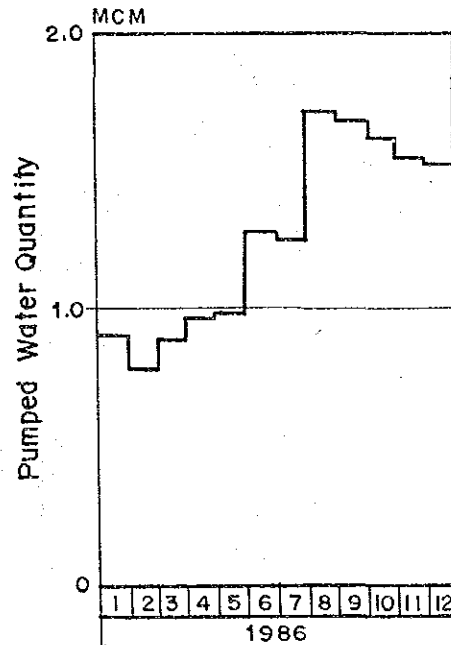
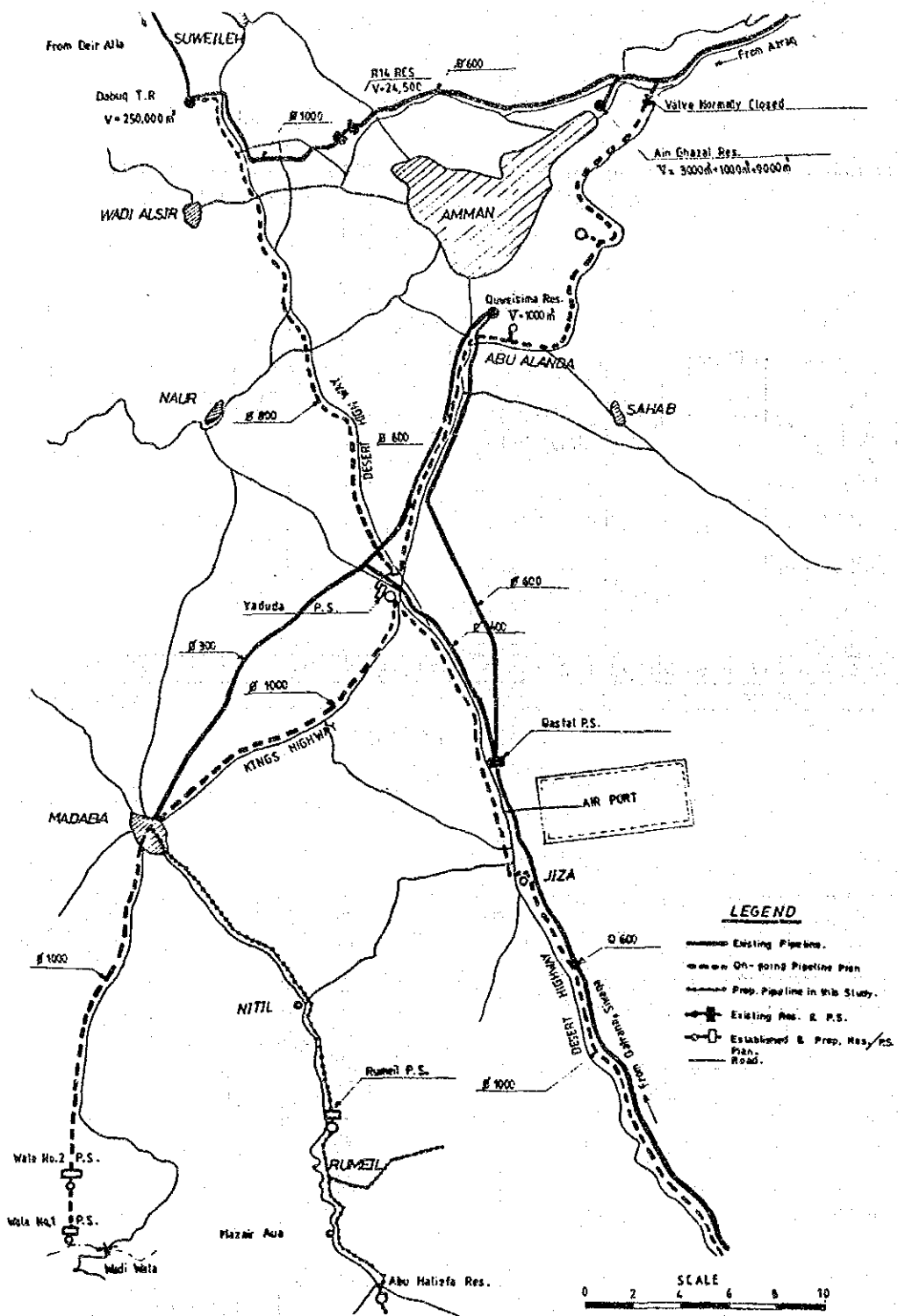


Azraq System



Annex M4319-3 カトラナ・シワッカ・カスクル系よりアンマンへの送水量

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



Annex M4321

現況、進行中および計画中のパイプライン

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

Unit : (%)

Locality	1979 to 1985	1985 to 1990	1990 to 2005*
Amman city	5.0	5.0	4.0
Zarqa & Irbid cities	4.5	4.5	3.5
Ruseifa city	4.5	4.5	4.5
Other cities (over 10,000 pop.)	3.5	3.0	2.8
Towns (3,000 to 10,000 pop.)	3.0	2.8	2.5
Small communities (below 3,000 pop.)	2.0	1.8	1.6
National Average	3.7	3.6	3.1

* The period "1990 to 2000" shown in World Bank's report was altered to "1990 to 2005", assuming that the same growth rate will continue till the year 2005.
(after "Water Sector Study Report", World Bank, 1984)

Annex M5231 ジョルダンおよび調査地域内の将来人口

Unit: Thousand Persons

Governorate	1979 (Census)					1985 (Estimation)					1990 (Estimation)					2000 (Estimation)					2005 (Estimation)					
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	
	(1)+(2)	(3)+(4)	(1)+(2)	(3)+(4)	(3)+(4)	(1)+(2)	(3)+(4)	(1)+(2)	(3)+(4)	(3)+(4)	(1)+(2)	(3)+(4)	(1)+(2)	(3)+(4)	(3)+(4)	(1)+(2)	(3)+(4)	(1)+(2)	(3)+(4)	(3)+(4)	(1)+(2)	(3)+(4)	(1)+(2)	(3)+(4)	(3)+(4)	
Amman	1,132	22	1,154	19	1,173	1,471	24	1,495	22	1,517	1,825	27	1,852	24	1,876	2,612	32	2,644	29	2,673	3,129	35	3,164	32	3,196	
Irbid	4	-	4	607	611	5	-	5	725	730	5	-	5	834	839	6	-	6	1,067	1,073	6	-	6	1,209	1,215	
Balqa	177	-	177	31	148	140	-	140	36	176	160	-	160	40	200	206	-	206	48	254	233	-	233	53	286	
Karak	-	47	47	79	126	-	53	53	93	146	-	58	58	104	162	-	69	69	129	198	-	75	75	144	219	
Ma'an	-	-	-	75	75	-	-	-	89	89	-	-	-	101	101	-	-	-	127	127	-	-	-	-	143	143
Total	1,253	69	1,322	811	2,133	1,616	77	1,693	965	2,658	1,990	85	2,075	1,103	3,178	2,824	101	2,925	1,400	4,325	3,368	110	3,478	1,581	5,059	
%	(59)	(3)	(62)	(38)	(100)	(61)	(3)	(64)	(36)	(100)	(62)	(3)	(65)	(35)	(100)	(65)	(3)	(68)	(32)	(100)	(67)	(2)	(69)	(31)	(100)	

Note: Notation on population show in the table is classified according to the following categories of area;

(1) Greater Amman area (within 30km with center in the Amman city)

(2) Wadi Mujib basin area

(3) Study area; (1)+(2)

(4) Other area than (1) and (2) in Jordan

(5) Jordan

Annex M5311 一人当りの家庭用水需要量の推定値

Unit : l/c/d

Locality	1979	1985	1990	1995	2000	2005
Amman city	90	95	100	105	110	115
Zarka & Irbid cities	75	80	85	90	95	100
Cities over 10,000 pop.	65	70	75	80	85	90
Towns 3,000 to 10,000 pop.	60	65	70	70	75	80
Communities below 3,000 pop.	40	45	50	55	60	65

Annex M5322 非家庭用水需要量の推定値

Unit: %*

Locality	1979	1985	1990	1995	2000	2005
Amman city	20	20	20	25	25	25
Zarqa & Irbid cities	15	15	15	20	20	20
Cities over 10,000 pop.	10	10	10	15	15	15
Towns 3,000 to 10,000 pop.	10	10	10	15	15	15
Communities below 3,000 pop.	10	10	10	10	10	10

* Percent (%) shows a ratio of the non-domestic water demand to the domestic water demand.

Annex M5332 給水系統の中の水損失

Unit: %*

Reference Locality	1975	1982	1985	1990	2000	2005
[1]						
Amman Zarqa & Irbid cities	35	-	25	-	15	-
Other localities	30	-	20	-	15	-
[2]All localities	20	-	-	-	20	-
[3]All localities	-	20	-	20	-	20

Note: [1], [2] & [3] mean respective reference shown in Section M5.1.

* Percent (%) shows a ratio of water loss to the domestic and non-domestic water supplies (except large-scale industrial water supply).

Annex M5341 一人当りの都市用水需要量の推定値

Unit: l/c/d

Locality	1979	1985	1990	1995	2000	2005
Amman city	130	137	144	158	165	172
Zarqa & Irbid cities	104	110	117	130	137	144
Cities over 10,000 pop.	86	92	99	110	117	124
Towns 3,000 to 10,000 pop.	79	86	92	97	104	110
Communities below 3,000 pop.	53	59	66	73	79	86

* Municipal water demand consists of domestic and non-domestic water demand and water losses in the distribution systems.

Annex MS351-1(1/2) 都市用水需要量の推定値

Unit : MCM/year

Governorate*	1979					1985					1990				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
			(1)+(2)		(3)+(4)			(1)+(2)		(3)+(4)			(1)+(2)		(3)+(4)
Amman	46.19	0.45	46.64	0.41	47.05	64.08	0.57	64.65	0.53	65.18	84.82	0.70	85.52	0.65	86.17
Irbid	0.08	-	0.08	16.70	16.78	0.09	-	0.09	21.83	21.92	0.12	-	0.12	27.47	27.59
Balqa	3.30	-	3.30	0.70	4.00	4.30	-	4.30	0.88	5.18	5.33	-	5.33	1.08	6.41
Karak	-	0.94	0.94	1.96	2.90	-	1.19	1.19	2.52	3.71	-	1.46	1.46	3.08	4.54
Ma'an	-	-	-	2.00	2.00	-	-	-	2.58	5.58	-	-	-	3.21	3.21
Total	49.57	1.39	50.96	21.77	72.73	68.47	1.76	70.23	28.34	98.57	90.27	2.16	92.43	35.49	127.92

Note: Nation on population shown in the table is classified according to the following categories of area;

(1) Greater Amman area (within 30 km with center in the Amman city)

(2) Wadi Mujib basin area

(3) Study Area; (1)+(2)

(4) Other area than (1) and (2) in Jordan

(5) Jordan

* According to the former administrative units.

Annex M5351-1(2/2) 都市用水需要量の推定値

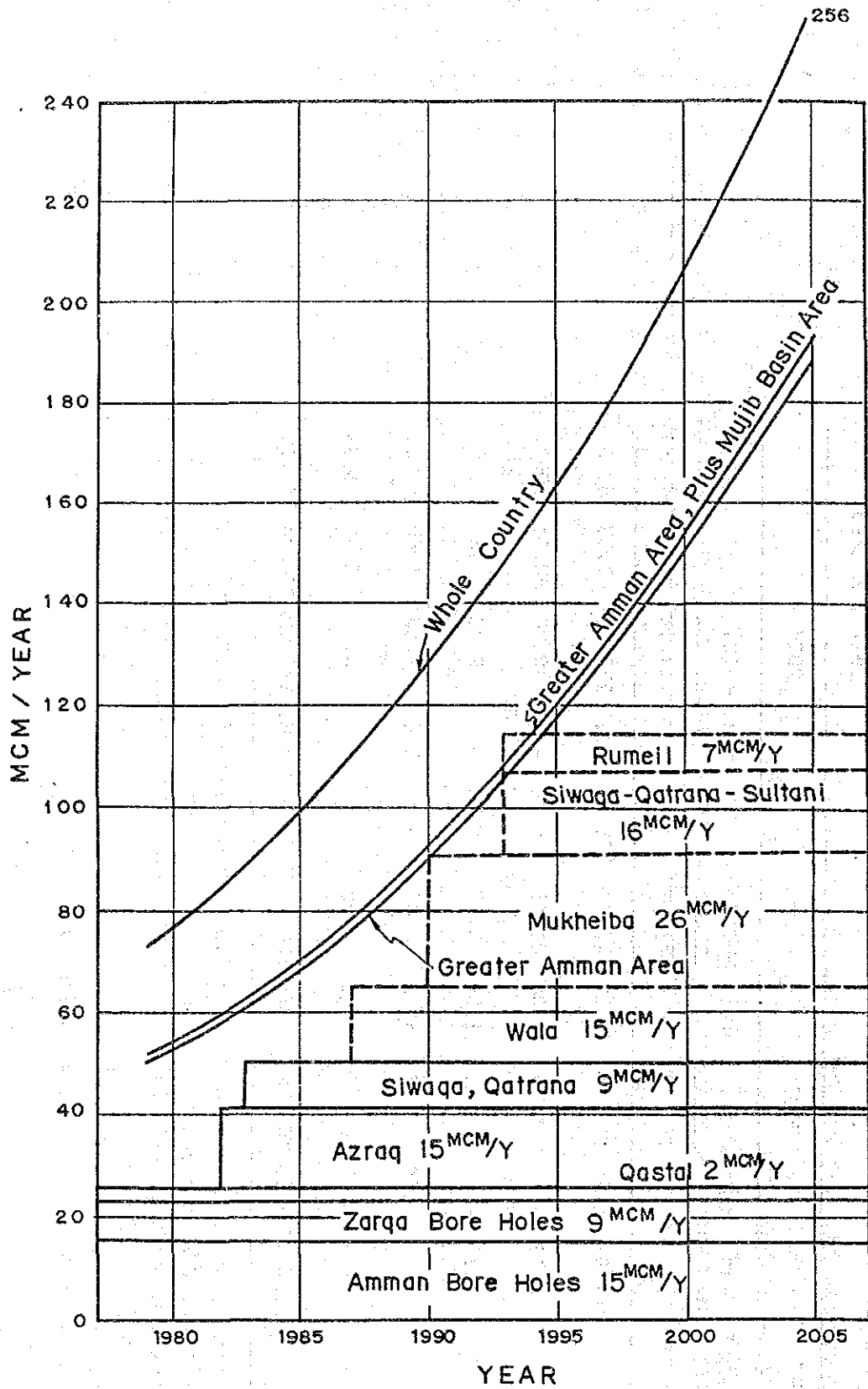
Unit : MCM/year

Governorate*	2000					2005				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
	(1)+(2)	(3)	(4)	(5)	(3)+(4)	(1)+(2)	(3)	(4)	(5)	(3)+(4)
Amman	141.56	0.99	142.55	0.92	143.47	178.30	1.17	179.47	1.08	180.55
Irbid	0.17	-	0.17	41.30	41.47	0.20	-	0.20	50.01	50.21
Balqa	8.11	-	8.11	1.54	9.65	9.82	-	9.82	1.83	11.05
Karak	-	2.06	2.06	4.59	6.65	-	2.43	2.43	5.49	7.92
Ma'an	-	-	-	4.83	4.83	-	-	-	5.83	5.83
Total	149.84	3.05	152.89	53.18	206.07	188.32	3.60	191.92	64.24	256.16

Note: Nation on population shown in the table is classified according to the following categories of area;

- (1) Greater Amman area (within 30 km with center in the Amman city)
- (2) Wadi Mujib basin area
- (3) Study Area; (1)+(2)
- (4) Other area than (1) and (2) in Jordan
- (5) Jordan

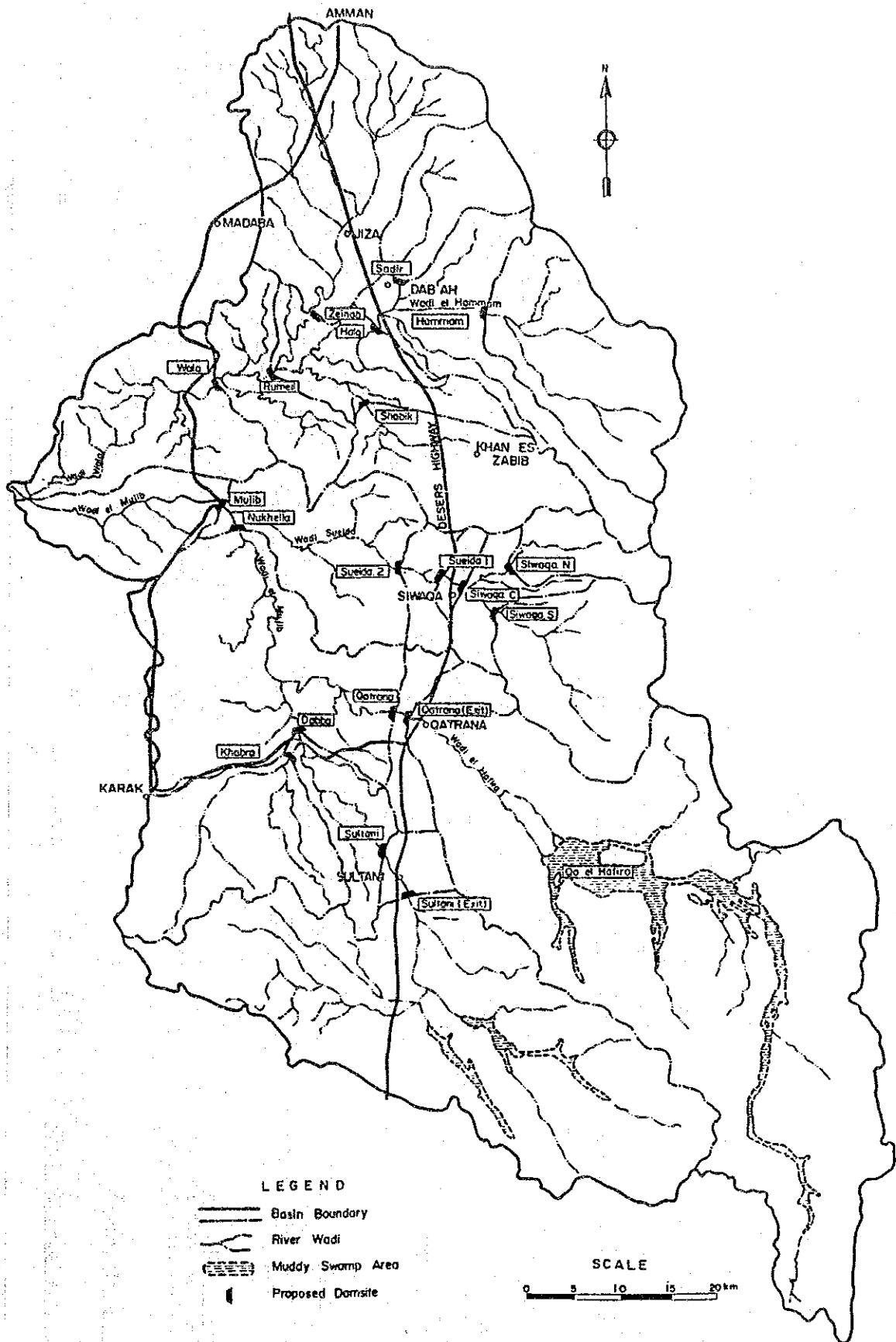
* According to the former administrative units.



Annex M5351-2 都市用水の需給曲線

THE HASHEMITE KINGDOM OF JORDAN
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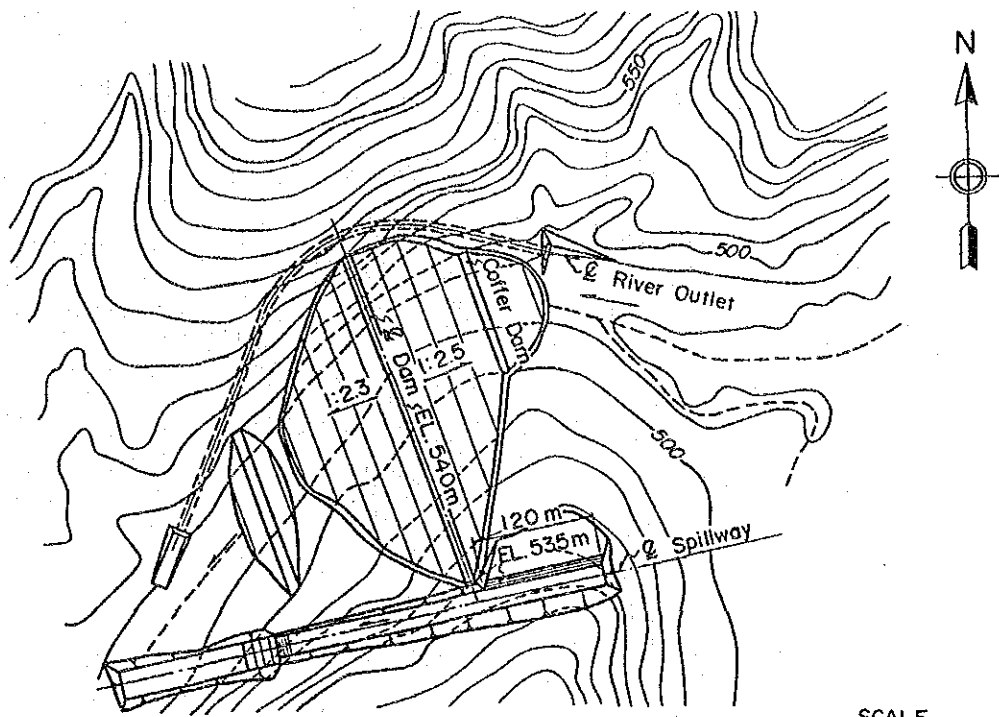
Annex M6312 調査地域と計画ダム地点

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

Annex M6319-1 計画ダムの諸元

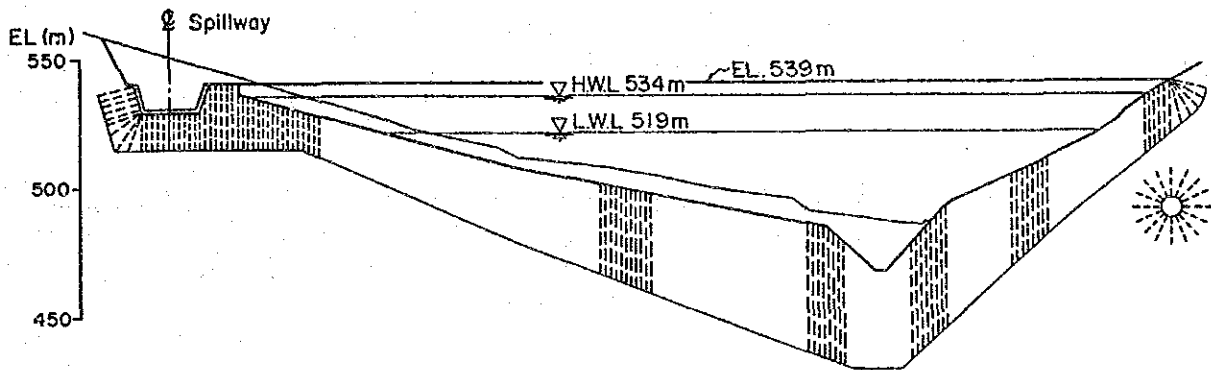
Item	(1) Wala	(2) (*) Hammam	(3) (*) Siwaqa C	(4) Khabra	(5) Nukheila	(6) Qatrana(Exist)	(7) Sultani(Exist)	(*) (*)
<u>Hydrological Condition</u>								
- Catchment area	(km ²) 1,770	340	440	390	3,560	1,490	950	
- Reservoir area	(km ²) 2.25	1.45	0.60	1.36	0.85	1.75	1.10	
- Annual average runoff	(MCM) 21.52	2.15	1.32	9.01	26.15	2.28	3.19	
- Most frequent annual runoff	(MCM) 19.31	1.91	1.10	6.12	20.75	1.78(4.00)<2	2.02	
- 200-year return peak discharge	(m ³ /sec) 1,550	620	525	490	2,250	-	-	
<u>Feature of Dam</u>								
- Dam type	Rockfill	Rockfill or Earthfill	Rockfill or Concrete	Rockfill	Rockfill or Concrete	Rockfill	Rockfill	
- Crest level	(El.m) 539.0	713.0	736.5	716.5	222.0	-	-	
- Dam height from river bed	(m) 55.0	13.0	13.5	26.5	43.0	-	-	
- (structural height)	(65.0)	(16.0)	(16.5)	(29.5)	(49.0)	-	-	
- Crest length	(m) 350	2,670	124	455	260	-	-	
- Top width	(m) 8	8	8	8	8	-	-	
- Dam volume	(10 ³ m ³) 920	680	28	290	420	-	-	
<u>Feature of Reservoir</u>								
- Storage capacity	(MCM) 28.95	2.25	1.65	9.18	13.05	6.0	1.20	
- Effective strage capacity	(MCM) 19.30	1.50	1.10	6.12	8.70	4.0	1.20	
- Dead storage(Sediment volume)	(MCM) 9.65	0.75	0.55	3.06	4.35	2.0	-	
<u>Feature of Spillway</u>								
- Overflow crest length	(El.m) 120	120	100	100	160	-	-	
- Overflow crest level	(m) 534.0	712.0	733.5	713.5	217.0	-	-	
<u>Storage Efficiency</u> <1	21	3	40	22	21	-	-	
<u>Available Potencial Water</u>	(MCM/y) 16.9	0.8	0.6	2.7	5.3	3.2<2	0.7	

Note: Features of dam are determined based on 1/7,500 topographic map but dam with a mark(*) are studied based on 1/15,000 topographic map.



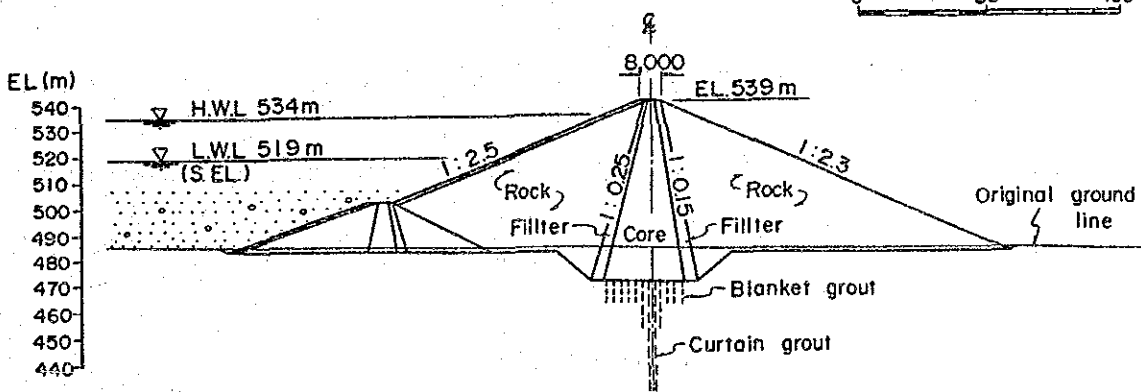
WALA DAM PLAN

SCALE
0 100 200m



UPSTREAM VIEW OF DAM

SCALE
0 50 100



TYPICAL SECTION OF DAM

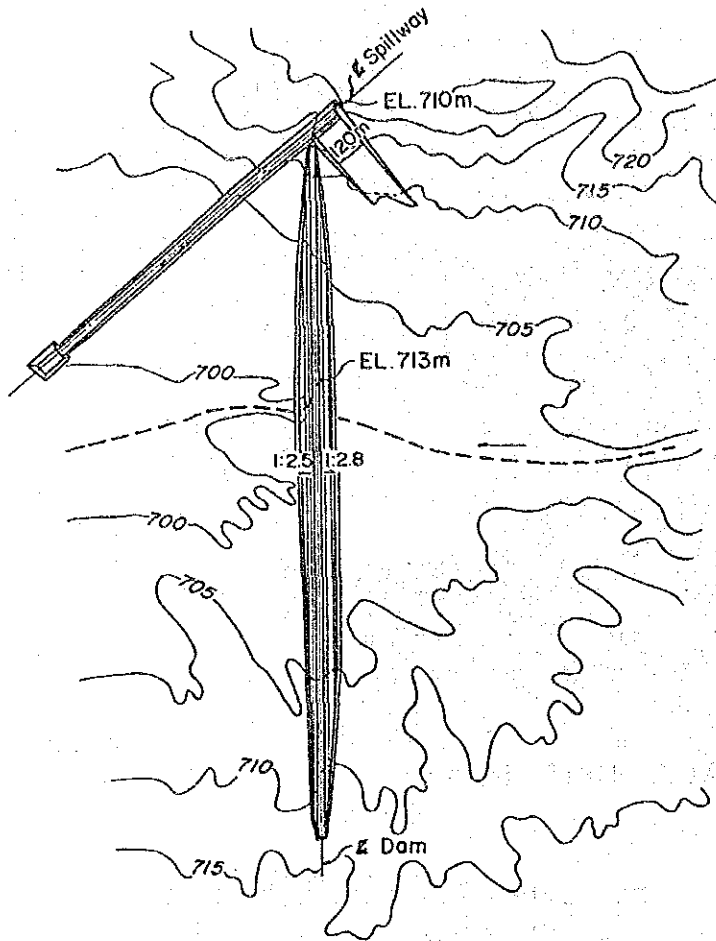
SCALE
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Annex M6319-2

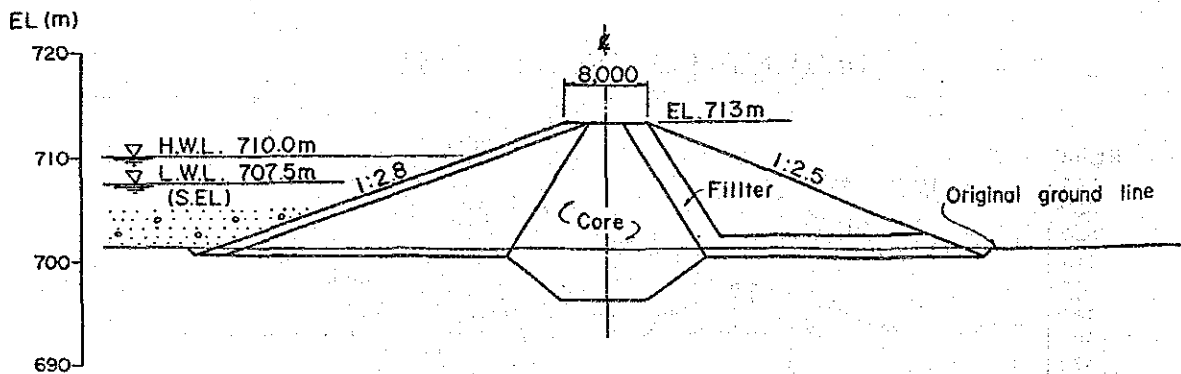
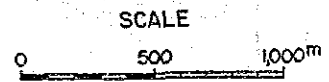
ワラ・ダム計画

THE HASHEMITE KINGDOM OF JORDAN
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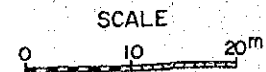
JAPAN INTERNATIONAL COOPERATION AGENCY



HAMMAM DAM PLAN

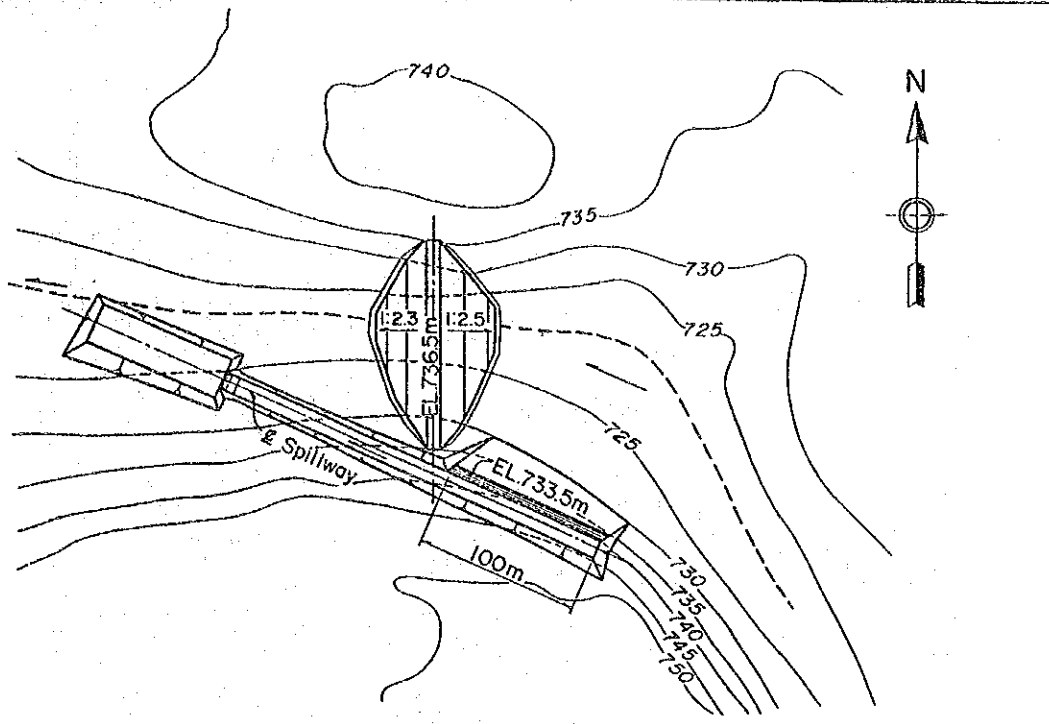


TYPICAL SECTION OF DAM

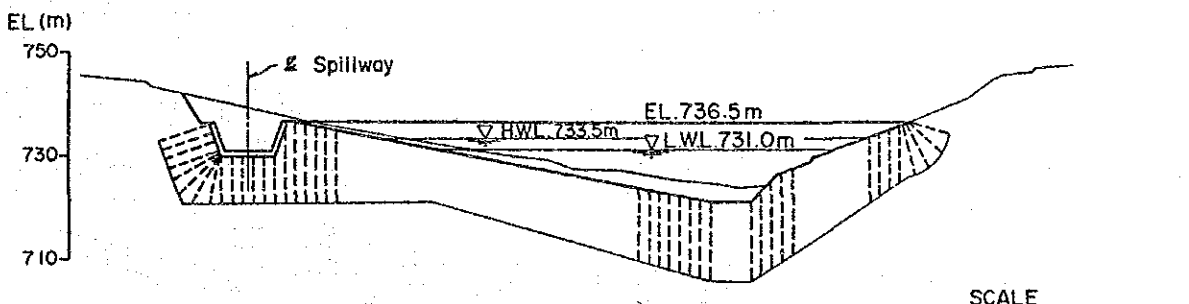


Annex M6319-3 ハمام・ダム計画

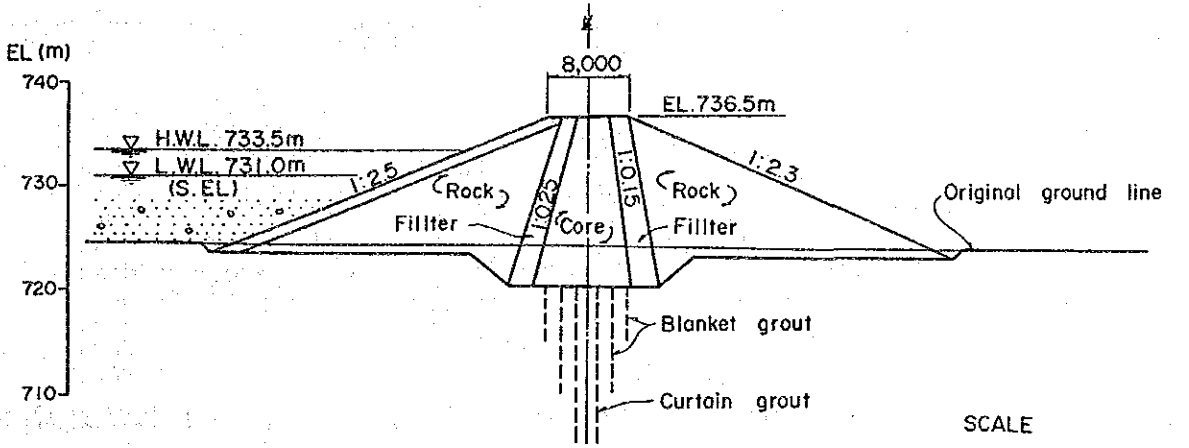
THE HASHEMITE KINGDOM OF JORDAN
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SIWAQA C PLAN



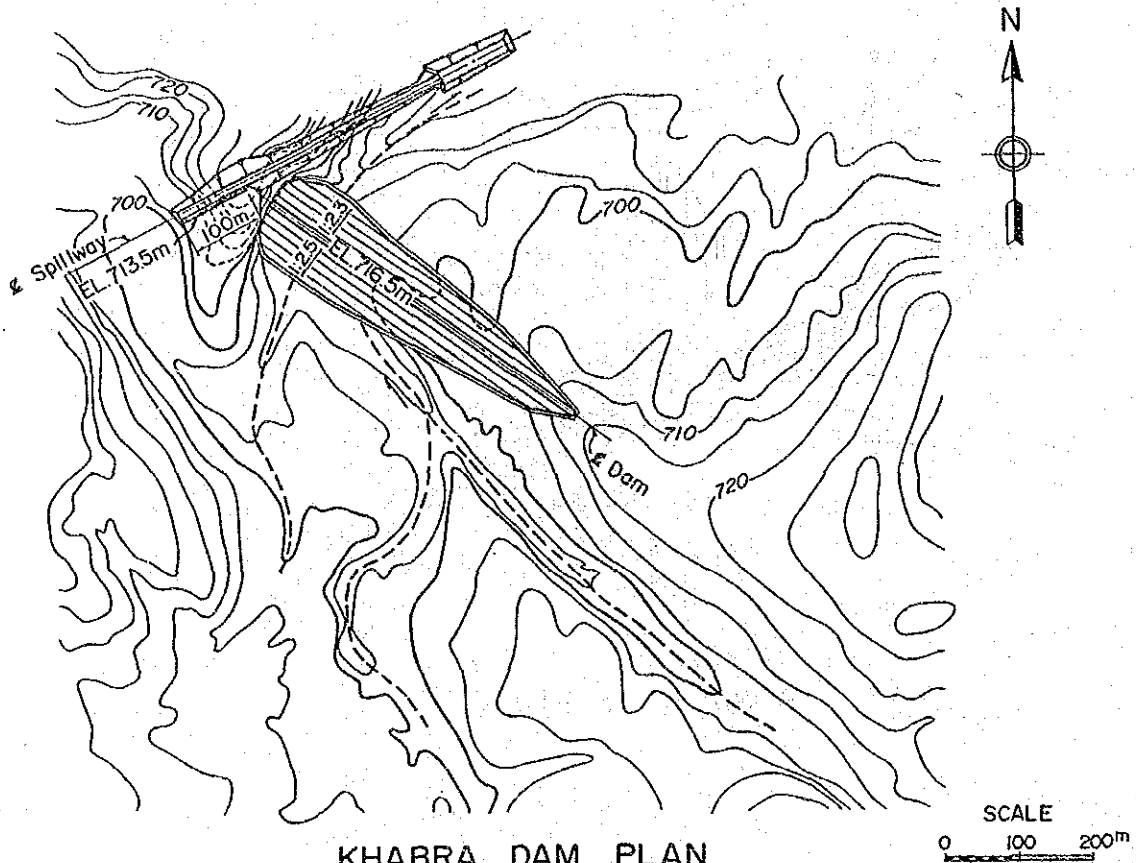
UPSTREAM VIEW OF DAM



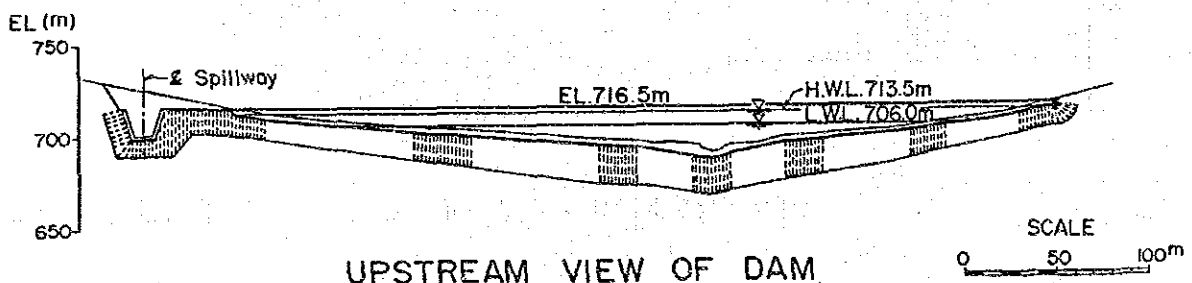
TYPICAL SECTION OF DAM

Annex M6319-4 シワッカ-C・ダム計画

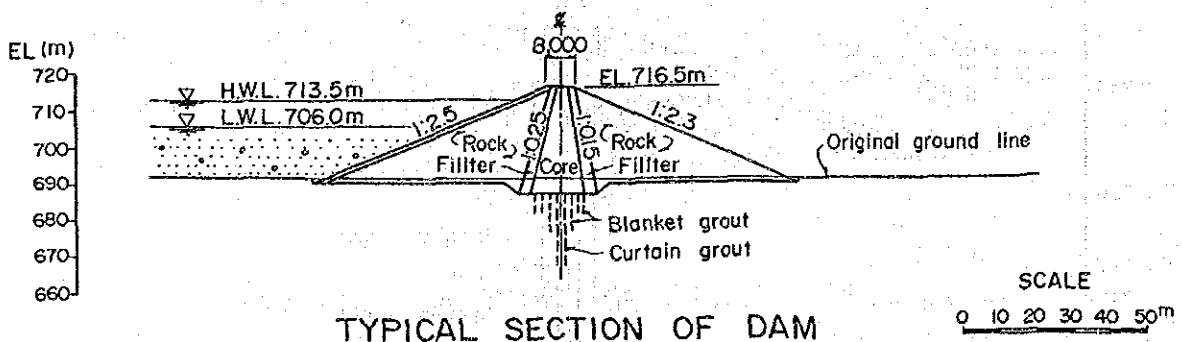
THE HASHEMITE KINGDOM OF JORDAN
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KHABRA DAM PLAN



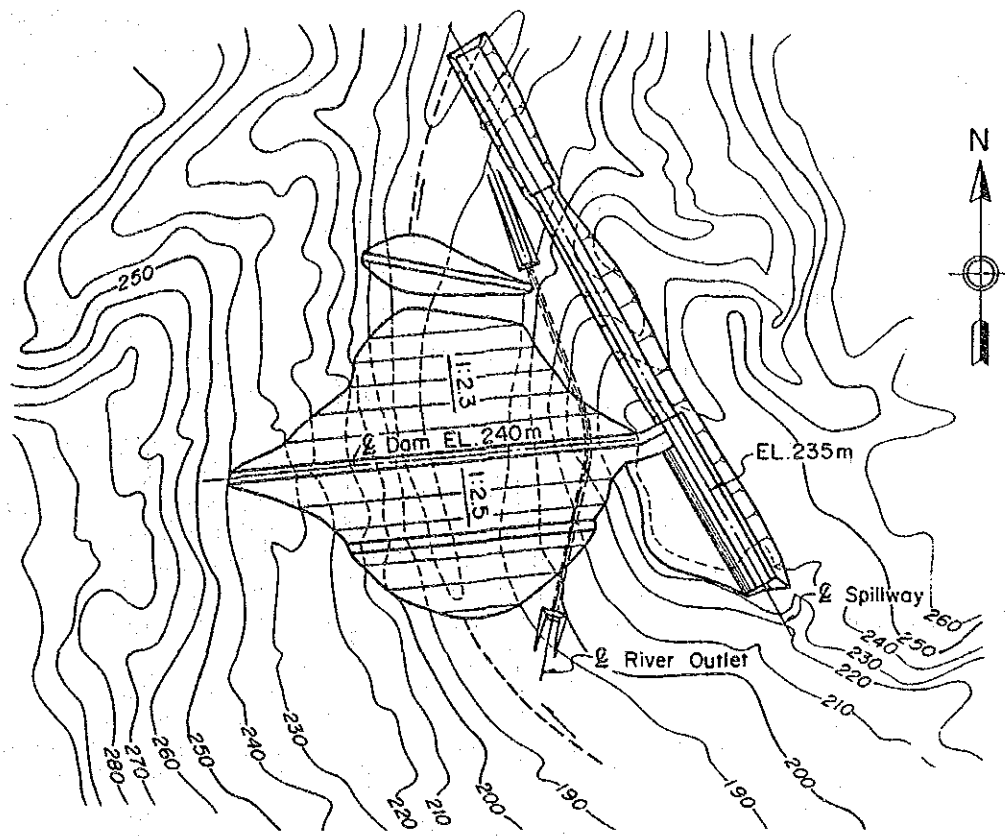
UPSTREAM VIEW OF DAM



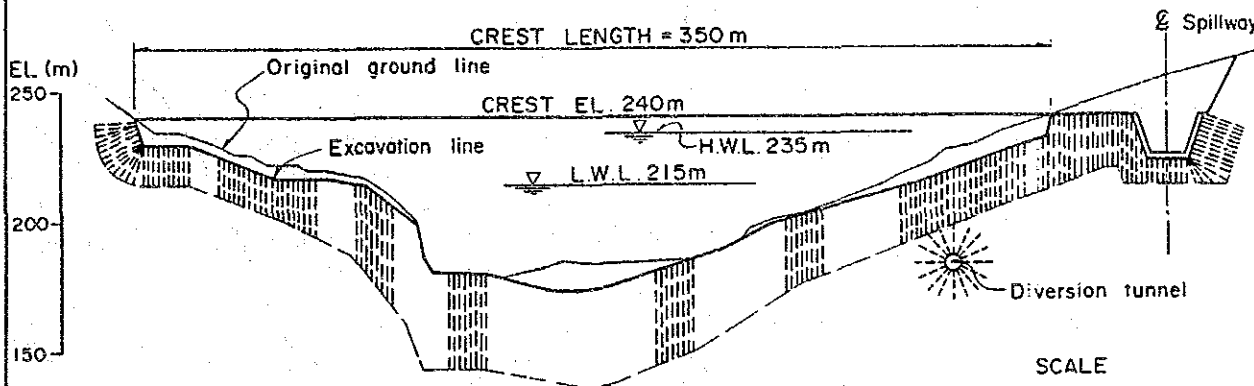
TYPICAL SECTION OF DAM

Annex M6319-5 カブラ・ダム計画

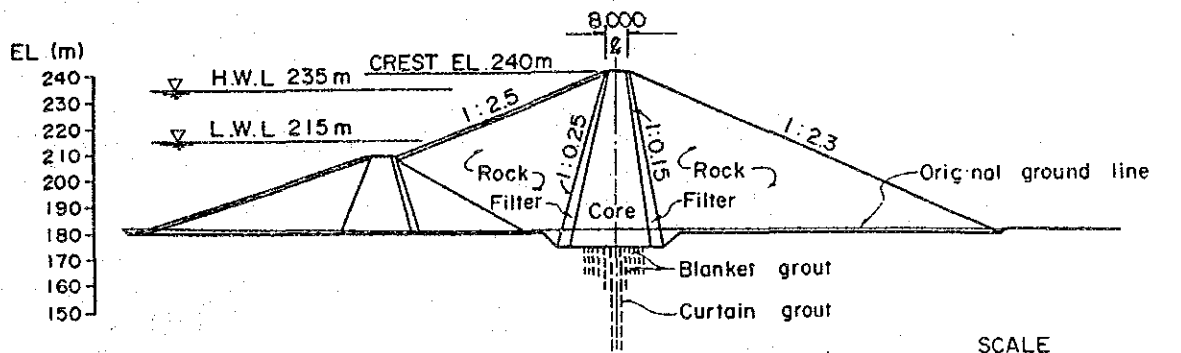
THE HASHEMITE KINGDOM OF JORDAN
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NUKHEILA DAM PLAN



UPSTREAM VIEW OF DAM



TYPICAL SECTION OF DAM

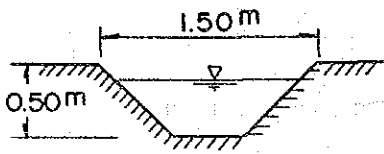
Annex M6319-6 ヌケイラ・ダム計画

THE HASHEMITE KINGDOM OF JORDAN
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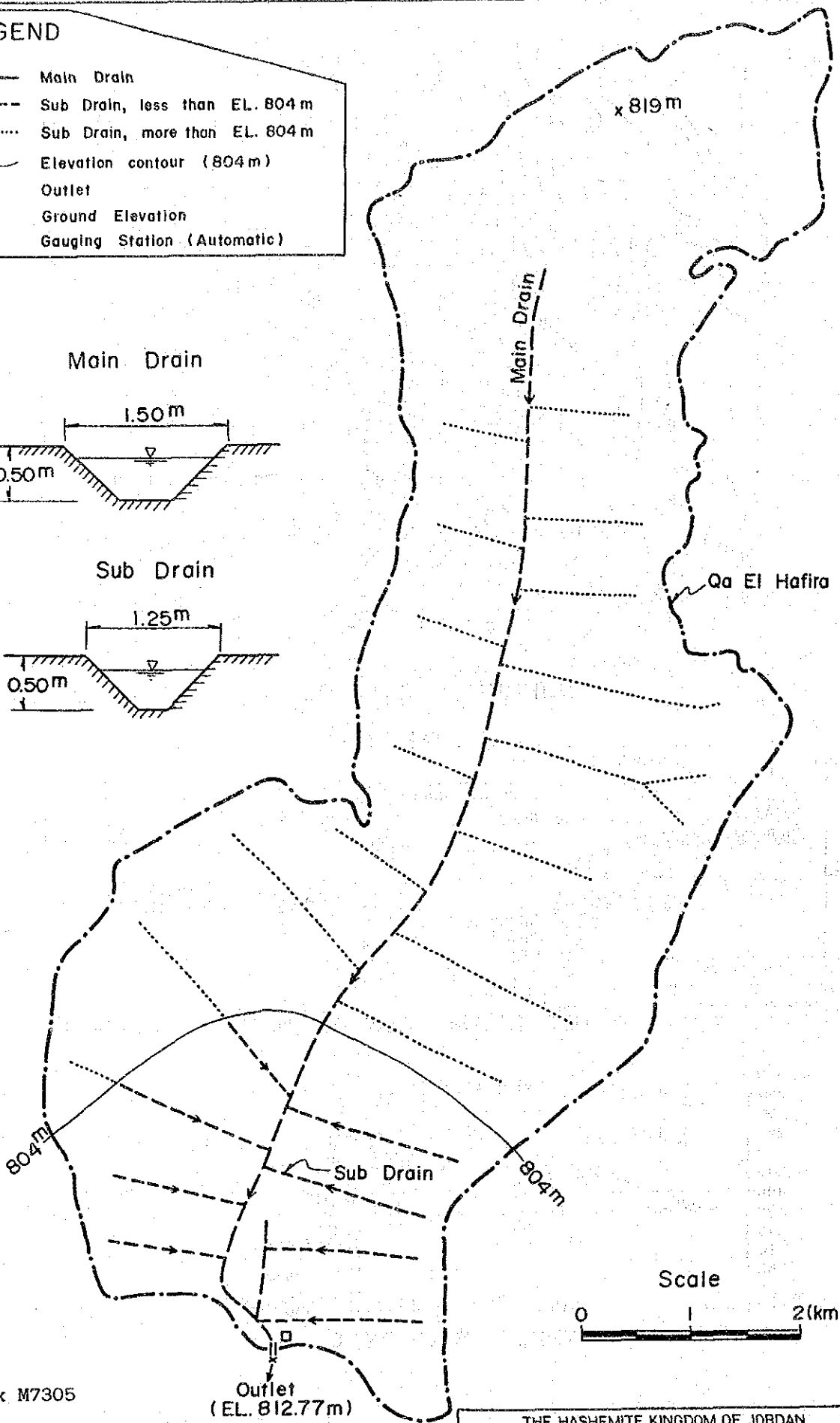
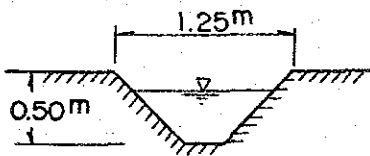
LEGEND

- Main Drain
- - - Sub Drain, less than EL. 804 m
- Sub Drain, more than EL. 804 m
- ~~~~ Elevation contour (804 m)
- ≡ Outlet
- x Ground Elevation
- Gauging Station (Automatic)

Main Drain



Sub Drain



Annex M7305

カ・エル・ファフィラ排水改良計画概略図

THE HASHEMITE KINGDOM OF JORDAN
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JAPAN INTERNATIONAL COOPERATION AGENCY

Annex M7319 表流水開発プラン

Proposed Plan	Main Purpose	Available Potential Water	Direct Cost (JD.1,000)
1. Wala	Compensation for irrigation water and water supply	1) 5 MCM/y: Shallow aquifer (base flow) 2) 6 MCM/y: Deep aquifer by injection 3) 6 MCM/y: Seepage to channel (Total 17 MCM/y)	1) Dam & Water facilities: 8,080 2) Injection wells (11 Nos.): 338 3) O&M for wells: 6.4/year
2. Hammam	Irrigation	0.8 MCM/y: Storage water	Dam & water facilities: 4,180
3. Siwaga C	Water supply	0.6 MCM/y: Storage water (Injection to deep aquifer)	1) Dam and water facilities: 250 2) Injection wells (2 Nos.): 66 3) O & M for wells: 1.2/year
4. Khabra	Undefined purpose	2.7 MCM/y: Storage water	Dam & water facilities: 2,550
5. Nukheila	Undefined purpose	1) 8.8 MCM/y: Storage water 2) 4.4 MCM/y: Seepage to channel (Total 13.2 MCM/y)	Dam & water facilities: 3,690
6. Qatrana (Exist.)	Water supply or irrigation	3.2 MCM/y: Deep aquifer by injection	1) Drainage work: 4 2) Injection wells (7 Nos.): 311 3) O&M for drainage and wells: 10.4/y
7. Sultani (Exist.)	Water supply	0.7 MCM/y: Deep aquifer by injection	1) Excavation work: 450 2) O&M for excavation and wells: 19.2/year

Annex M8304 (1/2) 年次別經濟的便益・費用

(I) Hammam Irrigation Scheme

Unit : JD 1,000

Year in Order	Economic Cost			Benefit
	Construction Cost	OM-cost	Total	
1	220	-	220	-
2	29	-	29	-
3	185	-	185	-
4	2,240	-	2,240	-
5	3,182	-	3,182	-
6	1,591	-	1,591	-
7	-	-	-	-
8	-	93	93	203
9	-	149	149	324
10	-	186	186	405
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:
50	-	186	186	405

(II) Qatrana Irrigation Scheme

Unit : JD 1,000

Year in Order	Economic Cost			Benefit
	Construction Cost	OM-cost	Total	
1	13	-	13	-
2	2	-	2	-
3	11	-	11	-
4	425	-	425	-
5	11	-	11	-
6	6	3	9	71
7	-	4	4	113
8	-	5	5	142
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:
50	-	5	5	142

Annex M8304 (2/2) 年次別経済的便益・費用

(III) Hamman and Qatran Irrigation Schemes

Unit : JD 1,000

Year in Order	Economic Cost			Benefit
	Construction Cost	OM-cost	Total	
1	233	-	233	-
2	31	-	31	-
3	196	-	196	-
4	2,665	-	2,665	-
5	3,193	-	3,193	-
6	1,597	3	1,600	71
7	-	4	4	113
8	-	98	98	345
9	-	154	154	466
10	-	191	191	547
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:
50	-	191	191	547

JICA