770
1.2	Maintenance cost for pump station	JD340
	Sub Total	JD1,110
2. Maintenance cost for dam & irrigation facilities		JD5,400
	Total	JD6,510
	Say	JD6,500

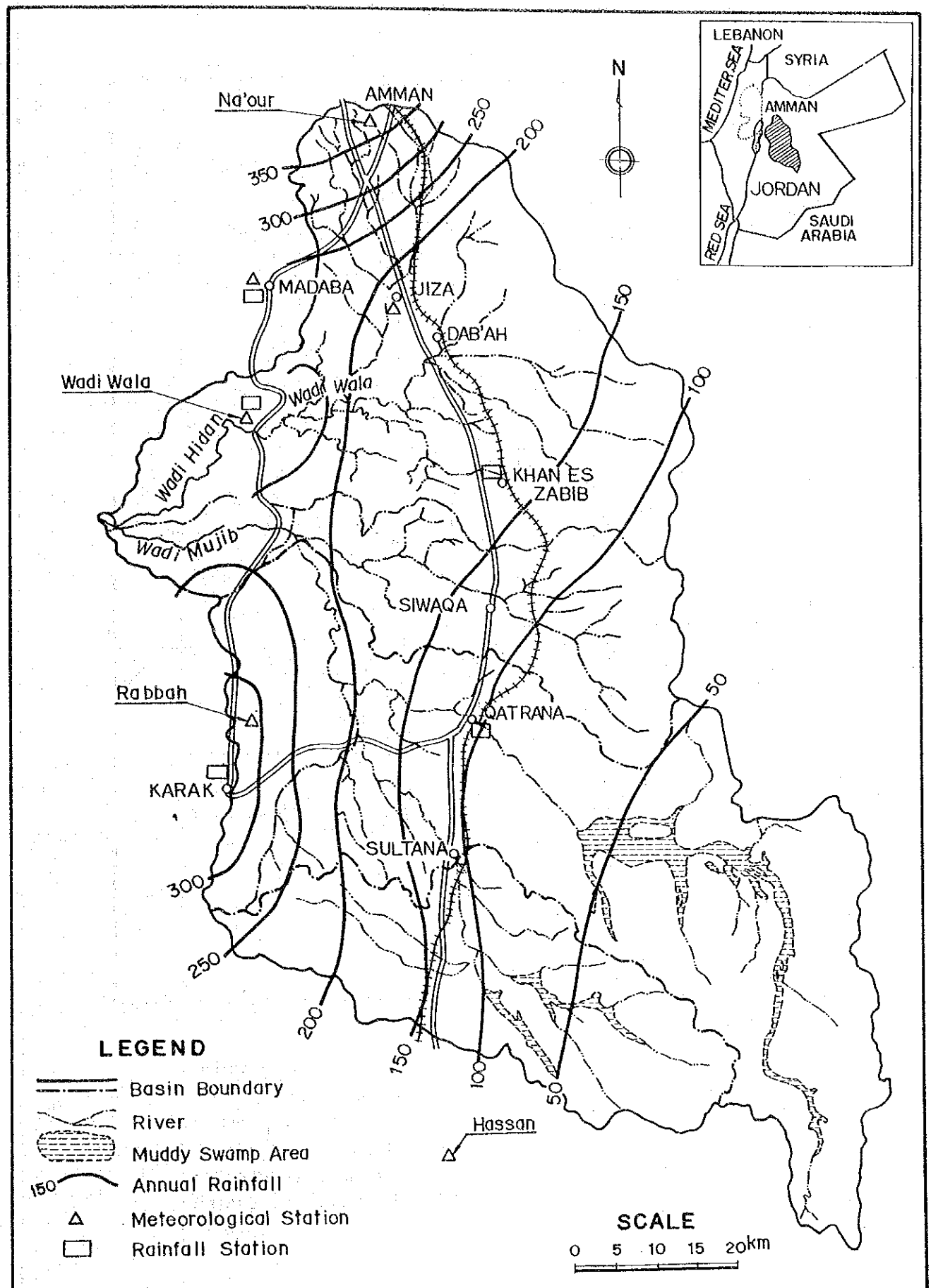
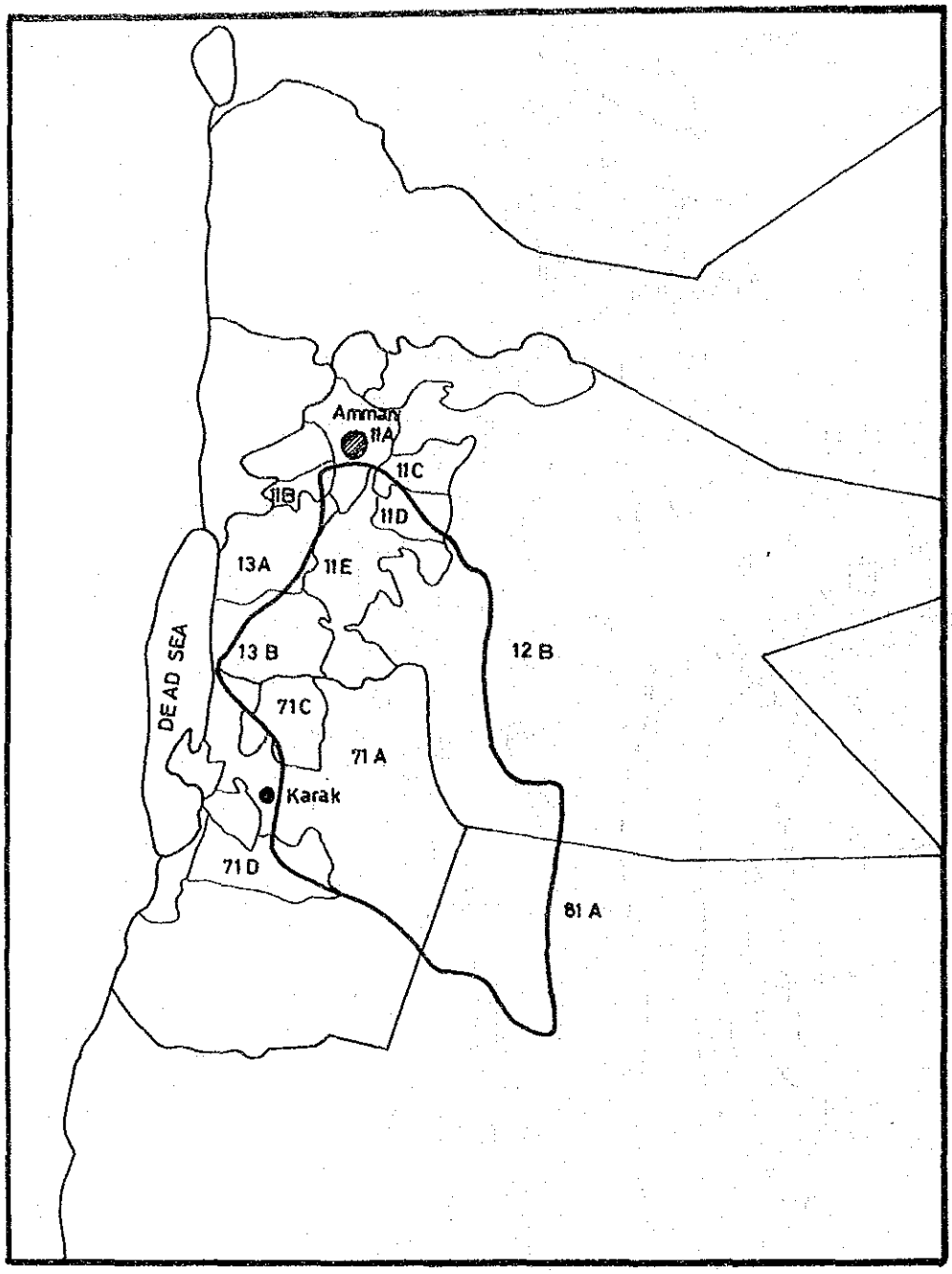


Fig. G - 2.1
Isohyet Map and Location of Weather Stations

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

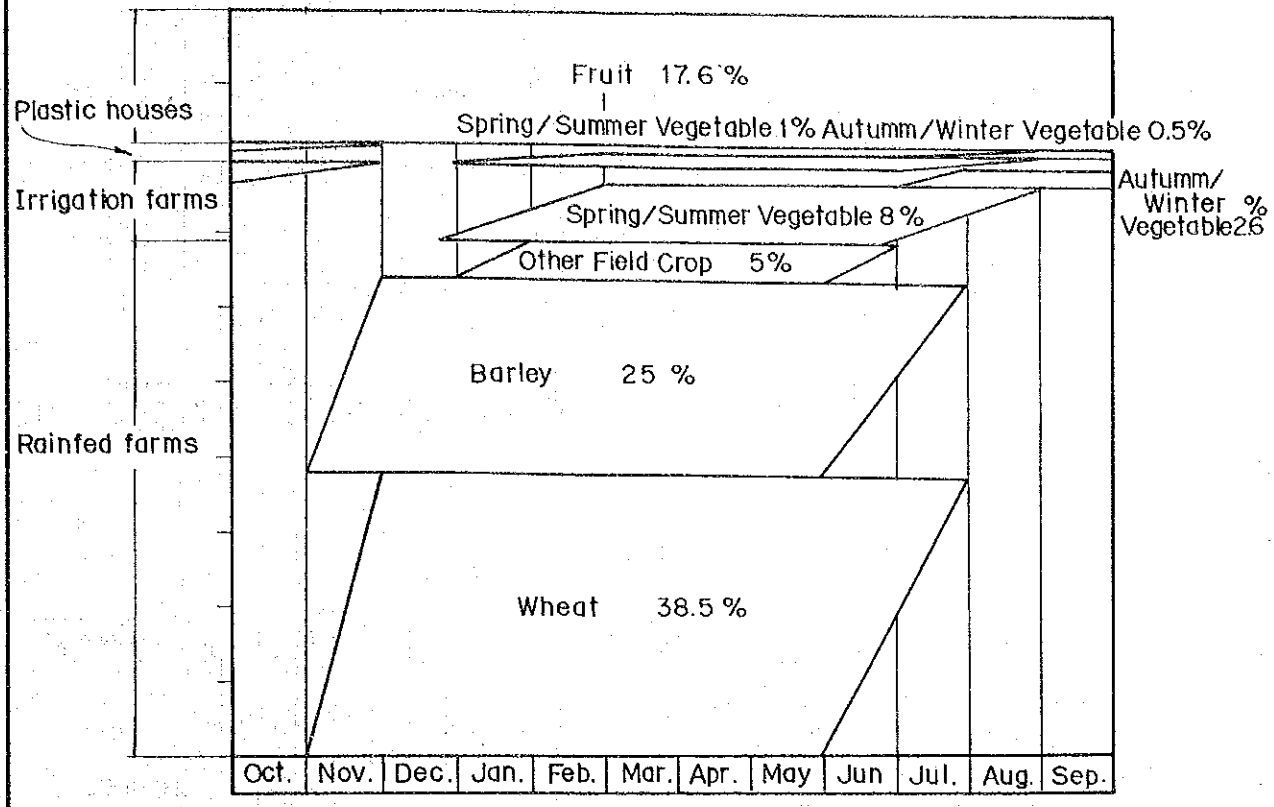


1	Amman Governorate
11A	Amman Sub District
11B	Na'oor Nahia
11C	Sahad Nahia
11D	Mowaqqar Nahia
11E	Jiza Nahia
12B	Azraq Nahia
13A	Madaba District
13B	Dieban Nahia
7	Karak Governorate
71A	Karak Sub District
71C	Al-Qasr Sub District
71D	Mazar Janoubiya Sub District
8	Ma'an Governorate
81A	Shaubak Sub District

Fig. G-2.2
Administrative Units

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

Amman Area



Karak Area

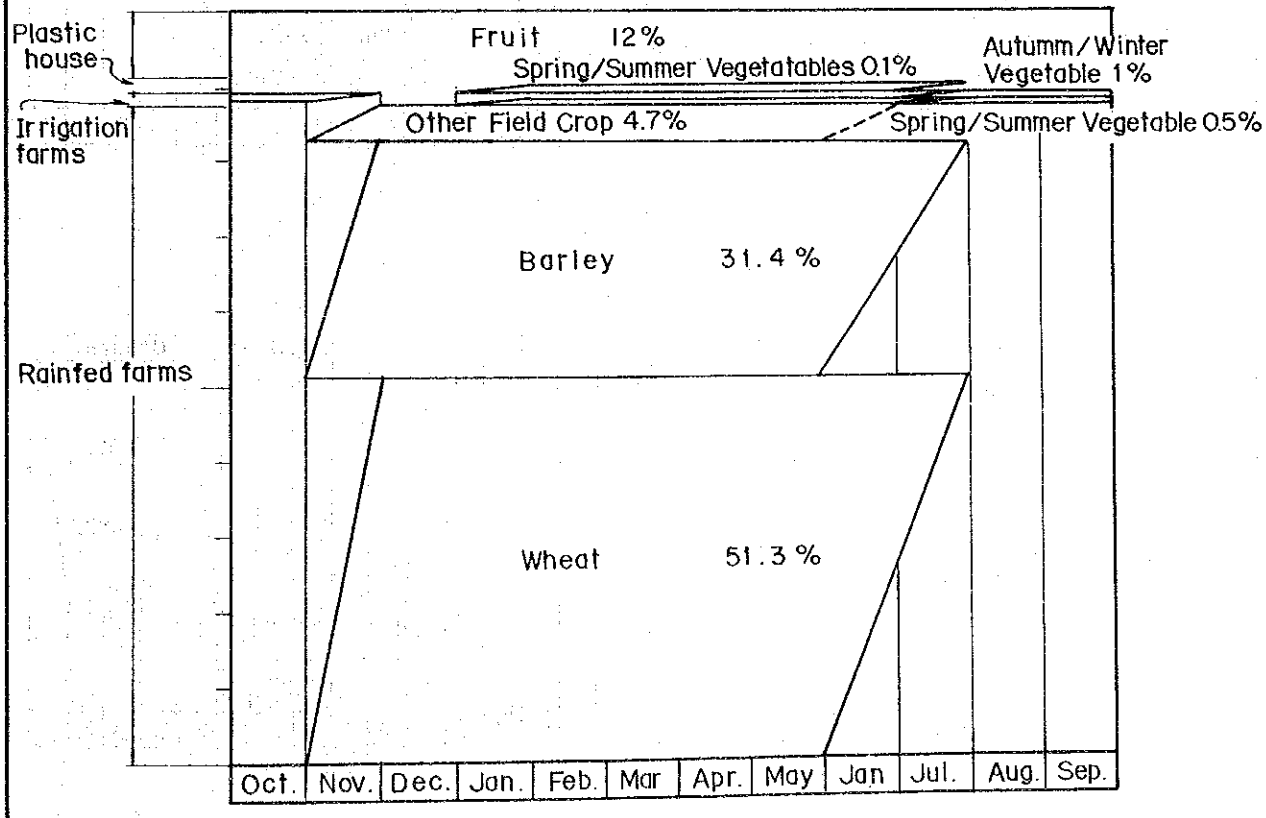


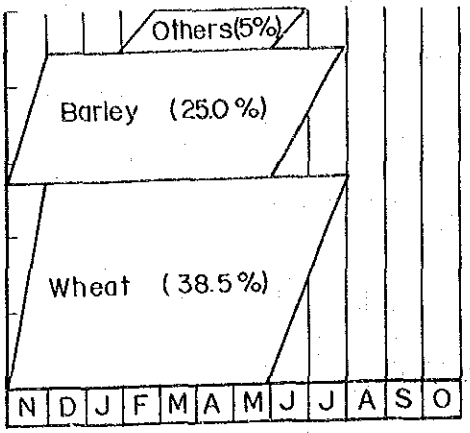
Fig. G - 2.3
Present Cropping Pattern (1/2)

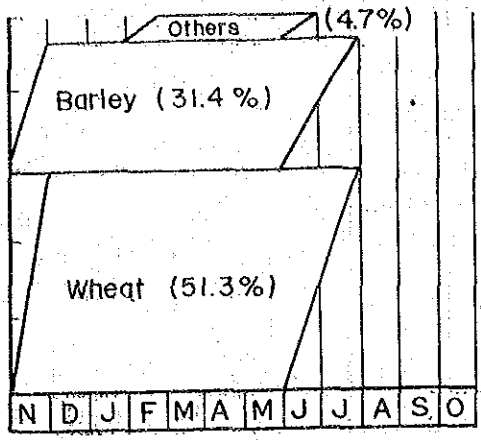
THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

Amman Area

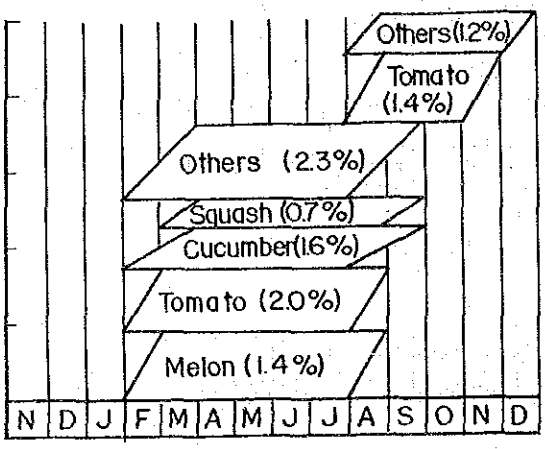
Karak Area

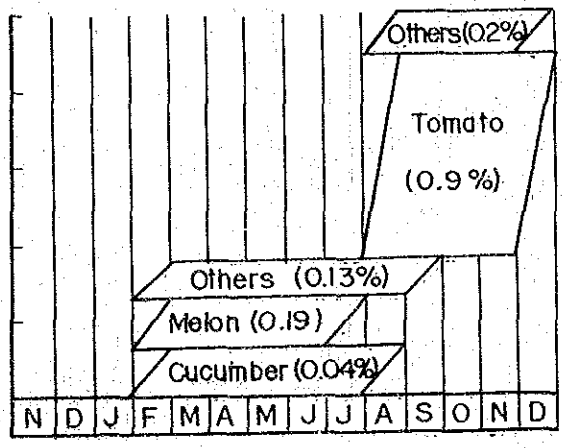
(I) Rainfed farms



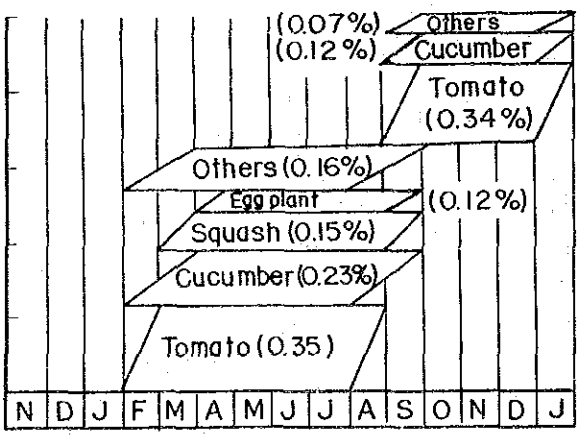


(II) Irrigated vegetable farms





(III) Plastic house farms



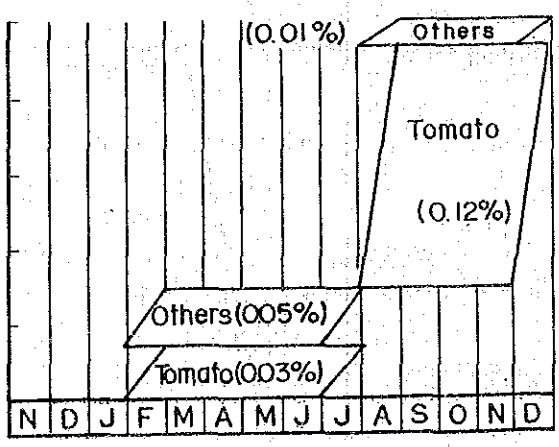


Fig. G-2.4

Present Cropping Pattern (2/2)

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. G-2.5
Present Organization

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

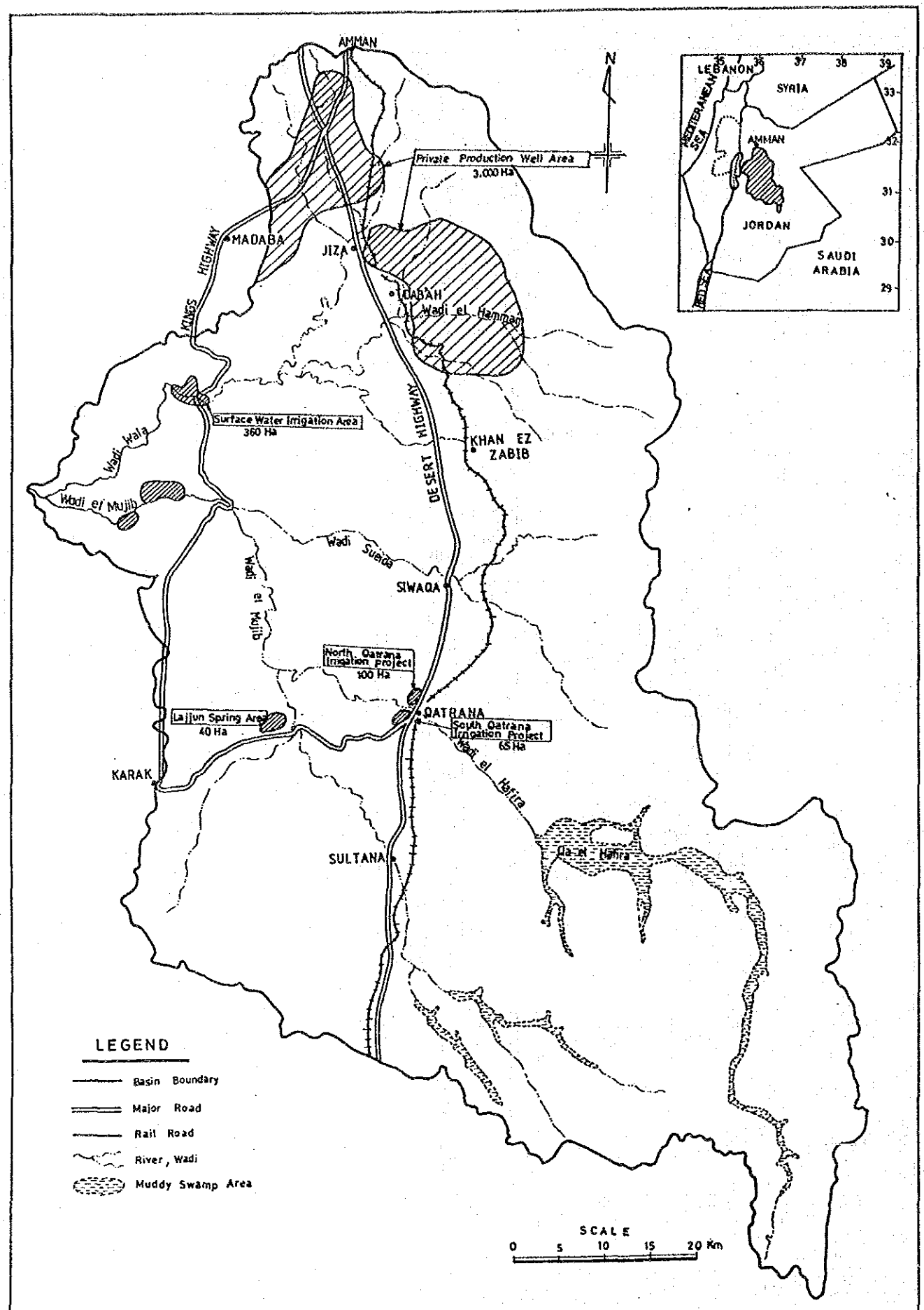
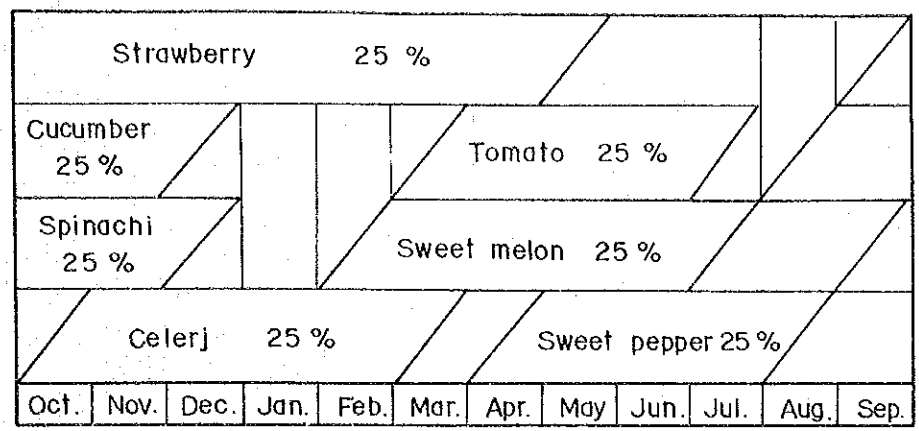


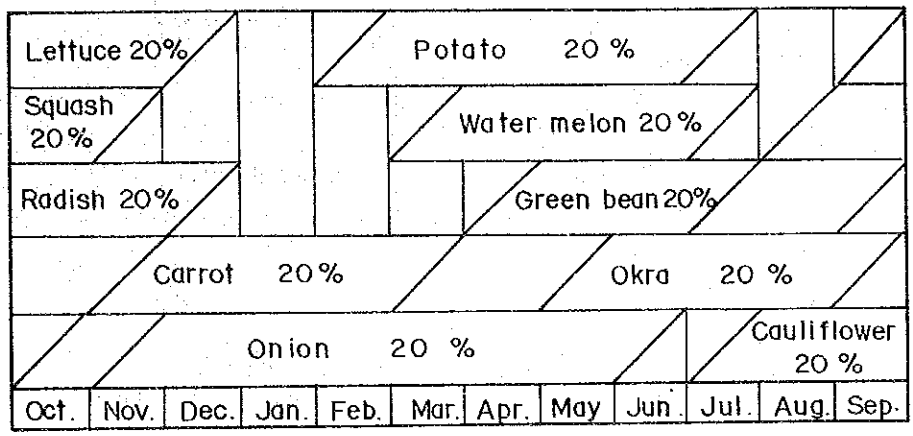
Fig. G-2.6
Existing Irrigation Schemes

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

TYPE - 1 (Plastic house)



TYPE - 2 (Open field) Year - round Irrigation



TYPE - 3 (Open field) Winter Season Irrigation

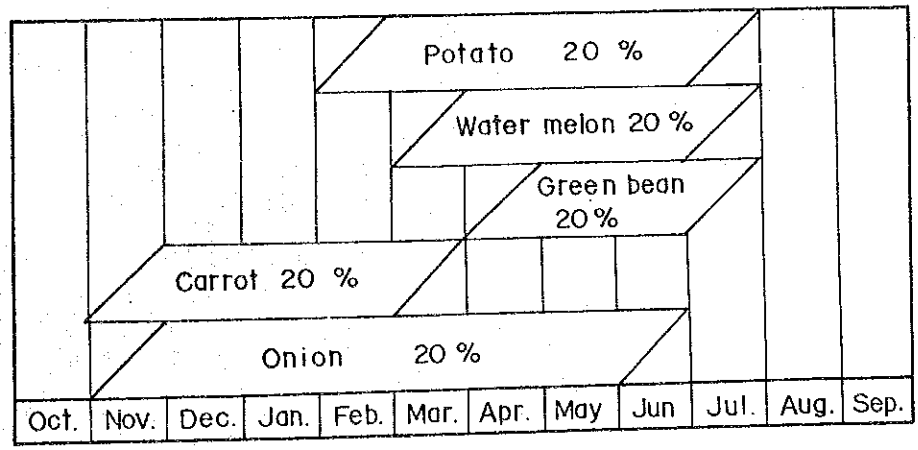


Fig. G-3.1
Proposed Cropping Pattern

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

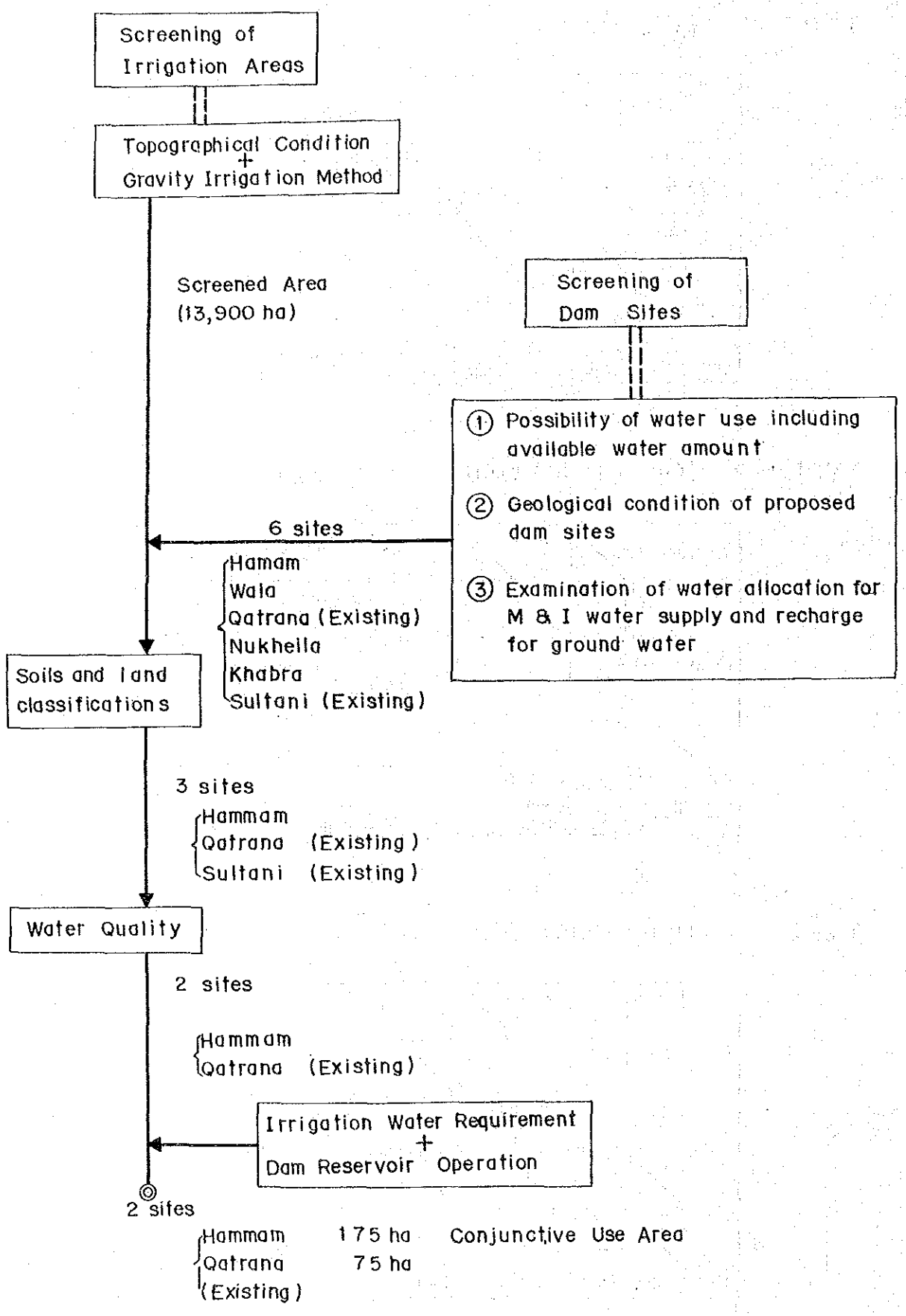
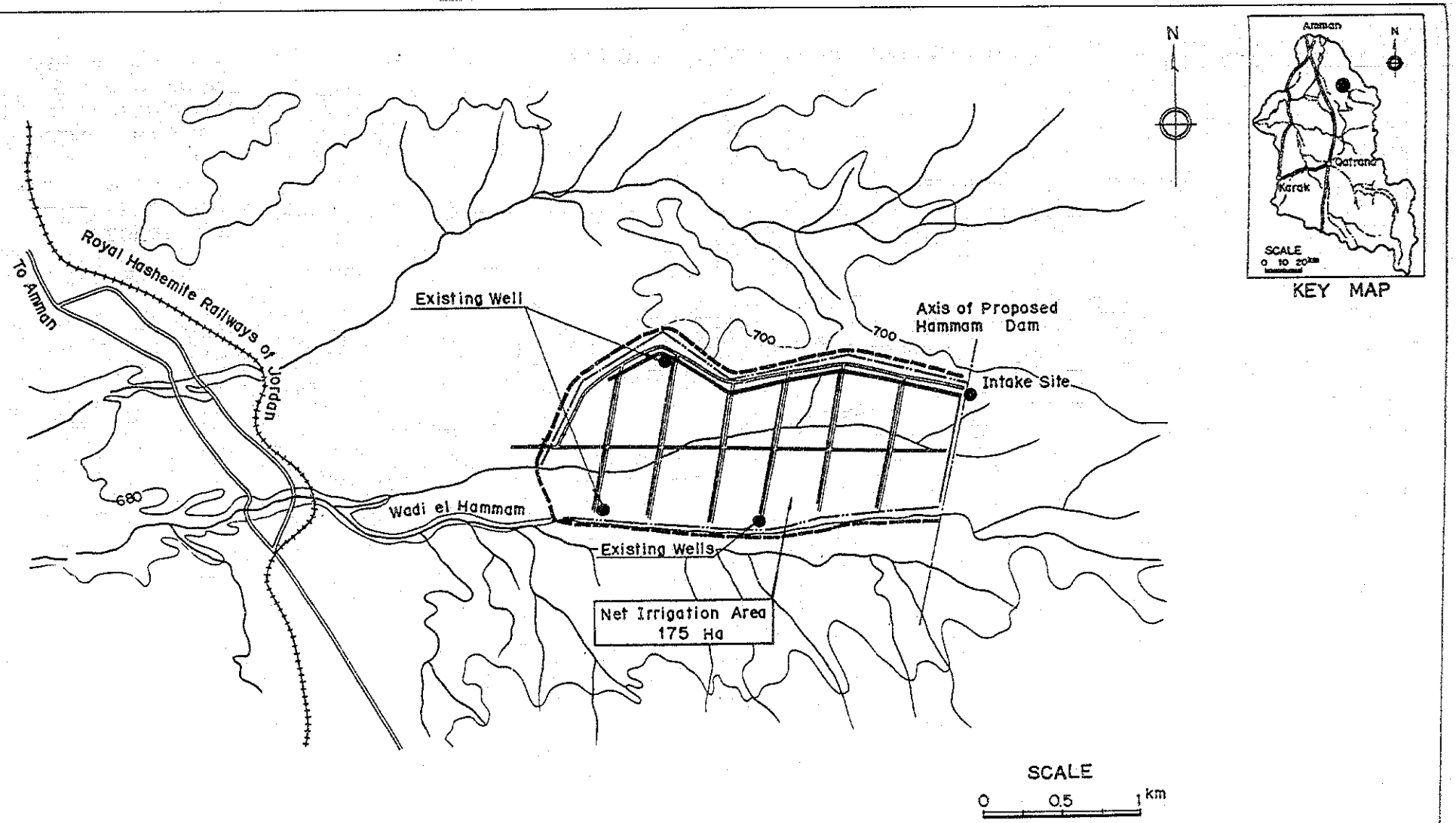


Fig. G-3.2
Flow Chart of Screening of Irrigation Area

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

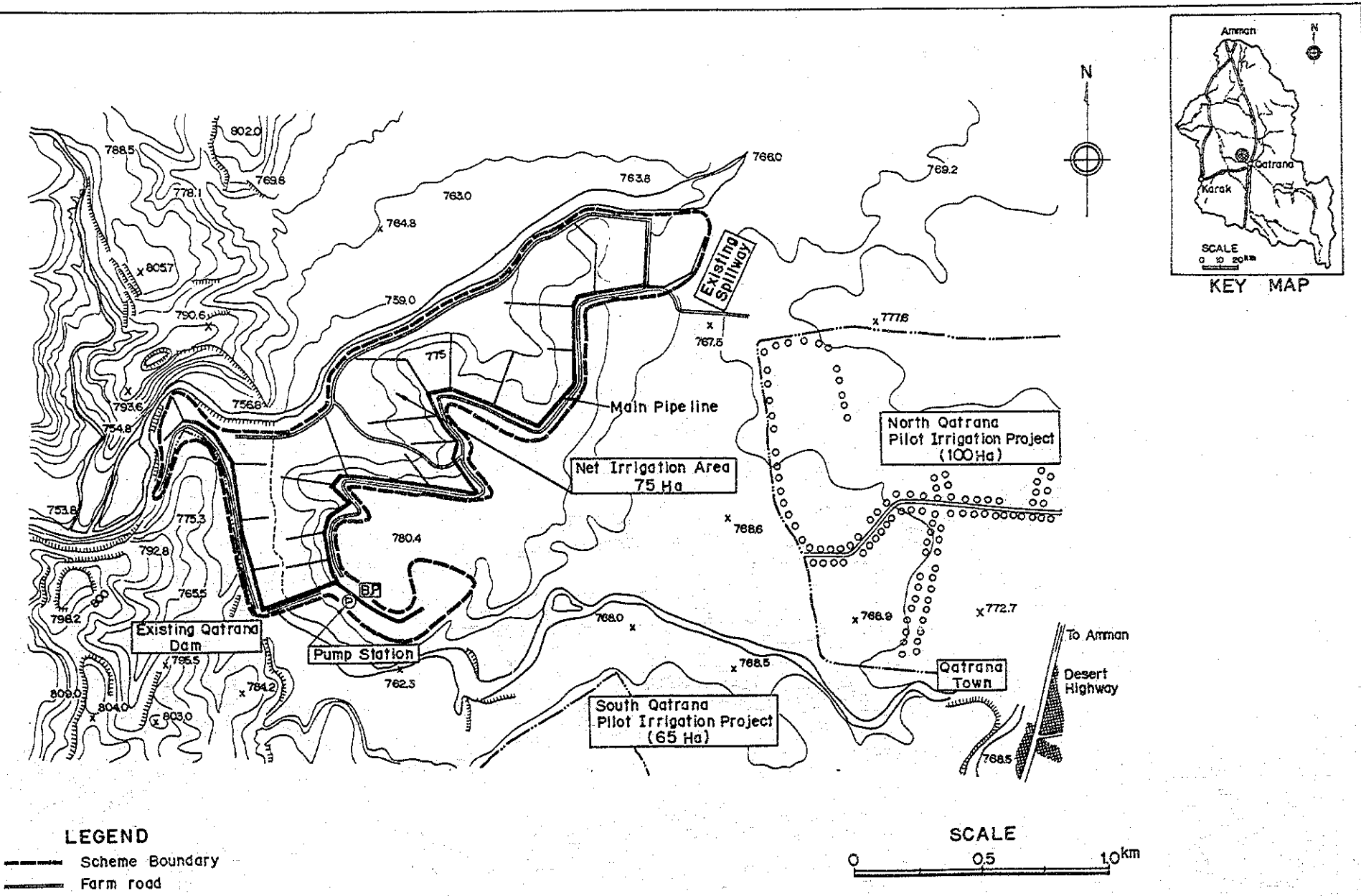


LEGEND

- Scheme Boundary
- Farm road
- Stone fence
- Main Pipeline
- Secondary Pipeline
- Existing Production Well

Fig. G - 3.3 The Dab'ah-Hammam Scheme Area

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

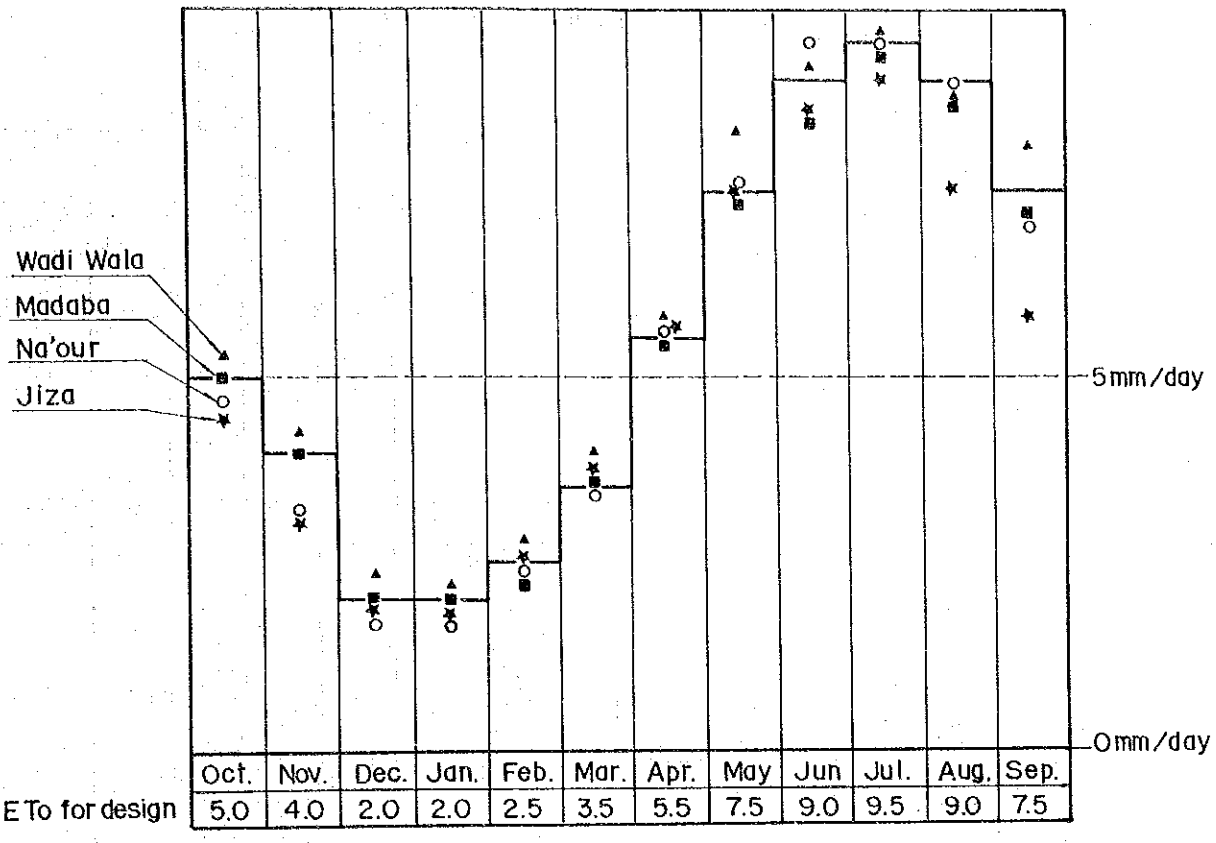


KEY MAP

Fig. G-3.4 The Qatrana Scheme Area

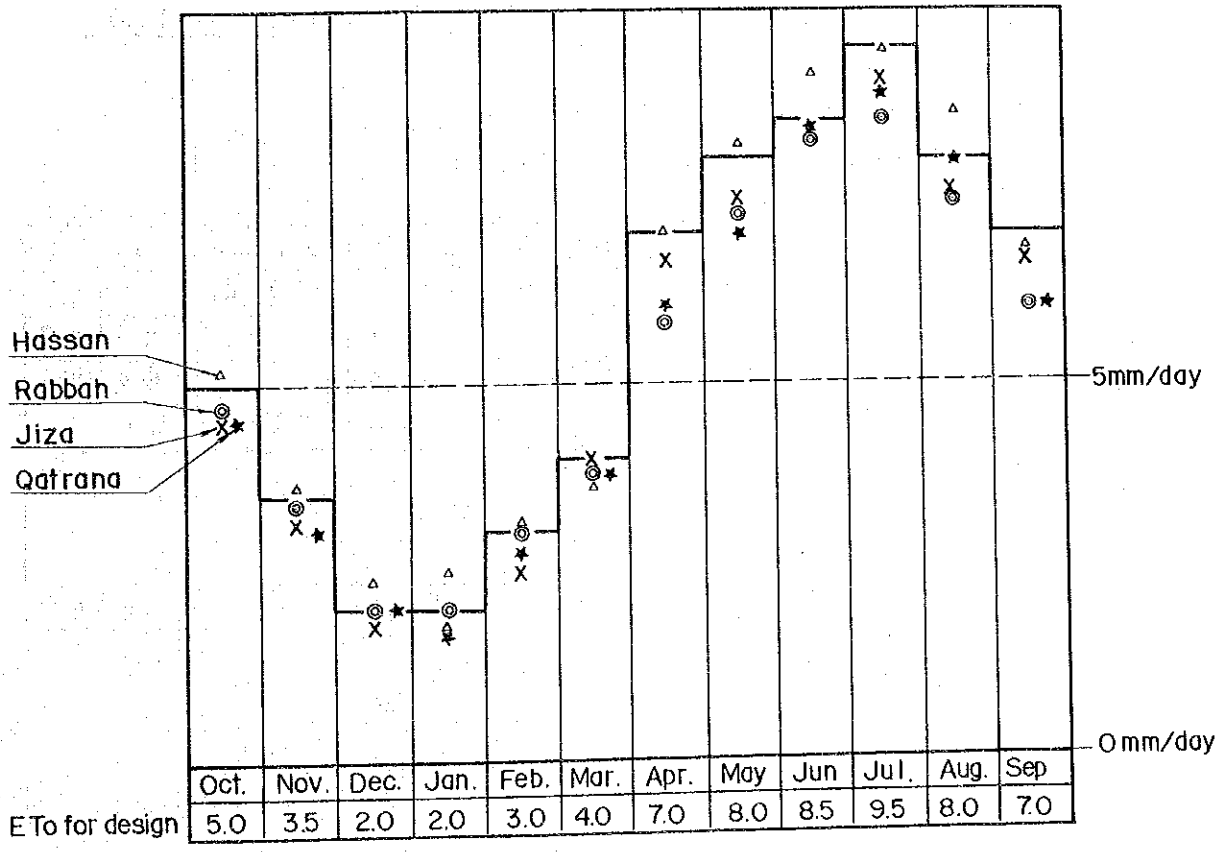
THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE
STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

(A) Dab'ah - Hammam Scheme Area



	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Aug.	Sep.
ETo for design	5.0	4.0	2.0	2.0	2.5	3.5	5.5	7.5	9.0	9.5	9.0	7.5

(B) Qatrana Scheme Area

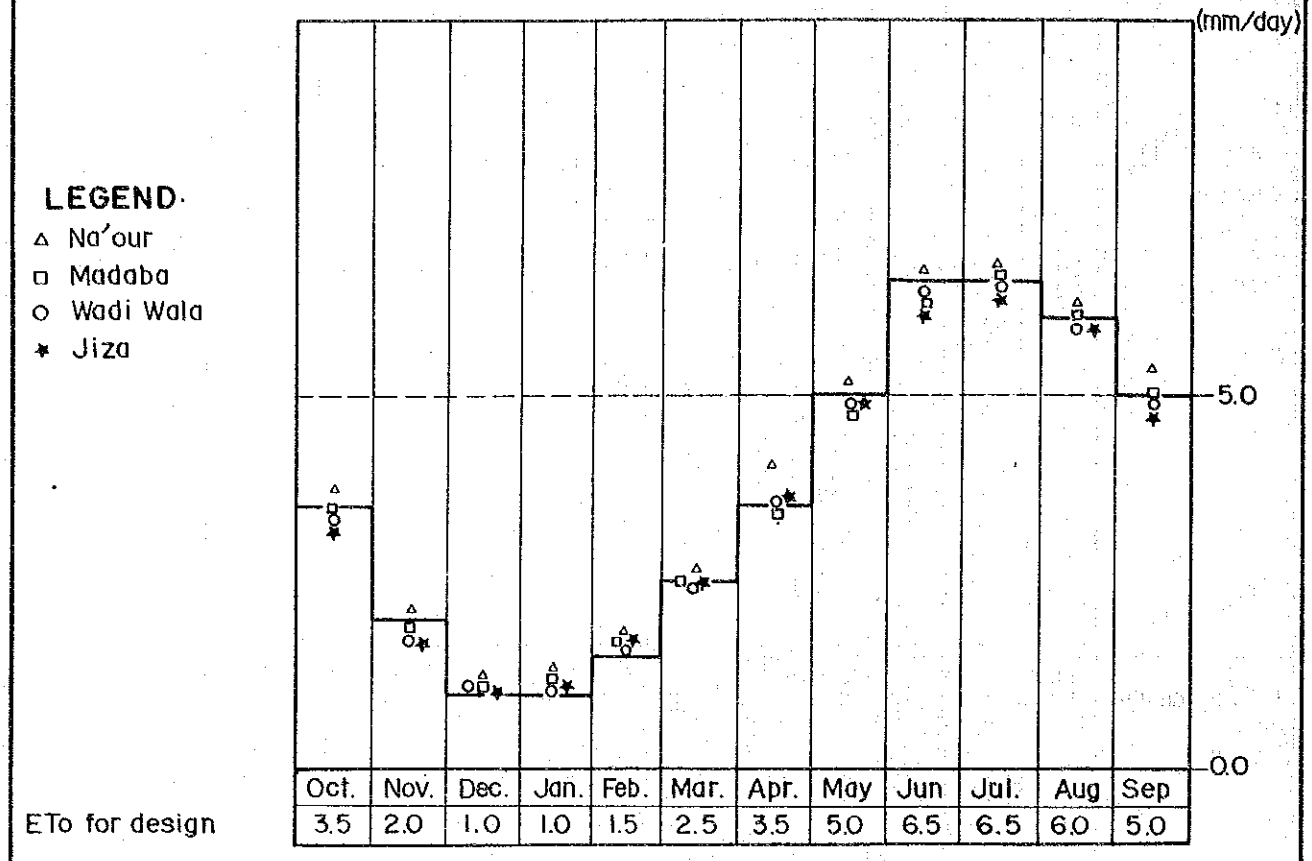


	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Aug.	Sep
ETo for design	5.0	3.5	2.0	2.0	3.0	4.0	7.0	8.0	8.5	9.5	8.0	7.0

Fig. G - 3.5
Potential Evapotranspiration

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

Dab'ah - Hammam Scheme Area



	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Aug	Sep
ETo for design	3.5	2.0	1.0	1.0	1.5	2.5	3.5	5.0	6.5	6.5	6.0	5.0

Estimated ETo for Plastic Houses (Modified Penman Method)

(mm /day)

Station	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Aug.	Sep.
① Na'our	3.4	1.8	1.1	1.1	1.6	2.4	3.5	4.8	6.3	6.4	5.8	4.8
② Madaba	3.5	1.9	1.1	1.2	1.5	2.4	3.4	4.7	6.3	6.5	6.0	5.0
③ Wadi Wala	3.8	2.2	1.3	1.4	1.8	2.7	4.1	5.2	6.7	6.7	6.2	5.3
④ Al Jiza	3.3	1.8	1.1	1.1	1.7	2.5	3.6	4.9	6.1	6.2	5.7	4.5
(A) Adopted ETo for Design												
(I) Dab'ah-Hamman Scheme Area	3.5	2.0	1.0	1.0	1.5	2.5	3.5	5.0	6.5	6.5	6.0	5.0

Fig. G - 3.6
Estimated ETo for Plastic Houses Farms

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

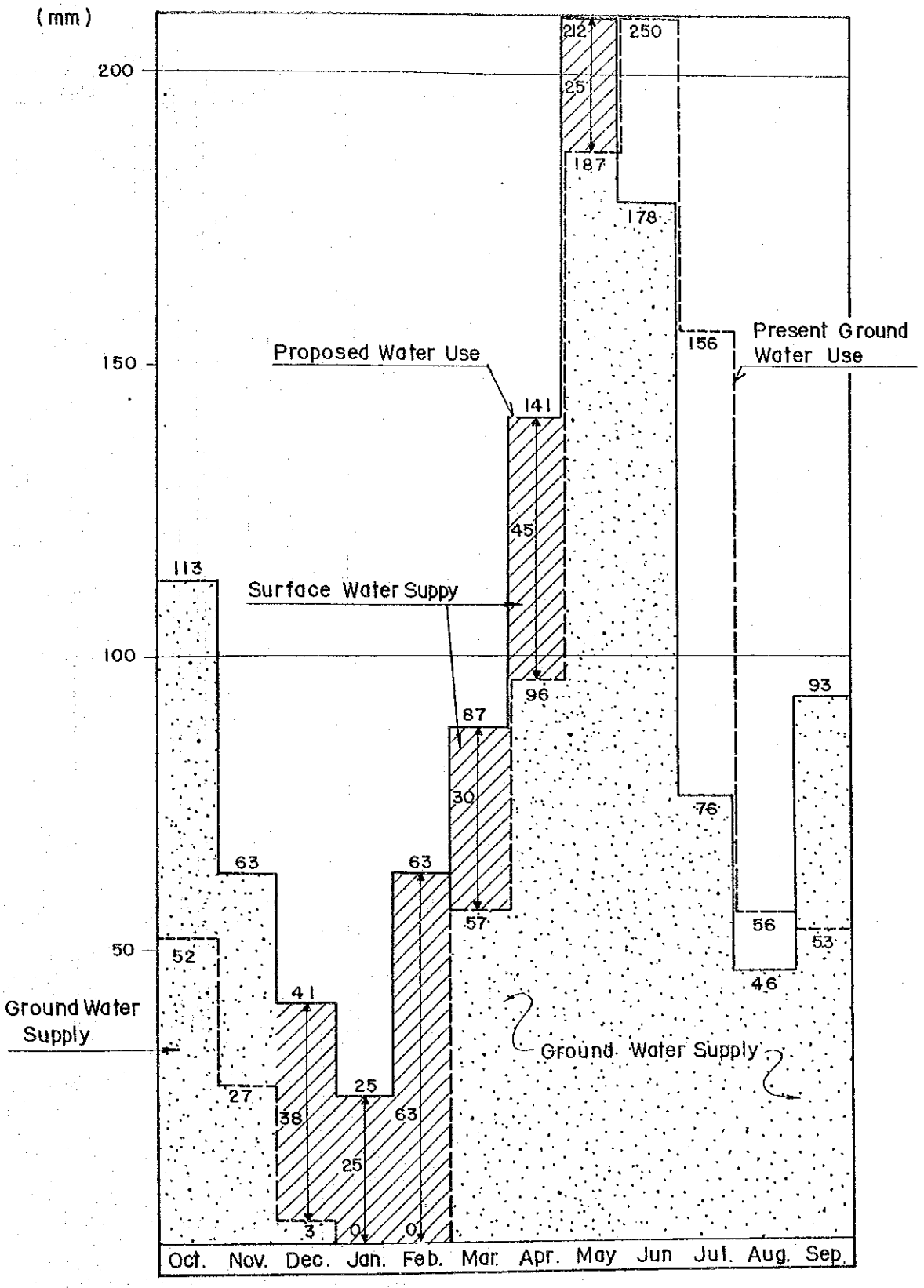
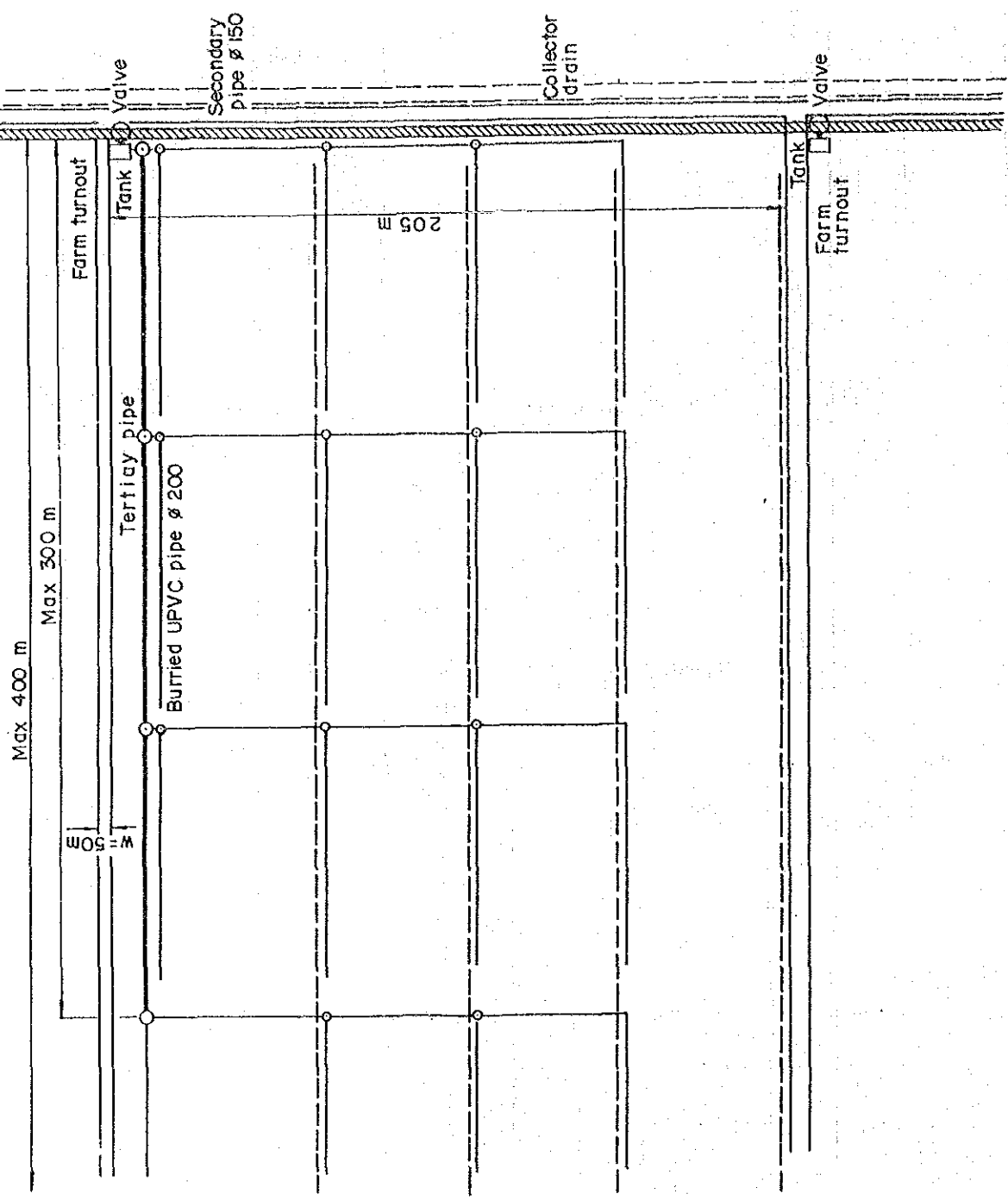


Fig. G-3.7
Seasonal Irrigation Water Use
(Existing Production Well Areas)

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY



Tertiary	ø 200	L = 300 m
Farm turnout		1 set
Farm road	w = 5 m	L = 400 m
Field Drain		L = 1,600 m

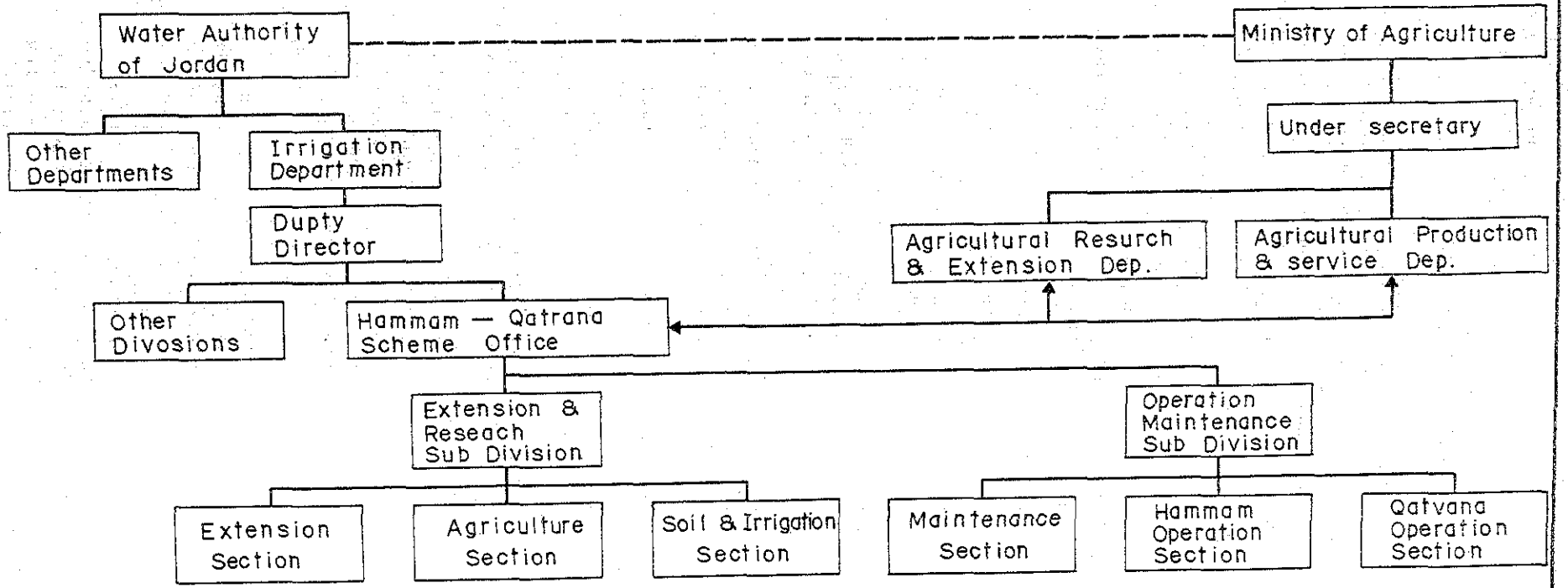
Drip tube irrigation facility L.S JD 600 / ha

Fig. G - 3.8

Typical Terminal Irrigation System (including tertiary pipe line net work) (8 Ha)

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. G - 4.1 Proposed Organization



Main Work :

	Extension works for existing holticultural farm in and around scheme areas.	Soil salinity Selection of suitable crops and crop yield.	Irrigation water requirement, leaching requirement and Meteorology.	Maintenance works of dam and irrigation facilities and equipments.	Pump and gate valves operation.	Pump and gate valves operation.

Required staff

							Total
Engineer	1	2	2	1	1	0	7+(3)
Technician	2	4	2	3	2	1	14
Other assistant person	3			2			5

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

Conditions of Soil Pit Sides (1/2)

Area	Pit No.	Soil Symbol	Soil Texture	Topography
Haman	T-1	C(	loamy	flat
	T-2	C(	loamy	flat
	20	Cf(	frag./loamy	undulating
	21	C(	loamy	flat
	22	Cf(	frag./loamy	undulating
	23	C(	loamy	flat
	27	Cf(	frag./loamy	undulating
	56	C(	loamy	flat
Jiza	1	C(	loamy	flat
	2	C(	loamy	flat
	54	C(	loamy	flat
	55	C(	loamy	flat
	57	C(	loamy	flat
Zainab	4	C(	loamy	flat
	5	Cf	frag./lithic	steep
	6	Cf(	frag./loamy	undulating
Rumeil & Wala	7	Cf(	frag./loamy	undulating
	8	Cx(	loamy	flat
	59	TF(	loamy	flat
Madaba	9	Cx(	loamy	flat
Halq	T-6	C(	loamy	flat
	58	C(	loamy	flat
Shabik	3	Cf(	frag./loamy	undulating
	50	Cf(	frag./loamy	undulating
Dab'a	25	C(	loamy	undulating
	26	C(	loamy	undulating
	28	C(	loamy	undulating
	29	Cf(	frag./loamy	undulating
	30	Cf(	frag./loamy	undulating
	31	Cf(	frag./loamy	undulating
Siwaqa	32	TOf	fragmental	steep
	33	Cf(	frag./loamy	undulating
	34	Cf(	frag./loamy	undulating
	35	C(	loamy	flat
	36	C(	loamy	flat
	T-4	Pf(	frag./loamy	flat
	37	Cf(	frag./loamy	undulating
	38	Cf(	frag./loamy	undulating
	39	Cf(	frag./loamy	undulating
	40	C(	loamy	flat

(to be continued)

Conditions of Soil Pit Sides (2/2)

Area	Pit No.	Soil Symbol	Soil Texture	Topography
Qatrana	T-3	Cf(	frag./loamy	undulating
	41	Cf(	frag./loamy	flat
	42	Cf(	frag./loamy	flat
	52	Cf(	frag./loamy	flat
	53	Pf(	frag./loamy	flat
	10	Cf	fragmental	hilly
	11	TOf	fragmental	steep
Sultani	T-5	Pf(	frag./loamy	flat
	19	TOf	fragmental	steep
	44	Cf(	frag./loamy	flat
	45	Cf(	frag./loamy	flat
	46	Pf	fragmental	hilly
	47	C(	loamy	flat
Dabba & Kabra	12	Cf	frag./lithic	hilly
	13	Cf	frag./lithic	hilly
	14	Cf(	frag./loamy	
	15	C(	loamy	flat
Adir	16	Cx(	loamy	flat

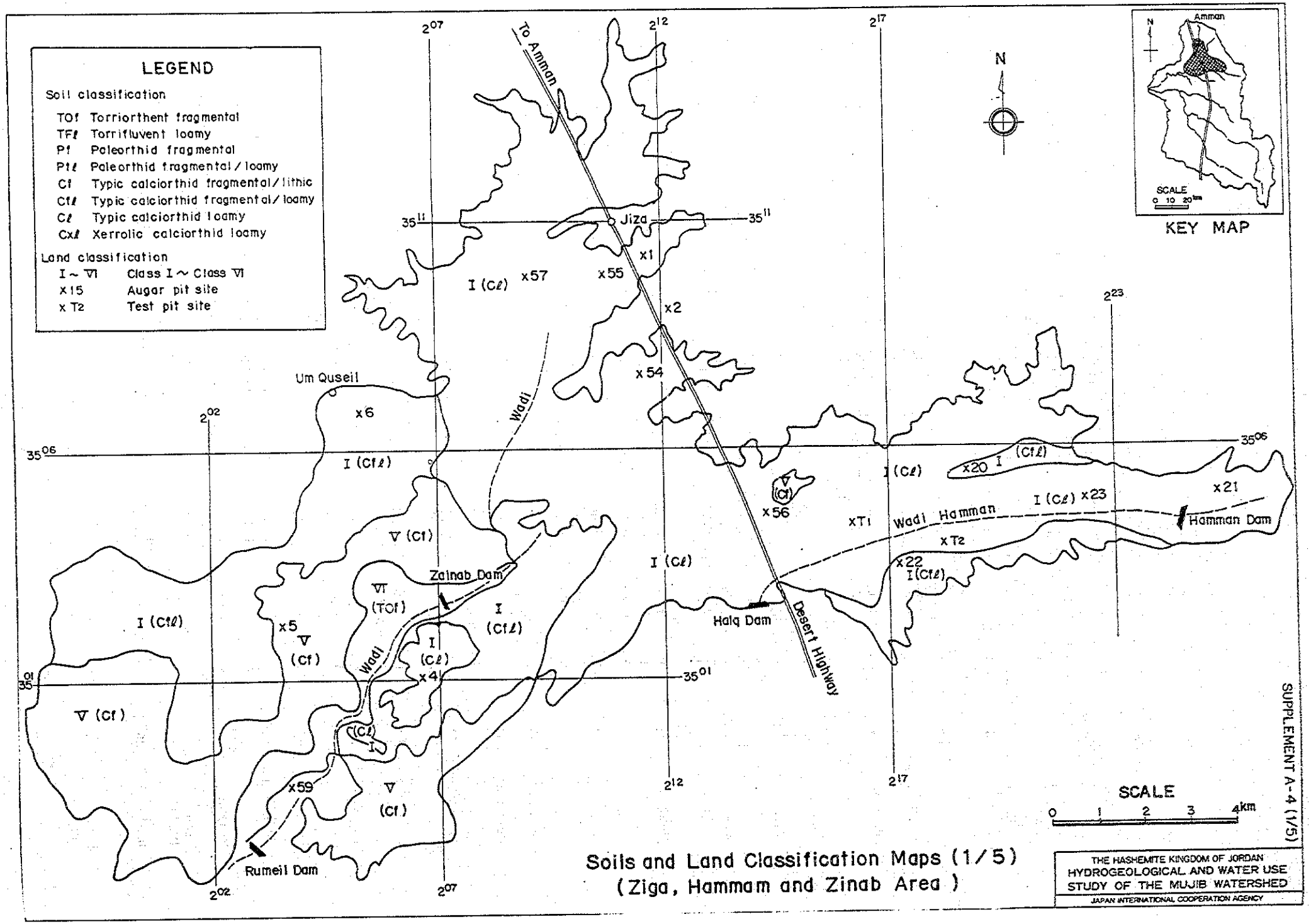
Soil Structure

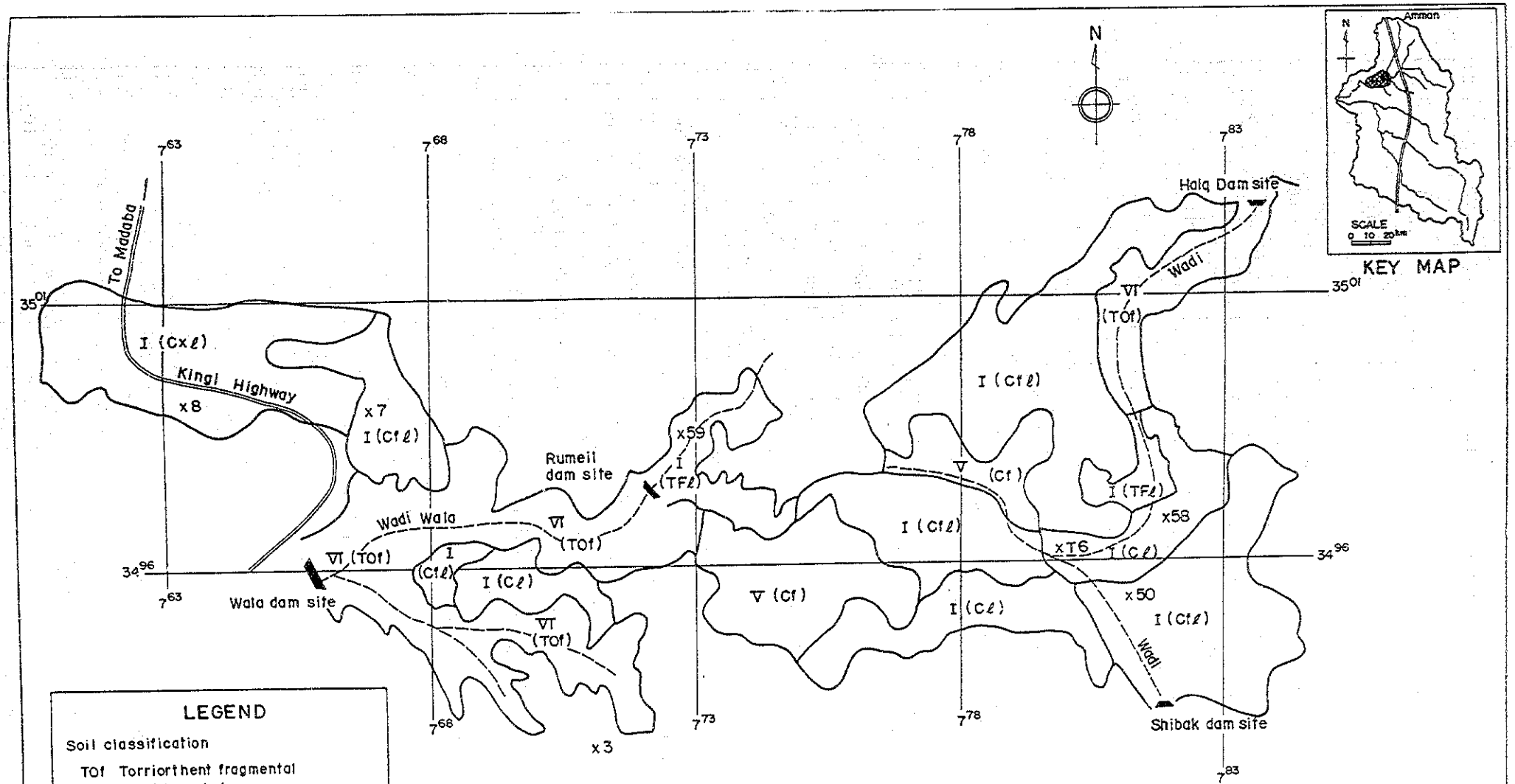
Location	Sample No.	Horizon	Corse Sand %	Fine Sand %	Silt %	Clay %	Soil Texture
Hamman	T-1	1	11.92	34.16	10.90	43.02	SC (sandy clay)
		2	2.20	45.64	48.89	9.22	L (loam)
Hamman	T-2	1	2.63	52.16	20.43	26.52	SCL (sandy clay loam)
		2	0.77	47.68	20.80	30.70	SCL (sandy clay loam)
Qatrana	T-3	1	5.34	56.28	18.70	19.75	SCL (sandy clay loam)
		2	2.40	46.37	22.10	29.15	SCL (sandy clay loam)
Qatrana	41	1	10.00	41.50	24.30	40.20	CL (clay loam)
		2	7.60	27.70	26.80	37.60	CL (clay loam)
		3	21.17	32.08	14.52	31.50	SCL (sandy clay loam)
Siwaqa	T-4	1	1.98	46.80	23.71	27.51	SCL (sandy clay loam)
		2	6.50	38.82	23.75	32.42	CL (clay loam)
Sultani	T-5	1	19.93	42.12	15.40	22.37	SCL (sandy clay loam)
		2	14.90	35.52	48.20	1.4	SiS (silty sand)
Shabik	T-6	1	9.59	53.33	18.54	18.54	SCL (sandy clay loam)
		2	9.50	47.71	21.35	21.43	SCL (sandy clay loam)
Madaba	9	1	6.97	37.38	23.00	32.65	SCL (sandy clay loam)

Note : Soil Samples are screened by the 2mm Sieve.

Chemical Properties of Soils

Location	Sample No.	Horizon	pH 1:1 extract	EC saturated extract m.mho/cm	Alkaline earth carbonate me/100gr	Exchangeable Cation me/100gr				Cation exchange capacity me/100gr
						Ca	Mg	K	Na	
Jiza	55	1	8.00	0.51	772.0	34.93	7.24	1.08	0.83	21.48
		2	8.20	0.60	741.6	36.18	8.63	0.62	1.38	26.55
Jiza	1	1		0.29						
				0.53						
Hamman	T-1	1	8.25	0.45	654.0	29.44	6.00	1.03	1.13	21.32
		2	8.20	2.17	504.0	32.44	9.62	1.56	2.09	23.00
		3	8.00	5.70	794.6	35.18	12.09	0.77	8.74	26.35
Hamman	T-2	1	8.15	0.62	567.0	30.94	6.99	2.36	1.13	16.63
		2	8.20	1.28	572.0	29.44	9.87	1.21	1.91	19.33
		3		1.05						
Hamman	22	1		0.19						
Hamman	23	1		1.20						
		2		4.30						
Siwaqa	T-4	1	8.01	0.34	489.7	37.18	8.80	2.46	1.13	20.55
		2	8.35	0.91	765.7	25.45	7.65	1.13	2.09	14.40
		3		2.90						
Qatrana	T-3	1	8.20	0.54	736.7	29.69	5.43	2.87	1.61	17.31
		2	8.18	0.66	765.6	30.68	5.10	3.18	0.91	15.69
		3	8.70	0.51	751.0	27.94	6.41	2.28	1.70	15.11
Qatrana	41-A	1	7.75	7.50	809.2	33.18	10.12	0.97	5.61	18.72
		2	8.10	0.59	862.0	29.69	8.39	0.33	1.27	18.68
		3	8.05	1.40	1,046.6	25.05	6.33	0.13	1.23	14.68
Qatrana	41-B	1		0.38						
Qatrana	52	1		3.00						
		2		1.65						
Qatrana	53	1		1.90						
		2		6.30						
Sultani	T-5	1	7.75	20.10	867.0	41.67	9.54	0.67	12.26	17.42
		2	7.75	19.10	954.3	34.43	9.05	0.28	13.56	24.08
Sultani	44	1		9.20						
		2		1.85						
Sultani	47	1		2.00						
Shabik	T-6	1	7.95	0.48	722.0	32.68	4.85	1.59	0.65	17.82
		2	7.95	0.53	731.6	35.93	6.25	0.80	0.83	20.46
Madaba	9	1	7.75	0.21	567.0	38.92	6.50	1.08	0.53	27.29
Libb (Wala)	8	1		0.21						
		2		0.20						
Dab'a	26	1		3.30						
		2		6.20						
Dabba Dam	14	1		3.50						

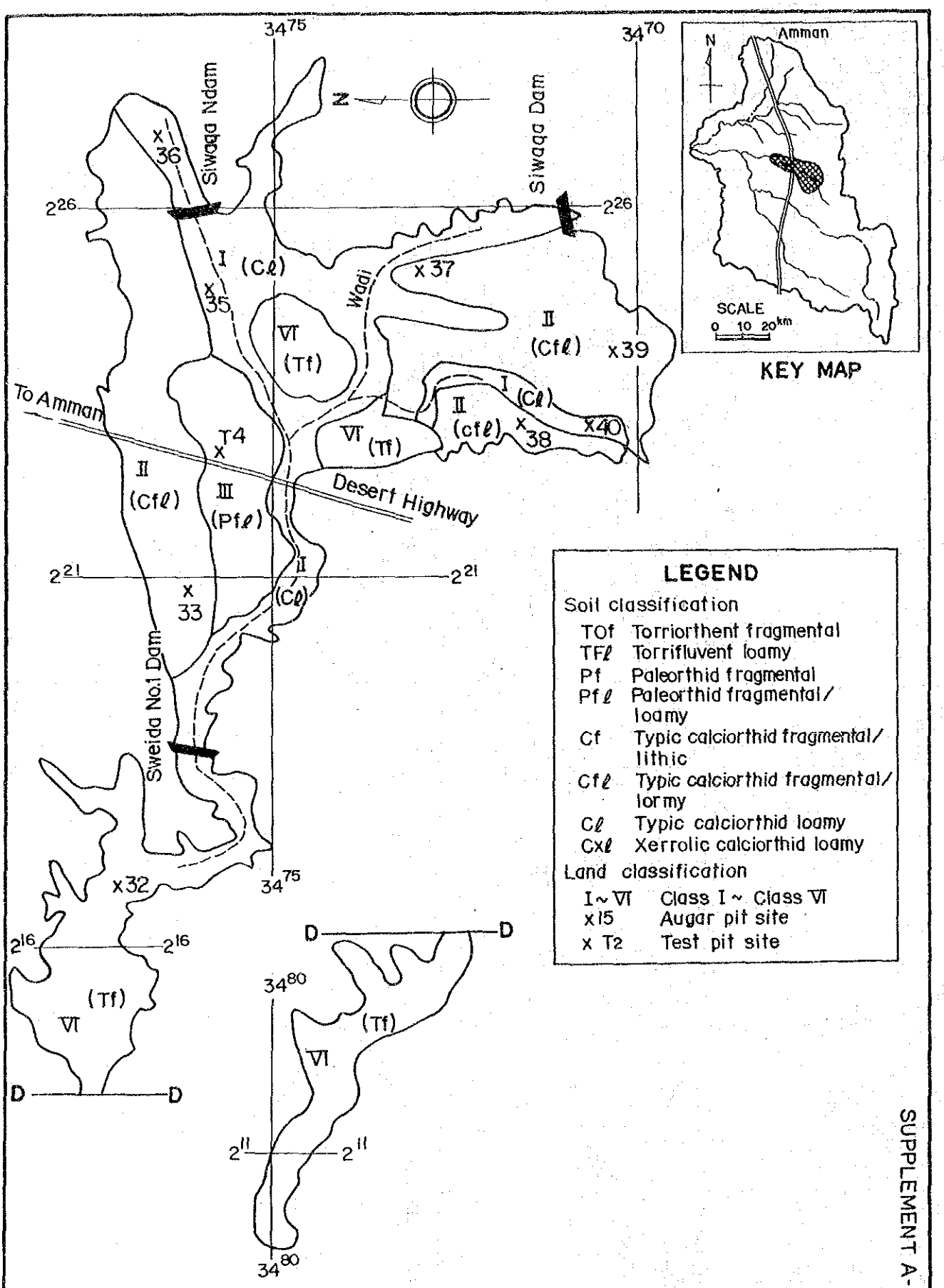

LEGEND
Soil classification
TOf Torriorthent fragmental
TFℓ Torrifluvent loamy
Pf Paleorthid fragmental
Pfℓ Paleorthid fragmental / loamy
Cf Typic calciorthid fragmental/ lithic
Cfℓ Typic calciorthid fragmental/ loamy
Cℓ Typic calciorthid loamy
Cxℓ Xerrolic calciorthid loamy
Land classification
I ~ VI Class I ~ Class VI
x15 Augar pit site
x T2 Test pit site
To Amman
Jiza
Um Quseil
Wadi
Zainab Dam
Halq Dam
Desert Highway
Wadi Hamman
Hamman Dam
Rumeil Dam
N
Amman
SCALE
KEY MAP
SCALE
0 1 2 3 4km
Soils and Land Classification Maps (1/5)
(Ziga, Hammam and Zinab Area)
THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY
SUPPLEMENT A-4 (1/5)



Soils and Land Classification Maps (2/5)
(Wala and Rumeil Area)

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

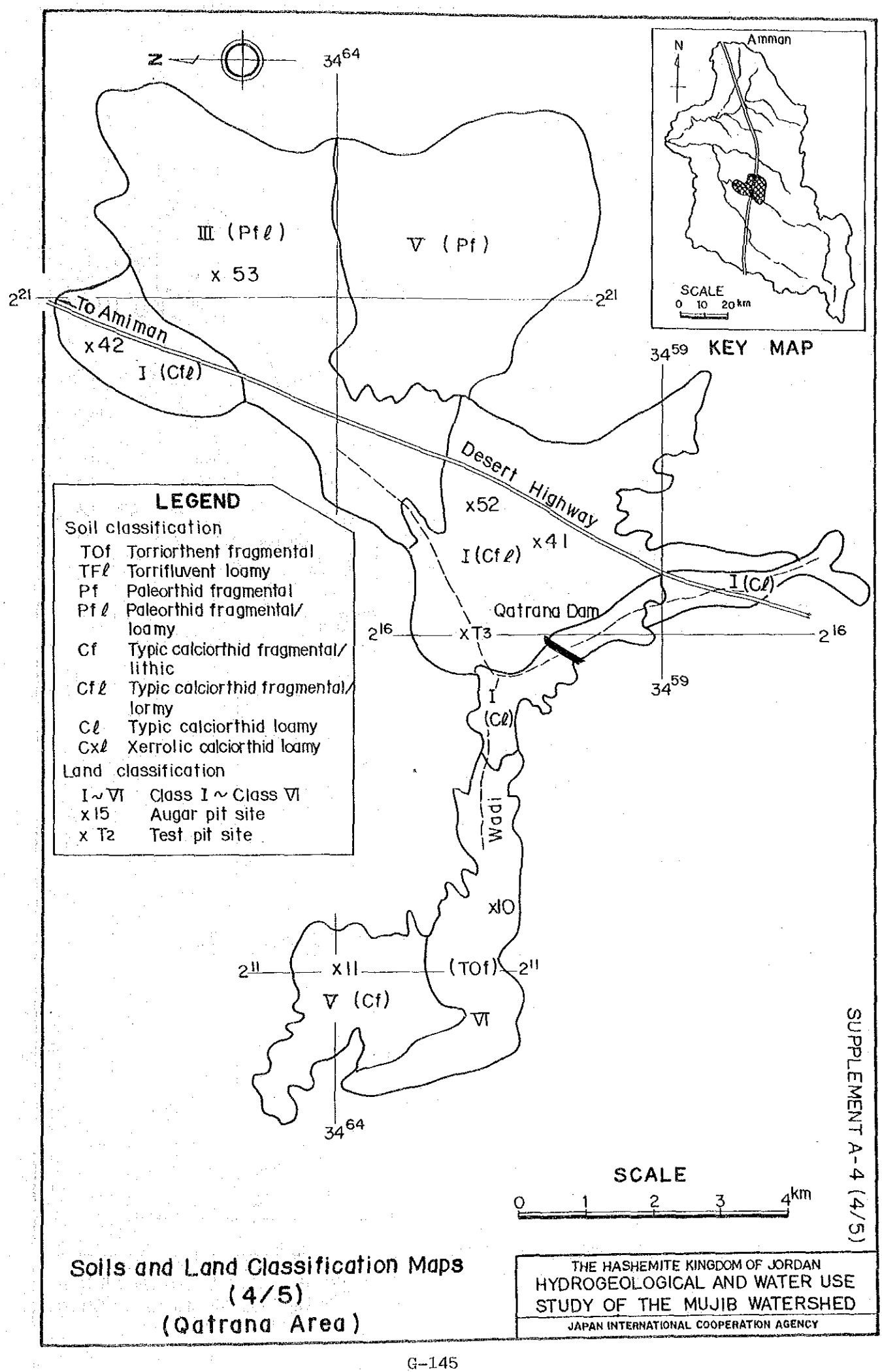
SUPPLEMENT A-4 (2/5)



Soils and Land Classification Maps (3/5) (Siwaqa Area)

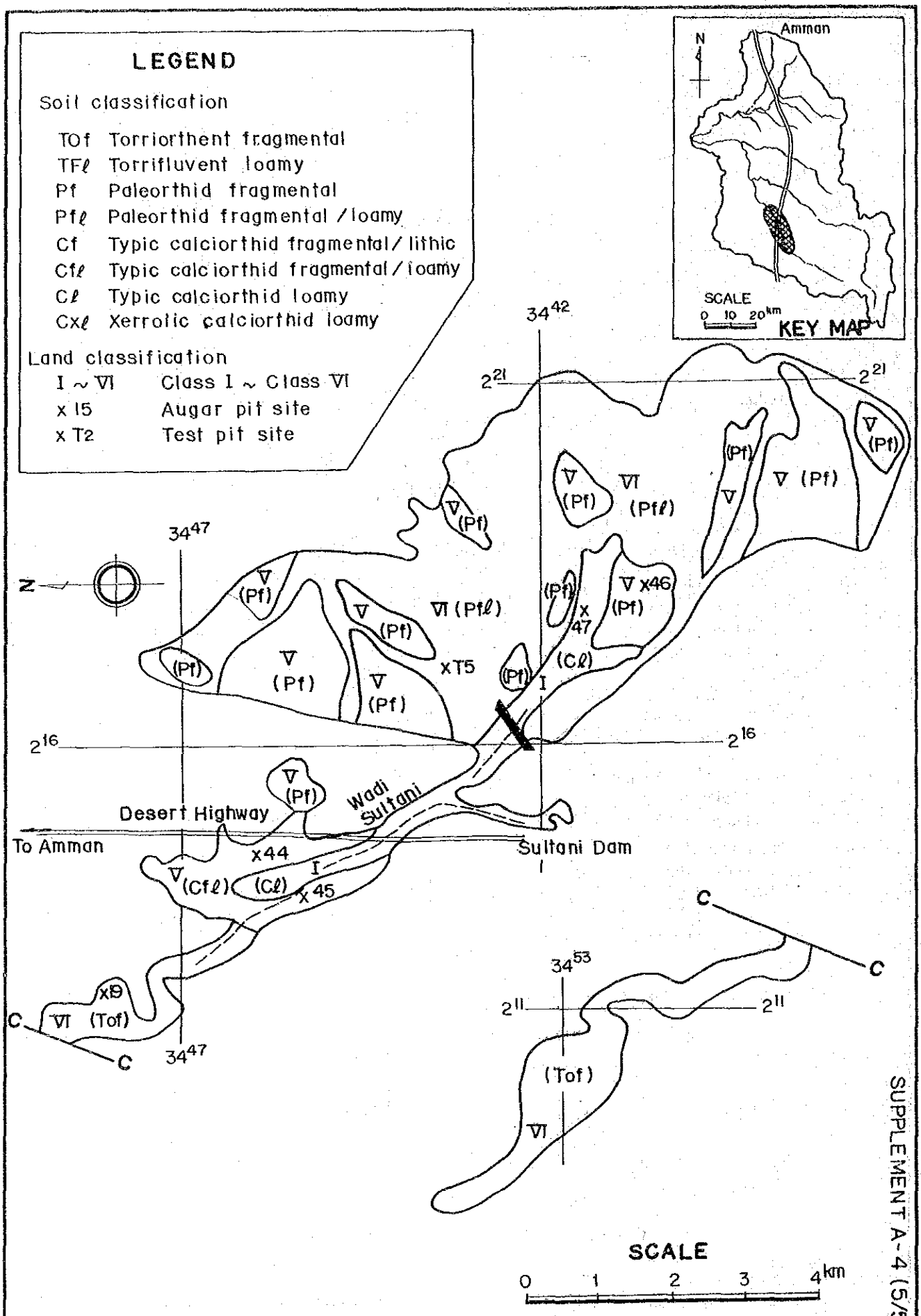
SUPPLEMENT A-4 (3/5)

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY



Soils and Land Classification Maps (4/5) (Qatrana Area)

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY



Soils and Land Classification Maps
(5 / 5)
(Sultani Area)

THE HASHEMITE KINGDOM OF JORDAN
HYDROGEOLOGICAL AND WATER USE STUDY OF THE MUJIB WATERSHED
JAPAN INTERNATIONAL COOPERATION AGENCY

IRRIGATION WATER REQUIREMENT Type-1 (MM/MONTH)

	CROPPING PATTERN	PROPOTION	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
(CONJUNCTIVE USE AREA)															
	PLASTIC HOUSES														
	ET(O)			108.50	60.00	31.00	31.00	42.00	77.50	105.00	155.00	195.00	201.50	186.00	150.00
	STRAW BERRY														
1	KC			0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.43				0.43
	PLANTED AREA(%)			1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50				0.50
	CU			93.31	51.60	26.66	26.66	36.12	66.65	90.30	33.33	0.00	0.00	0.00	32.25
	LAND PREPARATION REQ.														60
	CROP IRR.REQ.		.25	93.31	51.60	26.66	26.66	36.12	66.65	90.30	33.33	0.00	0.00	0.00	92.25	517
				23.33	12.90	6.67	6.67	9.03	16.66	22.58	8.33	0.00	0.00	0.00	23.06	129
	CELERY														
2	KC			0.23	0.58	0.81	0.96	0.96	0.46						
	PLANTED AREA(%)			0.50	1.00	1.00	1.00	1.00	0.50						
	CU			12.48	34.80	25.11	29.76	40.32	17.83	0.00	0.00	0.00	0.00	0.00	0.00
	LAND PREPARATION REQ.			60											
	CROP IRR.REQ.		.25	72.48	34.80	25.11	29.76	40.32	17.83	0.00	0.00	0.00	0.00	0.00	0.00	220
				18.12	8.70	6.28	7.44	10.08	4.46	0.00	0.00	0.00	0.00	0.00	0.00	55
	PEPPERS														
3	KC								0.18	0.41	0.64	0.88	0.82	0.36	
	PLANTED AREA(%)								0.13	0.88	1.00	1.00	0.88	0.13	
	CU			0.00	0.00	0.00	0.00	0.00	1.74	37.67	99.20	171.60	144.58	8.37	0.00
	LAND PREPARATION REQ.								30	30					
	CROP IRR.REQ.		.25	0.00	0.00	0.00	0.00	0.00	31.74	67.67	99.20	171.60	144.58	8.37	0.00	523
				0.00	0.00	0.00	0.00	0.00	7.94	16.92	24.80	42.90	36.14	2.09	0.00	131

	CUCUMBER													
4	KC		0.74	0.80	0.37								0.16	0.48
	PLANTED AREA(%)		1.00	1.00	0.50								0.50	1.00
	CU		80.29	48.00	5.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.88	72.00
	LAND PREPARATION REQ.												60	
	CROP IRR.REQ.	.25	80.29	48.00	5.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	74.88	72.00
			20.07	12.00	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.72	18.00
	TOMATO													
5	KC							0.25	0.67	0.96	0.98	0.44		
	PLANTED AREA(%)							0.50	1.00	1.00	1.00	0.50		
	CU		0.00	0.00	0.00	0.00	0.00	9.69	70.35	148.80	191.10	44.33	0.00	0.00
	LAND PREPARATION REQ.							60						
	CROP IRR.REQ.	.25	0.00	0.00	0.00	0.00	0.00	69.69	70.35	148.80	191.10	44.33	0.00	0.00
			0.00	0.00	0.00	0.00	0.00	17.42	17.59	37.20	47.78	11.08	0.00	0.00
	SPINACH													0.17
6	KC		0.49	0.76	0.44									0.50
	PLANTED AREA(%)		1.00	1.00	0.50									
	CU		53.17	45.60	6.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.75
	LAND PREPARATION REQ.													60
	CROP IRR.REQ.	.25	53.17	45.60	6.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.75
			13.29	11.40	1.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.19
	SWEETMELON													
7	KC						0.20	0.49	0.73	0.88	0.78	0.34		
	PLANTED AREA(%)						0.50	1.00	1.00	1.00	0.88	0.13		
	CU		0.00	0.00	0.00	0.00	4.20	37.98	76.65	136.40	133.09	8.56	0.00	0.00
	LAND PREPARATION REQ.						60							
	CROP IRR.REQ.	.25	0.00	0.00	0.00	0.00	64.20	37.98	76.65	136.40	133.09	8.56	0.00	0.00
			0.00	0.00	0.00	0.00	16.05	9.49	19.16	34.10	33.27	2.14	0.00	0.00

TOTAL CROP IRR REQ.		74.81	45.00	16.08	14.11	35.16	55.97	76.24	104.43	123.95	49.37	20.81	59.25	675
LEACHING REQ.	0.10	8.31	5.00	1.79	1.57	3.91	6.22	8.47	11.60	13.77	5.49	2.31	6.58	75
NET IRR. REQ.(MM/MONTH)		83.12	50.00	17.87	15.67	39.07	62.19	84.71	116.03	137.72	54.85	23.13	65.83	750
IRR. EFFICIENCY	0.77													
TOTAL GROSS IRR.REQ.	(MM/MON)	108.66	65.36	23.36	20.49	51.07	81.29	110.74	151.68	180.02	71.70	30.23	86.06	981
	(MM/DAY)	4	2	1	1	2	3	4	5	6	2	1	3	

IRRIGATION WATER REQUIREMENT Type-2 (MM/MONTH)

CROPPING PATTERN	PROPOTION	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
(CONJUNCTIVE USE AREA)														
OPEN FIELD														
ET(0)			155.00	120.00	62.00	62.00	70.00	108.50	165.00	232.50	270.00	294.50	279.00	225.00
EFFECTIVE RAINFALL				0.00	0.00	0.00	0.00	0.00						
LETTUCE														
1 KC			0.49	0.76	0.44									0.17
PLANTED AREA(%)			1.00	1.00	0.50									0.50
CU			75.95	91.20	13.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.13
LAND PREPARATION REQ.														60
EFFECTIVE RAINFALL			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CROP IRR.REQ.	.2		75.95	91.20	13.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	79.13
			15.19	18.24	2.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.83
POTATO														
2 KC							0.24	0.66	0.96	0.96	0.43			
PLANTED AREA(%)							0.50	1.00	1.00	1.00	0.50			
CU			0.00	0.00	0.00	0.00	8.40	71.61	158.40	223.20	58.05	0.00	0.00	0.00
LAND PREPARATION REQ.							60							
EFFECTIVE RAINFALL			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CROP IRR.REQ.	.2		0.00	0.00	0.00	0.00	68.40	71.61	158.40	223.20	58.05	0.00	0.00	0.00
			0.00	0.00	0.00	0.00	13.68	14.32	31.68	44.64	11.61	0.00	0.00	0.00
ONION														
3 KC					0.28	0.68	0.88	0.94	0.90	0.81	0.37			
PLANTED AREA(%)					0.50	1.00	1.00	1.00	1.00	1.00	0.50			
CU			0.00	0.00	8.68	42.16	61.60	101.99	148.50	188.33	49.95	0.00	0.00	0.00
LAND PREPARATION REQ.					60									
EFFECTIVE RAINFALL			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CROP IRR.REQ.	.2		0.00	0.00	68.68	42.16	61.60	101.99	148.50	188.33	49.95	0.00	0.00	0.00
			0.00	0.00	13.74	8.43	12.32	20.40	29.70	37.67	9.99	0.00	0.00	0.00

260

52

580

116

661

132

	CAULIFLOWER													
4	KC		0.86	0.46								0.16	0.56	
	PLANTED AREA(%)		1.00	0.50								0.50	1.00	
	CU		133.30	27.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.32	126.00	
	LAND PREPARATION REQ.												60		
	EFFECTIVE RAINFALL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	CROP IRR.REQ.	.2	133.30	27.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.32	126.00	369
			26.66	5.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.46	25.20	74
	CARROT														
5	KC				0.29	0.77	0.89	0.42							
	PLANTED AREA(%)				0.50	1.00	1.00	0.50							
	CU		0.00	0.00	8.99	47.74	62.30	22.79	0.00	0.00	0.00	0.00	0.00	0.00	
	LAND PREPARATION REQ.				60										
	EFFECTIVE RAINFALL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	CROP IRR.REQ.	.2	0.00	0.00	68.99	47.74	62.30	22.79	0.00	0.00	0.00	0.00	0.00	0.00	202
			0.00	0.00	13.80	9.55	12.46	4.56	0.00	0.00	0.00	0.00	0.00	0.00	40
	OKRA														
6	KC								0.23	0.64	0.94	0.91	0.38		
	PLANTED AREA(%)								0.50	1.00	1.00	1.00	0.50		
	CU		0.00	0.00	0.00	0.00	0.00	0.00	18.98	148.80	253.80	268.00	53.01	0.00	
	LAND PREPARATION REQ.								60						
	EFFECTIVE RAINFALL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	CROP IRR.REQ.	.2	0.00	0.00	0.00	0.00	0.00	0.00	78.98	148.80	253.80	268.00	53.01	0.00	803
			0.00	0.00	0.00	0.00	0.00	0.00	15.80	29.76	50.76	53.60	10.60	0.00	161
	WATERMELON														
7	KC						0.20	0.49	0.73	0.88	0.78	0.34			
	PLANTED AREA(%)						0.50	1.00	1.00	1.00	0.88	0.13			
	CU		0.00	0.00	0.00	0.00	7.00	53.17	120.45	204.60	184.28	12.52	0.00	0.00	
	LAND PREPARATION REQ.						60								
	EFFECTIVE RAINFALL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	CROP IRR.REQ.	.2	0.00	0.00	0.00	0.00	67.00	53.17	120.45	204.60	184.28	12.52	0.00	0.00	642
			0.00	0.00	0.00	0.00	13.40	10.63	24.09	40.92	36.86	2.50	0.00	0.00	128

	SQUASH														
8	KC		0.76	0.39									0.16	0.62	
	PLANTED AREA(%)		1.00	0.50									0.50	1.00	
	CU		117.80	23.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.32	139.50	
	LAND PREPARATION REQ.												60		
	EFFECTIVE RAINFALL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	CROP IRR.REQ.	.2	117.80	23.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.32	139.50	363
			23.56	4.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.46	27.90	73
	RADISHES														
9	KC		0.24	0.60	0.79	0.42									
	PLANTED AREA(%)		0.50	1.00	1.00	0.50									
	CU		18.60	72.00	48.98	13.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	LAND PREPARATION REQ.		60												
	EFFECTIVE RAINFALL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	CROP IRR.REQ.	.2	78.60	72.00	48.98	13.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	213
			15.72	14.40	9.80	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43
	GREENBEANS														
10	KC						0.19	0.50	0.76	0.44					
	PLANTED AREA(%)						0.50	1.00	1.00	0.50					
	CU		0.00	0.00	0.00	0.00	0.00	10.31	82.50	176.70	59.40	0.00	0.00	0.00	
	LAND PREPARATION REQ.						60								
	EFFECTIVE RAINFALL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	CROP IRR.REQ.	.2	0.00	0.00	0.00	0.00	0.00	70.31	82.50	176.70	59.40	0.00	0.00	0.00	389
			0.00	0.00	0.00	0.00	0.00	14.06	16.50	35.34	11.88	0.00	0.00	0.00	78
	TOTAL CROP IRR REQ		81.13	42.84	40.06	20.58	51.86	63.97	117.77	188.33	121.10	56.10	43.53	68.93	896
	LEACHING REQ.	0.10	9.01	4.76	4.45	2.29	5.76	7.11	13.09	20.93	13.46	6.23	4.84	7.66	100
	NET IRR.REQ. (MM/MONTH)		90.14	47.60	44.51	22.87	57.62	71.08	130.85	209.25	134.55	62.34	48.37	76.58	996
	IRR. EFFICIENCY	0.77													
	TOTAL GROSS IRR.REQ.	(MM/MON)	117.84	62.22	58.18	29.90	75.32	92.91	171.05	273.53	175.88	81.48	63.22	100.11	1302
		(MM/DAY)	4	2	2	1	3	3	6	9	6	3	2	3	

IRRIGATION WATER REQUIREMENT Type-3 for The Dab'ah-Hammam Scheme

(MM/MONTH)

	CROPPING PATTERN	PROPOTION	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
	OPEN FIELD														
	ET(O)			155.00	120.00	62.00	62.00	70.00	109.00	165.00	233.00	270.00	295.00	279.00	225.00
	EFFECTIVE RAINFALL														
	POTATO														
1	KC							0.24	0.66	0.96	0.96	0.43			
	PLANTED AREA(%)							0.50	1.00	1.00	1.00	0.50			
	CU			0.00	0.00	0.00	0.00	8.40	71.94	158.40	223.68	58.05	0.00	0.00	0.00
	LAND PREPARATION REQ.							60							
	EFFECTIVE RAINFALL			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CROP IRR.REQ.	.2		0.00	0.00	0.00	0.00	68.40	71.94	158.40	223.68	58.05	0.00	0.00	0.00
				0.00	0.00	0.00	0.00	13.68	14.39	31.68	44.74	11.61	0.00	0.00	0.00
	ONION														
2	KC					0.28	0.68	0.88	0.94	0.90	0.81	0.37			
	PLANTED AREA(%)					0.50	1.00	1.00	1.00	1.00	1.00	0.50			
	CU			0.00	0.00	8.68	42.16	61.60	102.46	148.50	188.73	49.95	0.00	0.00	0.00
	LAND PREPARATION REQ.					60									
	EFFECTIVE RAINFALL			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CROP IRR.REQ.	.2		0.00	0.00	68.68	42.16	61.60	102.46	148.50	188.73	49.95	0.00	0.00	0.00
				0.00	0.00	13.74	8.43	12.32	20.49	29.70	37.75	9.99	0.00	0.00	0.00
	CARROT														
3	KC					0.29	0.77	0.89	0.42						
	PLANTED AREA(%)					0.50	1.00	1.00	0.50						
	CU			0.00	0.00	8.99	47.74	62.30	22.89	0.00	0.00	0.00	0.00	0.00	0.00
	LAND PREPARATION REQ.					60									
	EFFECTIVE RAINFALL			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CROP IRR.REQ.	.2		0.00	0.00	68.99	47.74	62.30	22.89	0.00	0.00	0.00	0.00	0.00	0.00
				0.00	0.00	13.80	9.55	12.46	4.58	0.00	0.00	0.00	0.00	0.00	0.00

580	
116	
662	
132	
202	
40	

	WATERMELON													
4	KC						0.20	0.49	0.73	0.88	0.78	0.34		
	PLANTED AREA(%)						0.50	1.00	1.00	1.00	0.88	0.13		
	CU		0.00	0.00	0.00	0.00	7.00	53.41	120.45	205.04	184.28	12.54	0.00	0.00	
	LAND PREPARATION REQ.						60							
	EFFECTIVE RAINFALL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	CROP IRR.REQ.	.2	0.00	0.00	0.00	0.00	67.00	53.41	120.45	205.04	184.28	12.54	0.00	0.00	643
			0.00	0.00	0.00	0.00	13.40	10.68	24.09	41.01	36.86	2.51	0.00	0.00	129
	GREENBEANS													
5	KC						0.19	0.50	0.76	0.44				
	PLANTED AREA(%)						0.50	1.00	1.00	0.50				
	CU		0.00	0.00	0.00	0.00	6.65	54.50	125.40	51.26	0.00	0.00	0.00	0.00	
	LAND PREPARATION REQ.						60							
	EFFECTIVE RAINFALL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	CROP IRR.REQ.	.2	0.00	0.00	0.00	0.00	66.65	54.50	125.40	51.26	0.00	0.00	0.00	0.00	298
			0.00	0.00	0.00	0.00	13.33	10.90	25.08	10.25	0.00	0.00	0.00	0.00	60
	TOTAL CROP IRR REQ.		0.00	0.00	27.53	17.98	65.19	61.04	110.55	133.74	58.46	2.51	0.00	0.00	477
	LEACHING REQ.	0.09	0.00	0.00	2.72	1.78	6.45	6.04	10.93	13.23	5.78	0.25	0.00	0.00	47
	NET IRR.REQ. (MM/MONTH)		0.00	0.00	30.26	19.76	71.64	67.08	121.48	146.97	64.24	2.76	0.00	0.00	524
	IRR. EFFICIENCY	0.77													
	TOTAL GROSS IRR.REQ.	(MM/MON)	0.00	0.00	39.55	25.83	93.64	87.68	158.80	192.12	83.97	3.60	0.00	0.00	685
		(MM/DAY)	0	0	1	1	3	3	5	6	3	0	0	0	

IRRIGATION WATER REQUIREMENT Type-3 for the Qatrana Scheme (MM/MONTH)

	CROPPING PATTERN	PROPOTION	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
	OPEN FIELD														
	ET(O)		155.00	105.00	62.00	62.00	84.00	124.00	210.00	248.00	255.00	294.50	248.00	210.00	
	EFFECTIVE RAINFALL														
	POTATO														
1	KC						0.24	0.66	0.96	0.96	0.43				
	PLANTED AREA(%)						0.50	1.00	1.00	1.00	0.50				
	CU		0.00	0.00	0.00	0.00	10.08	81.84	201.60	238.08	54.83	0.00	0.00	0.00	
	LAND PREPARATION REQ.						60								
	EFFECTIVE RAINFALL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	CROP IRR.REQ.	.2	0.00	0.00	0.00	0.00	70.08	81.84	201.60	238.08	54.83	0.00	0.00	0.00	646
			0.00	0.00	0.00	0.00	14.02	16.37	40.32	47.62	10.97	0.00	0.00	0.00	129
	ONION														
2	KC				0.28	0.68	0.88	0.94	0.90	0.81	0.37				
	PLANTED AREA(%)				0.50	1.00	1.00	1.00	1.00	1.00	0.50				
	CU		0.00	0.00	8.68	42.16	73.92	116.56	189.00	200.88	47.18	0.00	0.00	0.00	
	LAND PREPARATION REQ.				60										
	EFFECTIVE RAINFALL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	CROP IRR.REQ.	.2	0.00	0.00	68.68	42.16	73.92	116.56	189.00	200.88	47.18	0.00	0.00	0.00	738
			0.00	0.00	13.74	8.43	14.78	23.31	37.80	40.18	9.44	0.00	0.00	0.00	148
	CARROT														
3	KC				0.29	0.77	0.89	0.42							
	PLANTED AREA(%)				0.50	1.00	1.00	0.50							
	CU		0.00	0.00	8.99	47.74	74.76	26.04	0.00	0.00	0.00	0.00	0.00	0.00	
	LAND PREPARATION REQ.				60										
	EFFECTIVE RAINFALL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	CROP IRR.REQ.	.2	0.00	0.00	68.99	47.74	74.76	26.04	0.00	0.00	0.00	0.00	0.00	0.00	218
			0.00	0.00	13.80	9.55	14.95	5.21	0.00	0.00	0.00	0.00	0.00	0.00	44

	WATERMELON													
4	KC						0.20	0.49	0.73	0.88	0.78	0.34		
	PLANTED AREA(%)						0.50	1.00	1.00	1.00	0.88	0.13		
	CU		0.00	0.00	0.00	0.00	8.40	60.76	153.30	218.24	174.04	12.52	0.00	0.00	
	LAND PREPARATION REQ.						60							
	EFFECTIVE RAINFALL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	CROP IRR.REQ.	.2	0.00	0.00	0.00	0.00	68.40	60.76	153.30	218.24	174.04	12.52	0.00	0.00	687
			0.00	0.00	0.00	0.00	13.68	12.15	30.66	43.65	34.81	2.50	0.00	0.00	137
	GREENBEANS													
5	KC						0.19	0.50	0.76	0.44				
	PLANTED AREA(%)						0.50	1.00	1.00	0.50				
	CU		0.00	0.00	0.00	0.00	7.98	62.00	159.60	54.56	0.00	0.00	0.00	0.00	
	LAND PREPARATION REQ.						60							
	EFFECTIVE RAINFALL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	CROP IRR.REQ.	.2	0.00	0.00	0.00	0.00	67.98	62.00	159.60	54.56	0.00	0.00	0.00	0.00	344
			0.00	0.00	0.00	0.00	13.60	12.40	31.92	10.91	0.00	0.00	0.00	0.00	69
	TOTAL CROP IRR REQ.		0.00	0.00	27.53	17.98	71.03	69.44	140.70	142.35	55.21	2.50	0.00	0.00	527
	LEACHING REQ.	0.09	0.00	0.00	2.72	1.78	7.02	6.87	13.92	14.08	5.46	0.25	0.00	0.00	52
	NET IRR.REQ. (MM/MONTH)		0.00	0.00	30.26	19.76	78.05	76.31	154.62	156.43	60.67	2.75	0.00	0.00	579
	IRR. EFFICIENCY	0.77													
	TOTAL GROSS IRR.REQ.	(MM/MON)	0.00	0.00	39.55	25.83	102.03	99.75	202.11	204.48	79.30	3.60	0.00	0.00	757
		(MM/DAY)	0	0	1	1	4	3	7	7	3	0	0	0	

CONSTRUCTION COST DAB'AH-HANMAH SCHEME AREA

(JD)

DESCRIPTION	UNIT	QUANTITY	FOREIGN CURRENCY UNIT COST	FOREIGN CURRENCY AMOUNT	LOCAL CURRENCY UNIT COST	LOCAL CURRENCY AMOUNT	TOTAL
1 INTAKE STRUCTURE							
1.1. CONCRETE	CUM	14	34.34	480.82	8.06	112.78	593.60
1.2. R.C.PIPE Ø500	LIN.M	42	9.90	415.80	3.30	138.60	554.40
1.3. METAL WORK							
SLIDE GATA Ø500	SET	1	307.00	307.00	93.00	93.00	400.00
SCREEN ,ETC.	TON	0.18	314.53	56.61	38.87	7.00	63.61
SUB TOTAL				1260.23		351.38	1611.61
2 REGULATING POND							
2.1.EARTH WORK							
EXCAVATION	CUM	3980	0.66	2626.80	0.34	1353.20	3980.00
BACKFILL	CUM	110	0.83	90.75	0.28	30.25	121.00
SANDFILL	CUM	350	1.83	640.50	1.17	409.50	1050.00
2.2.CONCRETE	CUM	660	34.34	22667.04	8.06	5316.96	27984.00
2.3.METAL WORK							
I-BEAM	TON	0.25	336.58	84.15	41.60	10.40	94.55
IRON BAR	TON	0.25	314.53	78.63	38.87	9.72	88.35
2.4.OTHER WORKS							
VINYLE SHEET ETC	SQ.M	2950	1.60	4720.00	0.40	1180.00	5900.00
SUB TOTAL				30907.87		8310.03	39217.90
3 PUMP STATION							
3.1.PUMP HOUSE	SQ.M	0	240.00	0.00	80.00	0.00	0.00
3.2.EQUIPMENT	SET	0	8000.00	0.00	2000.00	0.00	0.00
3.3.DISTRIBUTION	LIN.KM	0	8000.00	0.00	2000.00	0.00	0.00
3.4.TRANSFORMER							
200KVA	SET	0	1520.00	0.00	380.00	0.00	0.00
SUB TOTAL				0.00		0.00	0.00
4.SAND FILTER							
30 LIT/SEC	SET	8	10975.70	87805.60	2724.30	21794.40	109600
SUB TOTAL				87805.60		21794.40	109600
5.BOOSTER PUMP							
5.1.PUMP HOUSE	SQ.M	46	240.00	11040.00	80.00	3680.00	14720.00
5.2.EQUIPMENT	SET	4	8000.00	32000.00	2000.00	8000.00	40000.00
5.3.DISTRIBUTION	LIN.KM	4	8000.00	32000.00	2000.00	8000.00	40000.00
5.4.TRANSFORMER							
200KVA	SET	1	1520.00	1520.00	380.00	380.00	1900.00
SUB TOTAL				76560.00		20060.00	96620.00

6.MAIN PIPE LINE							
6.1.R.C.PIPE							
ø450	LIN.M	1200	8.40	10080.00	2.80	3360.00	13440.00
ø300	LIN.M	800	4.50	3600.00	1.50	1200.00	4800.00
6.2.AIR & TURNOUT							
VALVES	SET	7	967.50	6772.50	107.50	752.50	7525.00
6.3.CONCRETE	CUM	5	34.34	171.72	8.06	40.28	212.00
6.4.EARTH WORKS							
EXCAVATION	CUM	150	0.34	51.00	0.34	51.00	102.00
BACKFILL	CUM	5	0.83	4.13	0.28	1.38	5.50
SANDFILL	CUM	90	1.83	164.70	1.17	105.30	270.00
SUB TOTAL				20844.05		5510.46	26354.50
7.SECONDARY PIPE LINE							
7.1.R.C.PIPE							
ø150	LIN.M	5800	2.70	15660.00	0.90	5220.00	20880.00
7.2.AIR & TURNOUT							
VALVES	SET	0	967.50	0.00	107.50	0.00	0.00
7.3.CONCRETE	CUM	5	34.34	171.72	8.06	40.28	212.00
7.4.EARTH WORKS							
EXCAVATION	CUM	150	0.66	99.00	0.34	51.00	150.00
BACKFILL	CUM	5	0.83	4.13	0.28	1.38	5.50
SANDFILL	CUM	120	1.83	219.60	1.17	140.40	360.00
SUB TOTAL				16154.45		5453.06	21607.50
8.STONE FENCE & COLLECTOR DAIN							
8.1.EARTH WORK							
EXCAVATION	CUM	480	0.66	316.80	0.34	163.20	480.00
8.2.STONE MASONRY	CUM	705	4.50	3172.50	3.00	2115.00	5287.50
SUB TOTAL				3489.30		2278.20	5767.50
9.COLLECTOR DRAIN							
9.1.EARTH WORKS							
EXCAVATION	CUM	825	0.66	544.50	0.34	280.50	825.00
SUB TOTAL				544.50		280.50	825.00
10.FARM ROAD							
10.1.EARTH WORK							
EMBANKMENT	CUM	6020	0.83	4966.50	0.28	1655.50	6622.00
10.2.GRAVEL METAL	CUM	2580	3.71	9558.90	2.00	5147.10	14706.00
10.3.BRIDGE							
EXCAVATION	CUM	0	0.66	0.00	0.34	0.00	0.00
EMBANKMENT	CUM	0	0.83	0.00	0.28	0.00	0.00
CONCRETE	CUM	0	34.34	0.00	8.06	0.00	0.00
SUB TOTAL				14525.40		6802.60	21328.00

11.CROSS DRAIN							
11.1.EARTH WORKS							
EXCAVATION	CUM	175	0.66	115.50	0.34	59.50	175.00
BACKFILL	CUM	0	0.83	0.00	0.28	0.00	0.00
SANDFILL	CUM	5	1.83	9.15	1.17	5.85	15.00
11.2.STONE WORK							
RIPRAP	CUM	53	9.54	505.73	5.14	272.31	778.04
11.3.CONCRETE WORK							
R.C.PIPE							
Ø1000	LIN.M	40	37.65	1506.00	12.55	502.00	2008.00
CONCRETE	CUM	32	34.34	1099.01	8.06	257.79	1356.80
SUB TOTAL				3235.38		1097.46	4332.84
12.ON FARM DEVELOPMENT							
INCLUDING TERTIARY PIPE							
	HA	75	886.16	66462.00	293.84	22038.00	88500.00
SUB TOTAL				66462.00		22038.00	88500.00
13.BUILDINGS							
13.1.MAIN OFFICE	SQ.M	200	240.00	48000.00	80.00	16000	64000.00
13.2.FIELD OFFICE	SQ.M	60	240.00	14400.00	80.00	4800.00	19200.00
SUB TOTAL				62400.00		20800.00	83200.00
14.DAM	CUM	682000	5.27	3594140	3.98	2714360	6308500
TOTAL DIRECT COST				3978329		2829136	6807465
PROPORTION (%)				58		42	100

CONSTRUCTION COST QATRANA SCHEME AREA

(JD)

DESCRIPTION	UNIT	QUANTITY	FOREIGN CURRENCY UNIT COST	FOREIGN CURRENCY AMOUNT	LOCAL CURRENCY UNIT COST	LOCAL CURRENCY AMOUNT	TOTAL
1 INTAKE STRUCTURE							
1.1. CONCRETE	CUM	0	34.34	0.00	8.06	0.00	0.00
1.2. R.C.PIPE ø500	LIN.M	0	9.90	0.00	3.30	0.00	0.00
1.3. METAL WORK							
SLIDE GATA ø500	SET	0	307.00	0.00	93.00	0.00	0.00
SCREEN ,ETC.	TON	0	314.53	0.00	38.87	0.00	0.00
SUB TOTAL				0.00		0.00	0.00
2 REGULATING POND							
2.1.EARTH WORK							
EXCAVATION	CUM	2604	0.66	1718.64	0.34	885.36	2604.00
BACKFILL	CUM	85	0.83	70.13	0.28	23.38	93.50
SANDFILL	CUM	245	1.83	448.35	1.17	286.65	735.00
2.2.CONCRETE	CUM	447	34.34	15351.77	8.06	3601.03	18952.80
2.3.METAL WORK							
I-BEAM	TON	0.19	336.58	63.95	41.60	7.90	71.85
IRON BAR	TON	0.19	314.53	59.76	38.87	7.39	67.15
2.4.OTHER WORKS							
VINYLE SHEET ETC	SQ.M	1150	1.60	1840.00	0.40	460.00	2300.00
SUB TOTAL				19552.59		5271.71	24824.30
3 PUMP STATION							
3.1.PUMP HOUSE	SQ.M	46	240.00	11040.00	80.00	3680.00	14720.00
3.2.EQUIPMENT	SET	4	8000.00	32000.00	2000.00	8000.00	40000.00
3.3.DISTRIBUTION	LIN.KM	2	8000.00	16000.00	2000.00	4000.00	20000.00
3.4.TRANSFORMER							
200KVA	SET	1	1520.00	1520.00	380.00	380.00	1900.00
SUB TOTAL				60560.00		16060.00	76620.00
4.SAND FILTER							
30 LIT/SEC	SET	6	10975.70	65854.20	2724.30	16345.80	82200.00
SUB TOTAL				65854.20		16345.80	82200.00
5.BOOSTER PUMP							
5.1.PUMP HOUSE	SQ.M	39	240.00	9360.00	80.00	3120.00	12480.00
5.2.EQUIPMENT	SET	3	8000.00	24000.00	2000.00	6000.00	30000.00
5.3.DISTRIBUTION	LIN.KM	0	8000.00	0.00	2000.00	0.00	0.00
5.4.TRANSFORMER							
200KVA	SET	0	1520.00	0.00	380.00	0.00	0.00
SUB TOTAL				33360.00		9120.00	42480.00

6.MAIN PIPE LINE							
6.1.R.C.PIPE							
ø300	LIN.M	2900	4.50	13050.00	1.50	4350.00	17400.00
ø150	LIN.M	800	2.70	2160.00	0.90	720.00	2880.00
6.2.AIR & TURNOUT							
VALVES	SET	20	967.50	19350.00	107.50	2150.00	21500.00
6.3.CONCRETE	CUM	3	34.34	103.03	8.06	24.17	127.20
6.4.EARTH WORKS							
EXCAVATION	CUM	125	0.34	42.50	0.34	42.50	85.00
BACKFILL	CUM	3	0.83	2.48	0.28	0.83	3.30
SANDFILL	CUM	120	1.83	219.60	1.17	140.40	360.00
SUB TOTAL				34927.61		7427.89	42355.50
7.SECONDARY PIPE LINE							
7.1.R.C.PIPE							
ø150	LIN.M	4500	2.70	12150.00	0.90	4050.00	16200.00
7.2.AIR & TURNOUT							
VALVES	SET	0	967.50	0.00	107.50	0.00	0.00
7.3.CONCRETE	CUM	1	34.34	34.34	8.06	8.06	42.40
7.4.EARTH WORKS							
EXCAVATION	CUM	95	0.66	62.70	0.34	32.30	95.00
BACKFILL	CUM	2	0.83	1.65	0.28	0.55	2.20
SANDFILL	CUM	90	1.83	164.70	1.17	105.30	270.00
SUB TOTAL				12413.39		4196.21	16609.60
8.STONE FENCE & COLLECTOR DAIN							
8.1.EARTH WORK							
EXCAVATION	CUM	105	0.66	69.30	0.34	35.70	105.00
8.2.STONE MASONRY	CUM	165	4.50	742.50	3.00	495.00	1237.50
SUB TOTAL				811.80		530.70	1342.50
9.COLLECTOR DRAIN							
9.1.EARTH WORKS							
EXCAVATION	CUM	30	0.66	19.80	0.34	10.20	30.00
SUB TOTAL				19.80		10.20	30.00
10.FARM ROAD							
10.1.EARTH WORK							
EMBANKMENT	CUM	2800	0.83	2310.00	0.28	770.00	3080.00
10.2.GRAVEL METAL	CUM	1260	3.71	4668.30	2.00	2513.70	7182.00
10.3.ACCESS FOR SPILLWAY							
EXCAVATION	CUM	100	0.66	66.00	0.34	34.00	100.00
EMBANKMENT	CUM	0	0.83	0.00	0.28	0.00	0.00
RIPRAP	CUM	100	9.54	954.20	5.14	513.80	1468.00
SUB TOTAL				7998.50		3831.50	11830.00

11.CROSS DRAIN							
11.1.EARTH WORKS							
EXCAVATION	CUM	175	0.66	115.50	0.34	59.50	175.00
BACKFILL	CUM	0	0.83	0.00	0.28	0.00	0.00
SANDFILL	CUM	5	1.83	9.15	1.17	5.85	15.00
11.2.STONE WORK							
RIPRAP	CUM	53	9.54	505.73	5.14	272.31	778.04
11.3.CONCRETE WORK							
R.C.PIPE							
ø1000	LIN.M	40	37.65	1506.00	12.55	502.00	2008.00
CONCRETE	CUM	32	34.34	1099.01	8.06	257.79	1356.80
SUB TOTAL				3235.38		1097.46	4332.84
12.ON FARM DEVELOPMENT INCLUDING TERTIARY PIPE	HA	75	886.16	66462.00	293.84	22038.00	88500.00
SUB TOTAL				66462.00		22038.00	88500.00
13.BUILDINGS							
13.1.MAIN OFFICE	SQ.M	200	240.00	48000.00	80.00	16000	64000.00
13.2.FIELD OFFICE	SQ.M	60	240.00	14400.00	80.00	4800.00	19200.00
SUB TOTAL				62400.00		20800.00	83200.00
14.DAM	CUM	682000	4.92	3355440	3.71	2530220	5885660
TOTAL DIRECT COST				3739629		2644996	6384625
PROPORTION (%)				59		41	100

JICA