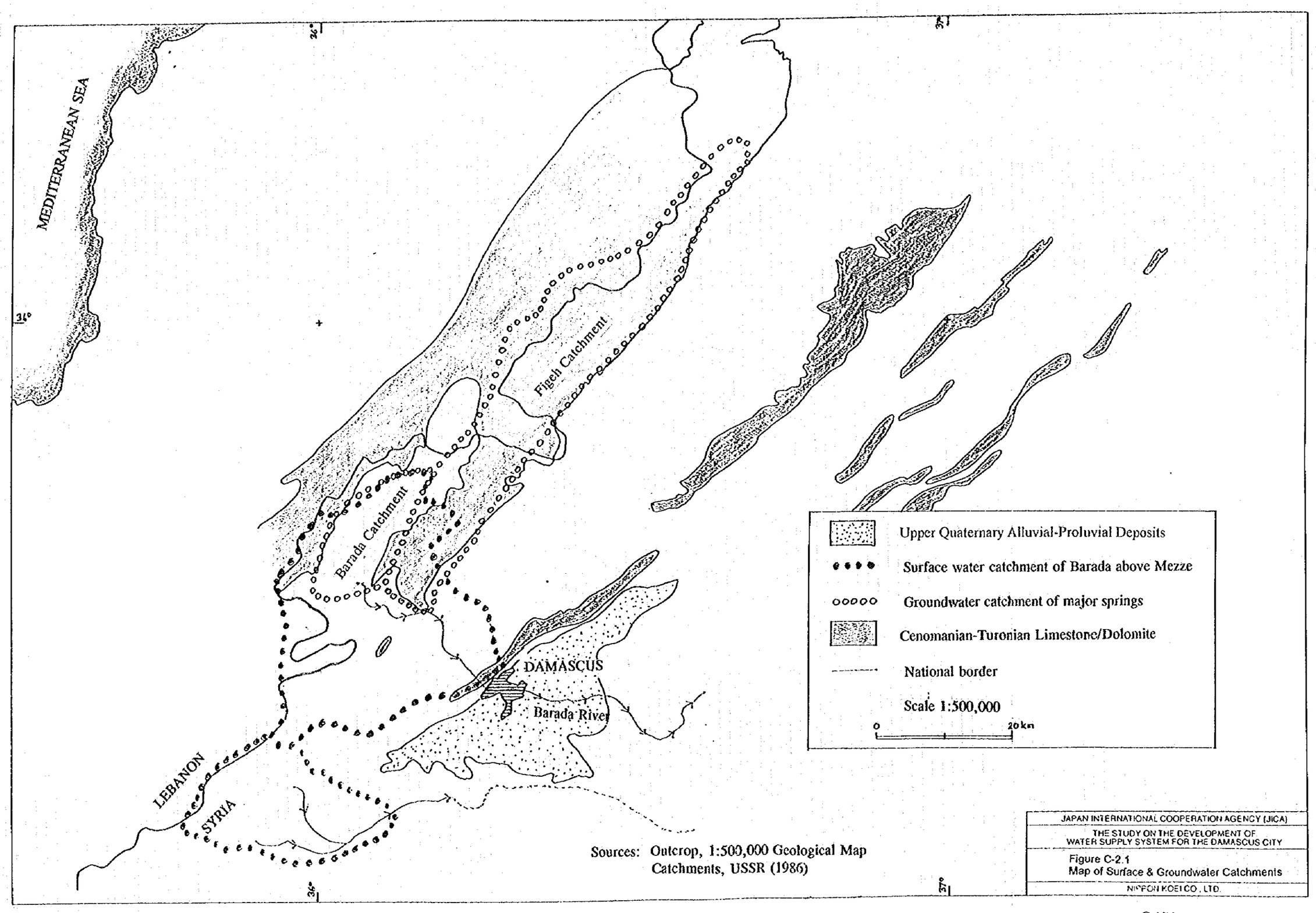
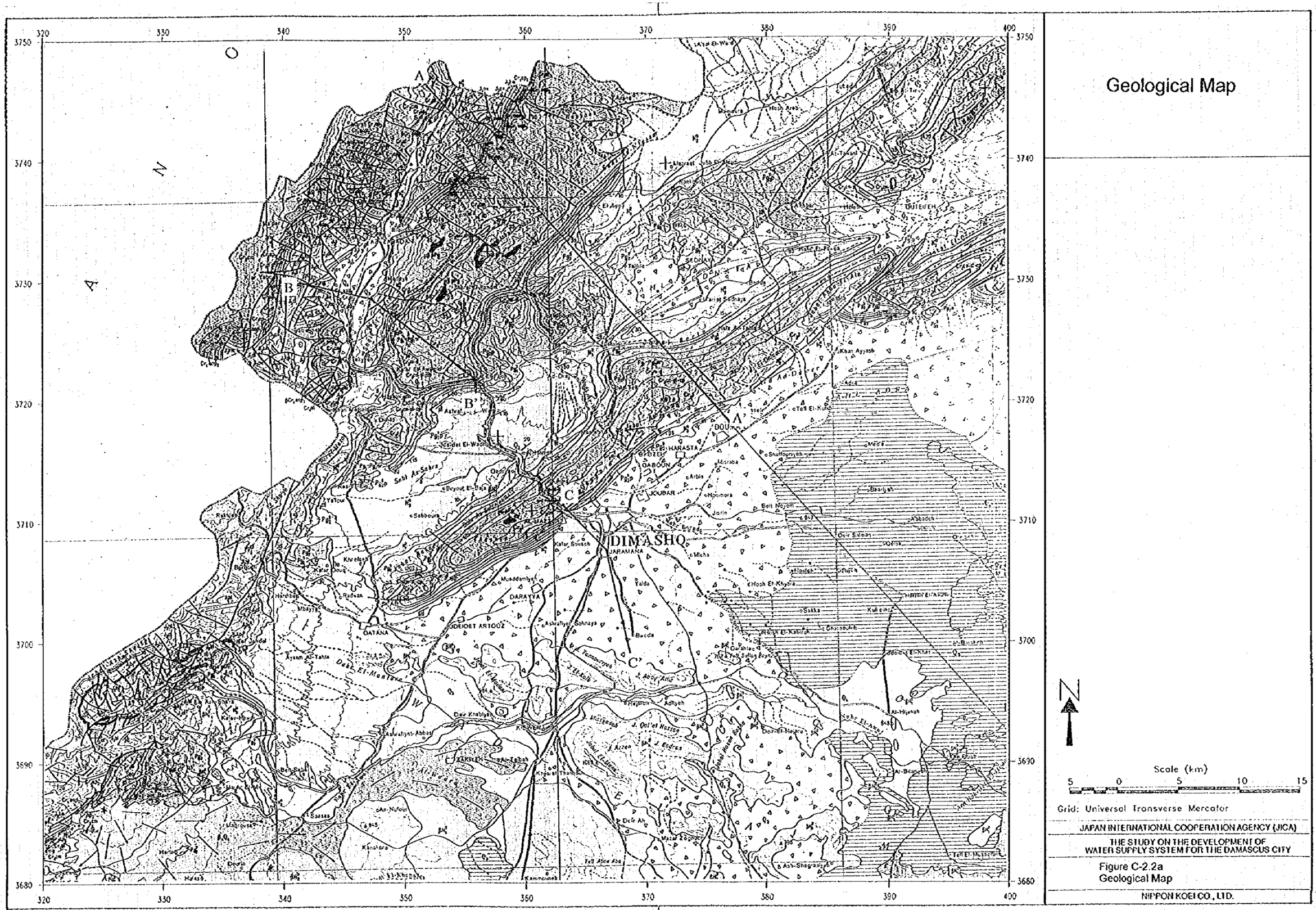
FIGURES



Sources: Outcrop, 1:500,000 Geological Map
Catchments, USSR (1986)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.1 Map of Surface & Groundwater Catchments
NIPPON KOEI CO., LTD.


Geological Map
DIMASHQ
HARASTA
DOUMA
JOUBAR
DARAYYA
QATANA
JDEIDET ARTOUZ
ZAKIYEH
JARAMANA
Scale (km)
5 0 5 10 15
Grid: Universal Transverse Mercator
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.2a
Geological Map
NIPPON KOEI CO., LTD.

Geological Map

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF
WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2 2a
Geological Map

NIPPON KOEI CO., LTD

QUATERNARY

Pleistocene

- Q_4 — Recent. Pebbles, sands, loams, clays
- $\beta_4 Q_4$ — Recent. Subalkaline basalts, anamesites
- $\beta_4 Q_4$ — Recent. Subalkaline basalts, ankaramites, anamesites, hyalobasalts, scoria, agglomerates, volcanic bombs
- $\beta_4 Q_4$ — Recent. Subalkaline basalts, anamesites
- $\beta_4 Q_4$ — Recent. Alkaline basalts, basalts, anamesites, hyalobasalts, scoria, agglomerates, volcanic bombs
- βQ_4 — Recent. Subalkaline basalts, anamesites, scoria, agglomerates
- Q_3 — Upper-Quaternary. Conglomerates, sandstones, sandy loams, loams, limestones, calcareous tuffs, marls
- $Q_2^{1} / Q_2^{2}\beta Q_2$ — Middle Quaternary. 1. Conglomerates, sandstones. 2. Subalkaline basalts, anamesites
- Q_1 — Lower Quaternary. Limestones, calcareous tuffs, pebbles
- βQ_1 — Lower Quaternary. Basalts, anamesites, dolerites, scoria, agglomerates

NEOGENE

- βN_2 — Pliocene. Basalts, alkaline basalts, dolerites, anamesites
- N_2^b / $N_2^{b\,1} / N_2^{b\,2}\beta N_2^b$ — Pliocene, upper part. 1. Marls, limestones, flinty beds. 2. Analcitites, teschenites, subalkaline basalts and anamesites, red clays
- N_2^a — Pliocene, lower part. Yellow-grey conglomerates, sandstones
- N_1^2 / $N_1^{2\,1} / N_1^{2\,2}\beta N_1^2$ — Middle Miocene. 1. Red-coloured sandstones, conglomerates, clays; variegated marls, limestones. 2. Basalts, plagiobasalts, ankaramites, picrites
- N_1^1 — Lower Miocene. Quartz sands, interbedded with limestones

PALEOGENE

- Pg_3 — Oligocene. Limestones, sandstones
- Pg_2^3 — Upper Eocene. Limestones
- Pg_2^{2+3} — Middle and Upper Eocene, undivided. Limestones, marls, flints*
- Pg_2^{2-3} — Middle - Upper Eocene, undifferentiated. Limestones
- Pg_2^2 — Middle Eocene. Chalky limestones, marls, flints, some beds of shelly-detrital algae limestones
- $Pg_1-Pg_2^1$ — Paleocene - Lower Eocene, undivided. Chalky limestones, marls and flints*
- $Pg_1-P_2^1$ — Lower Eocene (subzone Acarinina pentacamerata). Alternation of chalky limestones, marls and flints; phosphate interlayers
- $Pg_1-Pg_2^1$ gl — Paleocene-Lower Eocene, subzone Globorotalia aragonensis. Chalky limestones, marls

- Post-Paleogene subvolcanic small cutting bodies of basalts

CRETACEOUS

- Cr_2sn-d — Cenonian-Danian, undivided. Chalky limestones, marls, dolomites, flints, sandstones*
- Cr_2m-d — Maestrichtian-Danian, undifferentiated. Chalky limestones, marls, occasional beds of flints
- $Cr_2cn+st+cp$ — Coniacian, Santonian and Campanian, jointly. Chalky limestones, marls, flints, dolomites, sandstones, phosphates
- Cr_2cp — Campanian. Limestones, flints, phosphate interbeds
- Cr_2cn+st — Coniacian and Santonian, jointly. Chalky limestones, marls
- Cr_2cm — Cenomanian and Turonian, undivided. Dolomites, limestones, marls*
- Cr_2t — Turonian. Limestones, dolomites
- Cr_2cm_2 — Cenomanian. Dolomites, limestones, marls
- Cr_1 — Lower Cretaceous, undivided. Limestones, dolomites, quartz sandstones with brown ironstone, clays, marls and basalts*
- Cr_1al — Albian. Limestones, dolomites, marls
- Cr_1ab_2 — Lower Cretaceous (Pre-Albian). Quartz sandstones and clays with brown ironstone, limestones
- Cr_1ap_2 — Aptian. Upper substage. Limestones („Falaise de Blanche"), quartz sandstones with brown ironstone, some clays and marls
- Cr_1ap_1 / $Cr_1ap_1^{1} / Cr_1ap_1^{2}$ — Lower Cretaceous (Pre-Upper Aptian). 1. Quartz sandstones with brown ironstone, occasional beds of clays. 2. Basalts, anamesites, dolerites

JURASSIC

- J_3 — Upper Jurassic, undivided. Limestones, marls*
- J_3t — Tithonian. Limestones, marls
- J_3km — Kimmeridgian. Limestones
- J_3ox — Oxfordian. Marls, limestones
- J_3cl — Callovian. Limestones, marls
- J_2 — Middle Jurassic, undifferentiated. Dolomites, limestones
- J_2bt — Bathonian. Ochreous oolitic limestones
- J_2bj_2 — Bajocian, upper part. Limestones, dolomites
- $J_2bj_1^{b}$ / $J_2bj_1^{b\,1} / J_2bj_1^{b\,2}\beta$ — Bajocian, middle part. 1. Dolomites, limestones. 2. Spilites
- $J_2bj_1^{a}$ — Bajocian, lower part. Dolomites
- $J_1(?)$ — Lower Jurassic (?). Limestones

GENETIC TYPES OF QUATERNARY DEPOSITS

- Scoria, basalt agglomerates, volcanic bombs
- Shelly limestones horizon
- Sandstones horizon
- Lacustrine
- Eolian
- Alluvium
- Proluvium (rock debris)

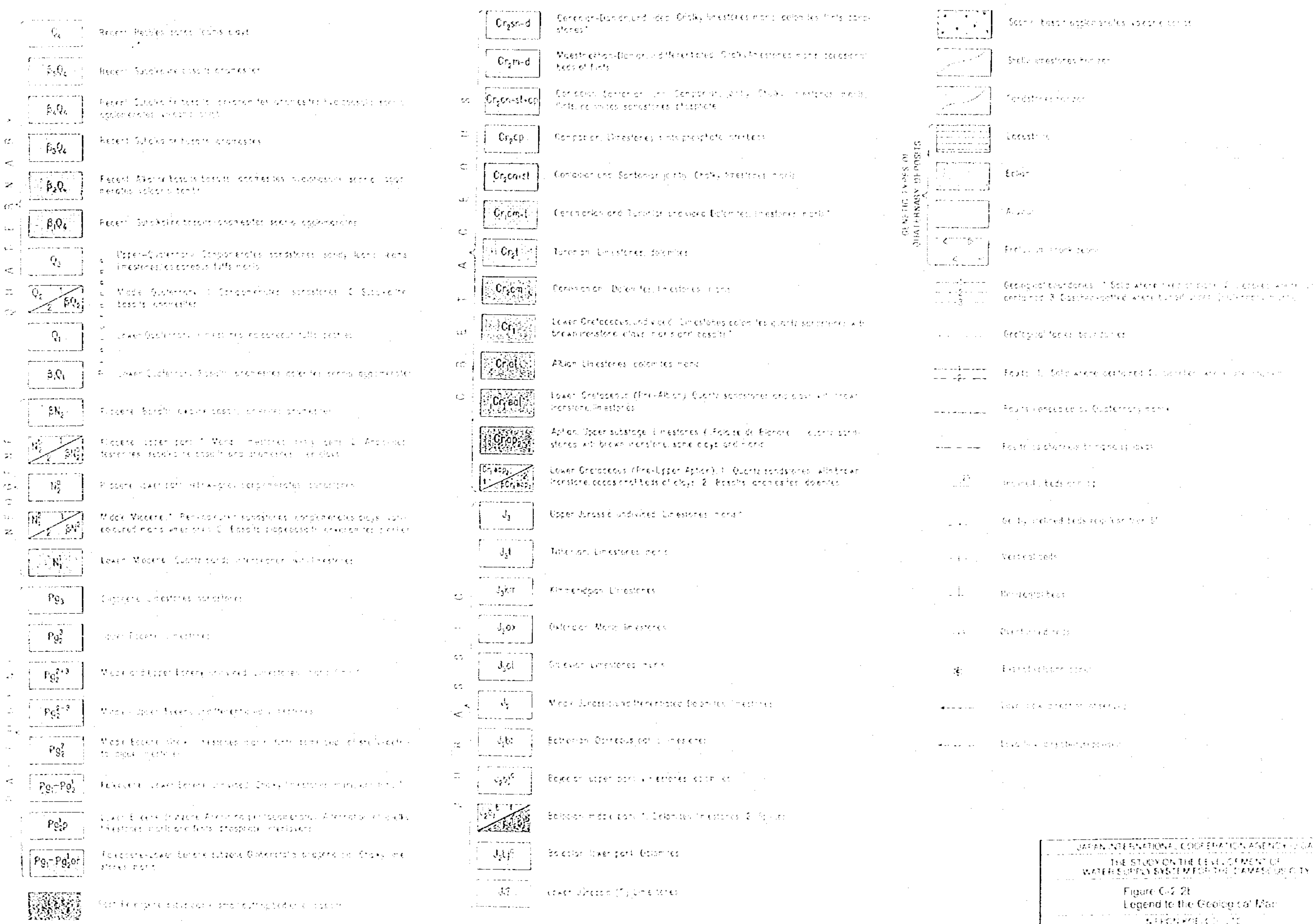
- 1 / 2 / 3 — Geological boundaries: 1. Solid where fixed at place. 2. Dashed where uncertained. 3. Dashed-dotted where buried under Quaternary mantle
- Geological facies boundaries
- 1 / 2 — Faults: 1. Solid where certained, 2. Dashed where uncertained
- Faults concealed by Quaternary mantle
- Faults as channels bringing up lavas
- 25 — Inclined beds and dip
- Gently inclined beds (dip less than 5°)
- Vertical beds
- Horizontal beds
- Overturned beds
- Extinct volcano cones
- Lava flow direction, observed
- Lava flow direction, supposed

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2.2b
Legend to the Geological Map

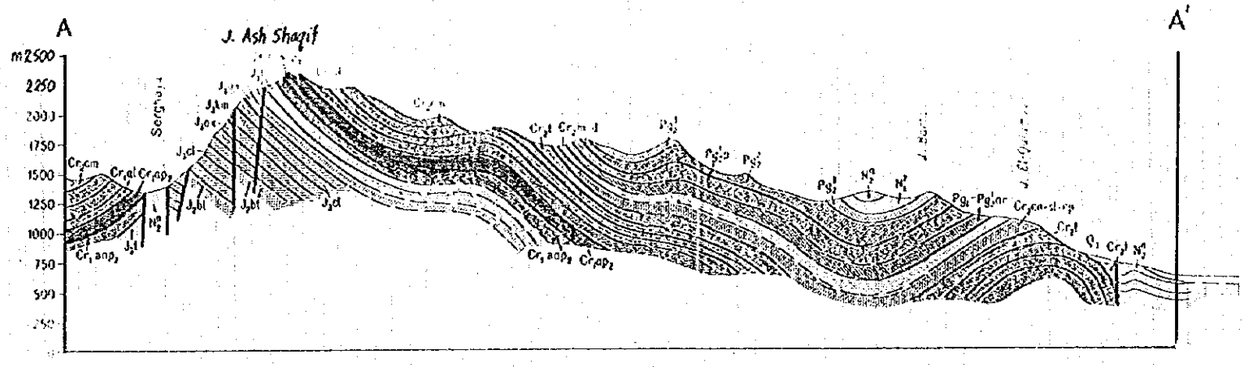
NIPPON KOEI CO., LTD.



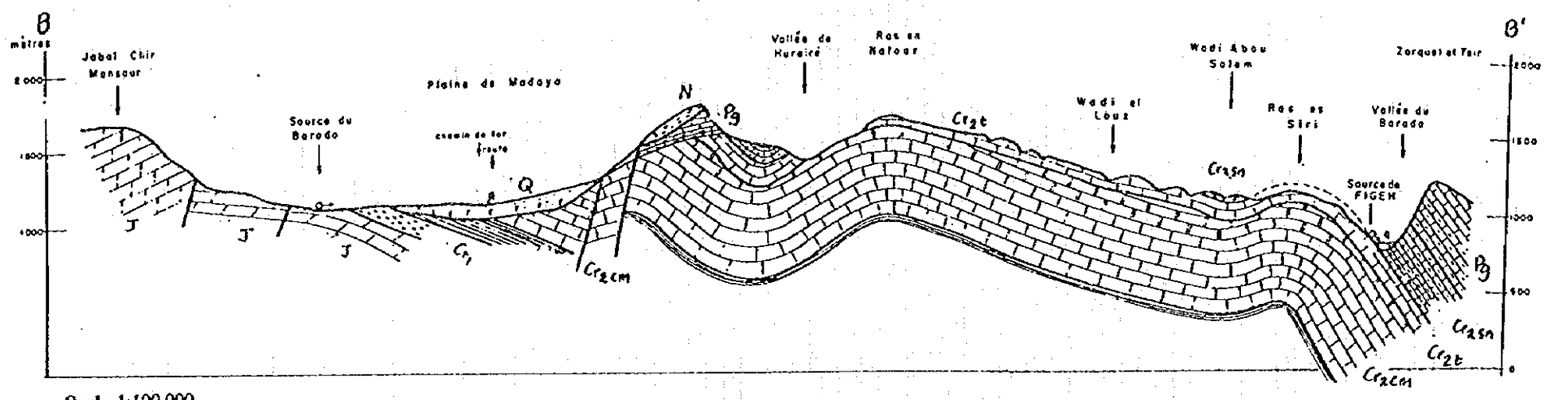
JAPAN INTERNATIONAL COOPERATION AGENCY JICA

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2.2b
Legend to the Geological Map



Scale 1:200,000

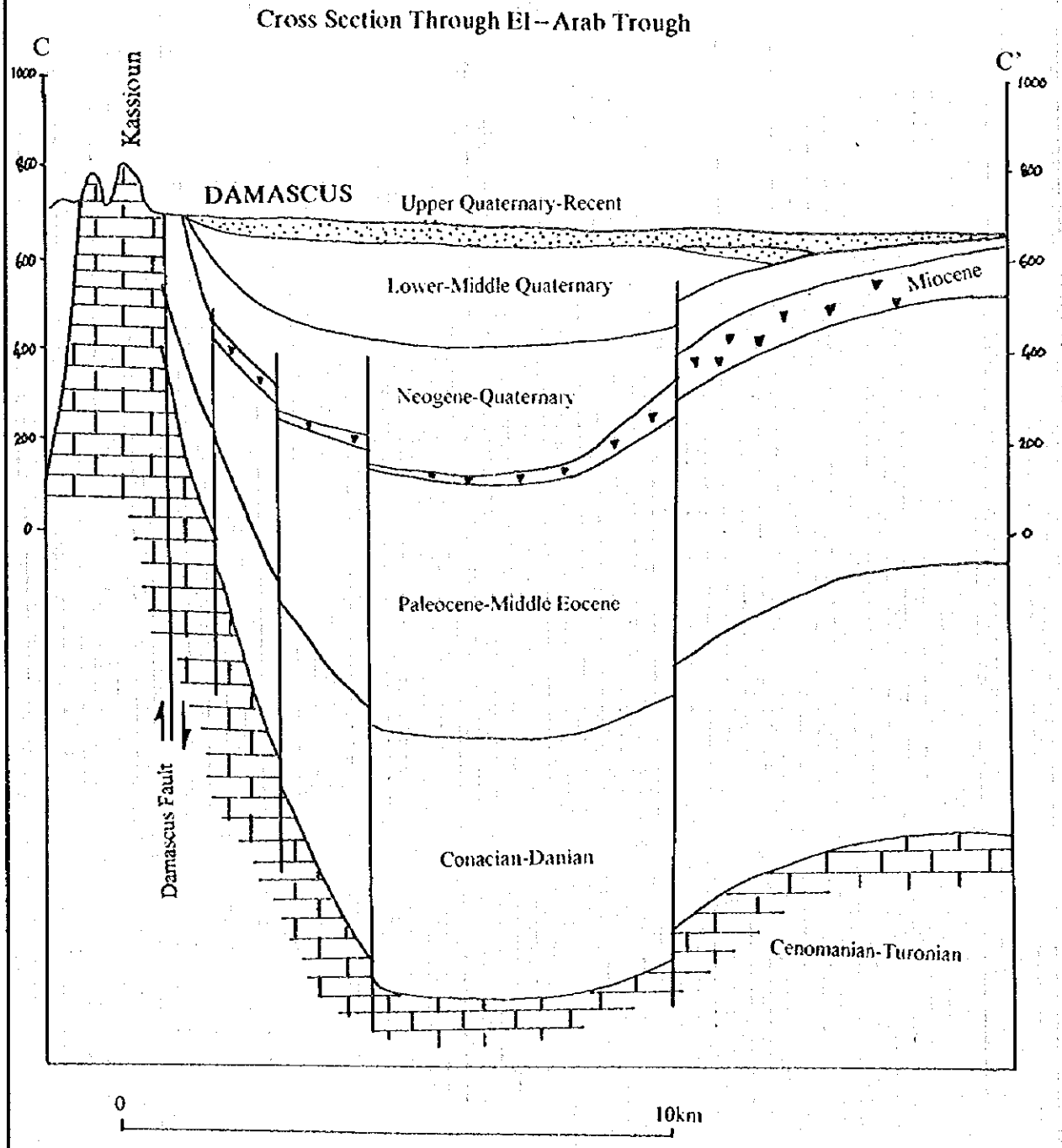


Scale 1:100,000

Sources: Geological Map of Syria Sheet I36–XII & I37–VII. Published 1964
SOGREAH, published in BRGM (1991)

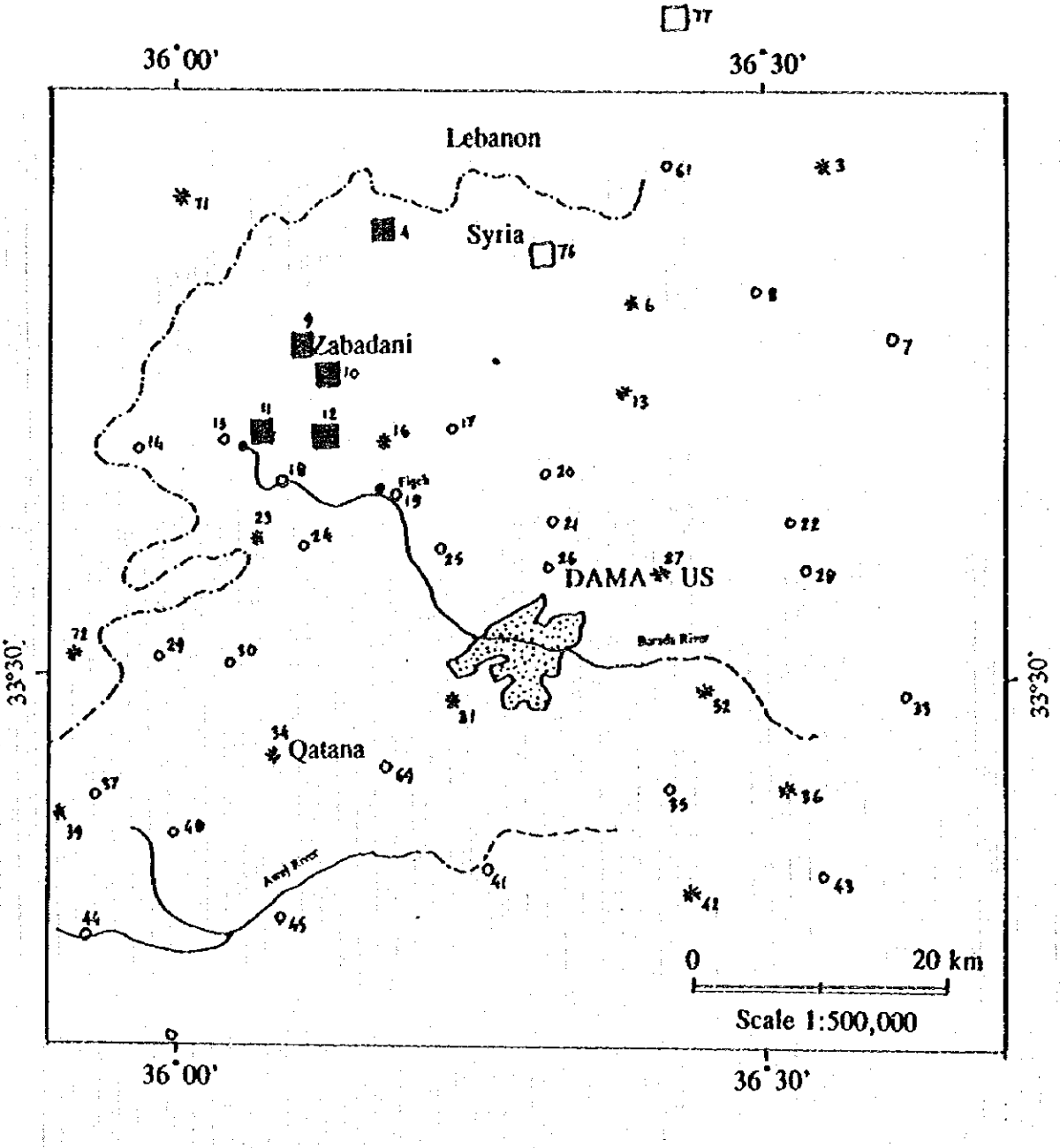
For the legend see Figure C-2.1b

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.3 Geological Cross Sections A and B
NIPPON KOEI CO., LTD.



Source: USSR (1986)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.4 Geological Cross Section C
NIPPON KOEI CO., LTD.



Meteorological or Rainfall Station Used by DAWSSA

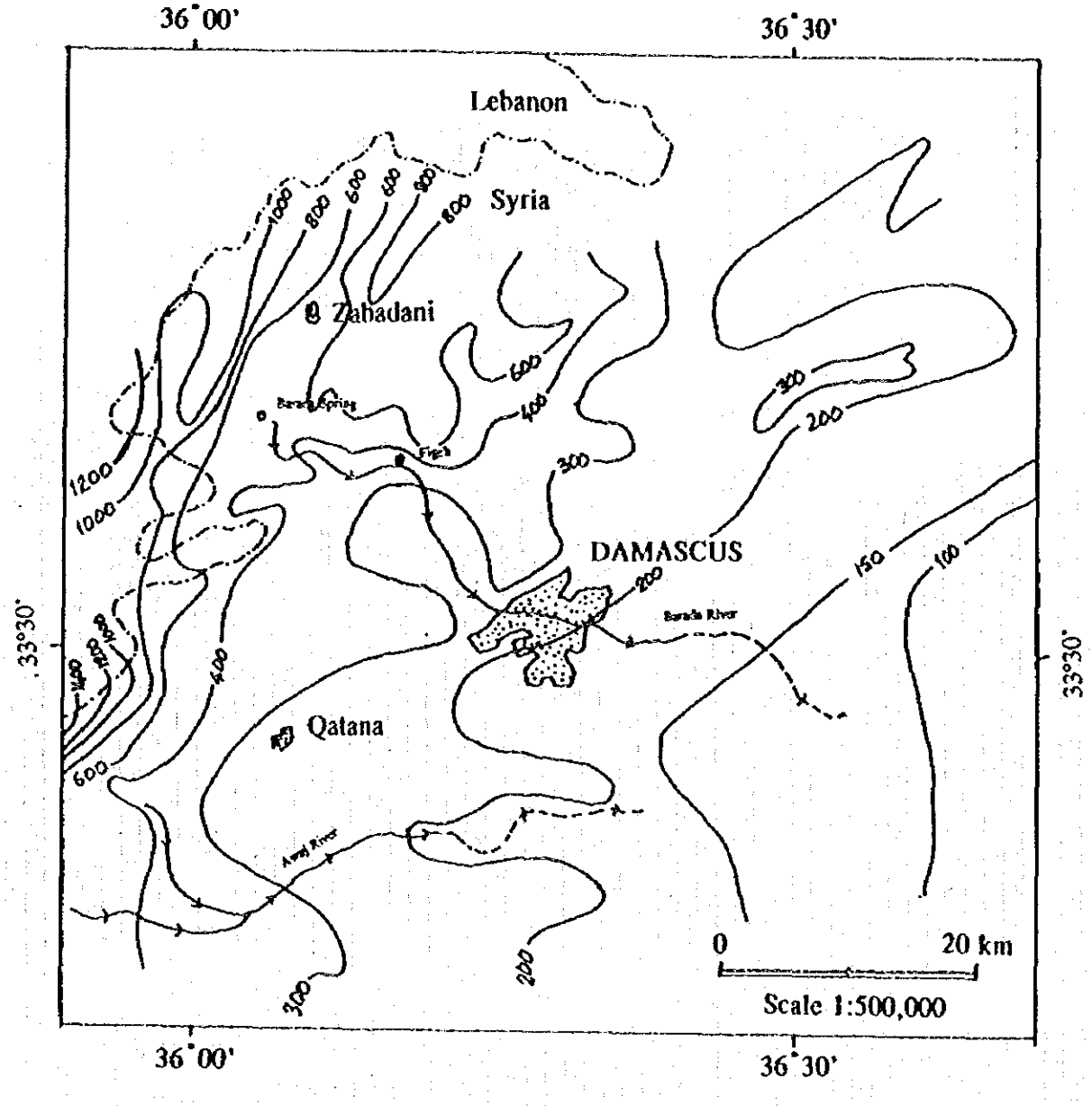
Meteorological or Rainfall Station Planned by DAWSSA

Other Meteorological Station

Other Rainfall Station

Source: USSR (1986)

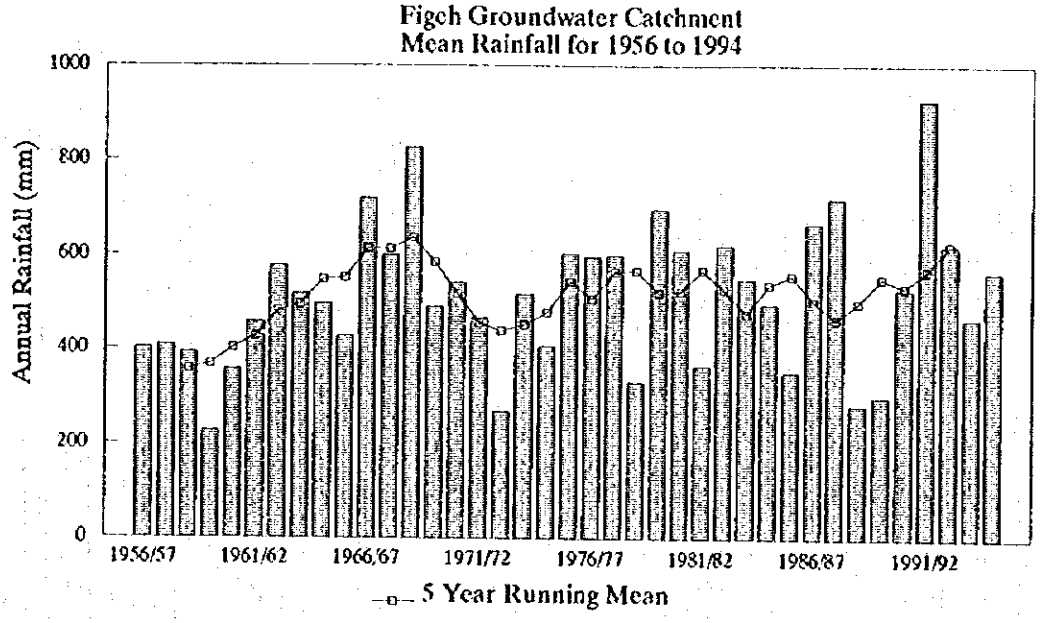
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.5 Map of the Meteorolgical Network
NIPPON KOEI CO., LTD.



300——— Mean Precipitation Isohyet in mm/y (Data up to 1984)

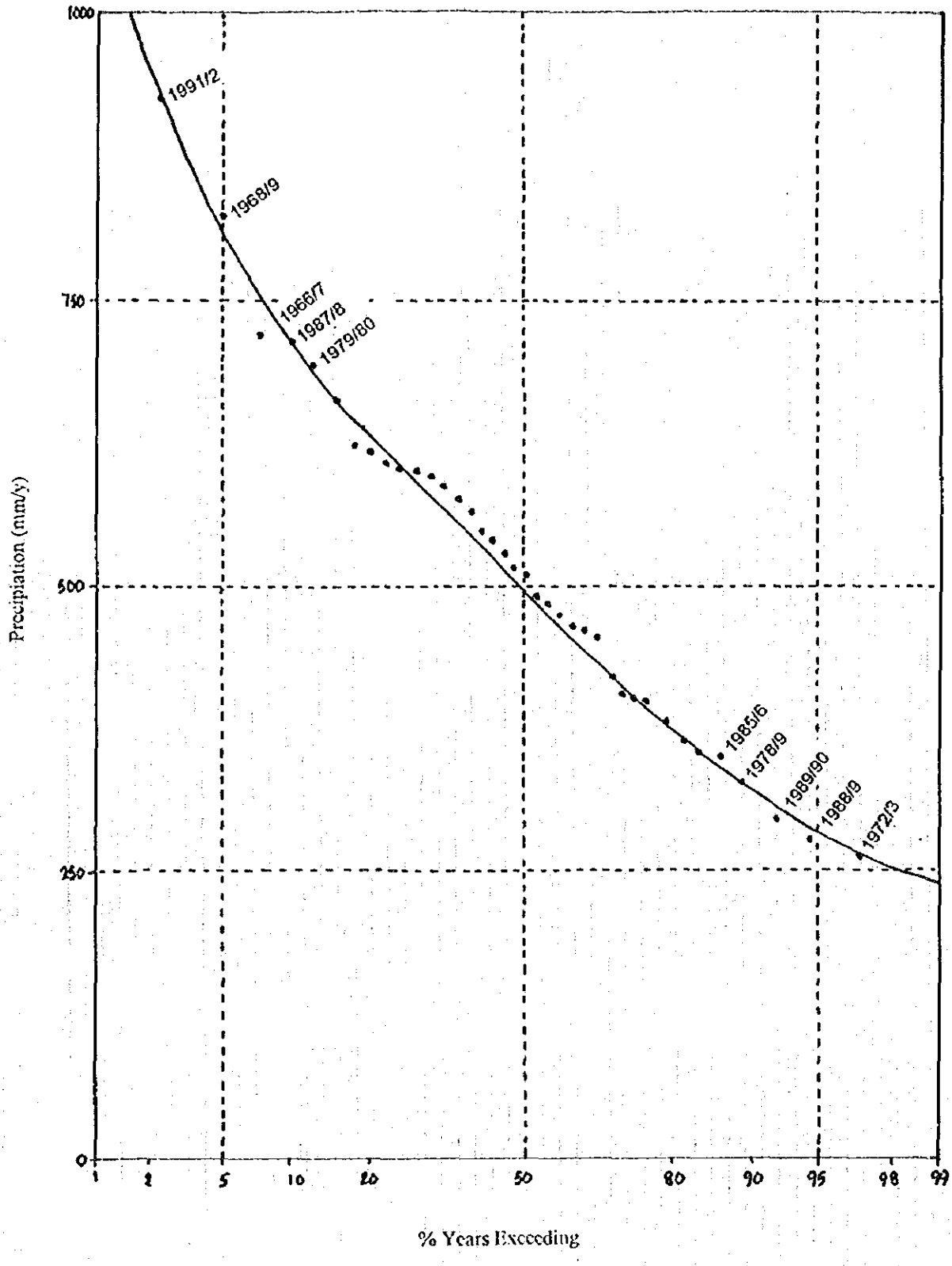
Source: USSR (1986)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.6 Map of Rainfall Distribution
NIPPON KOEI CO., LTD.

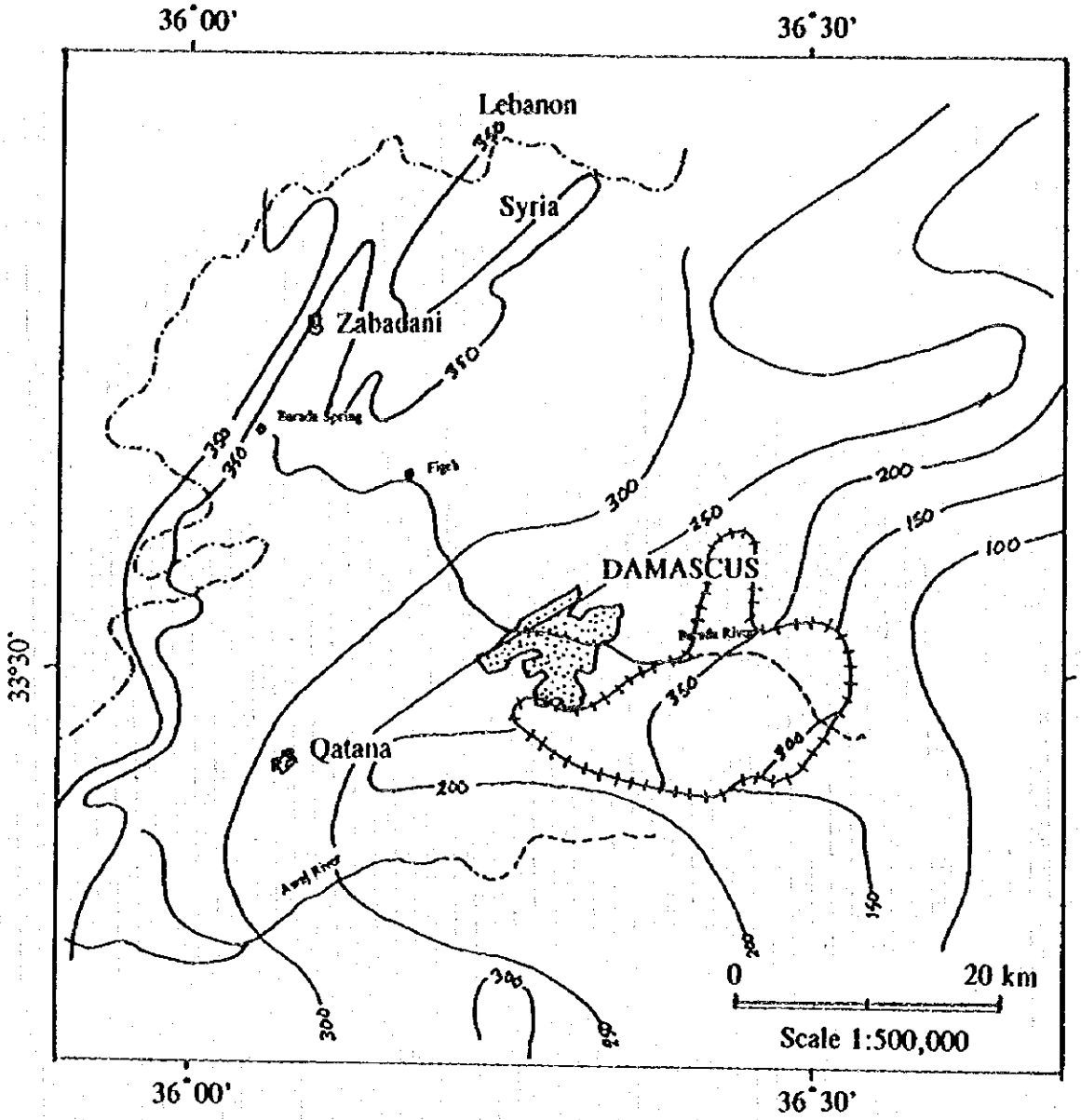


Data Source: DAWSSA

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.7 Annual Rainfall 1956/7 to 1994/5
NIPPON KOEI CO., LTD.

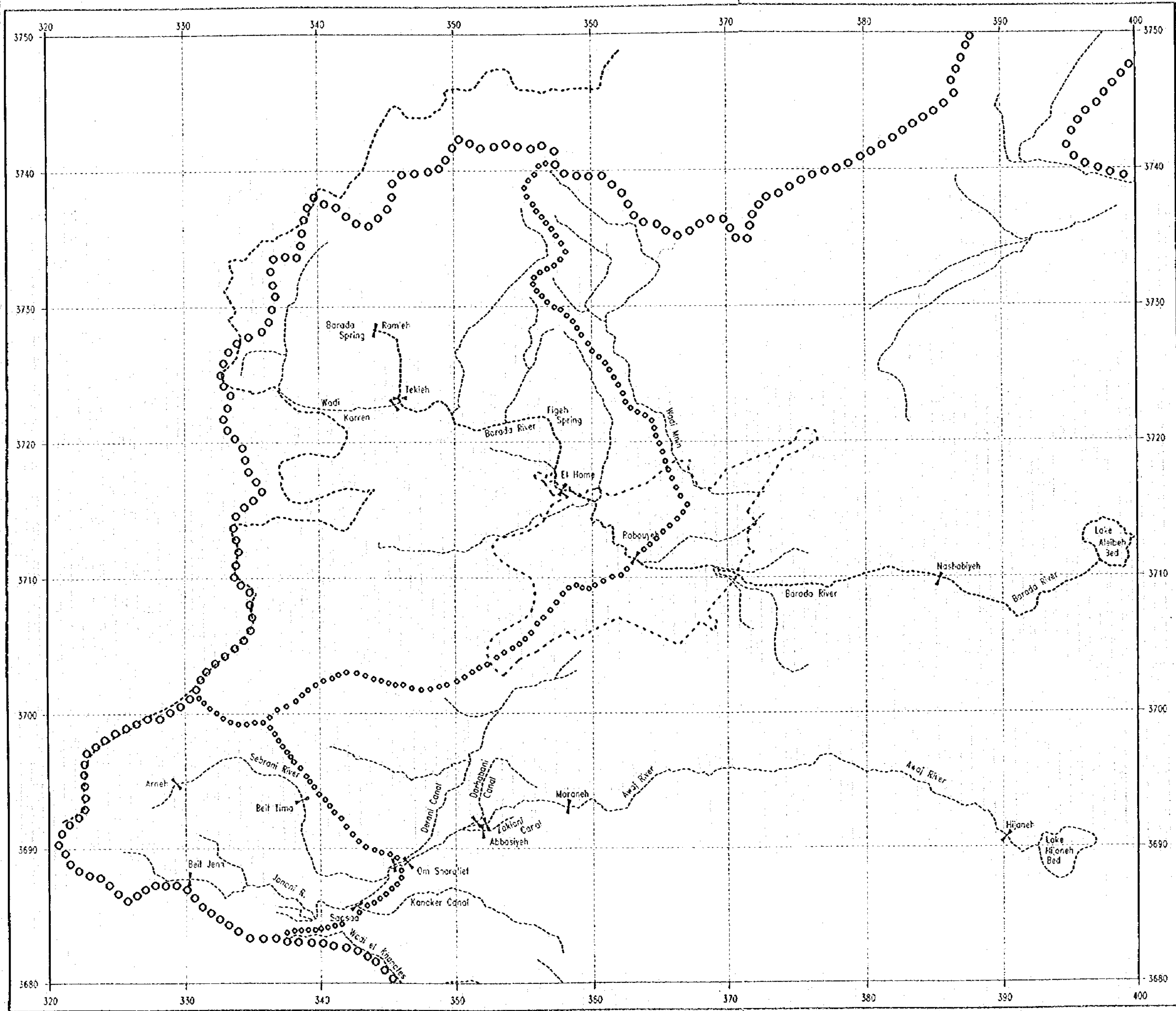


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.8 Annual Rainfall Probability Curve
NIPPON KOEI CO., LTD.



Source: USSR (1986)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.9 Map of Evaporation Distribution
NIPPON KOEI CO., LTD.



Hydrological Map

- Water course
- Main surface water catchment boundary
- Minor surface water catchment boundary
- International border
- Flow gauging station

Scale (km)
5 0 5 10 15

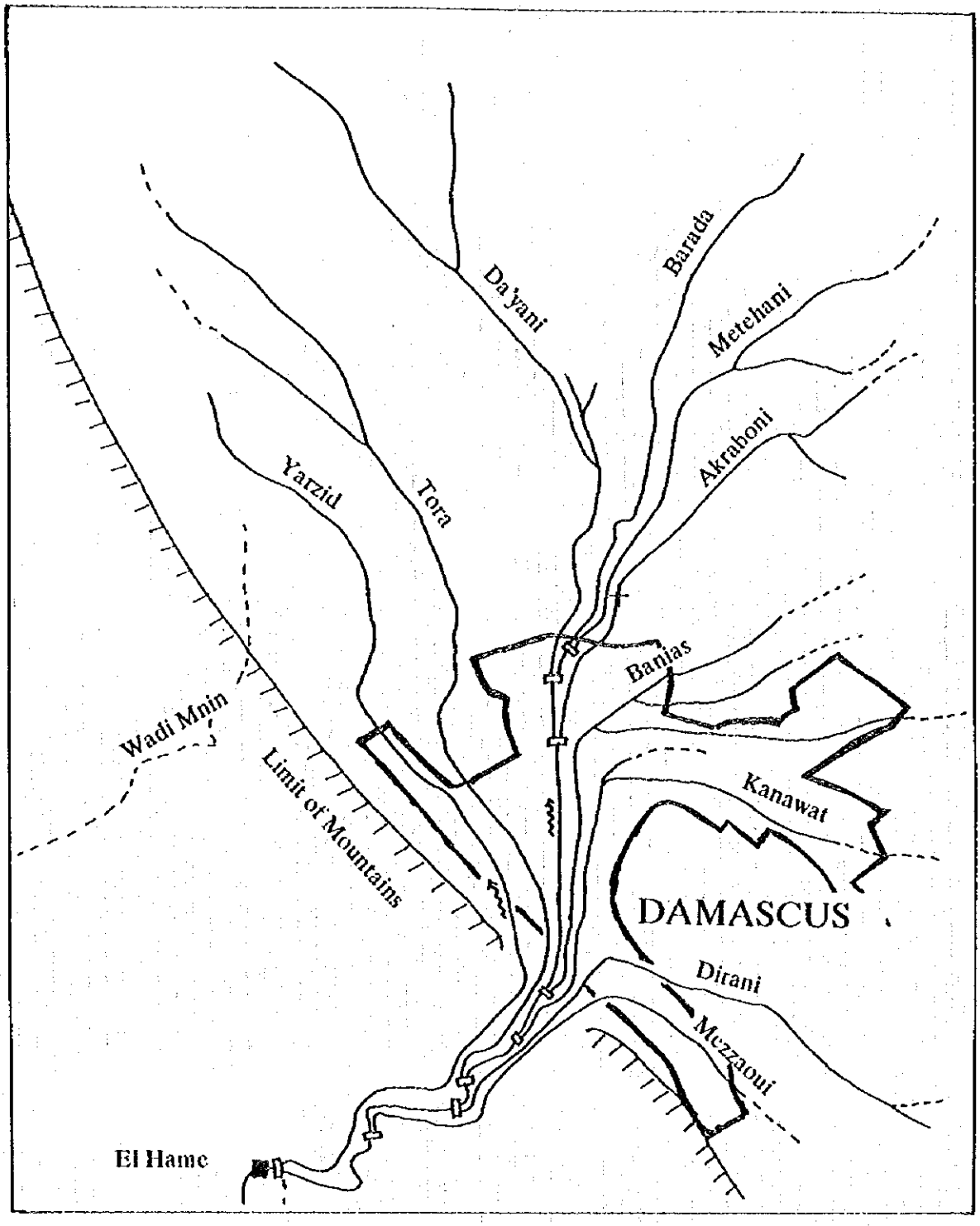
Grid: Universal Transverse Mercator

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2.10
Hydrological Map

NIPPON KOEI CO., LTD.



LEGEND

- Canal Offtake
- Flow Gauging Station
- Perennial Stream
- Ephemeral Stream

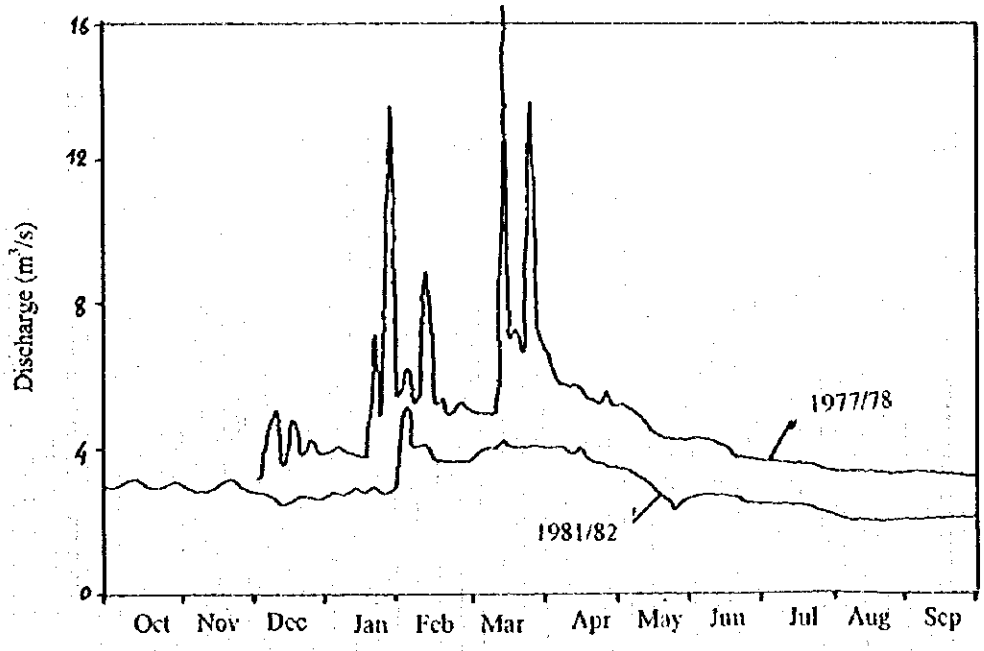
0 — 5 km

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2.11
Map of Canals within Damascus

NIPPON KOEI CO., LTD.



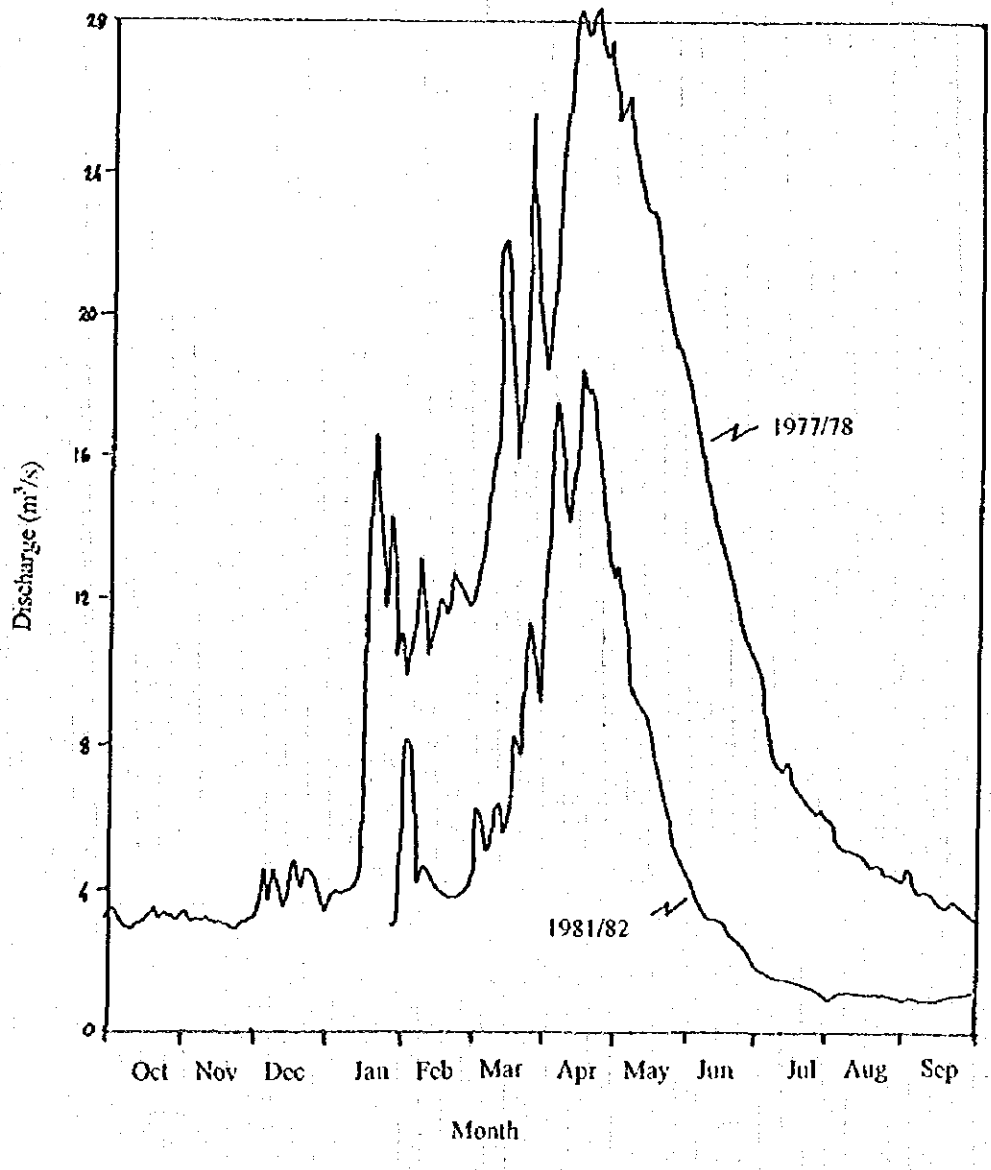
Source: USSR (1986)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2.12a
Hydrographs of the Barada at Teikeh

NIPPON KOEI CO., LTD.



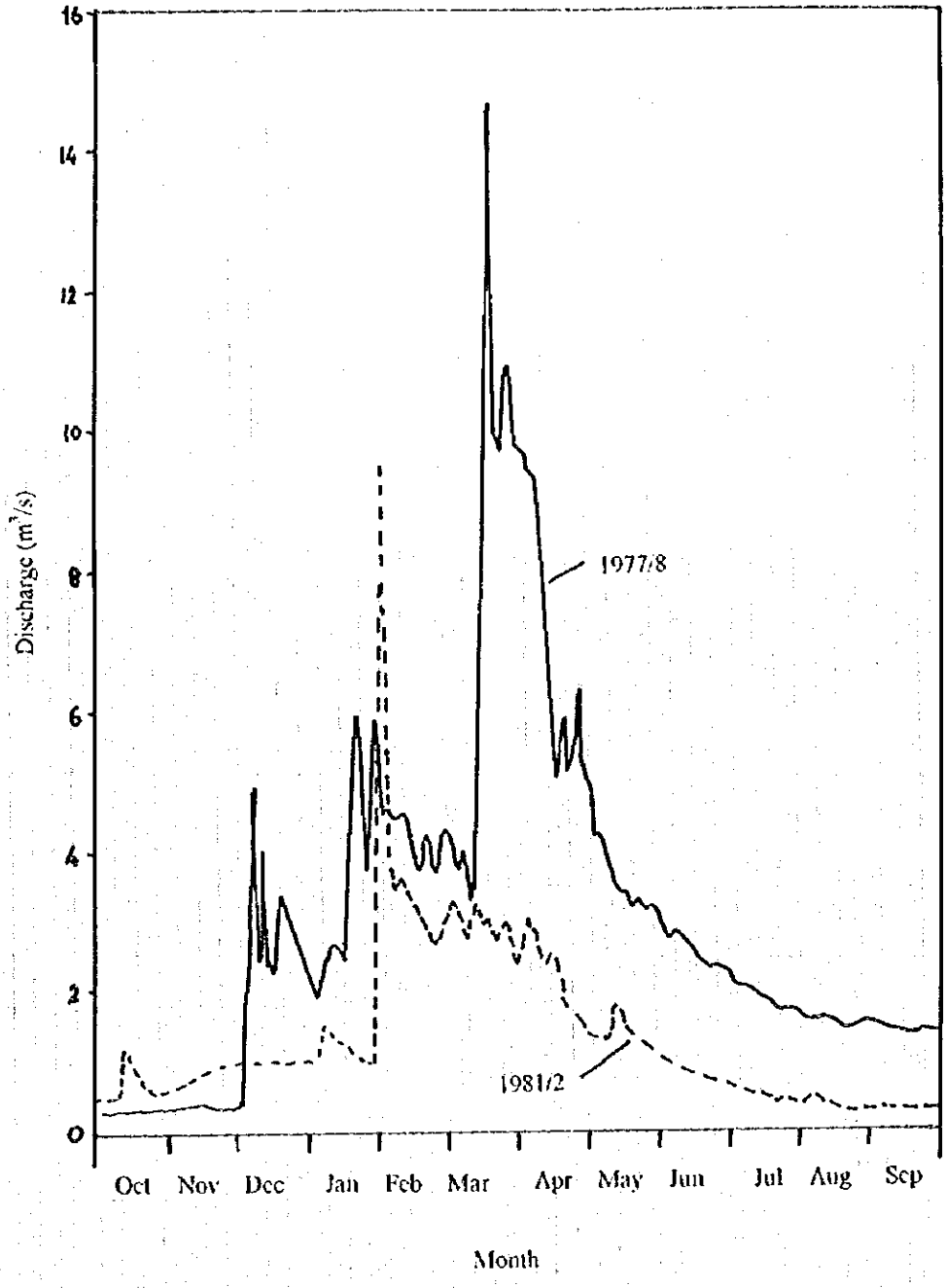
Source: USSR (1986)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2.12b
Hydrographs of the Barada at El Hame

NIPPON KOEI CO., LTD.

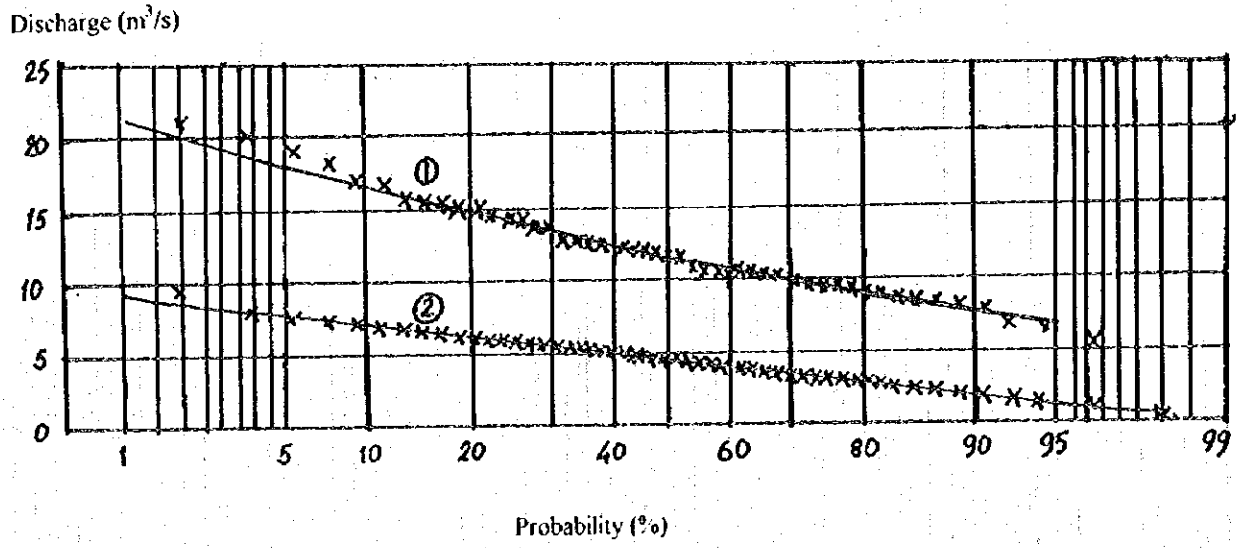


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

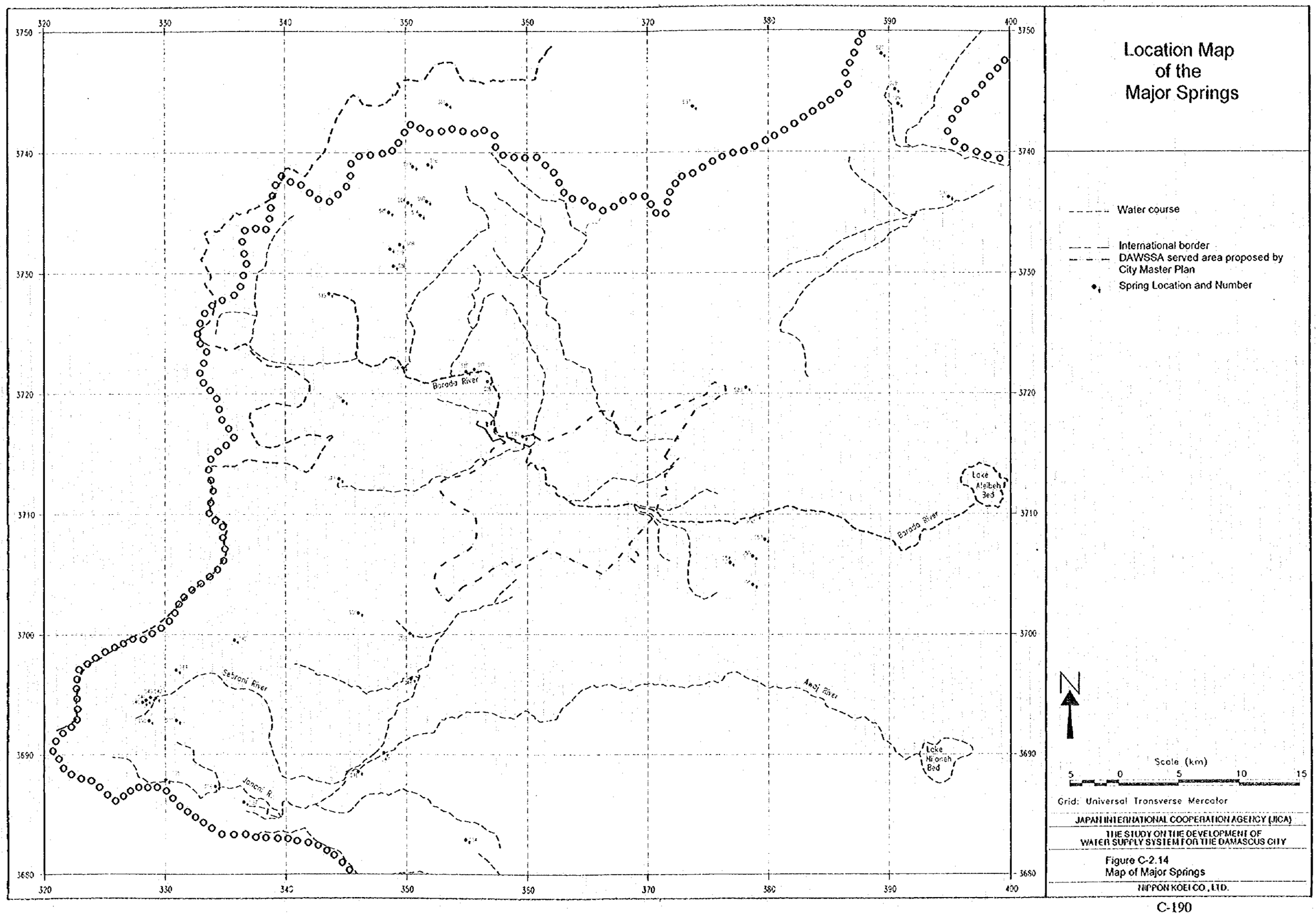
Figure C-2.12c
Hydrographs of the Awaj at Om Sharatiet

NIPPON KOEI CO., LTD.



1. Barada at El Hame
2. Awaj at Om Sharatiet

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.13 Stream Flow Probability Curves
NIPPON KOEI CO., LTD.



Location Map of the Major Springs

Water course

International border

DAWSSA served area proposed by City Master Plan

Spring Location and Number

N

Scale (km)

5 0 5 10 15

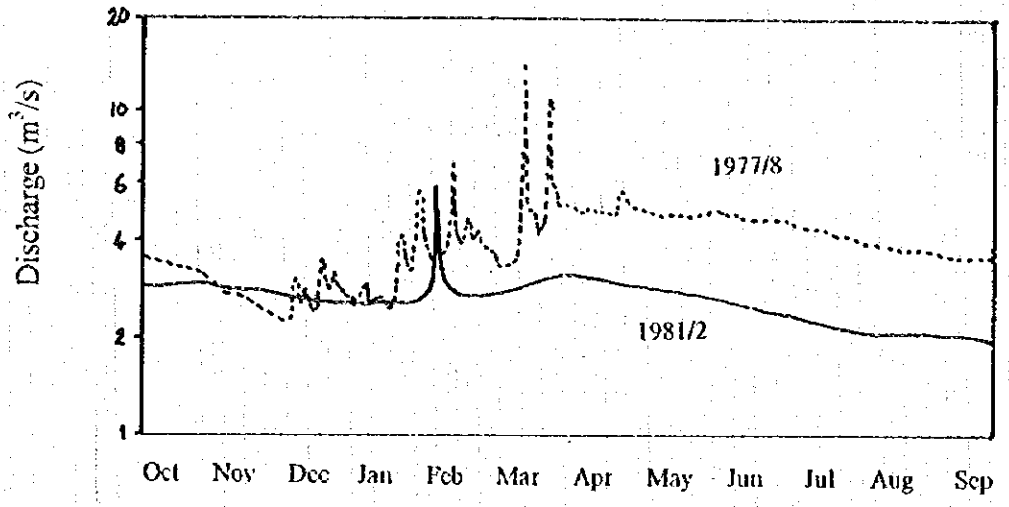
Grid: Universal Transverse Mercator

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

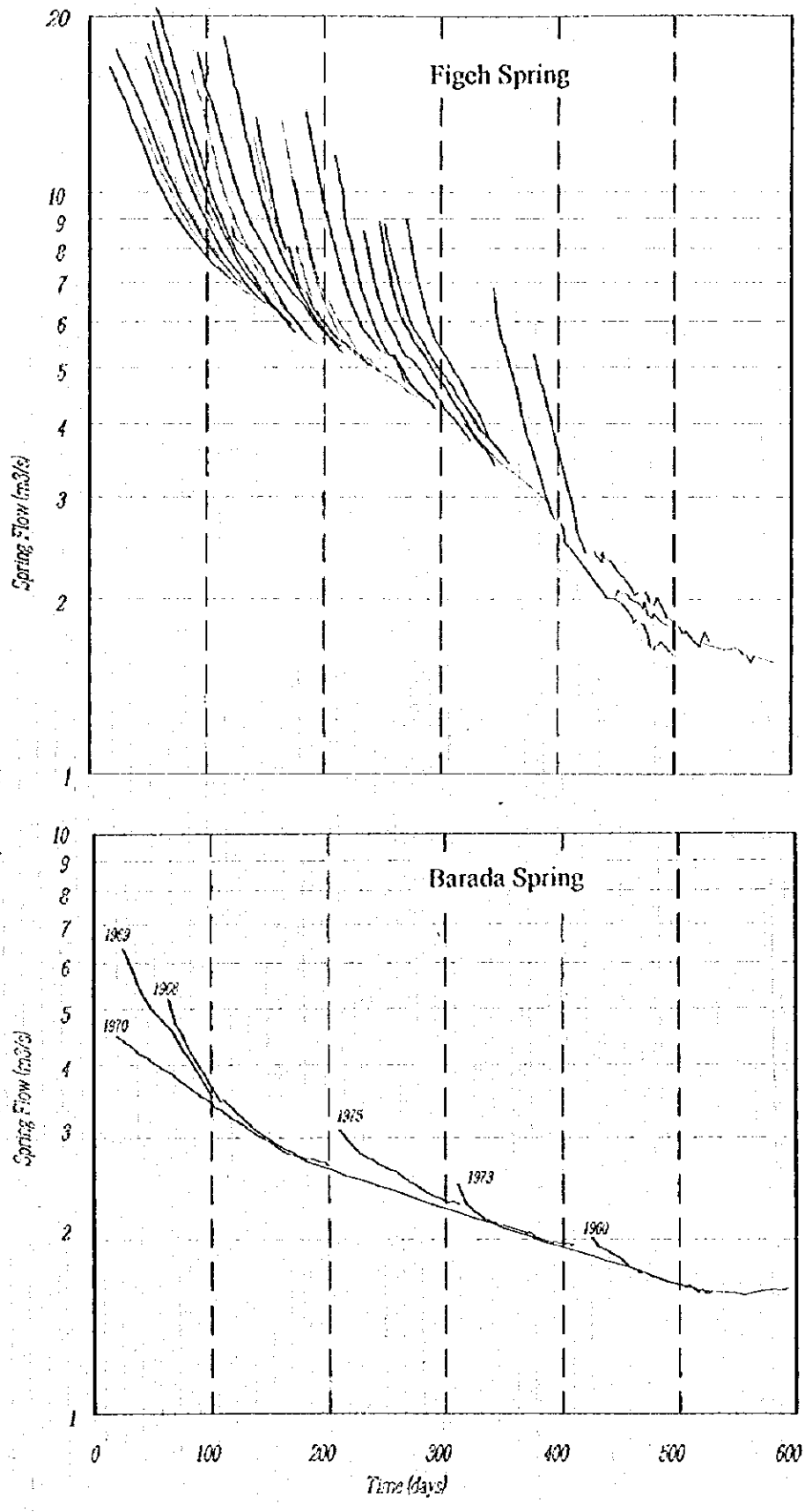
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2.14
Map of Major Springs

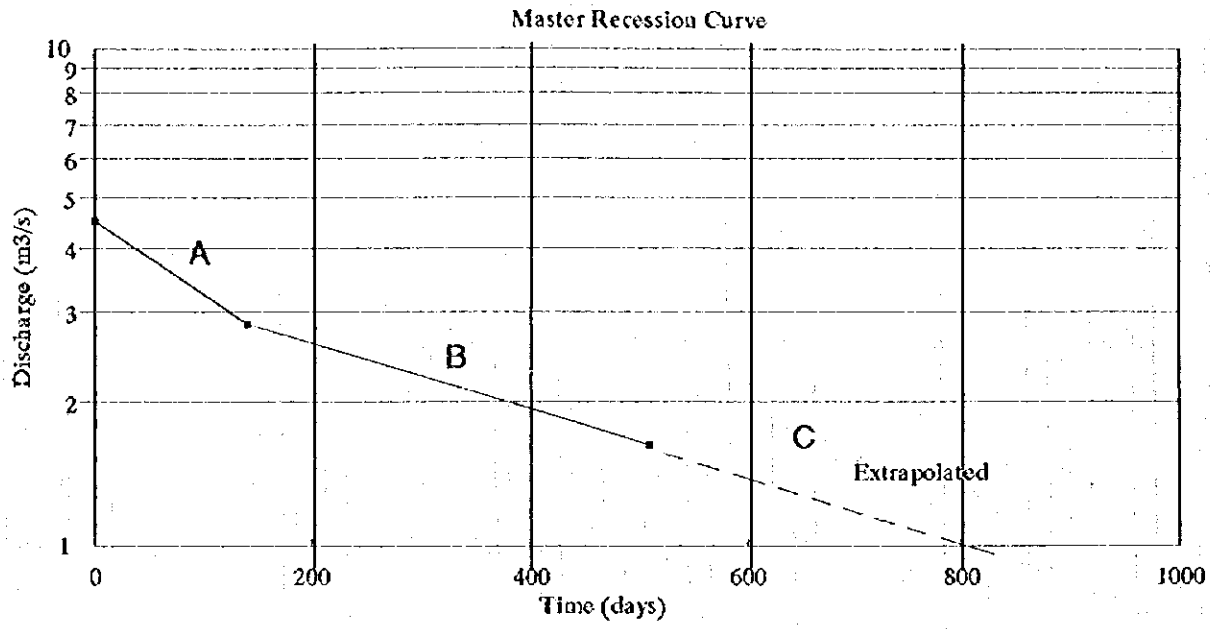
NIPPON KOEI CO., LTD.

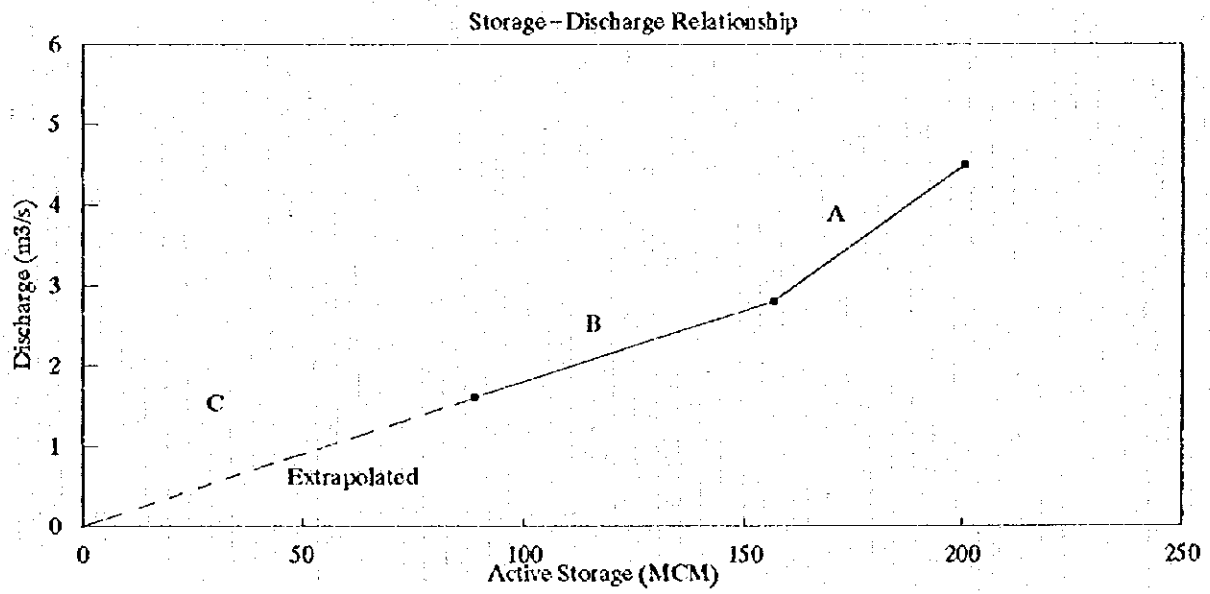


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.15 Typical Annual Hydrographs, Ramleh
NIPPON KOEI CO., LTD.



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.16 Recession Curves for Figeh & Barada Springs
NIPPON KOEI CO., LTD.





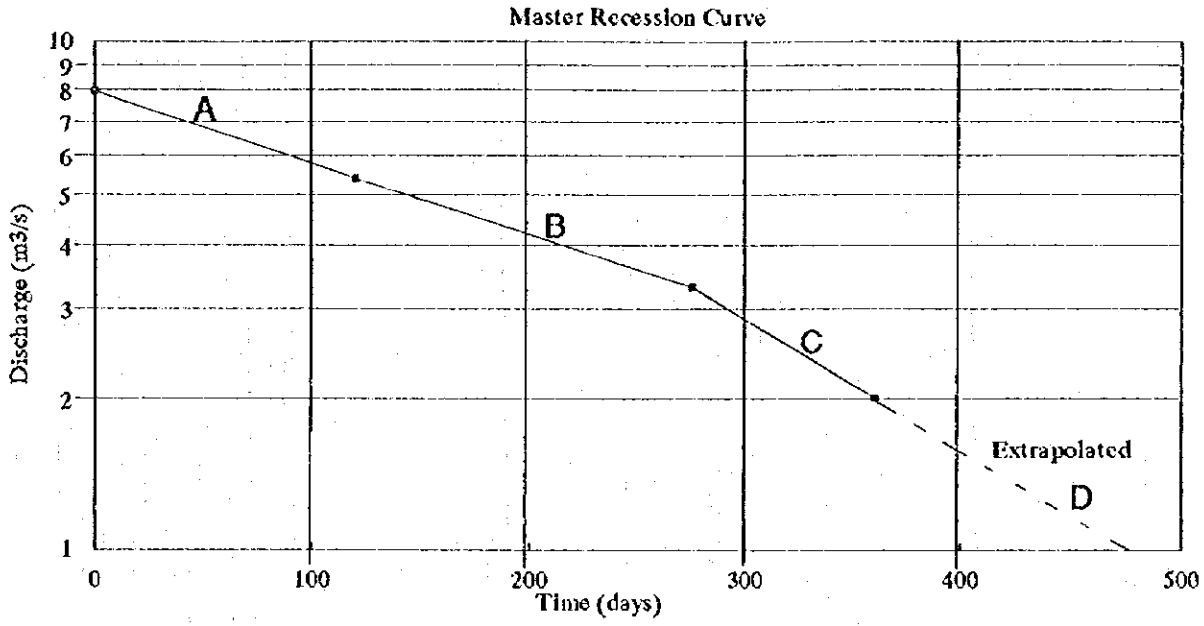
Section	Discharge (m3/s)	Storage (MCM)	Omega (/day)	Duration (days)
A	4.5 to 2.8	44	−0.00335	142
B	2.8 to 1.6	68	−0.00154	368
C	1.6 to 0.0	89	−0.00154	n/a
	TOTAL	201		

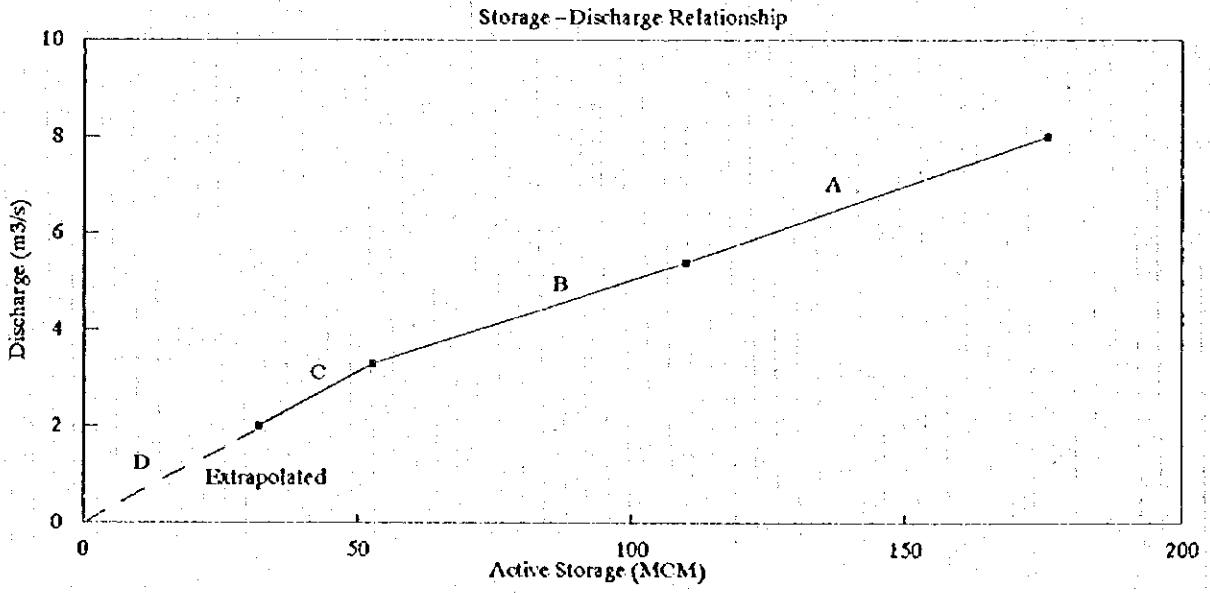
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2.17
Master Recession & Storage, Barada

NIPPON KOEI CO., LTD.





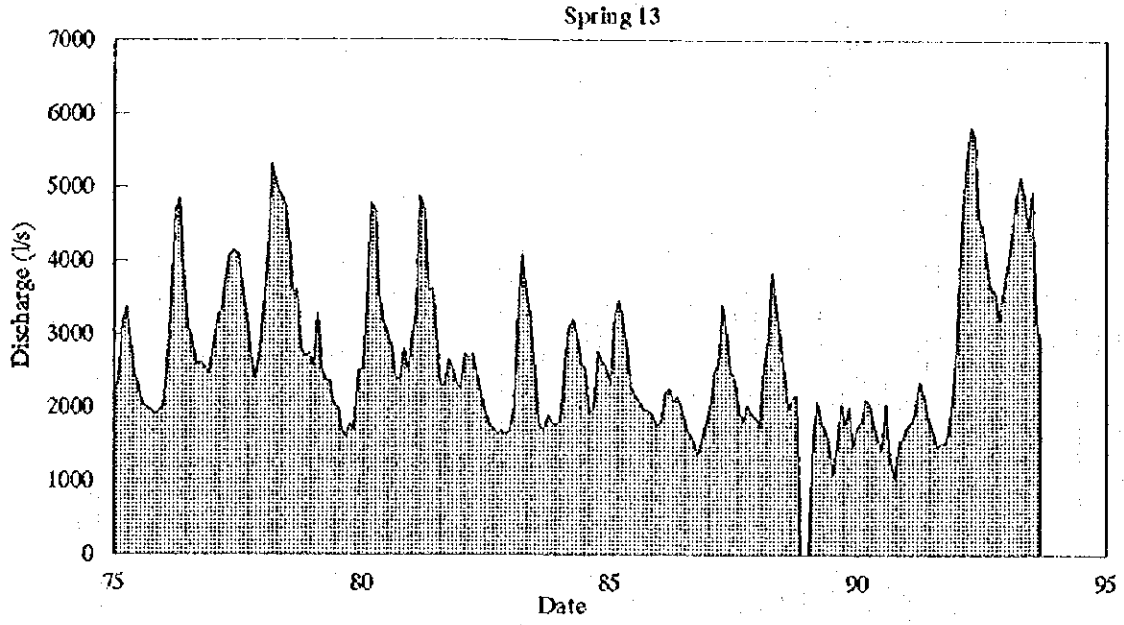
Section	Discharge (m3/s)	Storage (MCM)	Recession (/day)	Duration (days)
A	8.0 to 5.4	66.23	−0.0039	120
B	5.4 to 3.3	57.01	−0.0032	155
C	3.3 to 2.0	19.43	−0.0054	85
D	2.0 to 0.0	33.37	n/a	n/a
	TOTAL	**176.00**		

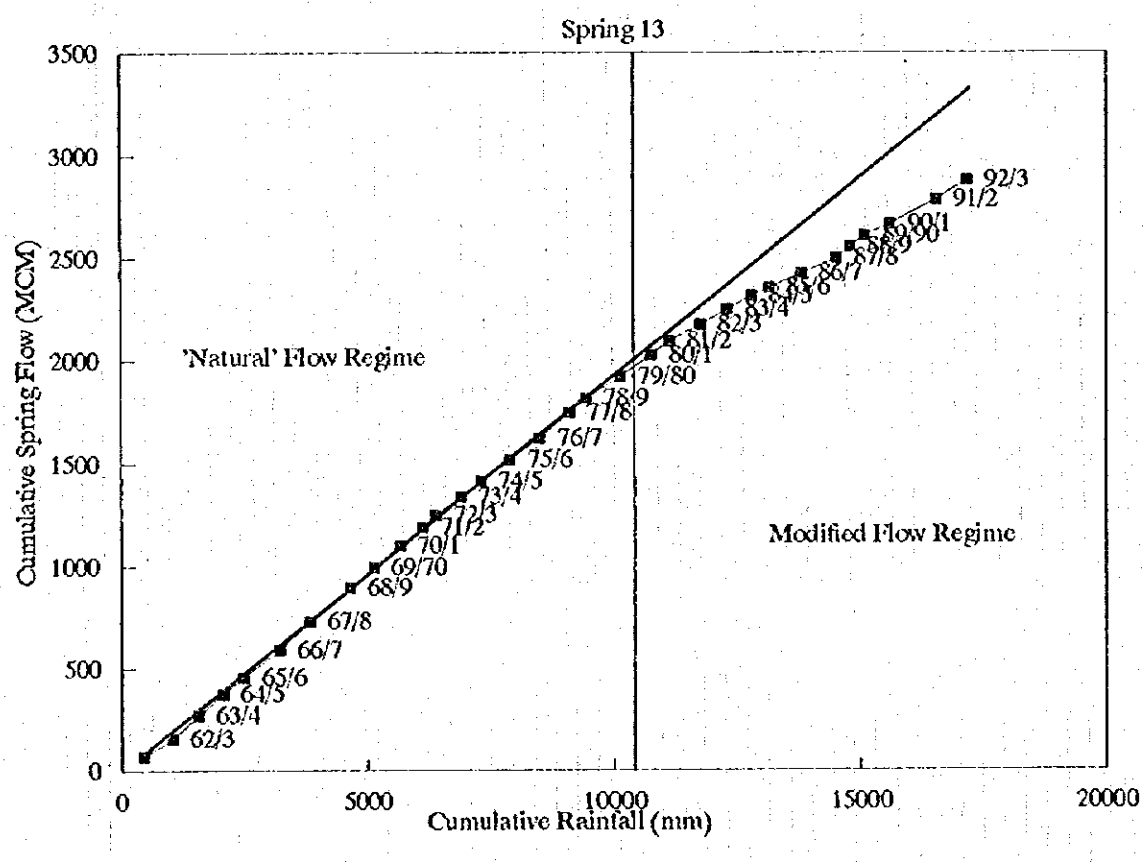
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

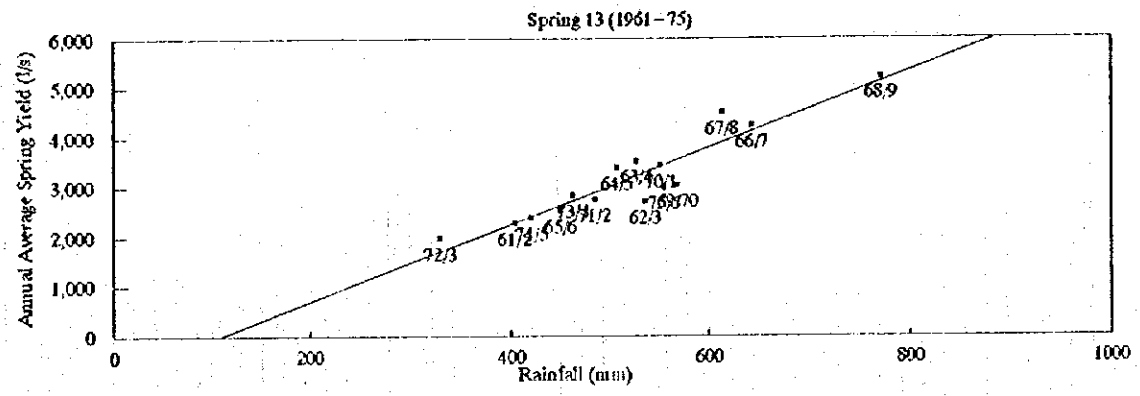
Figure C-2.18
Master Recession & Storage, Figeh

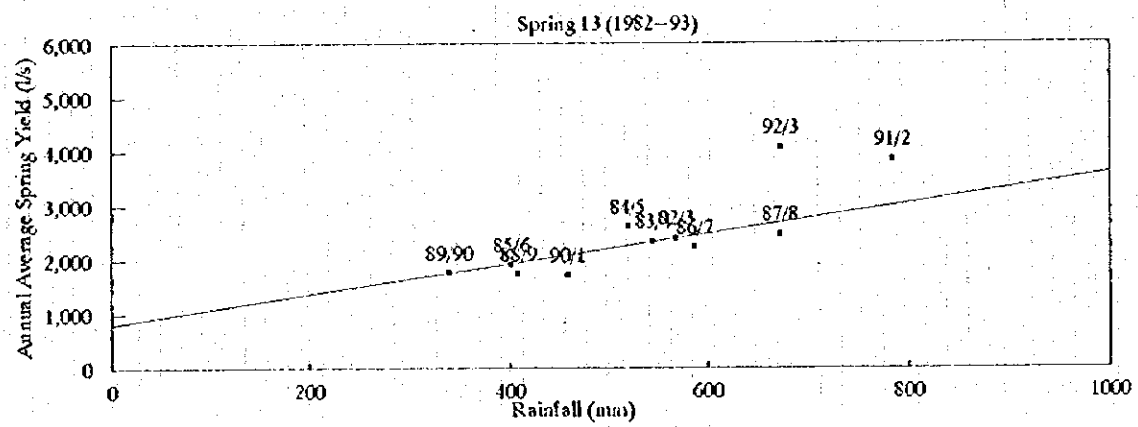
NIPPON KOEI CO., LTD.



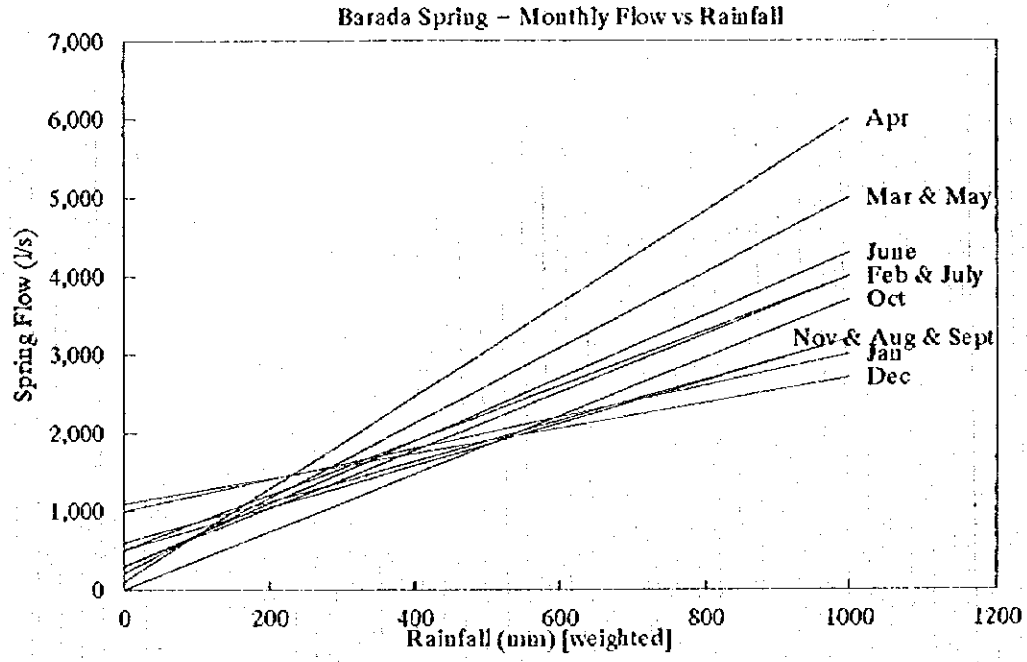


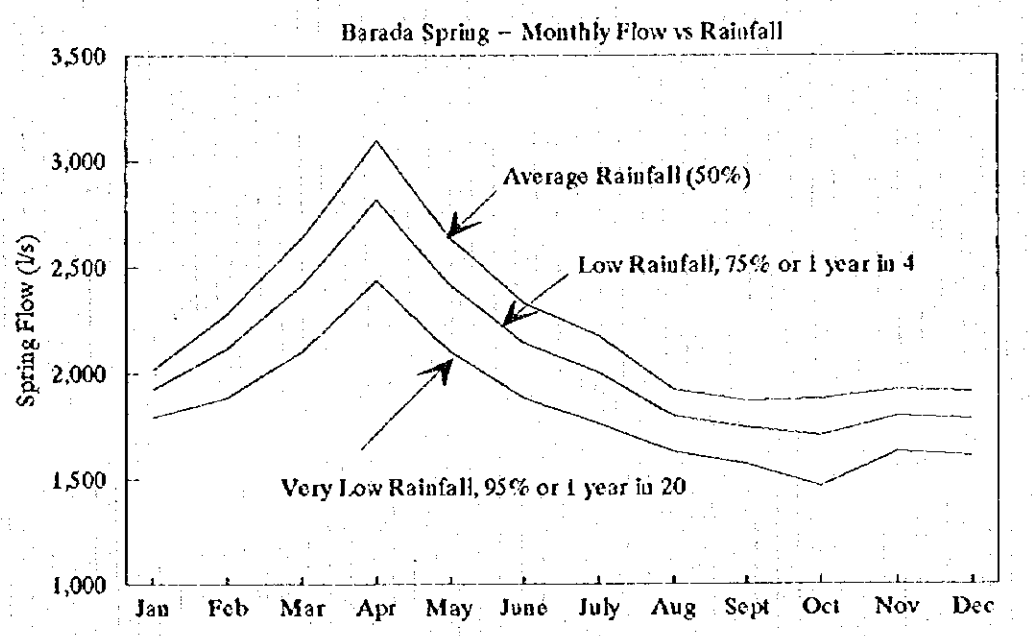
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.19 Hydrograph, Barada, 1975-93 Figure C-2.20 Cumulative Rainfall & Flow, Barada
NIPPON KOEI CO., LTD.



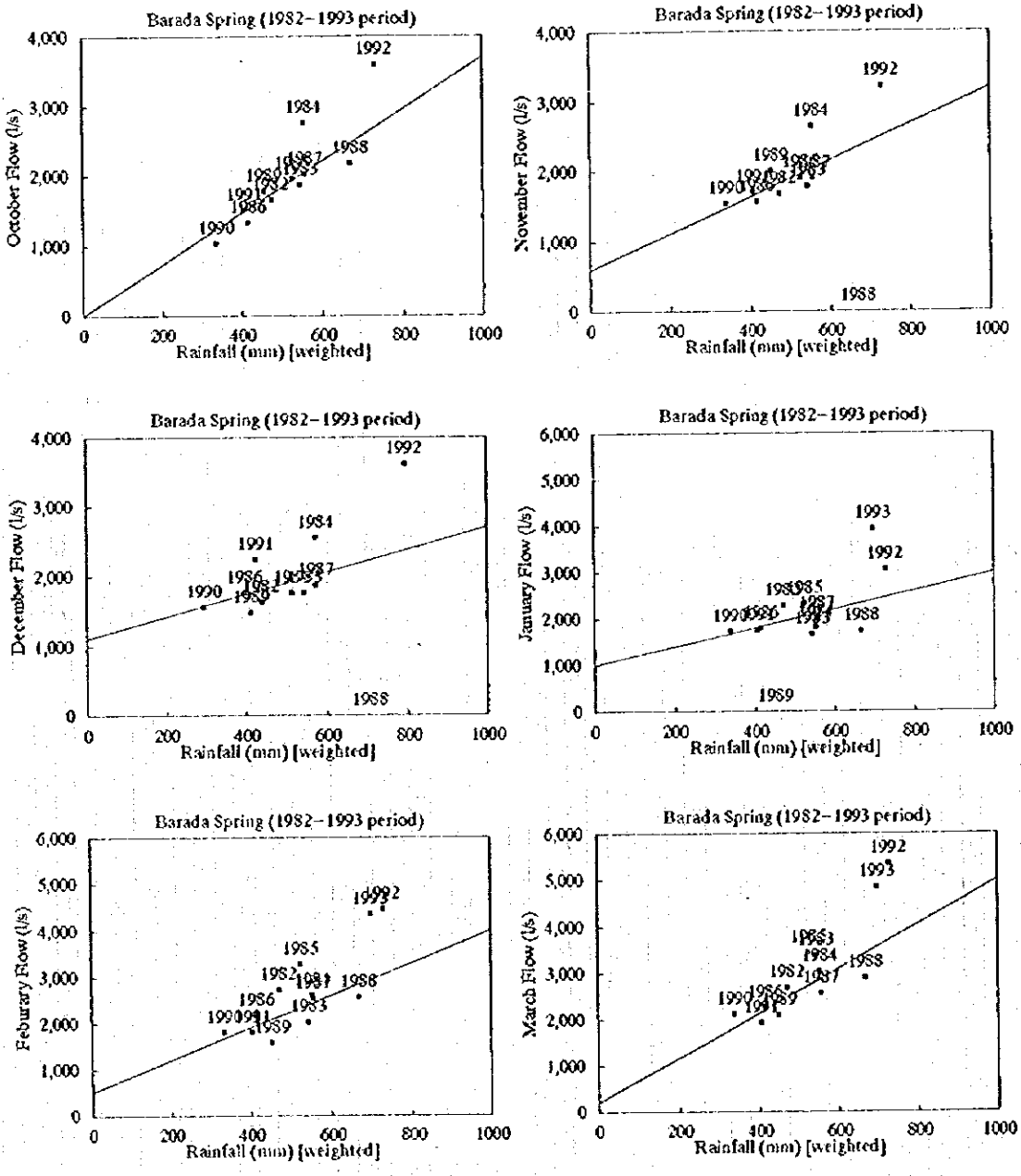


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.21 Rainfall & Discharge, Barada 1961-75 Figure C-2-22 Rainfall & Discahrge, Barada 1982-93
NIPPON KOEI CO., LTD.

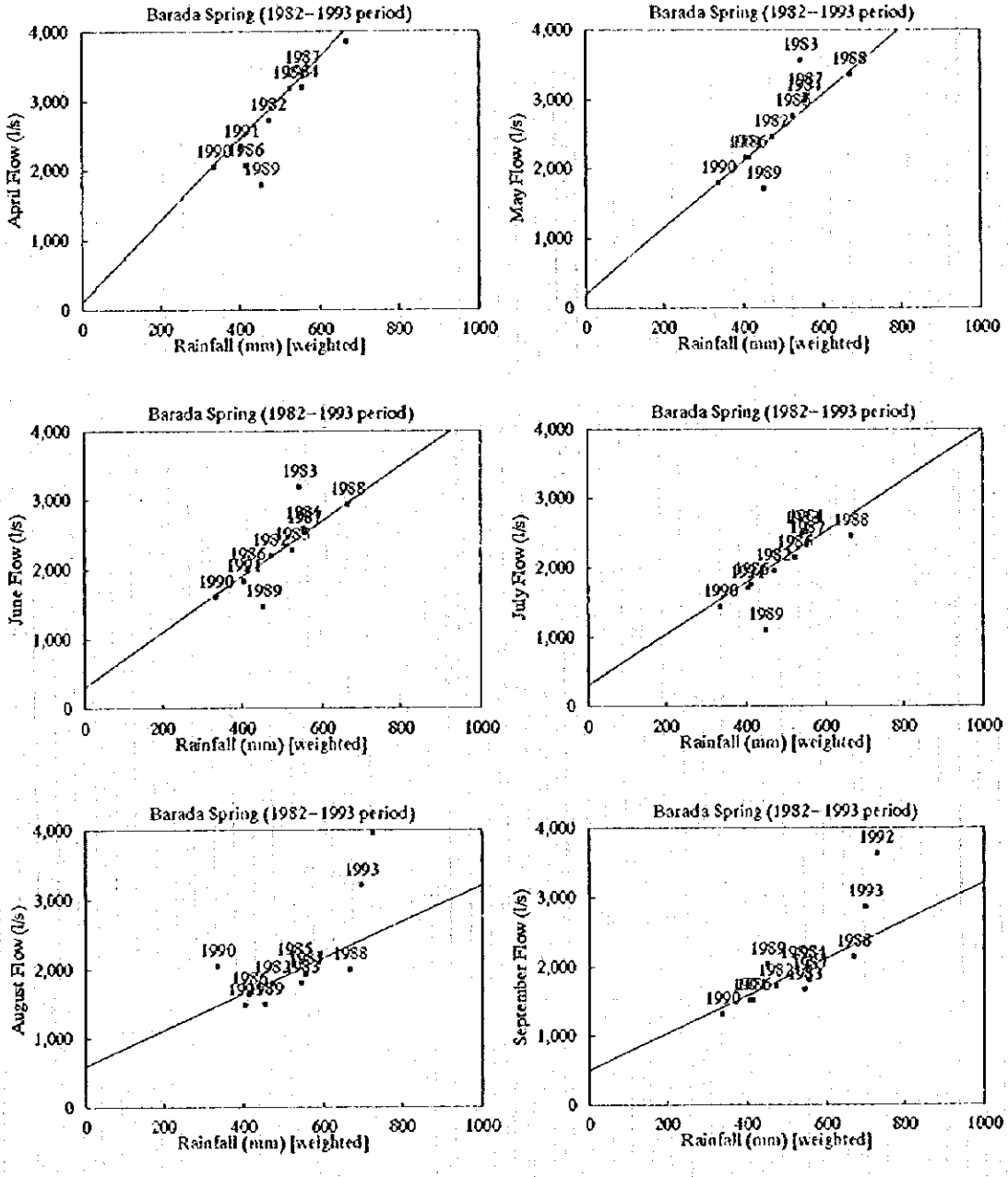




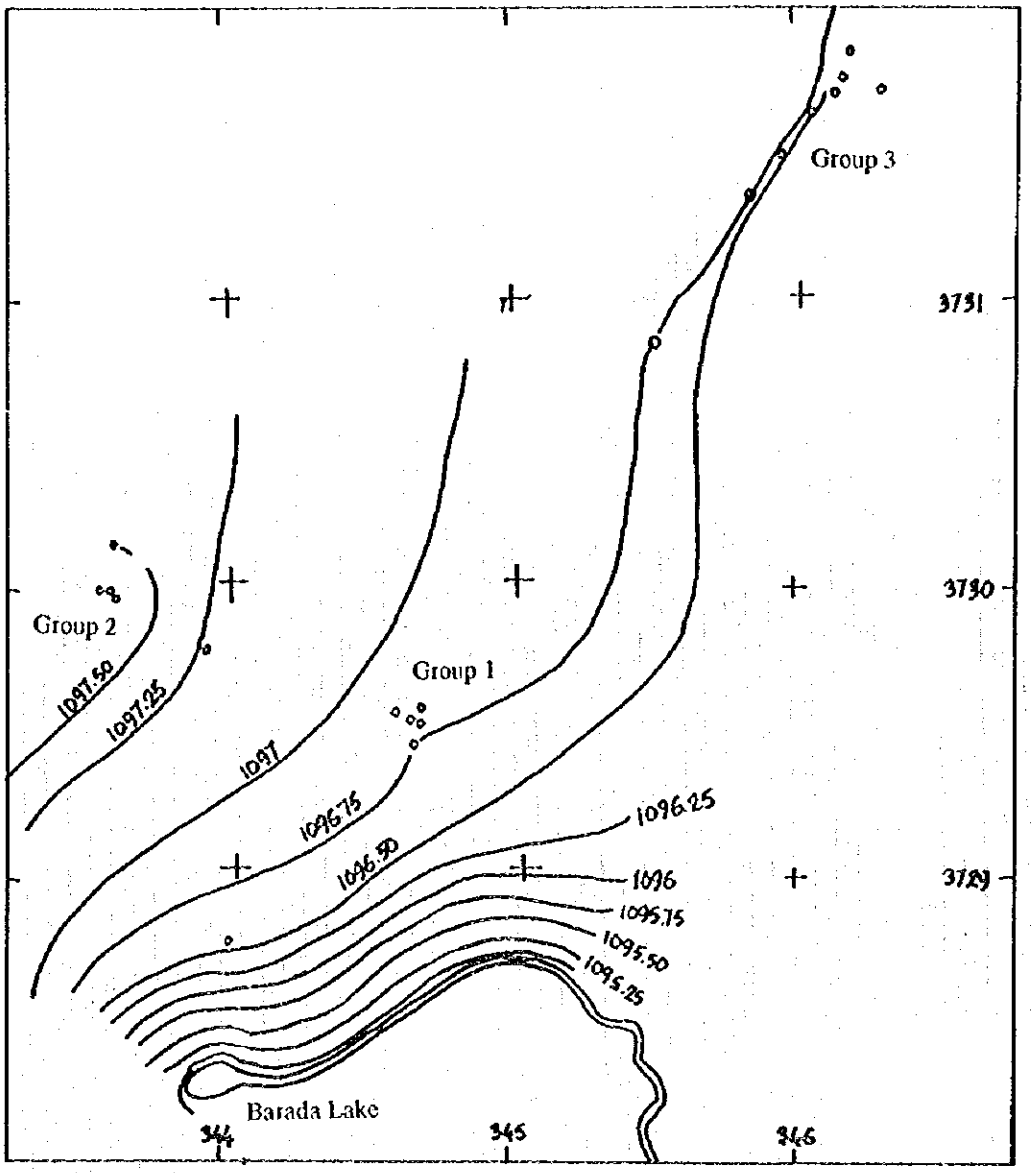
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.23 Predicted Monthly Flows & Rainfall Figure C-2.24 Predicted Annual Hydrographs
NIPPON KOEI CO., LTD.



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.25 Rainfall & Spring Discharge October to March
NIPPON KOEI CO., LTD.

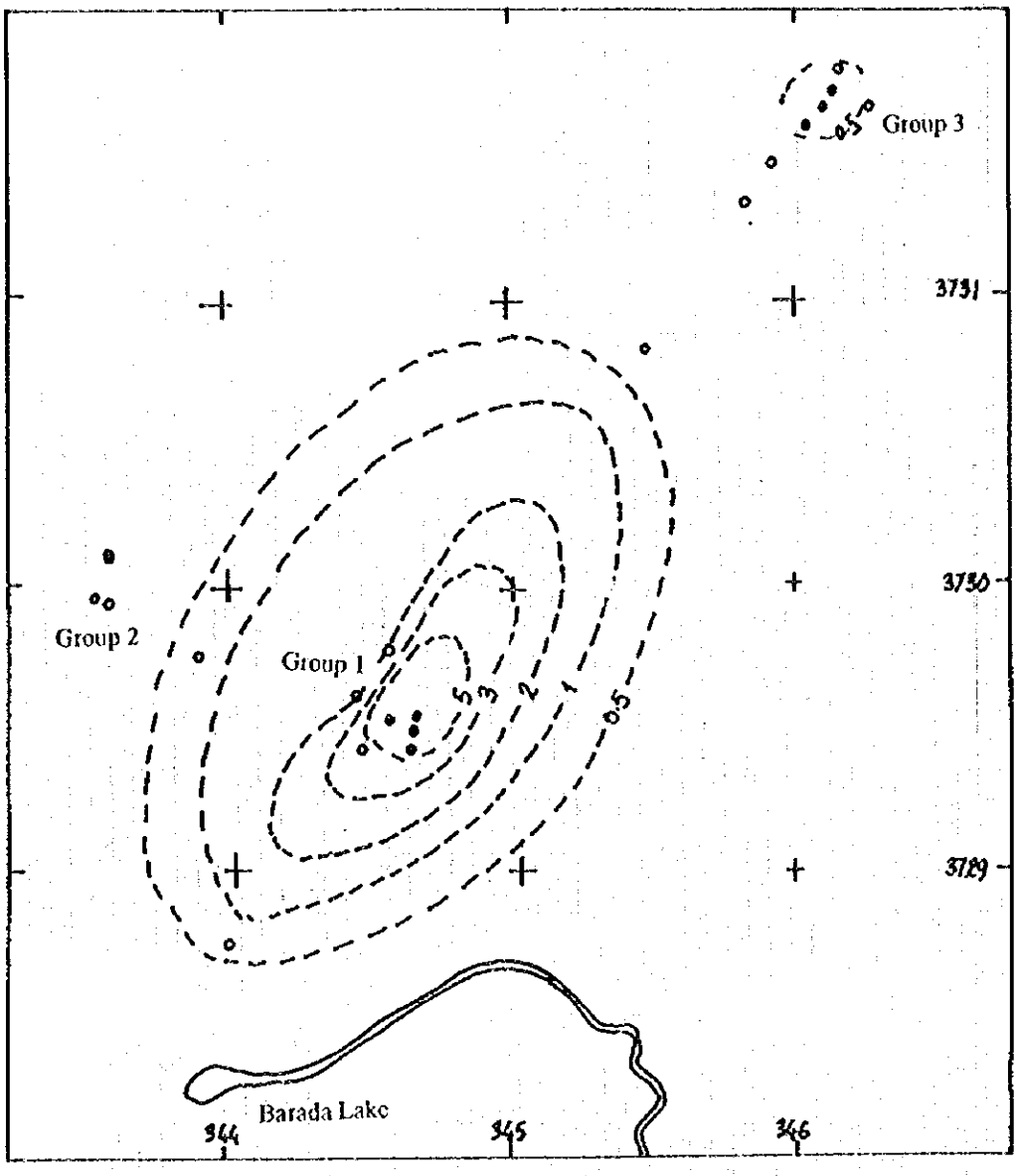


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.26 Rainfall & Spring Discharge April to September
NIPPON KOEI CO., LTD.



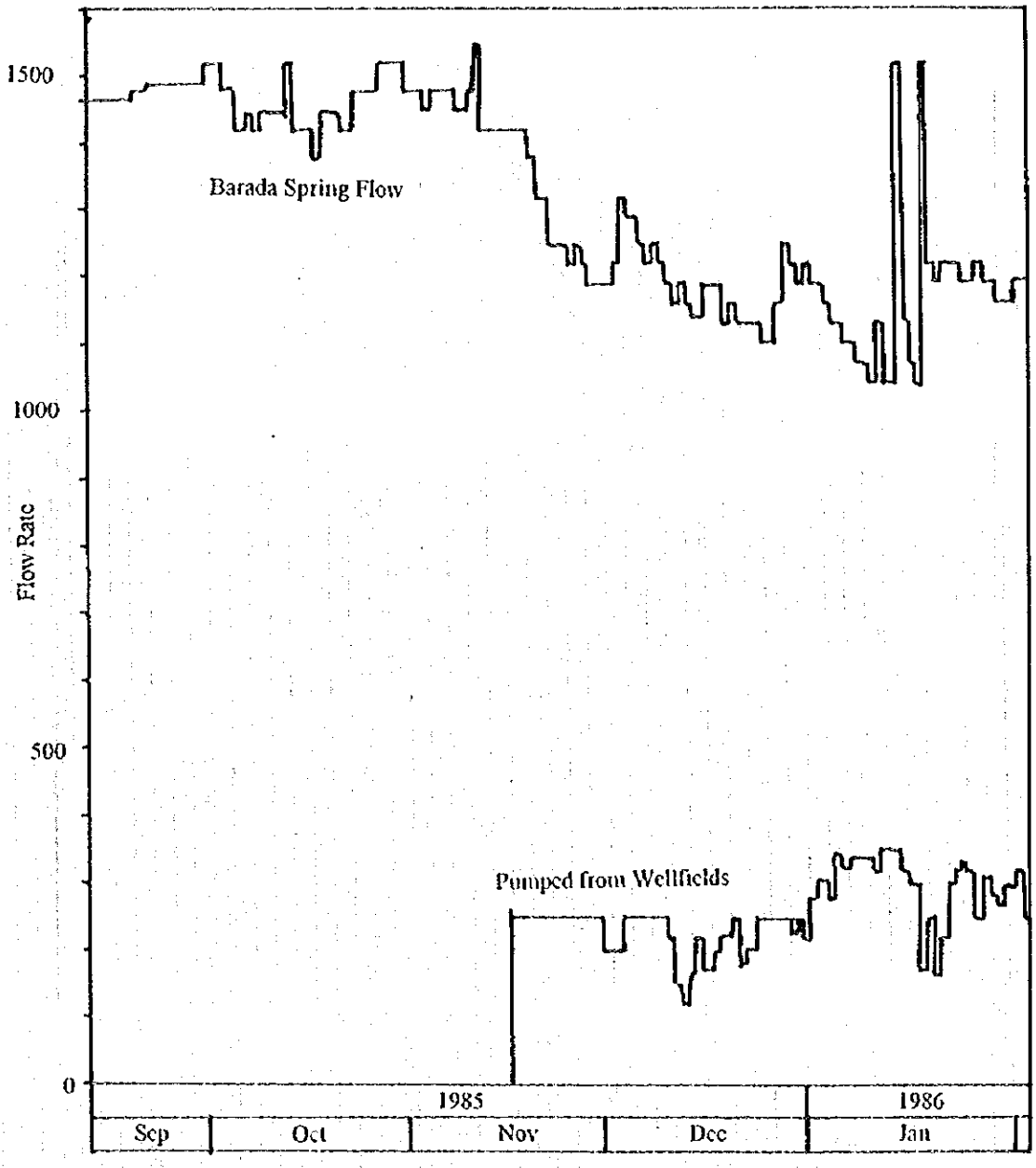
UTM Grid

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.27 Piezometry 1985, Barada
NIPPON KOEI CO., LTD.

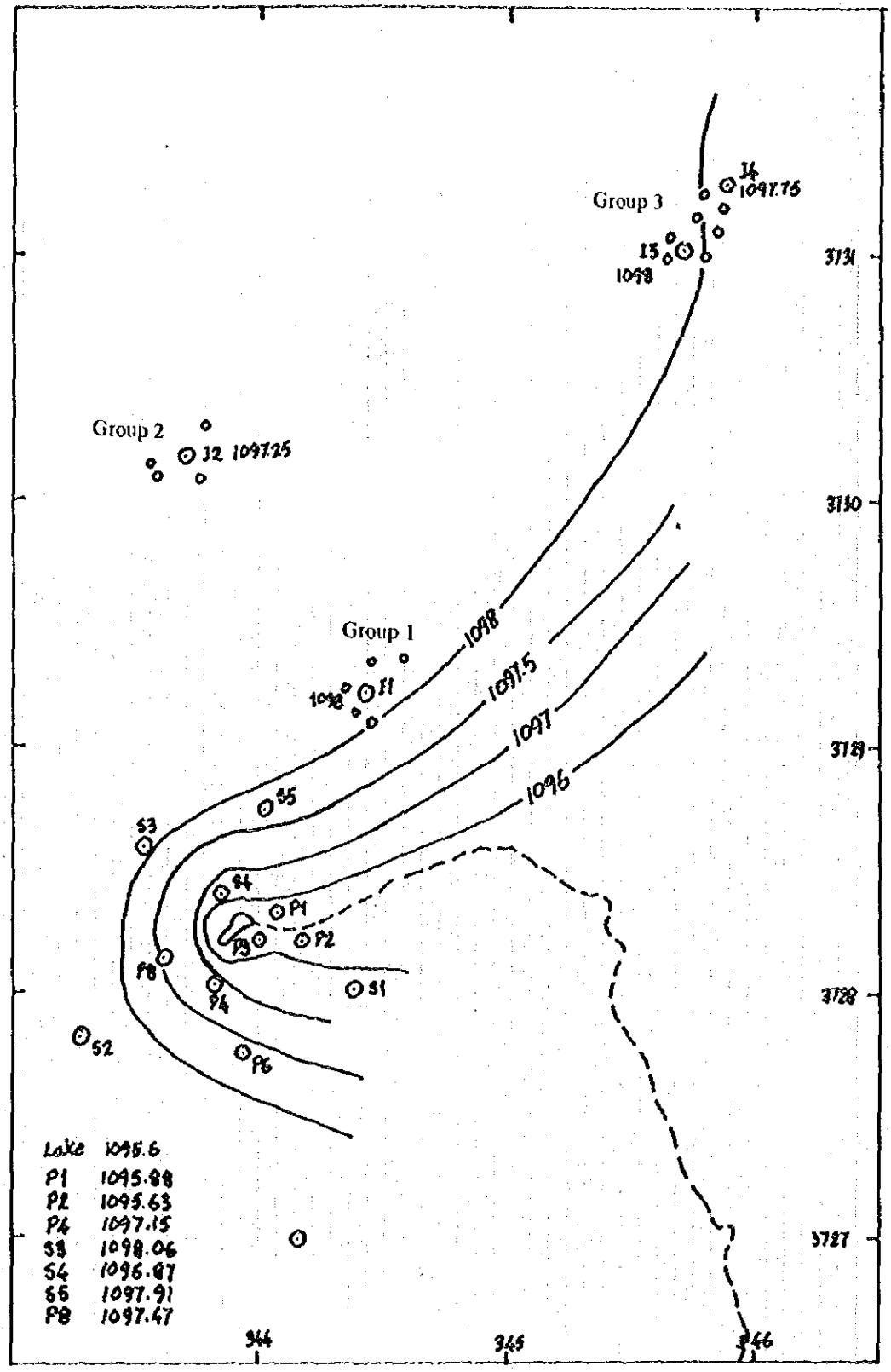


UTM Grid

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.28 Isodrawdowns 1985, Barada
NIPPON KOEI CO., LTD.

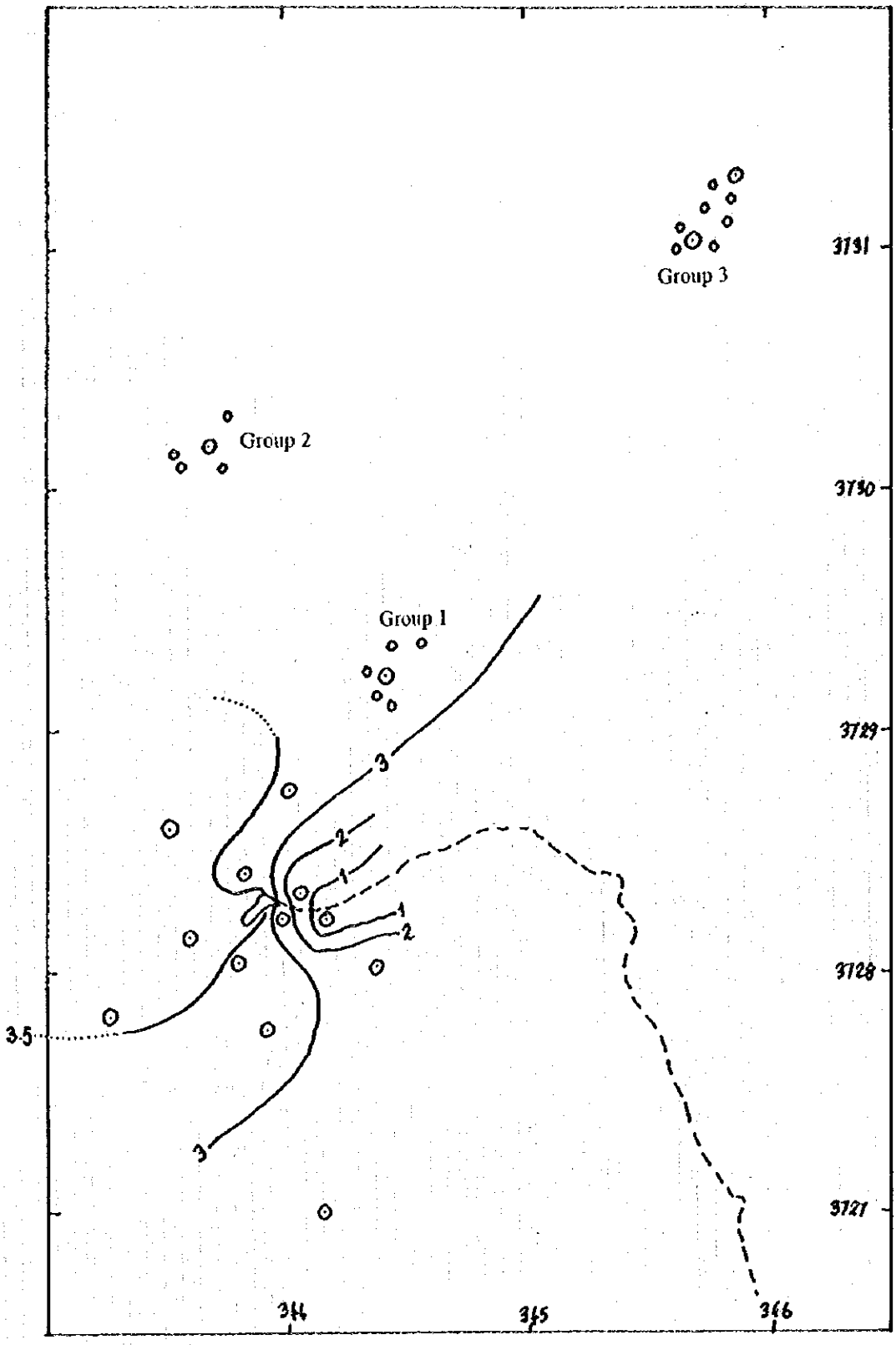


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.29 Barada Spring Flow & Quantity Pumped from Wellfields
NIPPON KOEI CO., LTD.



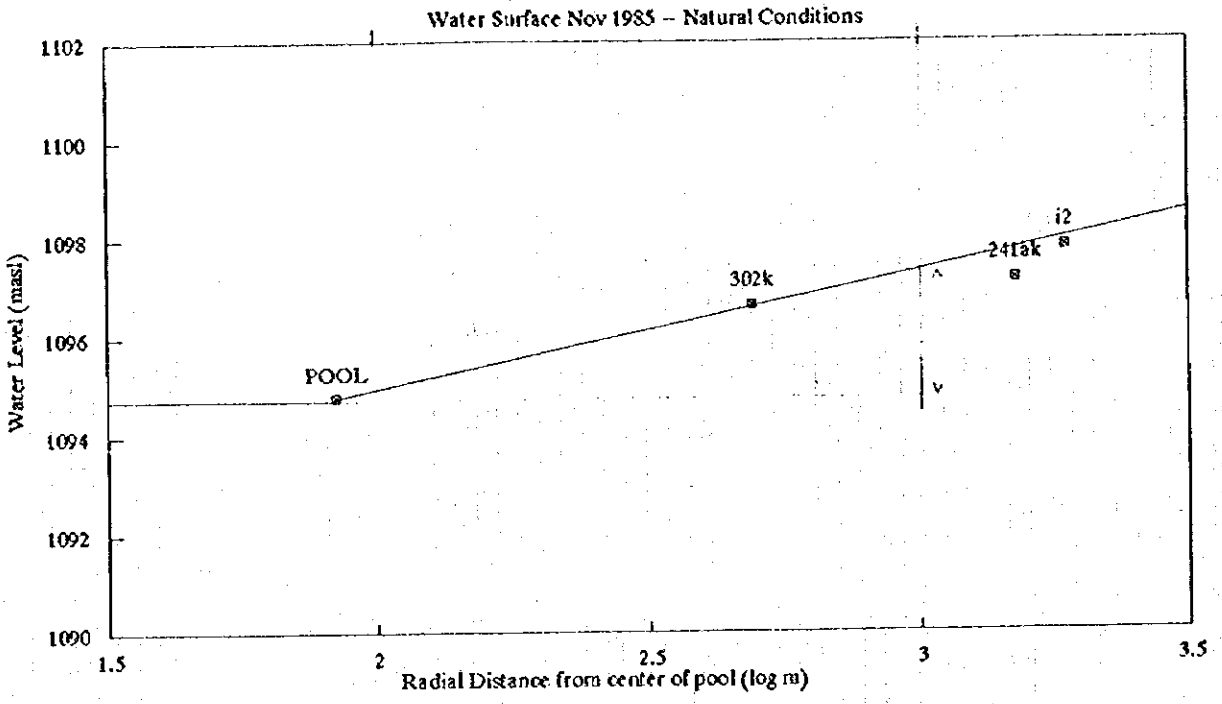
UTM Grid

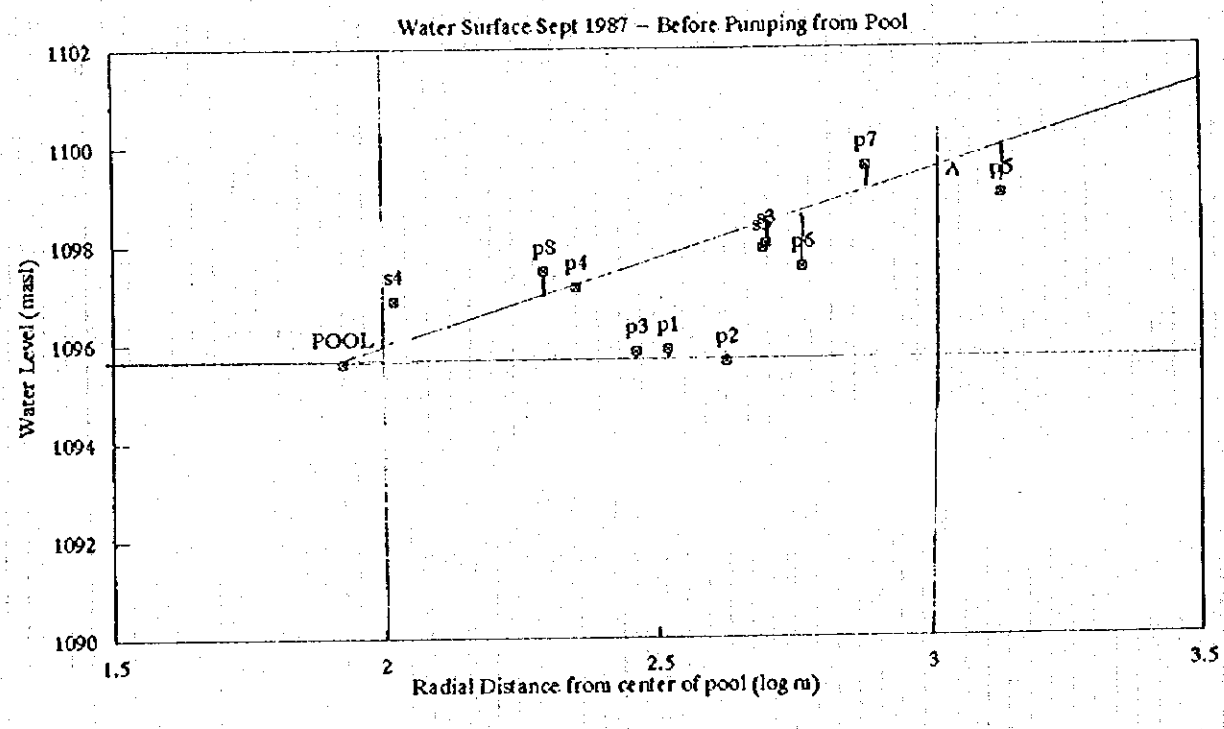
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.30 *Piezometry 1987, Barada*
NIPPON KOEI CO., LTD.



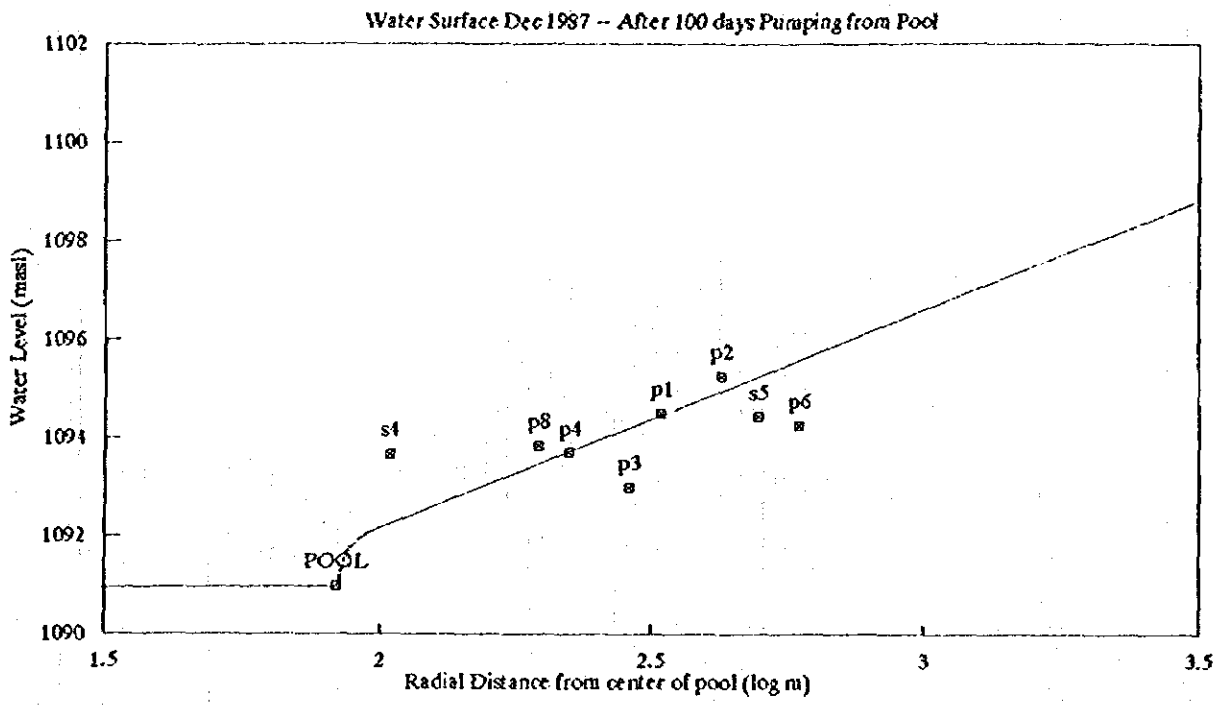
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.31 Isodrawdowns 1987, Barada
NIPPON KOEI CO., LTD.

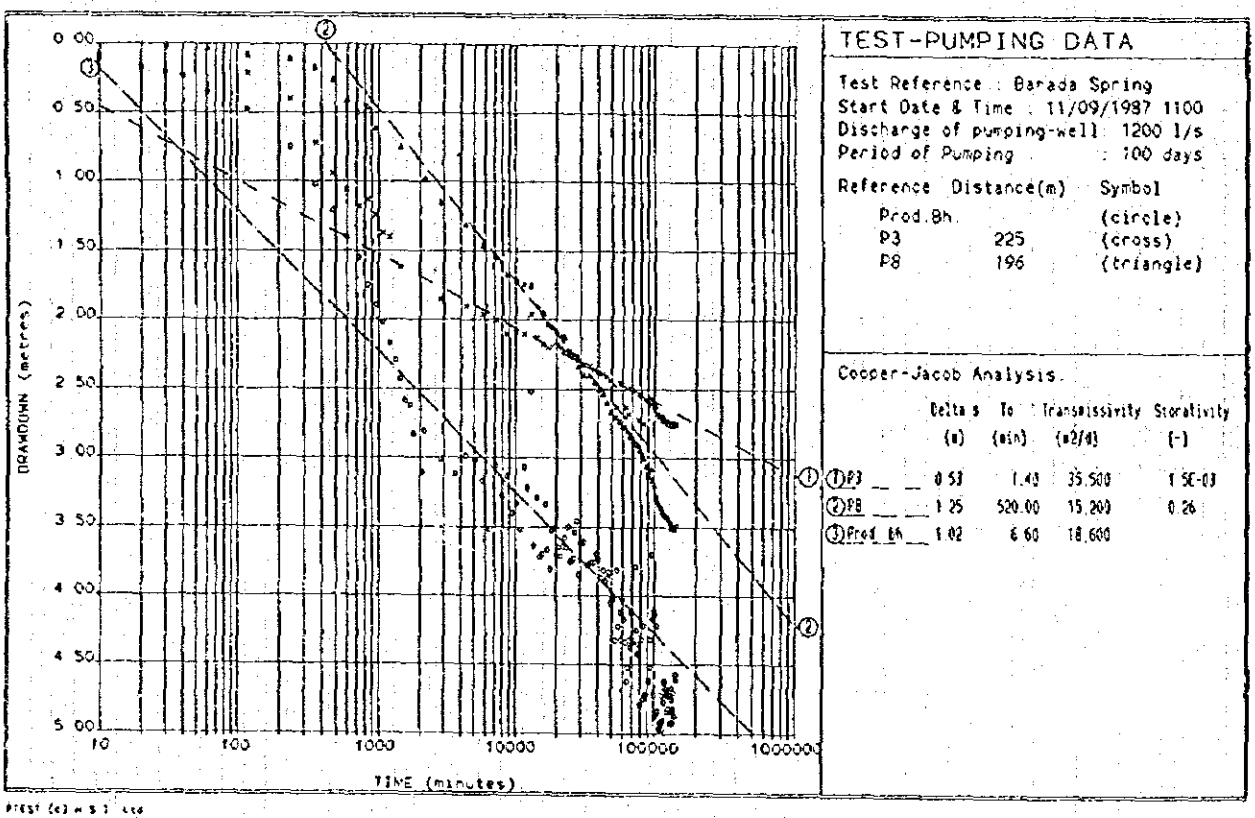
UTM Grid



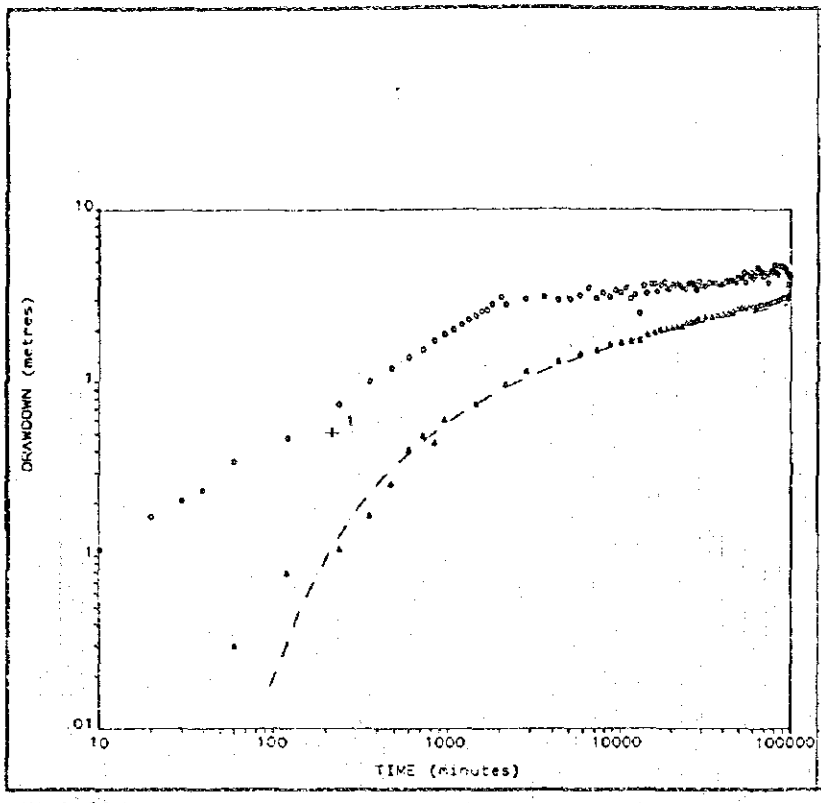


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.32a & b Analysis of Pumping Test Barada
NIPPON KOEI CO., LTD.





JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.32c &d Analysis of Pumping Test Barada
NIPPON KOEI CO., LTD.



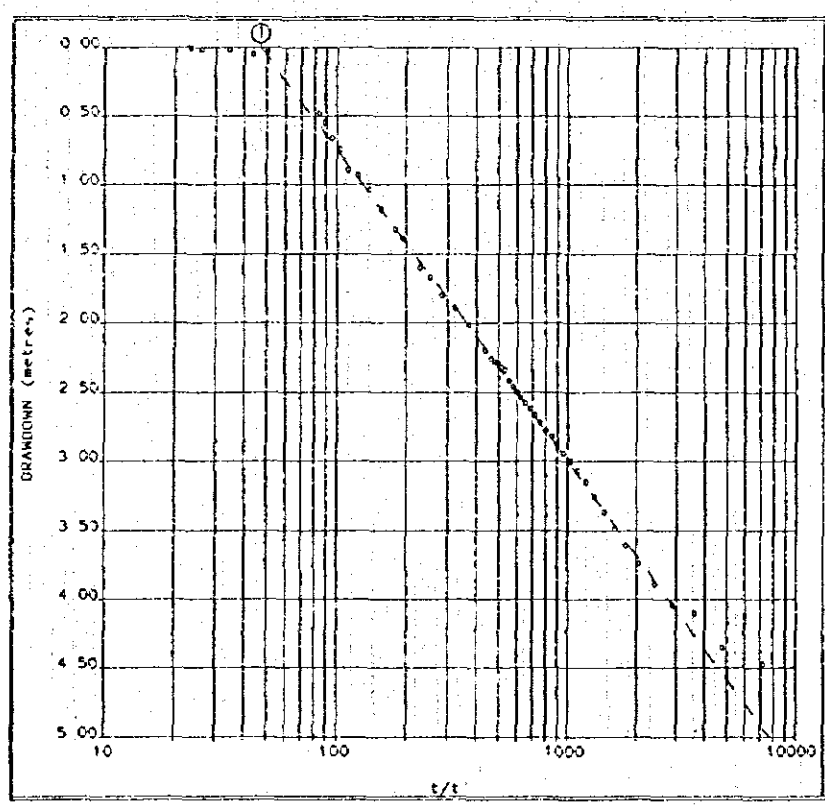
TEST-PUMPING DATA

Test Reference Barada Spring
Start Date & Time 11/09/1987 1100
Discharge of pumping-well 200 l/s
Period of Pumping 100 days

Reference	Distance(m)	Symbol
Prod Bh		(circle)
P8	196	(triangle)

Type-Curve Match

N.P	Radius (m)	Transmissivity (m2/d)	Storativity (-)
1	196.0	16,100	0.025



RECOVERY DATA

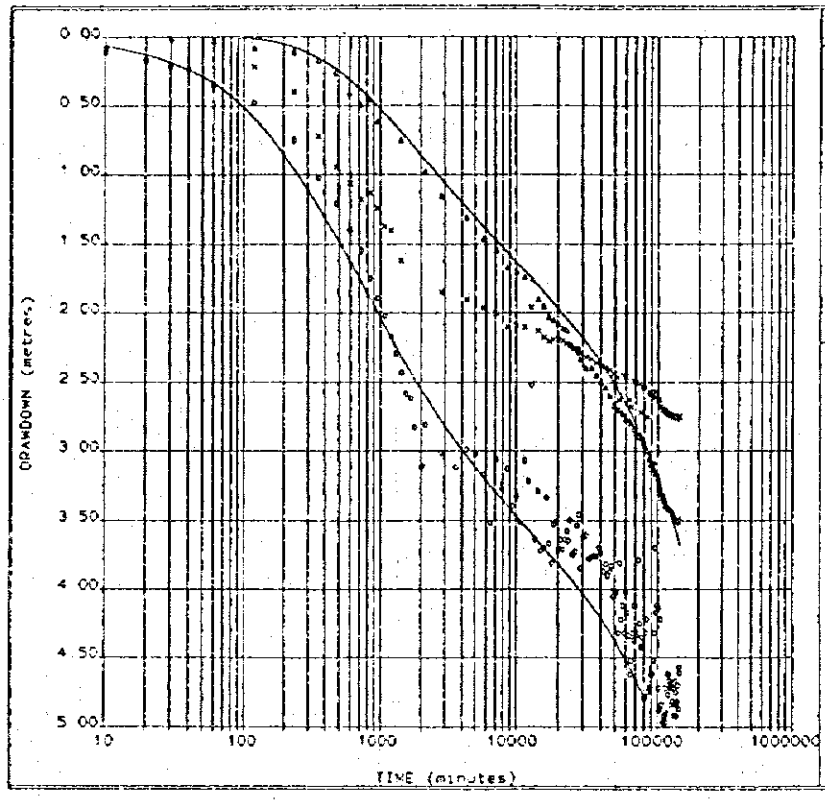
Test Reference Barada Spring
Start Date & Time 11/09/1987 1100
Discharge of pumping-well 2540 l/s
Period of Pumping 100 days

Reference	Distance(m)	Symbol
Prod.Bh		(circle)

Cooper-Jacob Analysis

	Delta s (m)	To (min)	Transmissivity (m2/d)	Storativity (-)
① Prod_Bh	2.25	4.7E+01	17,800	

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.32e & f Analysis of Pumping Test Barada
NIPPON KOEI CO., LTD.



TEST-PUMPING DATA

Test Reference : Barada Spring
Start Date & Time : 11/09/1987 1100
Discharge of pumping-well : 2540 l/s
Period of Pumping : 100 days

Reference	Distance(m)	Symbol
Prod.Bh.		(circle)
P3	225	(cross)
P8	196	(triangle)

Radial-Flow Simulation

Phase	Q(l/s)	Time(mins)
1	1200	144000

Observ. Wells at 450 m

Transmissivity 17000.0 m2/d to 4000 m
2000.0 m2/d to 10000 m
Storativity: 0.03

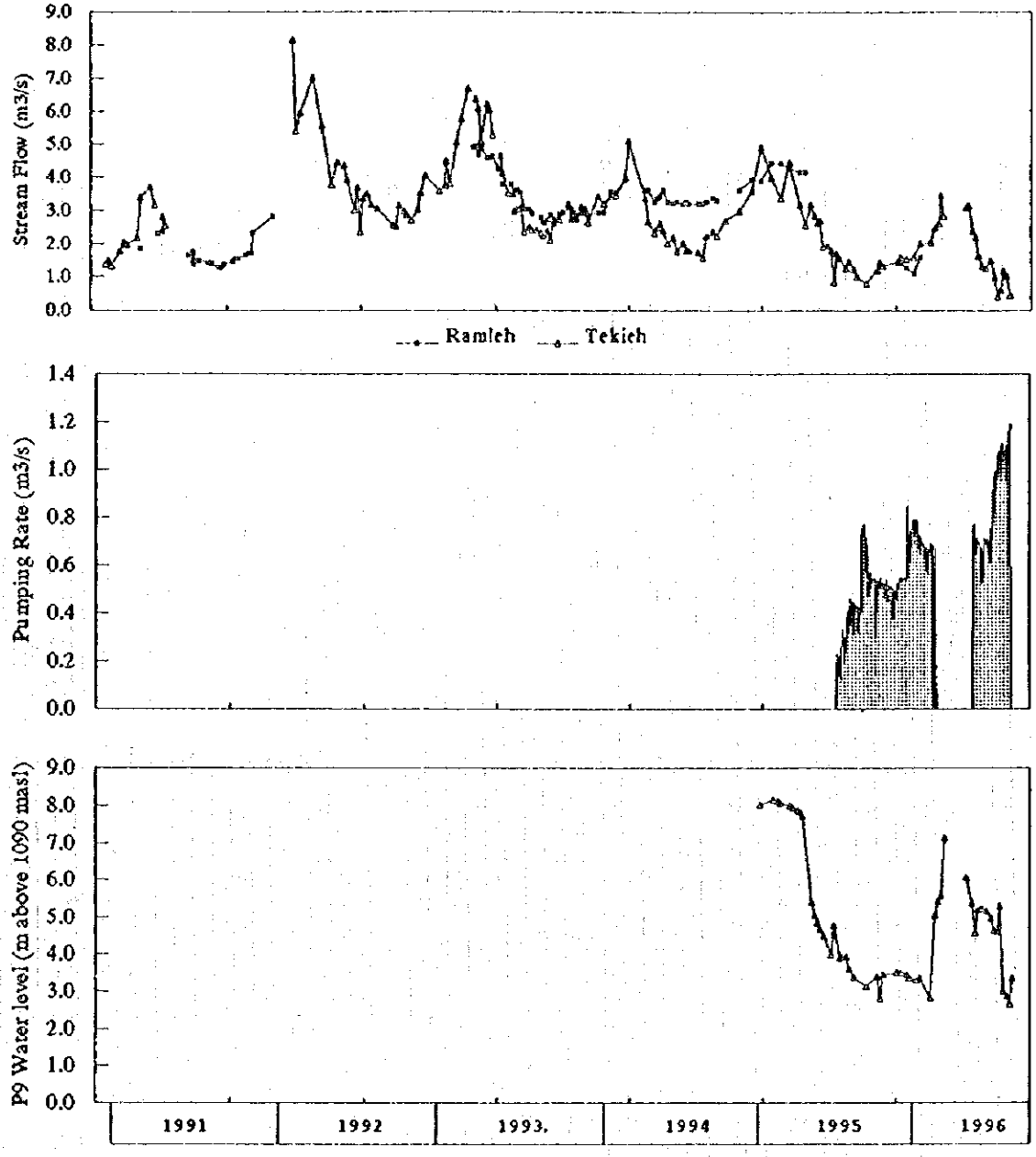
Well Loss Factor 0.0
Well Loss Exponent 2.0
Effective Well Radius 82.50 m

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

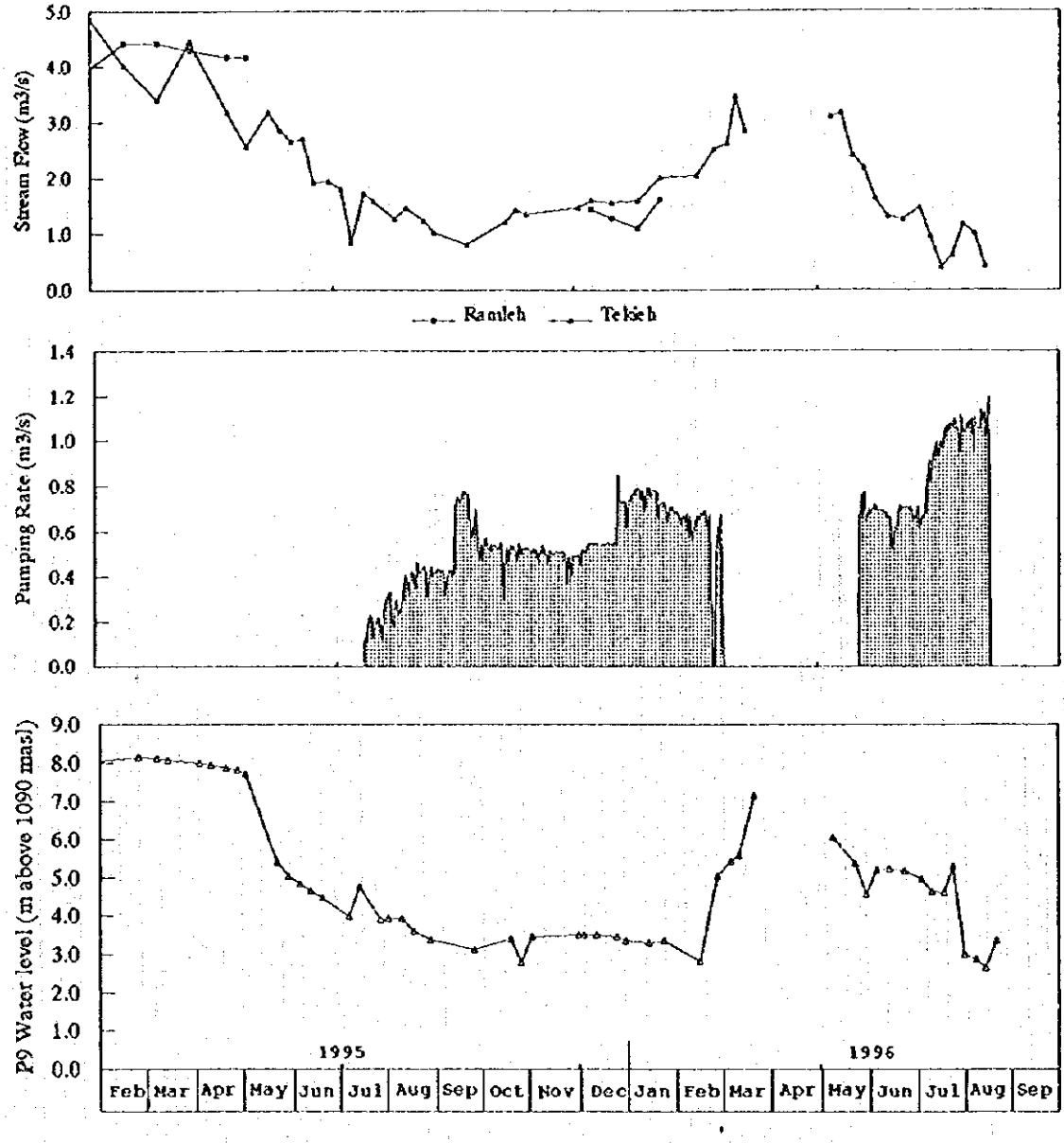
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2.32g
Analysis of Pumping Test Barada

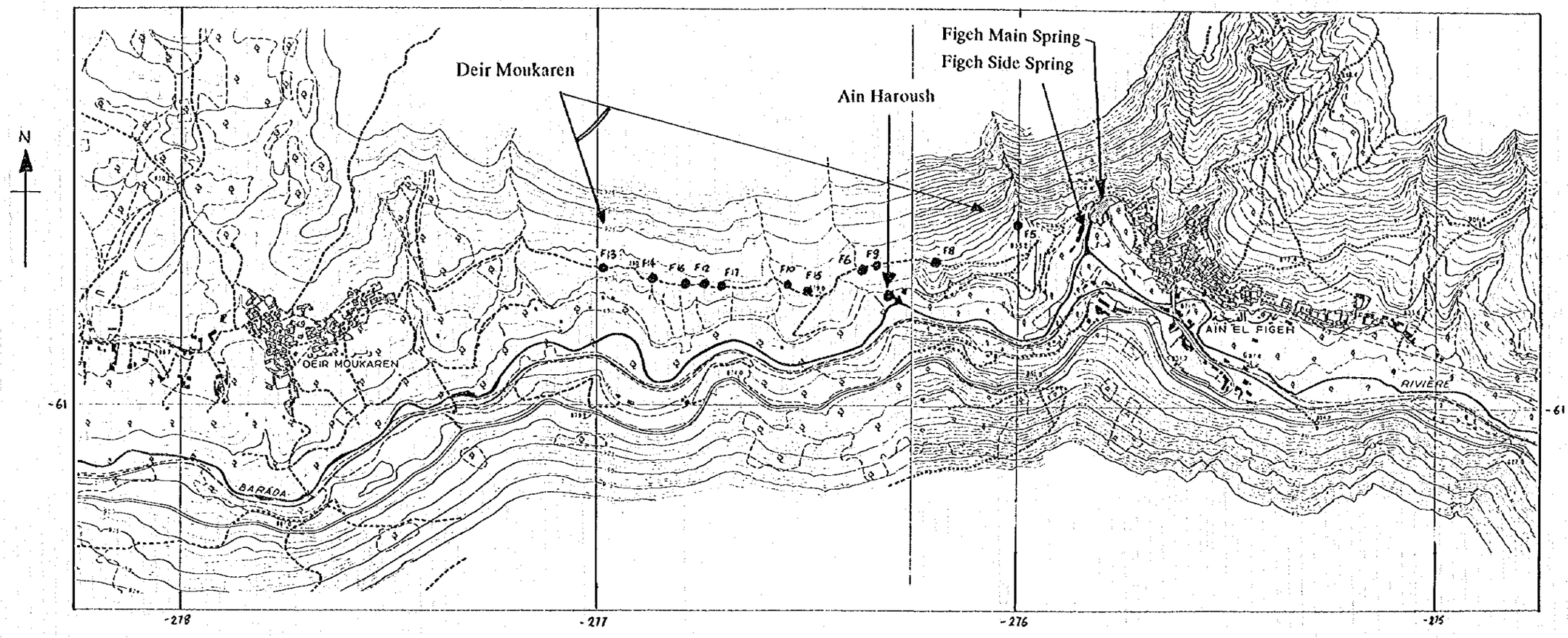
NIPPON KOEI CO., LTD.



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.33a Operational Use of Barada 1991-96
NIPPON KOEI CO., LTD.



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.33b Operational Use of Barada 1995-96
NIPPON KOEI CO., LTD.



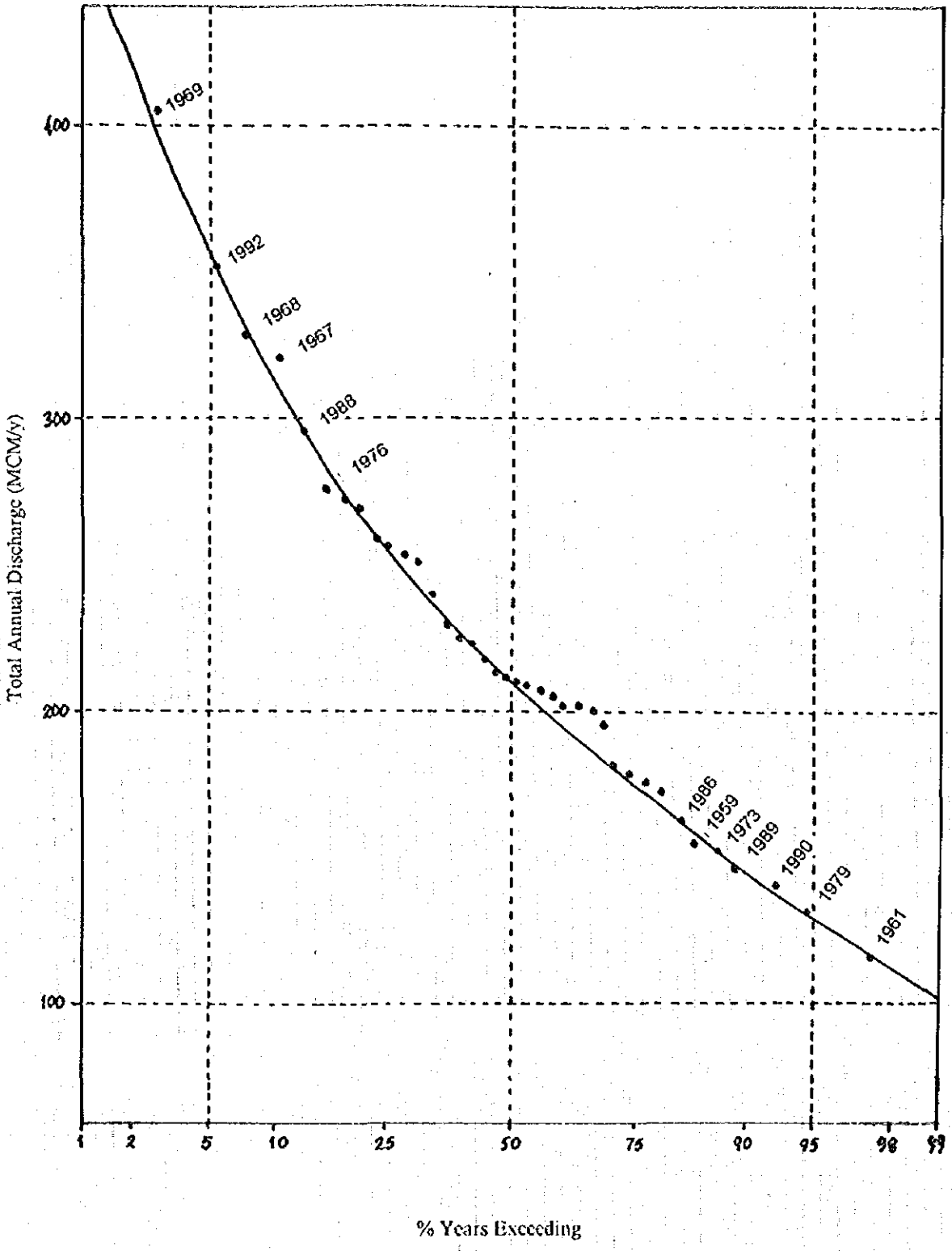
Source: 1:5,000 Map of Barada Valley (French Language)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

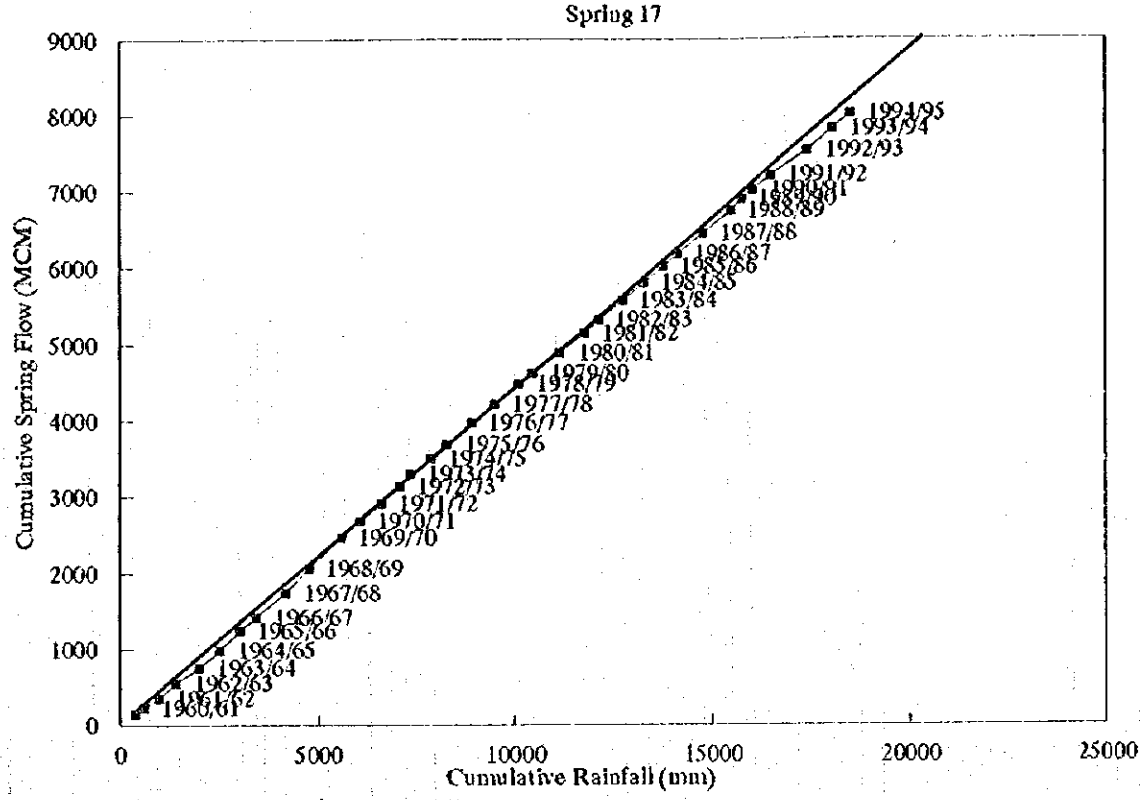
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

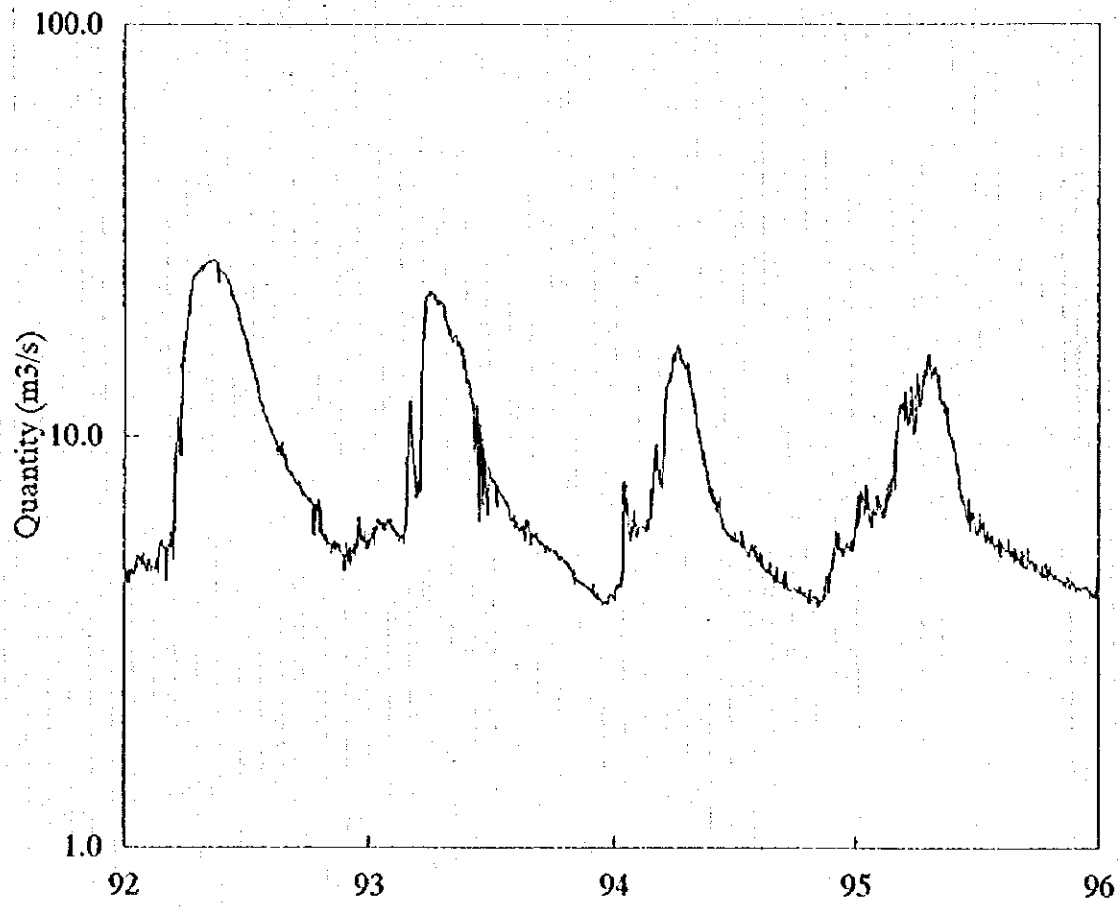
Figure C-2.34
Map of Springs in the Figeh Area

NIPPON KOEI CO., LTD

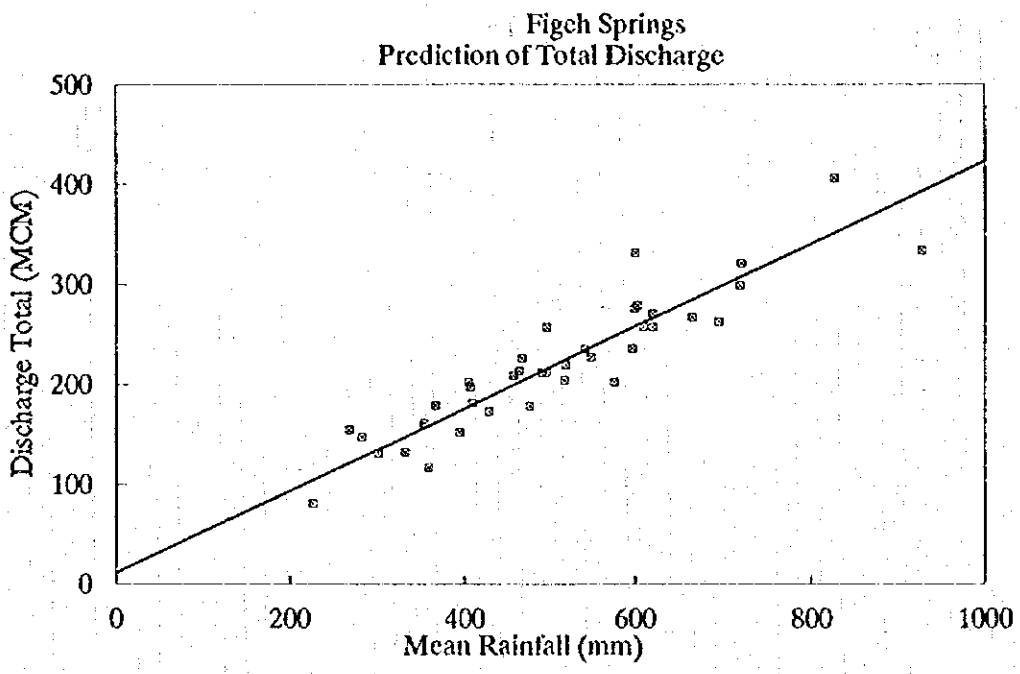


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.35 Annual Discharge Probability Curve
NIPPON KOEI CO., LTD.

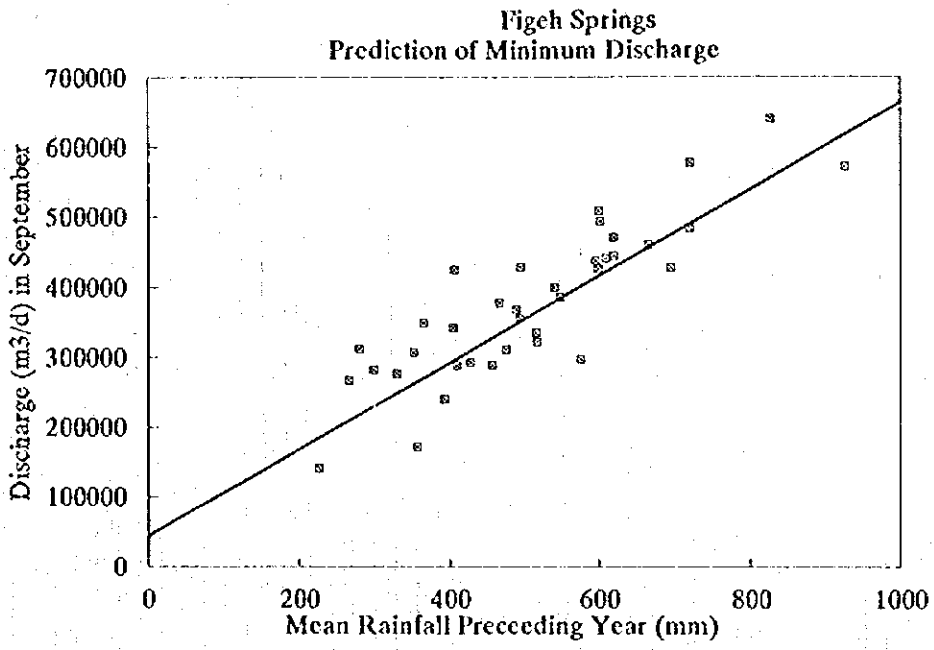


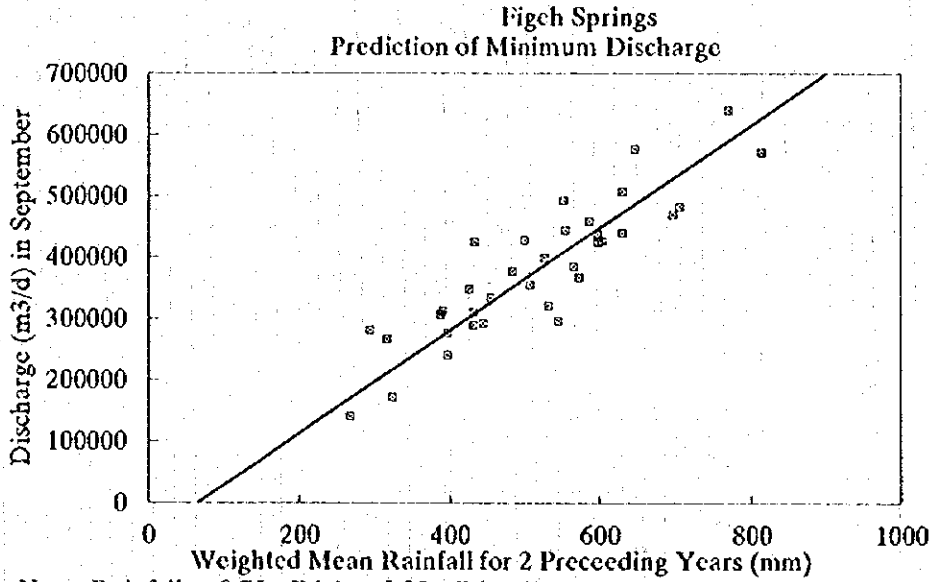


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.36 Cumulative Discharge & Rainfall, Figeh Figure C-2.37 Hydrographs 1992 to 1996, Figeh
NIPPON KOEI CO., LTD.



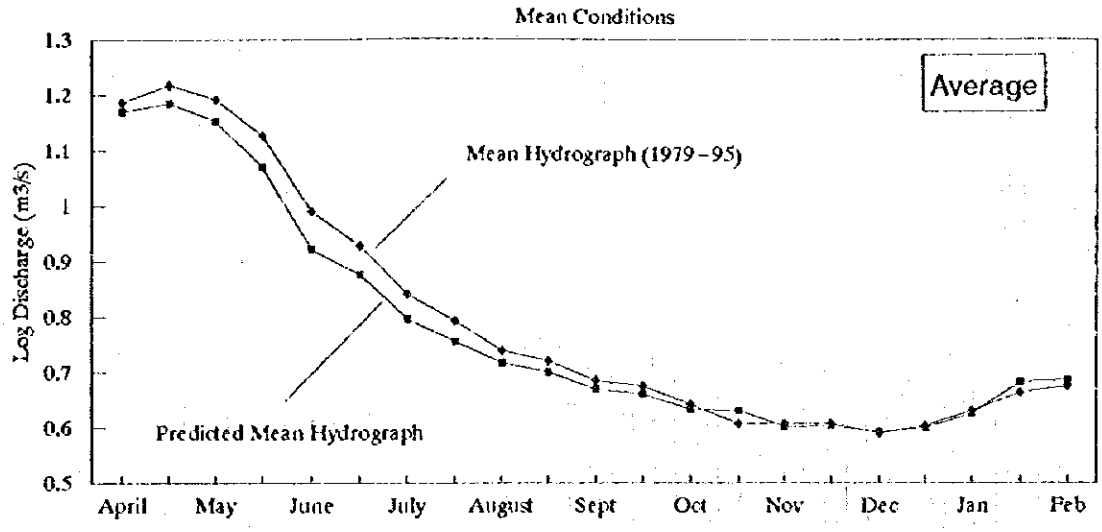
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.38 Rainfall & Total Discharge at Figeh
NIPPON KOEI CO., LTD.

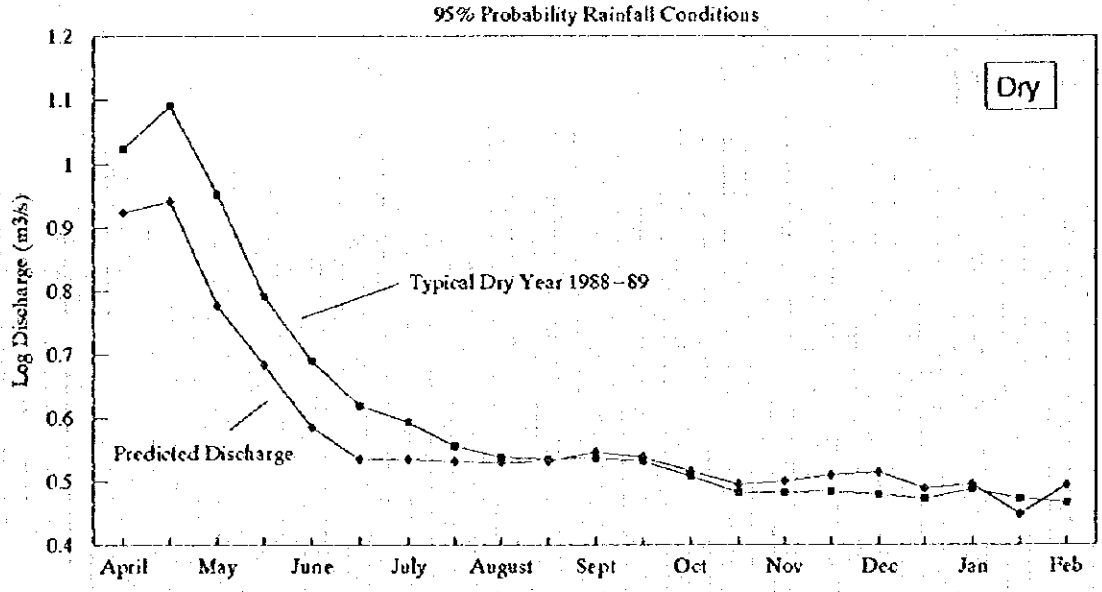


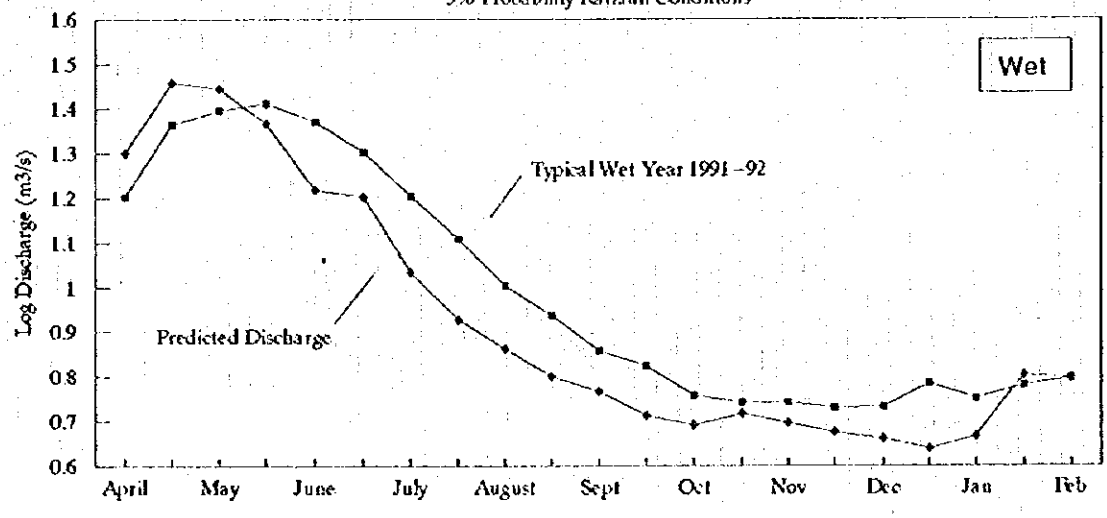


Note: Rainfall = 0.75 x R(n) + 0.25 x R(n−1)
Where: R is rainfall, n is year

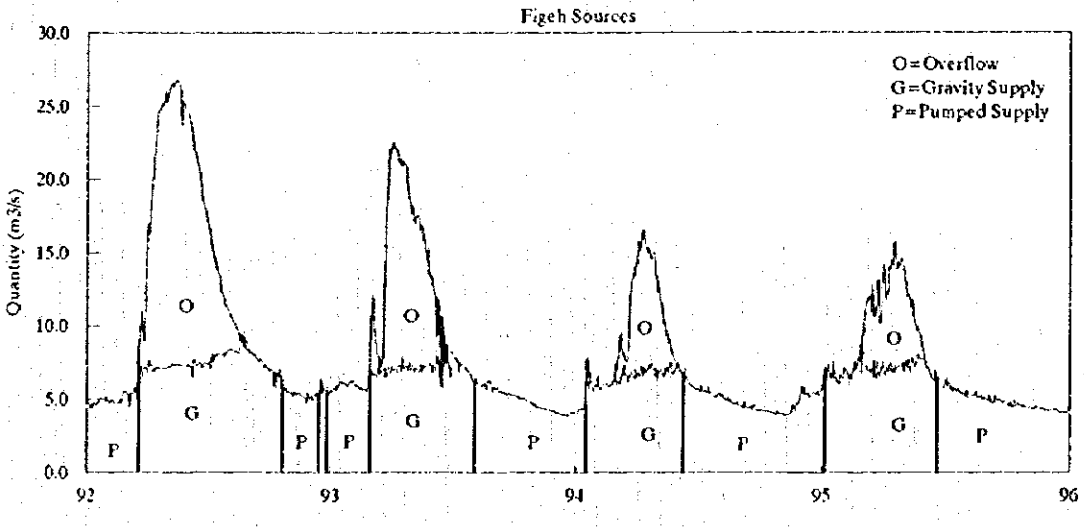
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.39 Rainfall & September Discharge at Figeh
NIPPON KOEI CO., LTD.



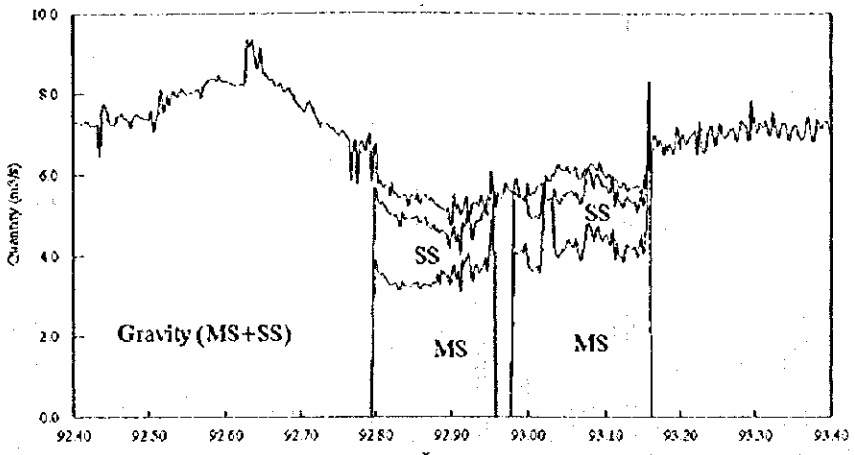


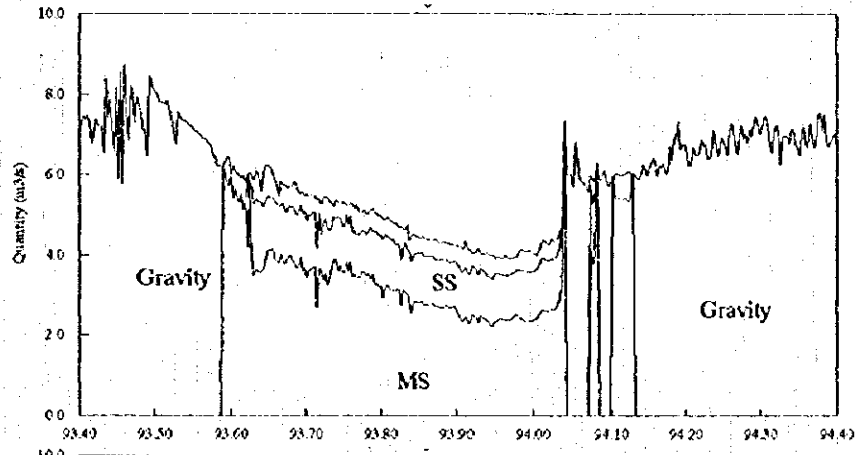


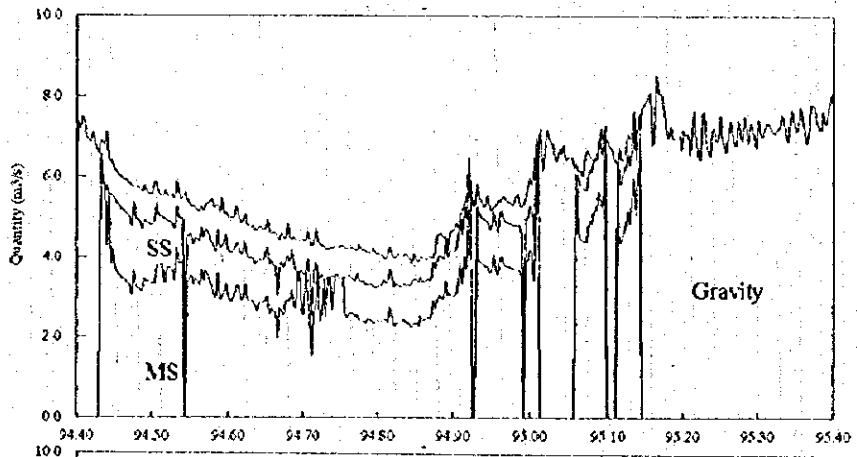
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.40 Actual & Predicted Flows at Figeh
NIPPON KOEI CO., LTD.

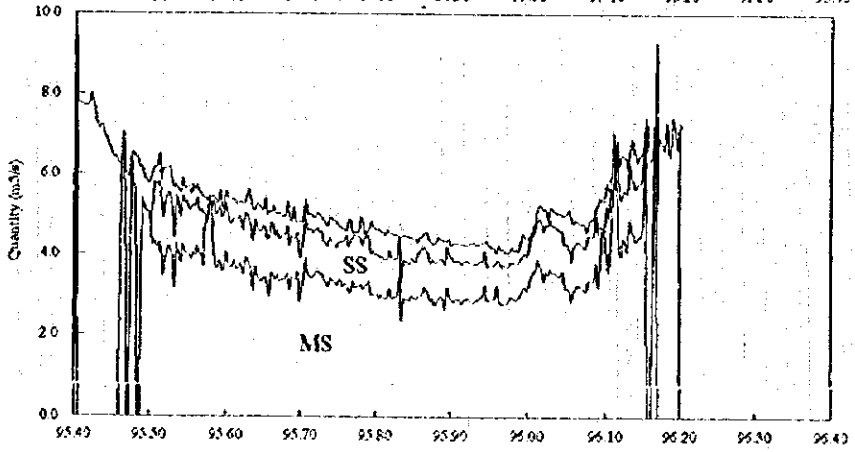


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.41 Operational Use of Figeh 1992-1996
NIPPON KOEI CO., LTD.









MS=Main Spring

SS=Side Spring

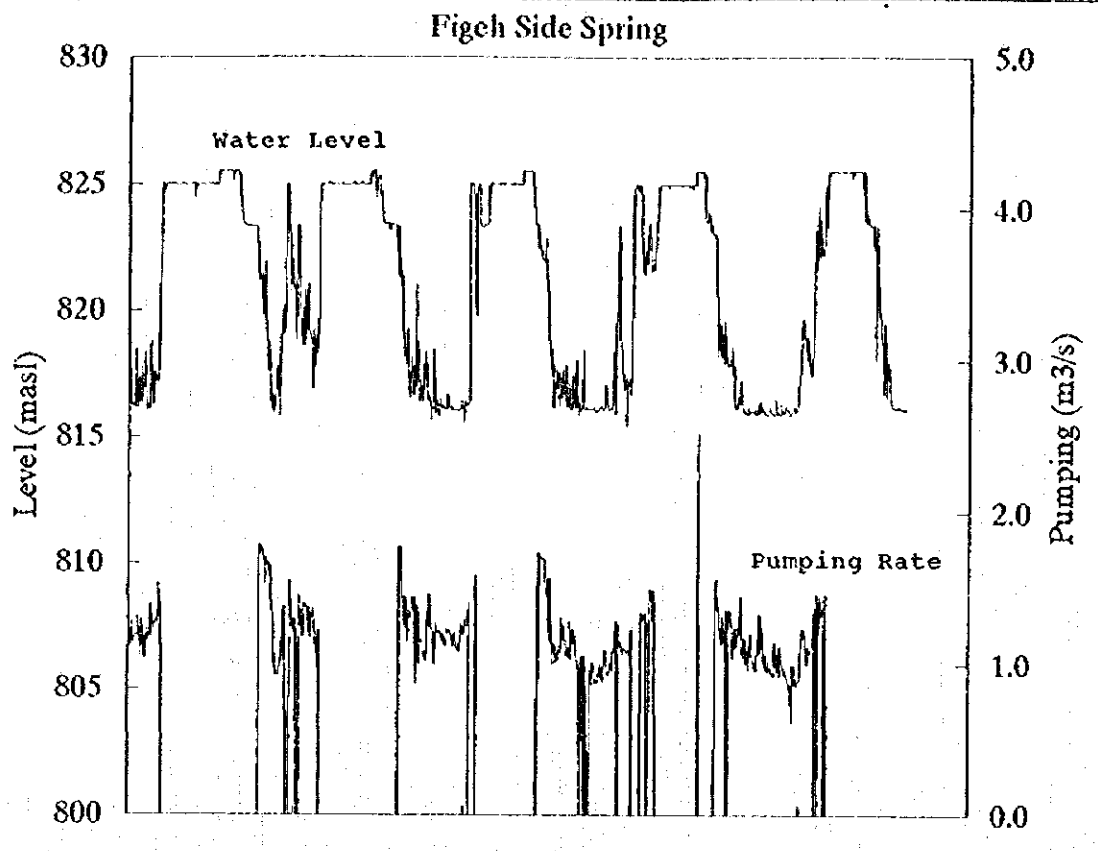
Harouch=Top

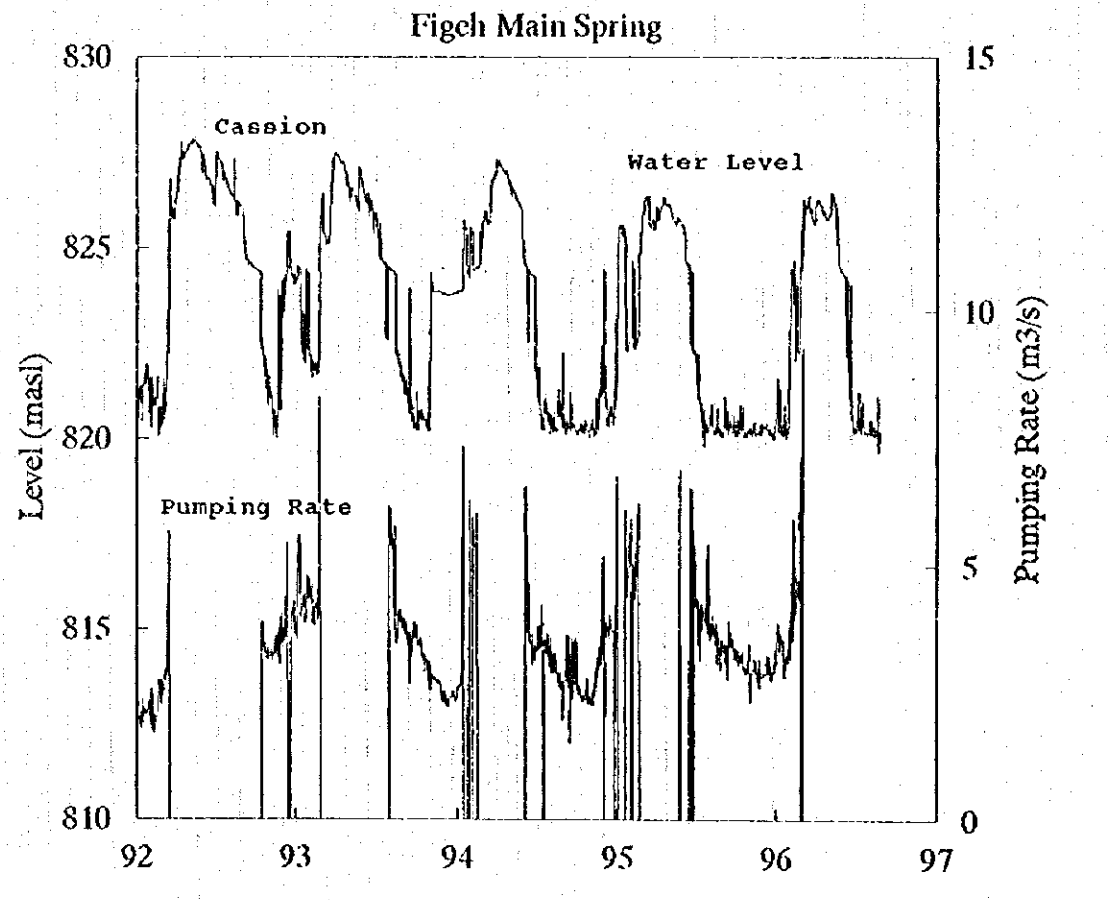
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

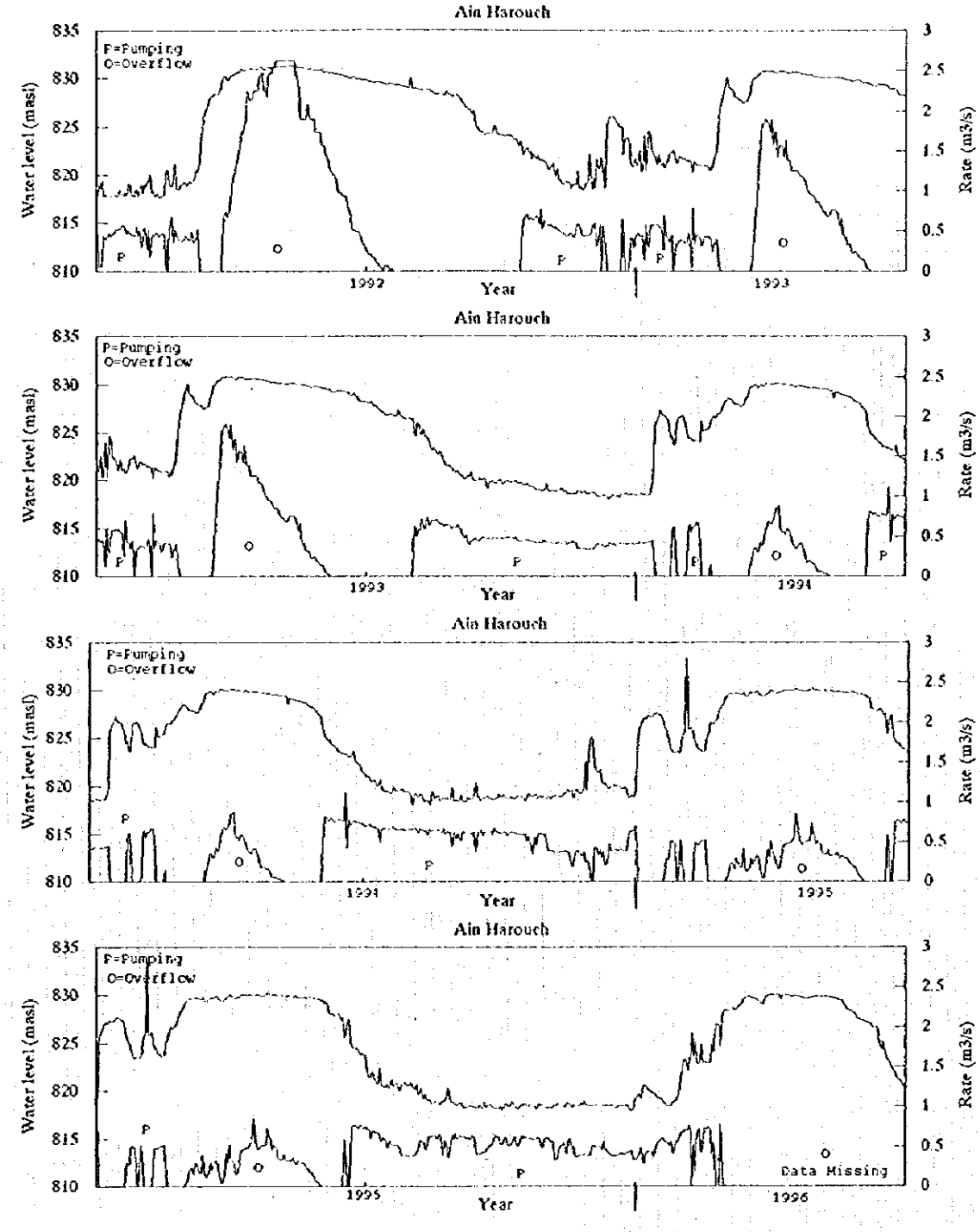
Figure C-2.42
Annual Graphs of Output, Figeh

NIPPON KOEI CO., LTD.

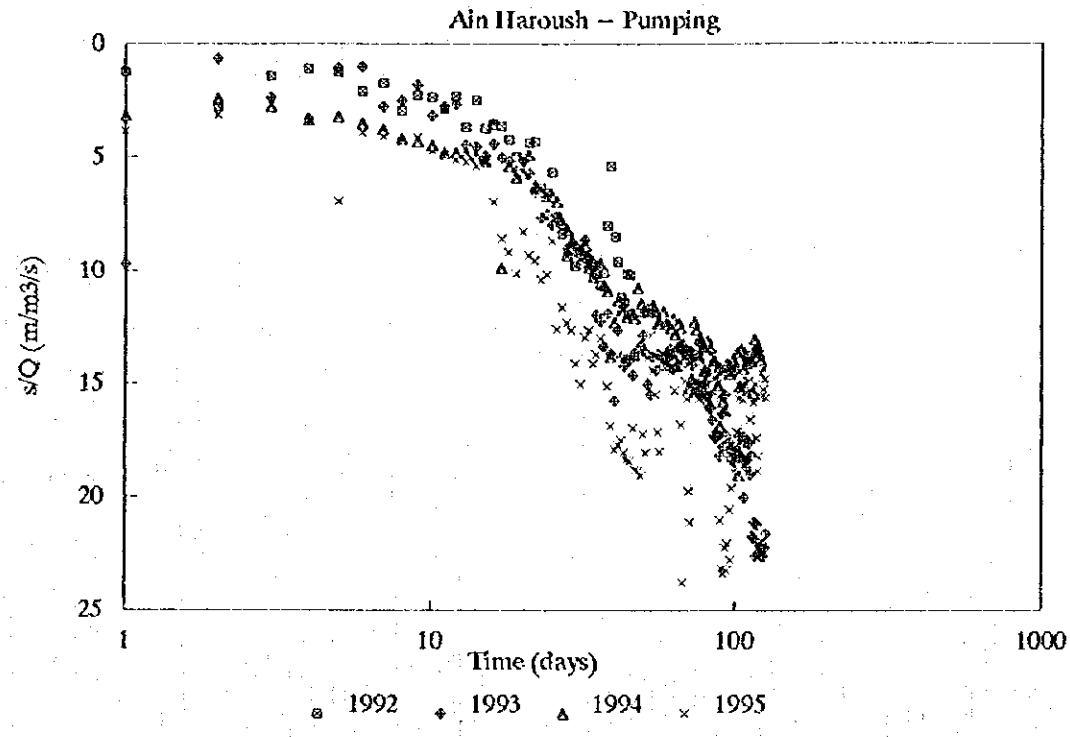


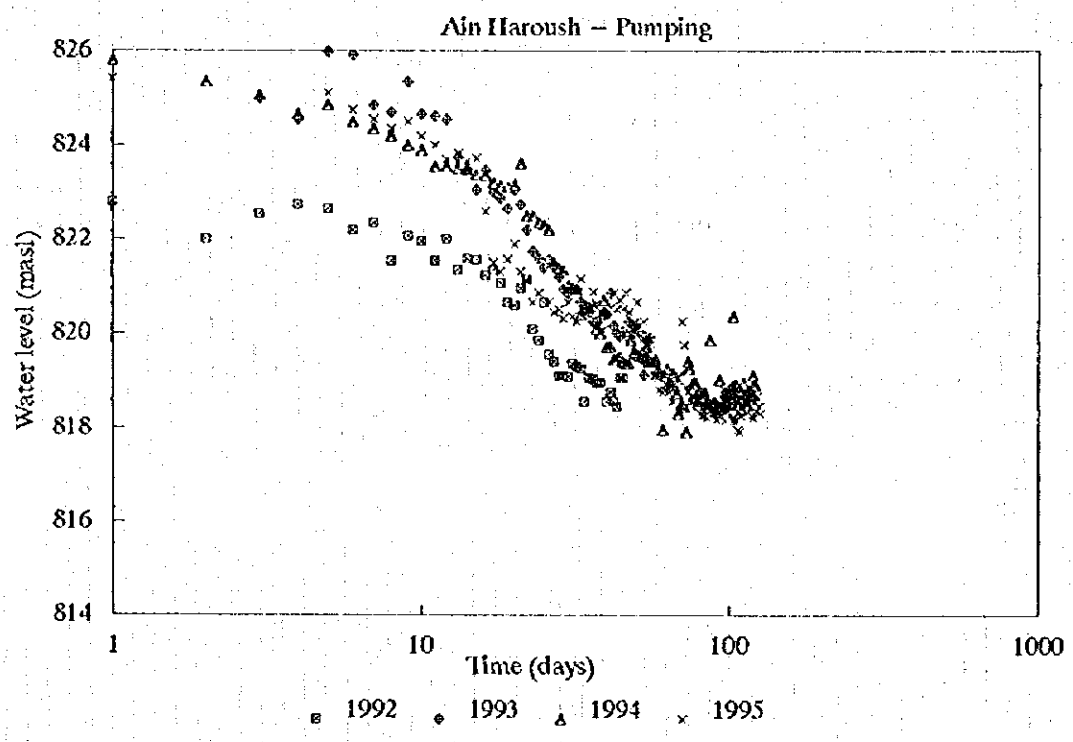


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.43 Water Levels & Pumping Side Spring Figure C-2.44 Water Levels & Pumping Main Spring
NIPPON KOEI CO., LTD.

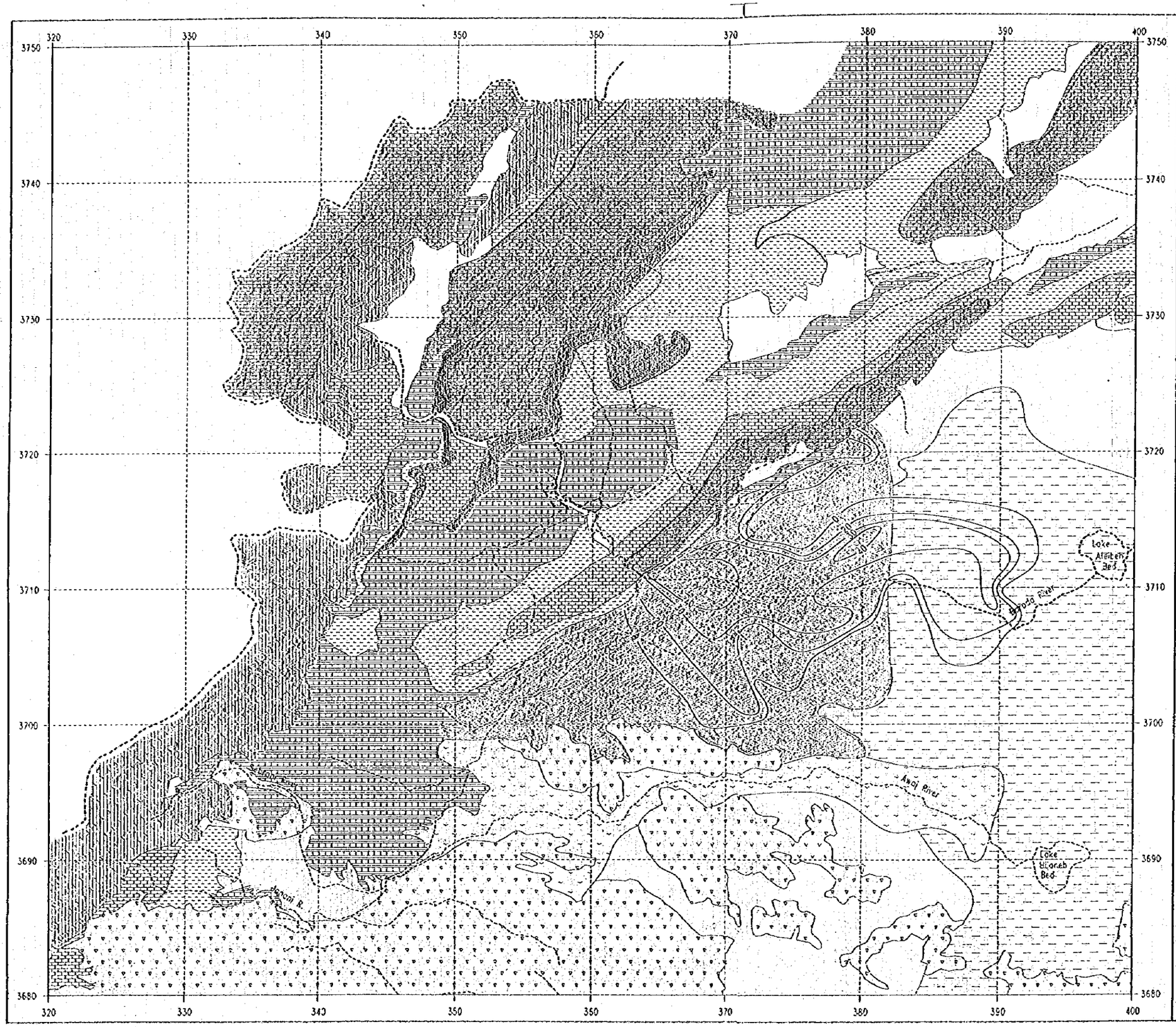


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.45 Hydrographs & Pumping Ain Haroush
NIPPON KOEI CO., LTD.





JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.46 Well Behaviour, Ain Haroush
NIPPON KOEI CO., LTD.



Hydrogeological Map

LEGEND

- —20— Upper Quaternary Pebble Beds Isopachites
- Water Courses
- Geological Boundarys
- International Boundarys
- DAWSSA served area proposed in City plan

Symbol

- Quaternary Alluvium
- Quaternary Sand & Gravel
- Quaternary, Lacustrine Deposits
- Neogene, Conglomerates
- Paleogene, Limestones & Marl
- Paleogene, Marl & Limestones
- Cretaceous, Limestone, Dolomite, Sandstone
- Jurassic, Limestone & Dolomite
- Neogene to Quaternary, Basalt

Aquifer Productivity

- Good
- Medium
- Poor
- Unproductive

N

Scale (km)

5 0 5 10 15

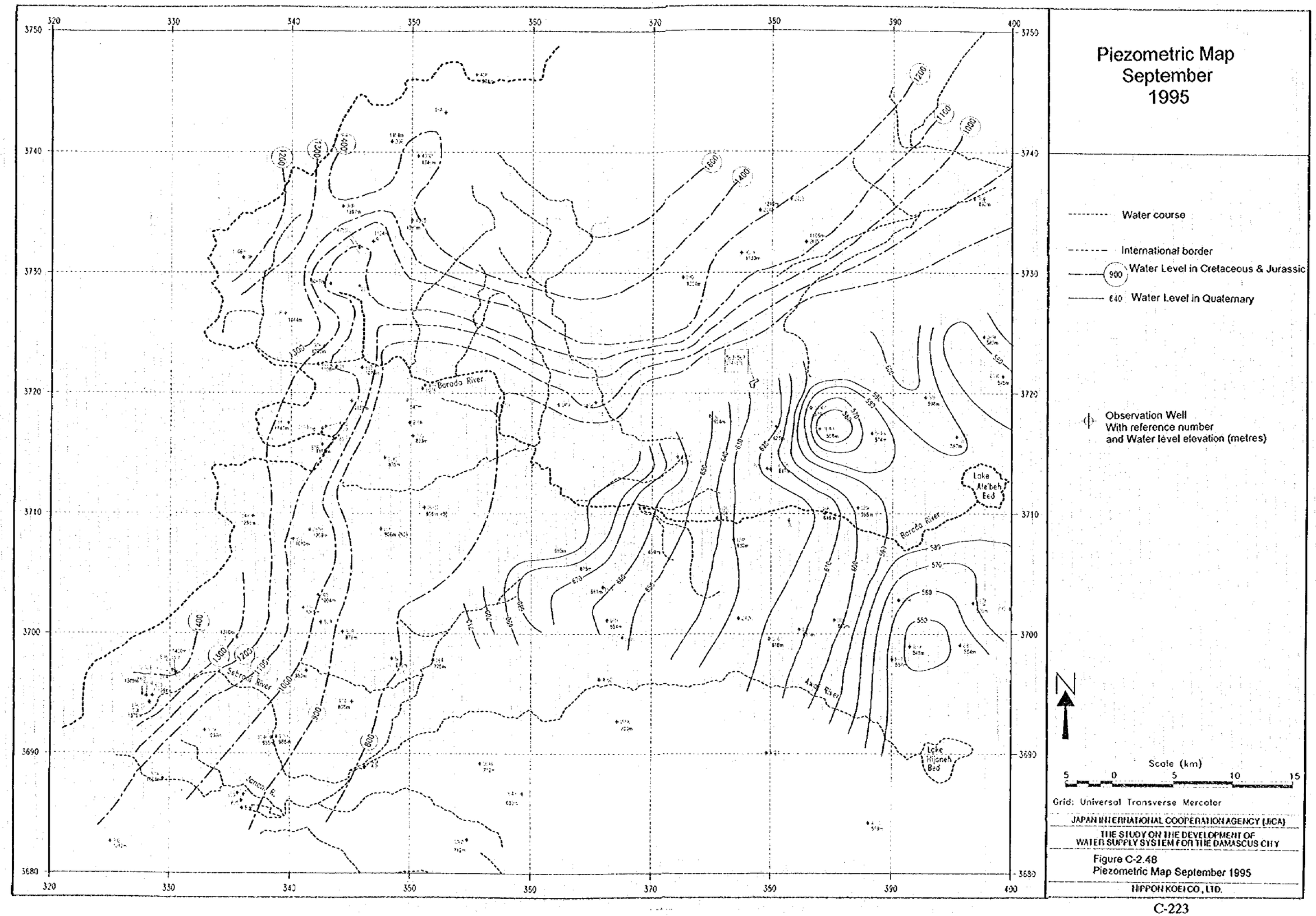
Grid: Universal Transverse Mercator

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2.47
Hydrogeological Map

NIPPON KOEI CO., LTD.



Piezometric Map September 1995

- Water course
- International border
- 900 Water Level in Cretaceous & Jurassic
- 640 Water Level in Quaternary
- Observation Well With reference number and Water level elevation (metres)

N

Scale (km)
5 0 5 10 15

Grid: Universal Transverse Mercator

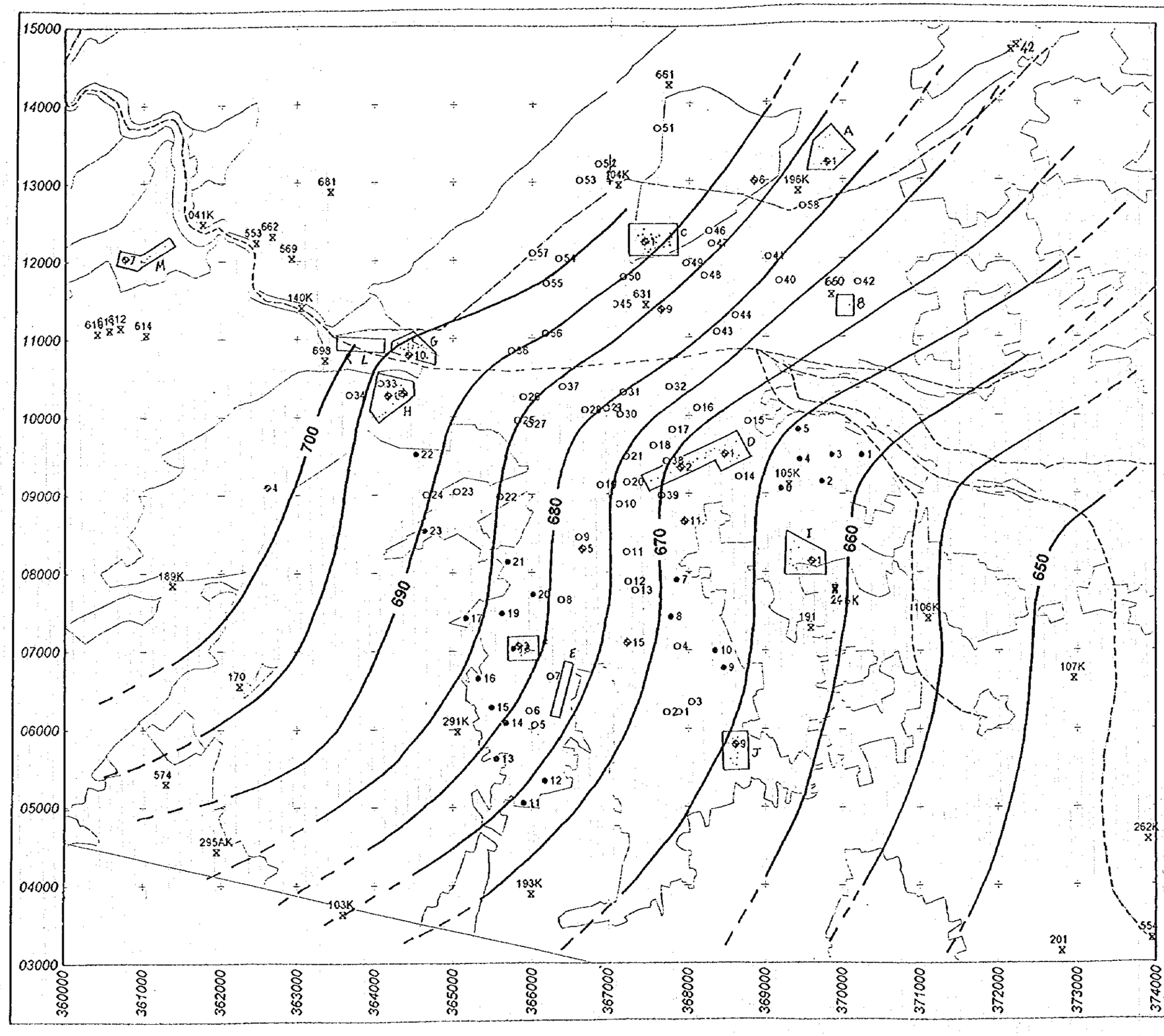
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2.48
Piezometric Map September 1995

NIPPON KOEI CO., LTD.

Piezometric Map
June 1994



Legend

DAWSSA Wellfield	Fringe Bh
Observation Bh	Emergency Bh
	Other Bh

Key to DAWSSA Wellfields

A	Kaboon
B	Jobar
C	Mazraa
D	Ibn Assaker
E	Kadam Railway
F	Kadam Store
G	Oumawiyin
H	University
I	Jaramana
J	Takadom
K	Kywan
L	Tishreen
M	Dummar

Contour Interval 5 m
UTM Grid
North at top of map

Scale 1:50,000

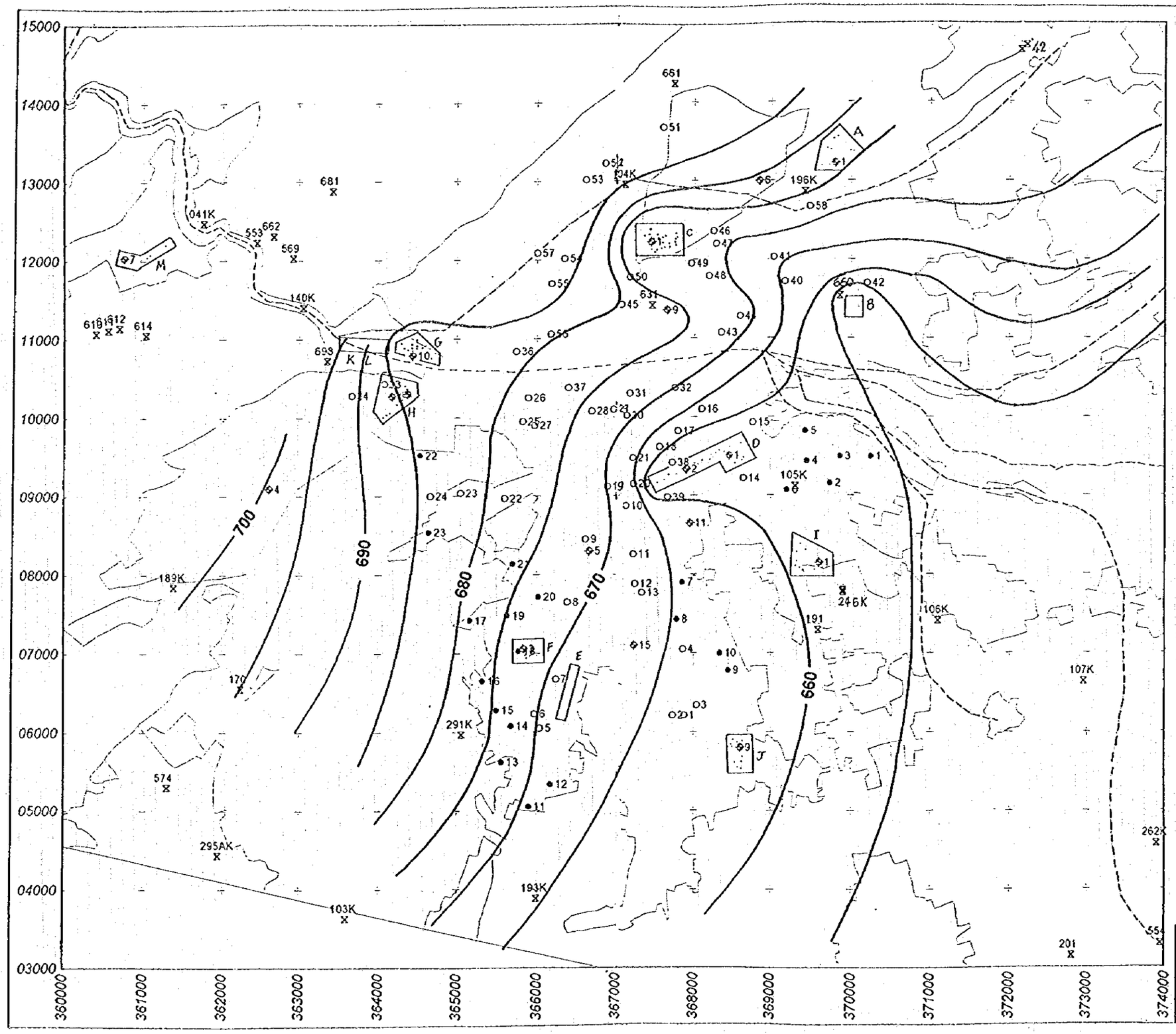
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2.49
Piezometric Map June 1994

NIPPON KOEI CO., LTD.

Piezometric Map
November 1994



Legend

DAWSSA Wellfield	Fringe Bh
Observation Bh	Emergency Bh
	Other Bh

Key to DAWSSA Wellfields

A	Kaboon
B	Jobar
C	Mazraa
D	Ibn Assaker
E	Kadam Railway
F	Kadam Store
G	Oumawiyin
H	University
I	Jaramana
J	Takadom
K	Kywan
L	Tishreen
M	Dummar

Contour Interval 5 m
UTM Grid
North at top of map

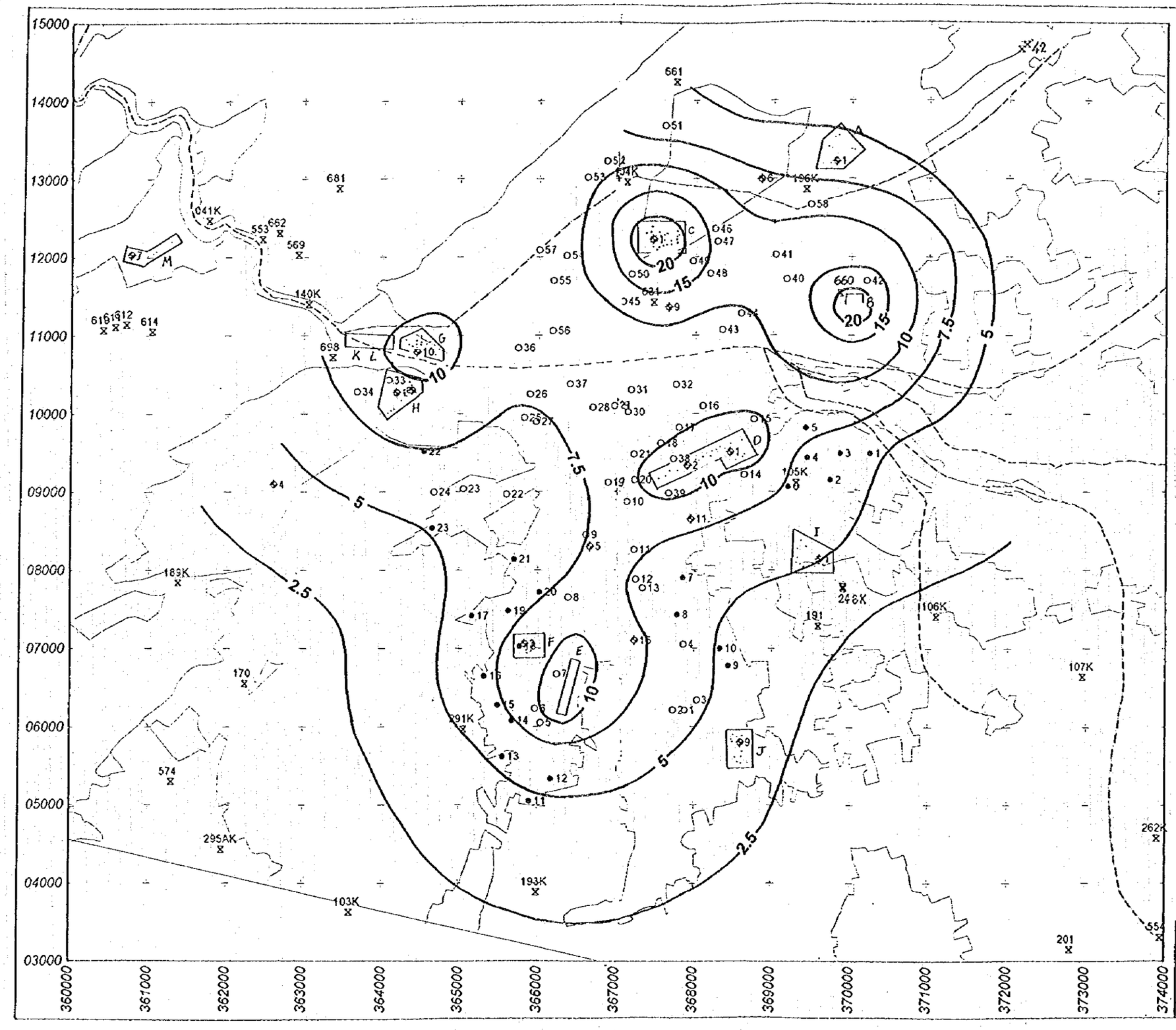
Scale 1:50,000

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2-50
Piezometric Map November 1994

NIPPON KOEI CO., LTD.



Isodrawdown Map
June-November 1994

Drawdowns in metres

Legend	
DAWSSA Wellfield	Fringe Bh
Observation Bh	Emergency Bh
	Other Bh

Key to DAWSSA Wellfields

A	Kaboon
B	Jobar
C	Mazraa
D	Ibn Assaker
E	Kadam Railway
F	Kadam Store
G	Oumawiyin
H	University
I	Jaramana
J	Takadom
K	Kywan
L	Tishreen
M	Dummar

Contour Interval Variable
UTM Grid
North at top of map
Scale 1:50,000

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

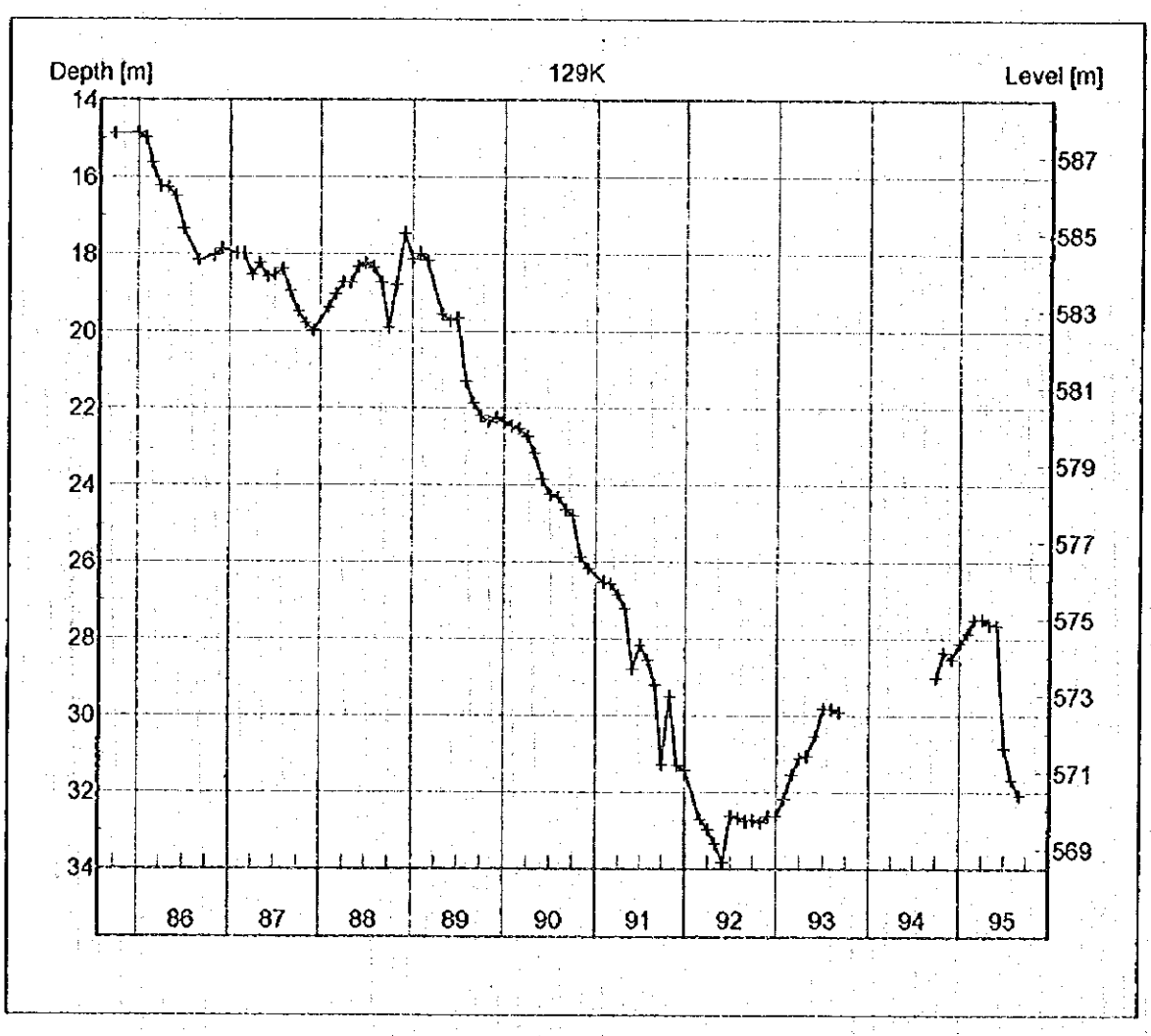
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2-51
Isodrawdown Map for 1994

NIPPON KOEI CO., LTD.

Groundwater Hydrograph

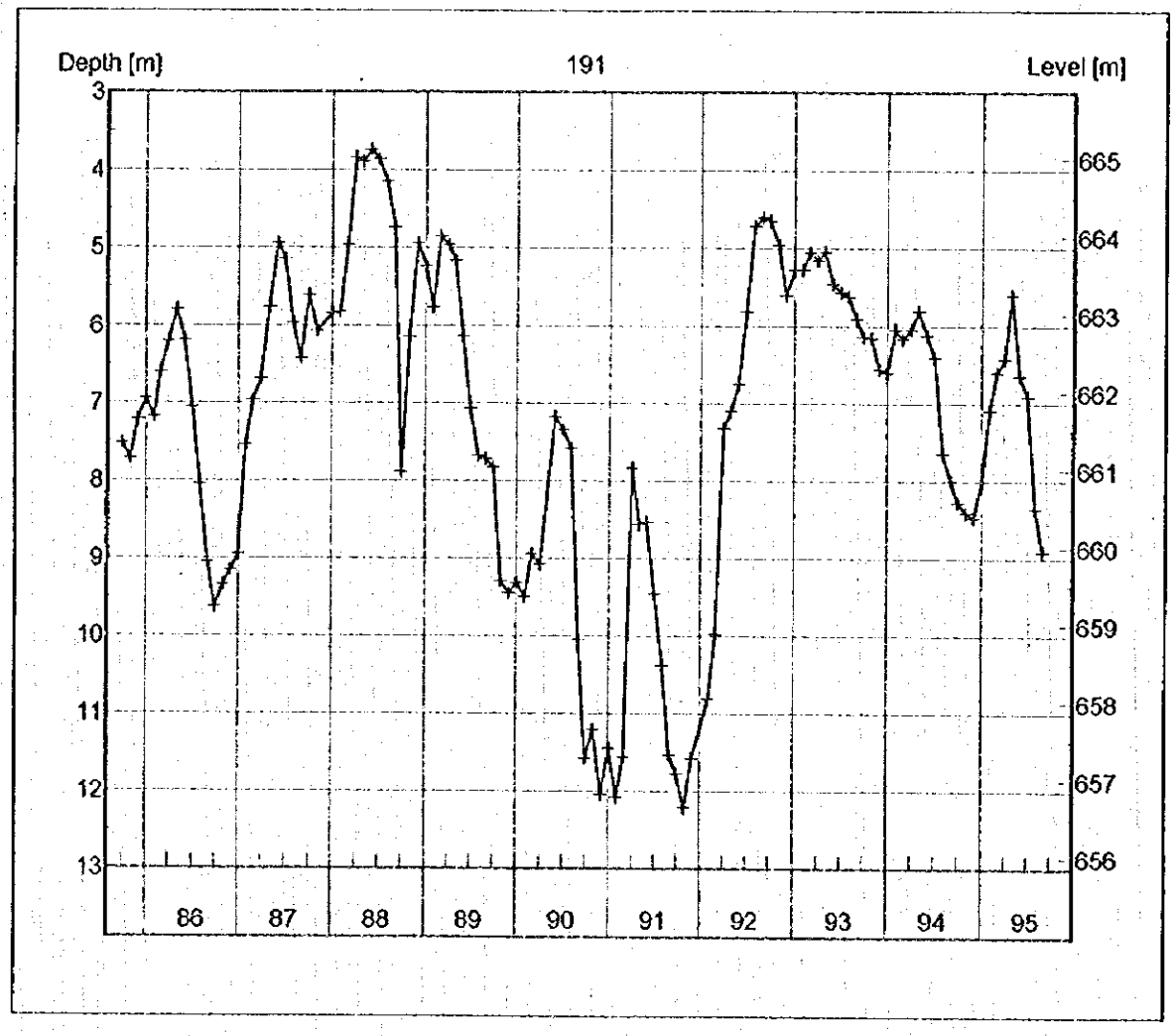
Well Id	Name	Ops. Number	Well Total Depth (m)
129K	Kafrain		40.0
Eastings (m)	**Northings (m)**	**Ground Surf. Elev.**	**Measuring Pt. Elev.**
396830	3702586	601.22	602.48



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.52 Groundwater Hydrograph Well 129K
NIPPON KOEI CO., LTD.

Groundwater Hydrograph

Well Id	Name	Ops. Number	Depth (m)
191			
Eastings (m)	**Northings (m)**	**Ground Surf. Elev.**	**Measuring Pt. Elev.**
369580	3707290	668.36	668.36

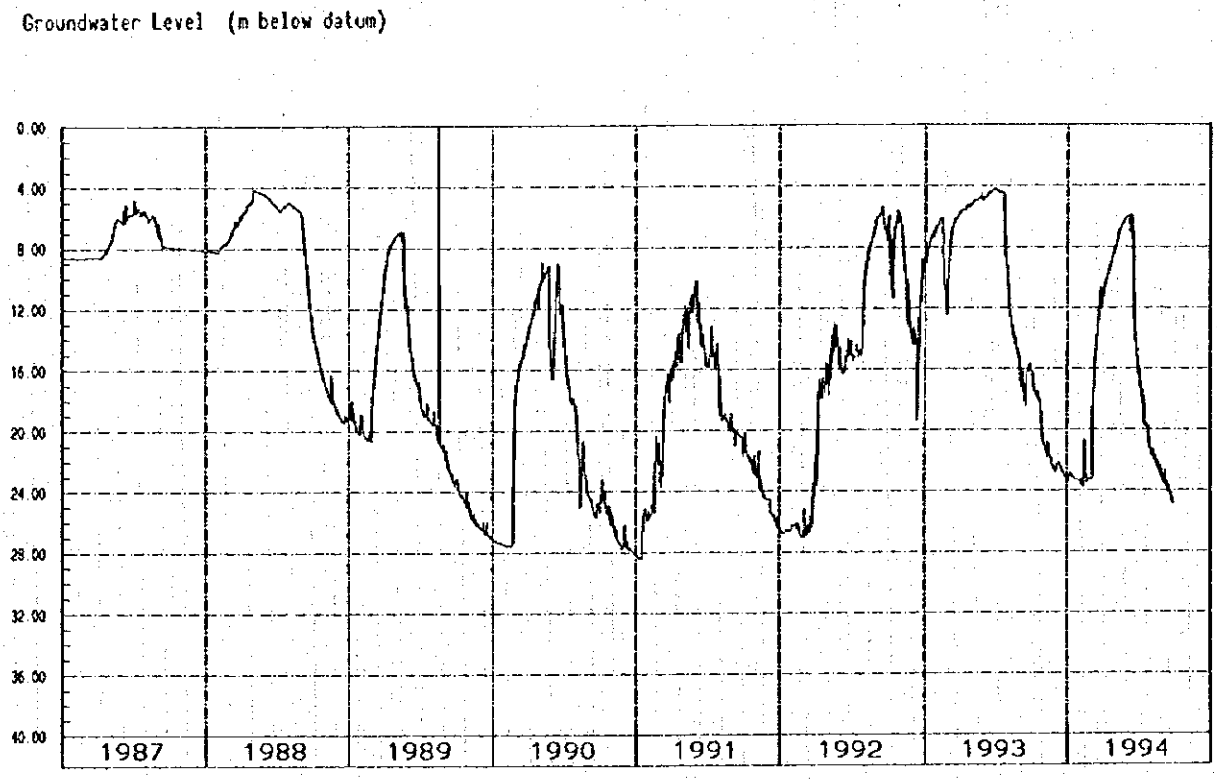


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2.53
Groundwater Hydrograph Well 191

NIPPON KOEI CO., LTD.

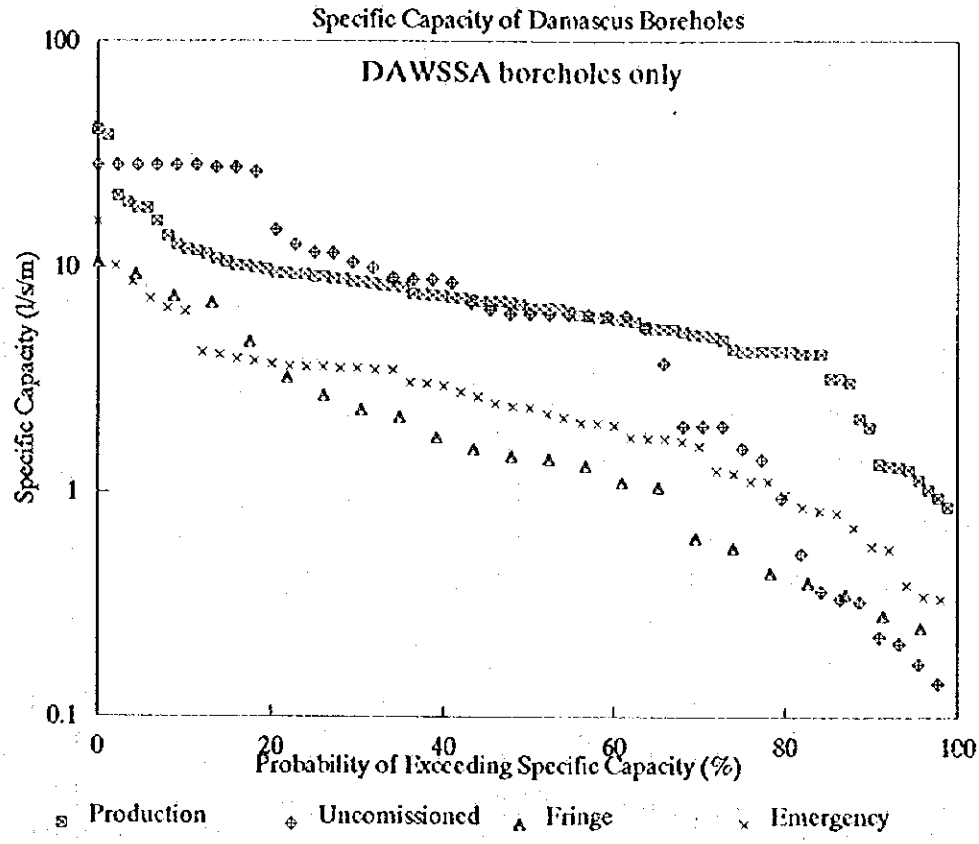


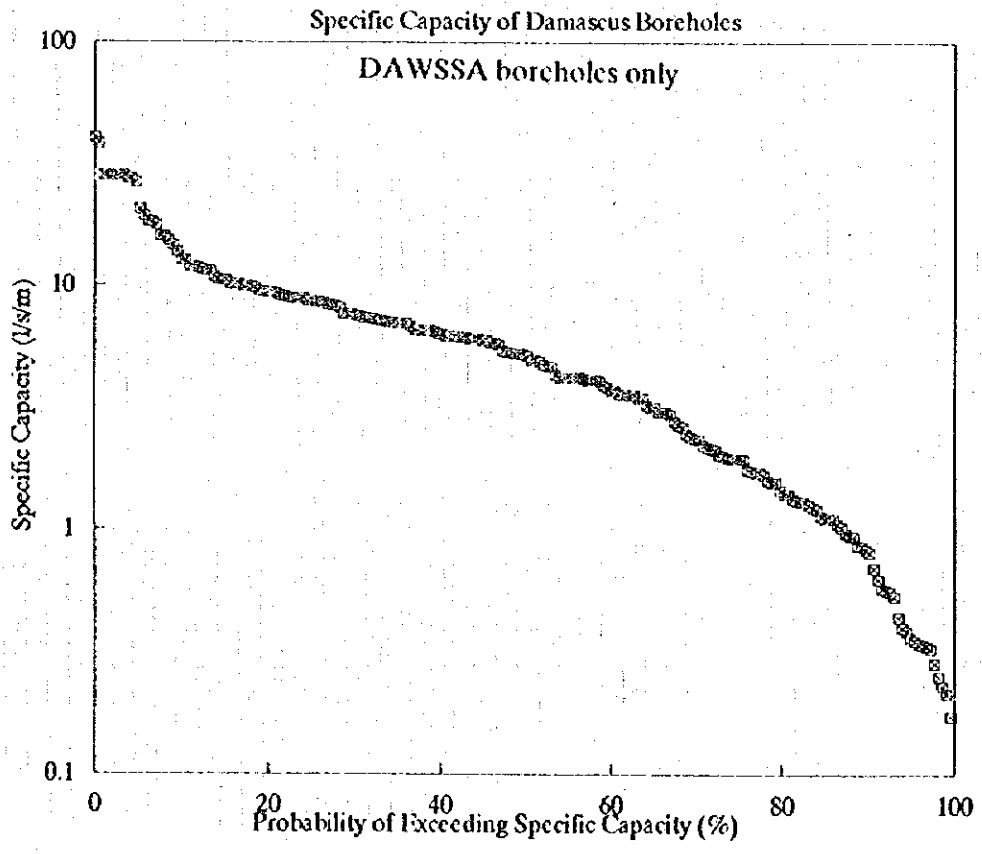
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-2.54
Groundwater Hydrograph Mazraa

NIPPON KOEI CO., LTD.

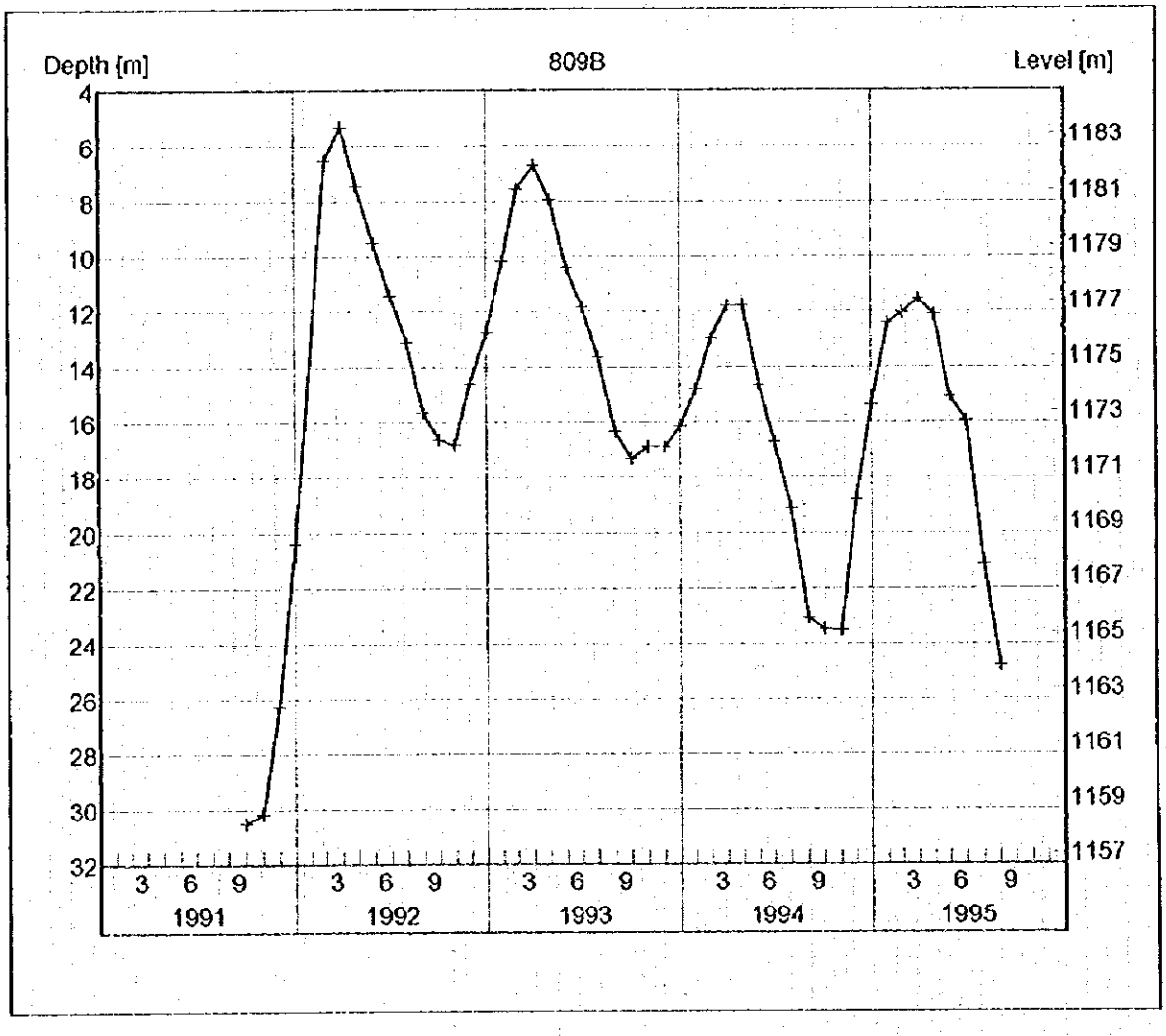




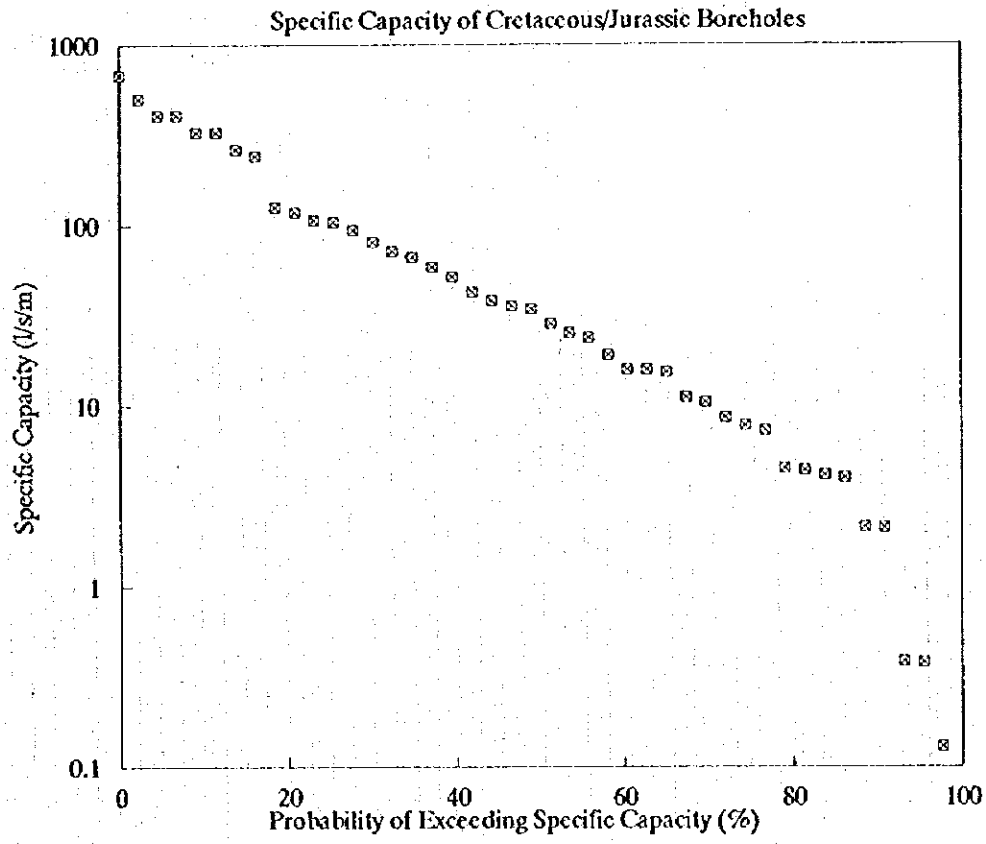
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.55 Quaternary Aquifer Specific Capacity
NIPPON KOEI CO., LTD.

Groundwater Hydrograph

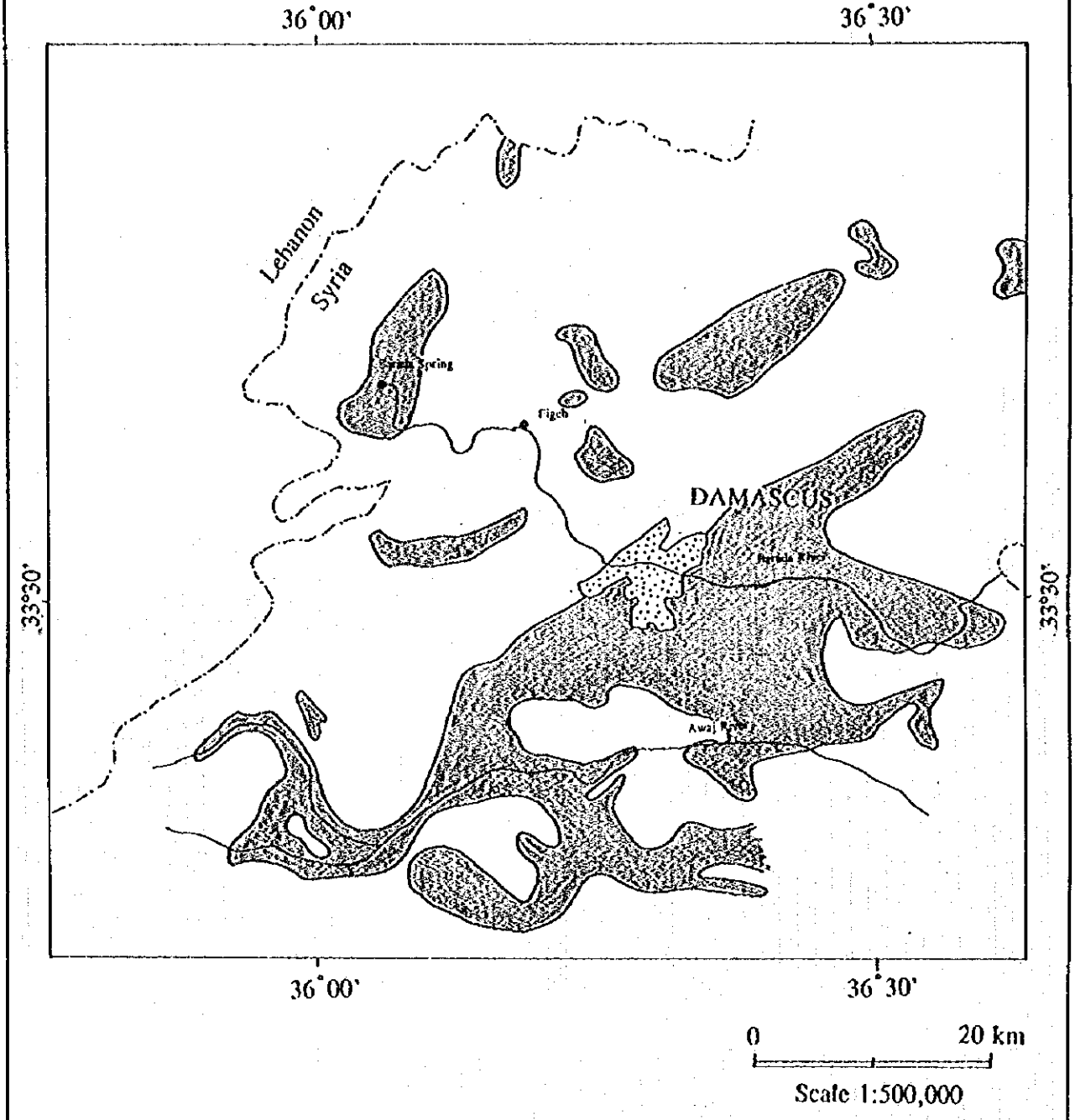
Well Id	Name	Ops. Number	Well Total Depth (m)
809B			
Eastings (m)	**Northings (m)**	**Ground Surf. Elev.**	**Measuring Pt. Elev.**
341954	3716959	1188.60	1188.60



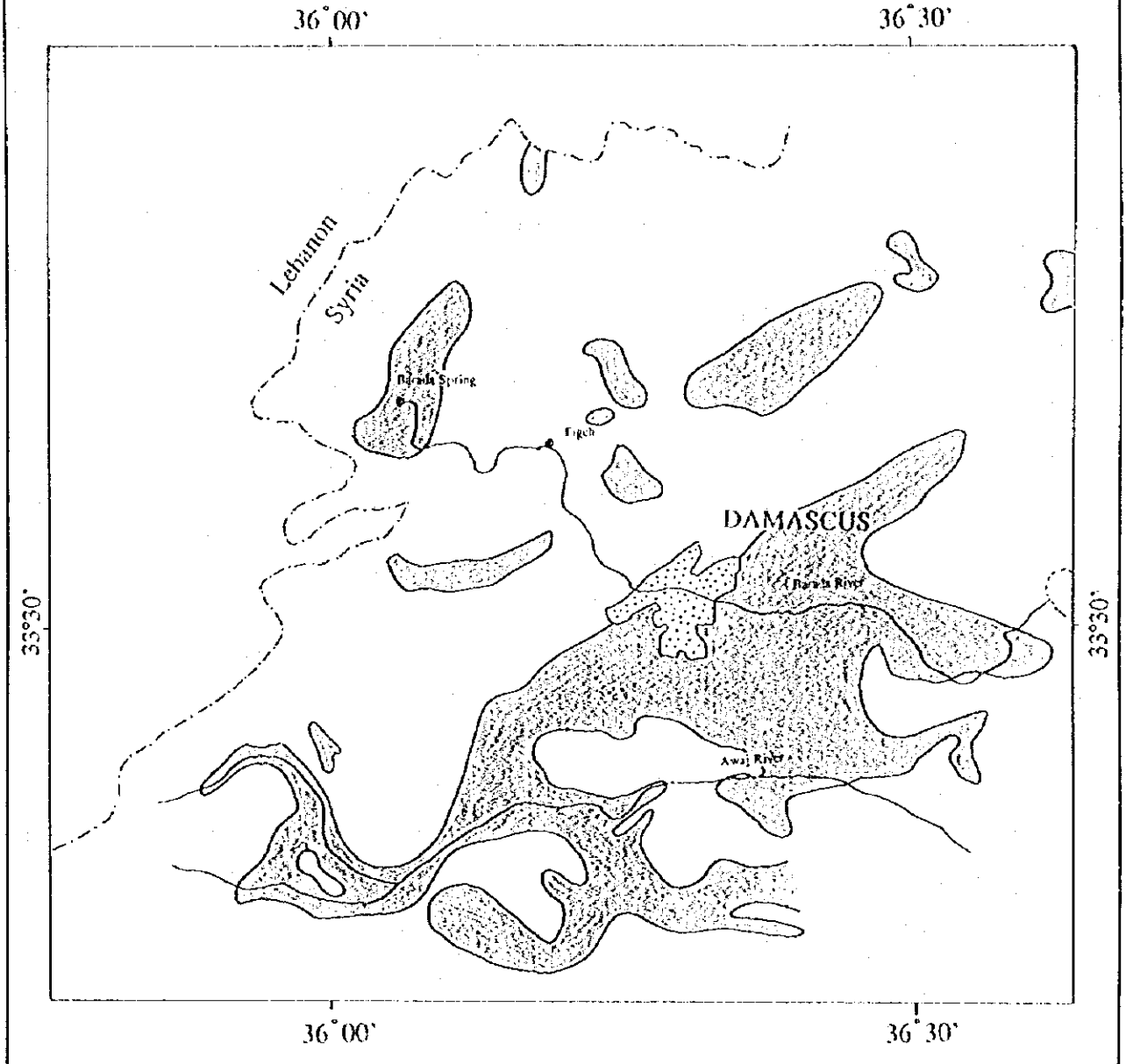
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.56 Groundwater Hydrograph Well 809B
NIPPON KOEI CO., LTD.



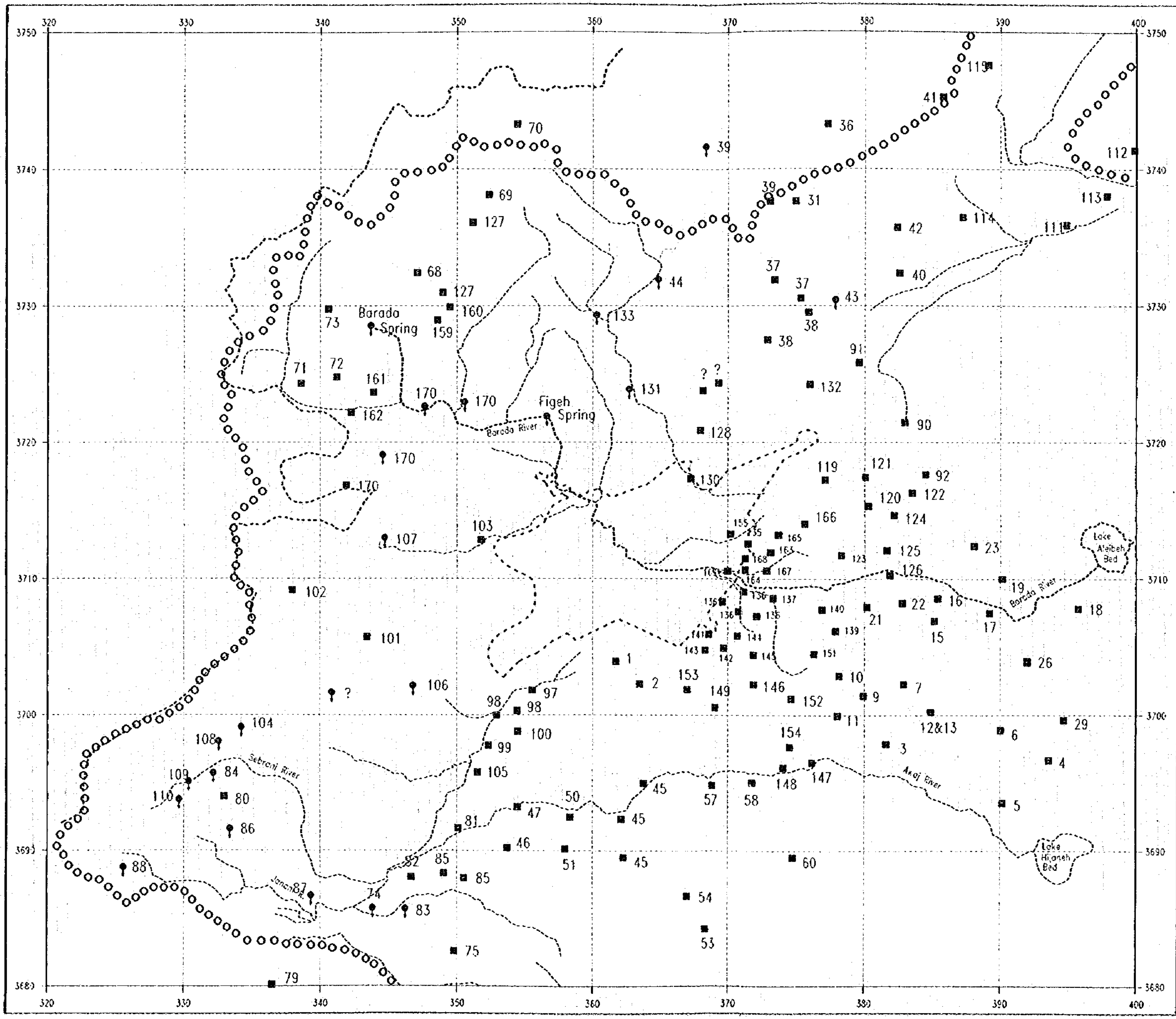
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-2.57 Karstic Aquifer Specific Capacity
NIPPON KOEI CO., LTD.



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-3.1 Map of Irrigated Areas
NIPPON KOEI CO., LTD.



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-3.1 Map of Irrigated Areas
NIPPON KOEI CO., LTD



Map of EDWSSR Water Sources

- - - - - DAWSSA served area proposed by City plan

■ EDWSSR Wellfield source

⫯ EDWSSR Spring source

Number Refers to Table

N

Scale (km)

5 0 5 10 15

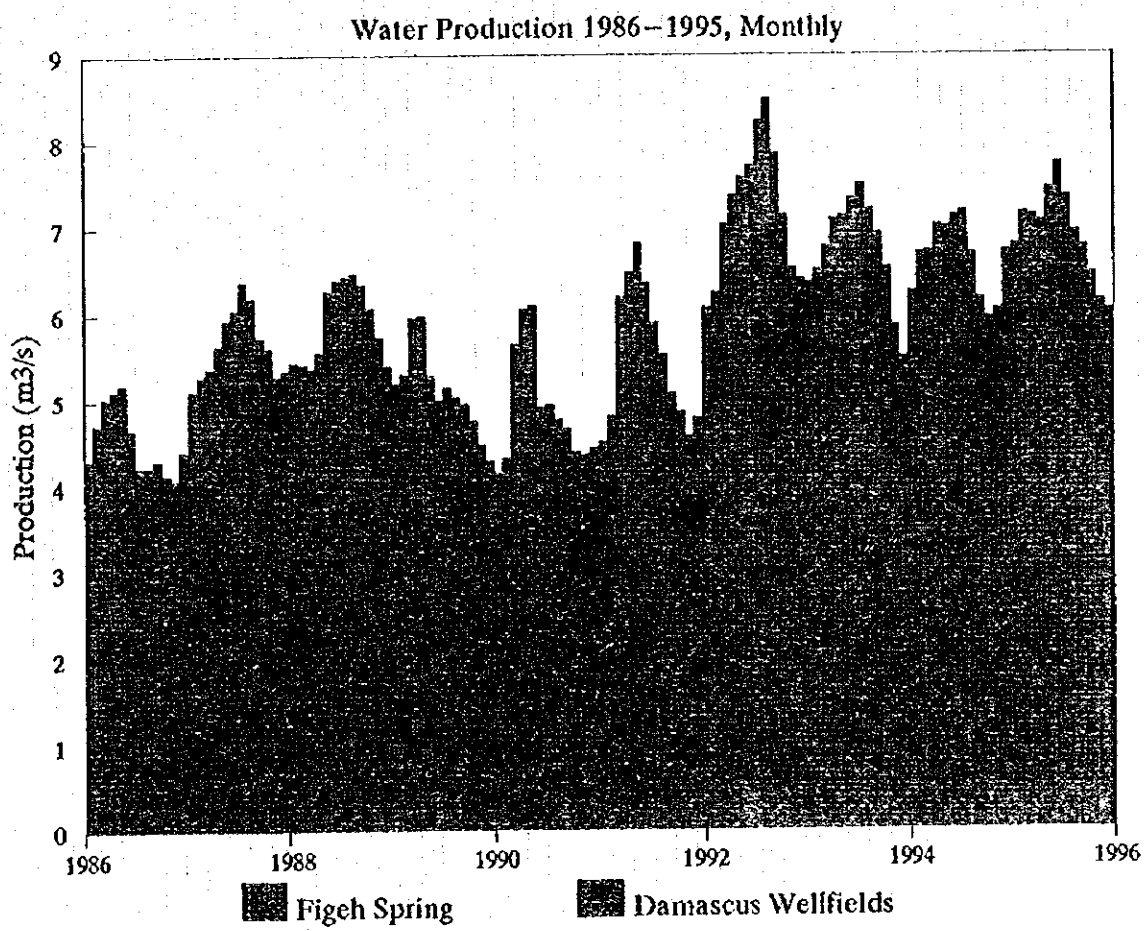
Grid: Universal Transverse Mercator

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

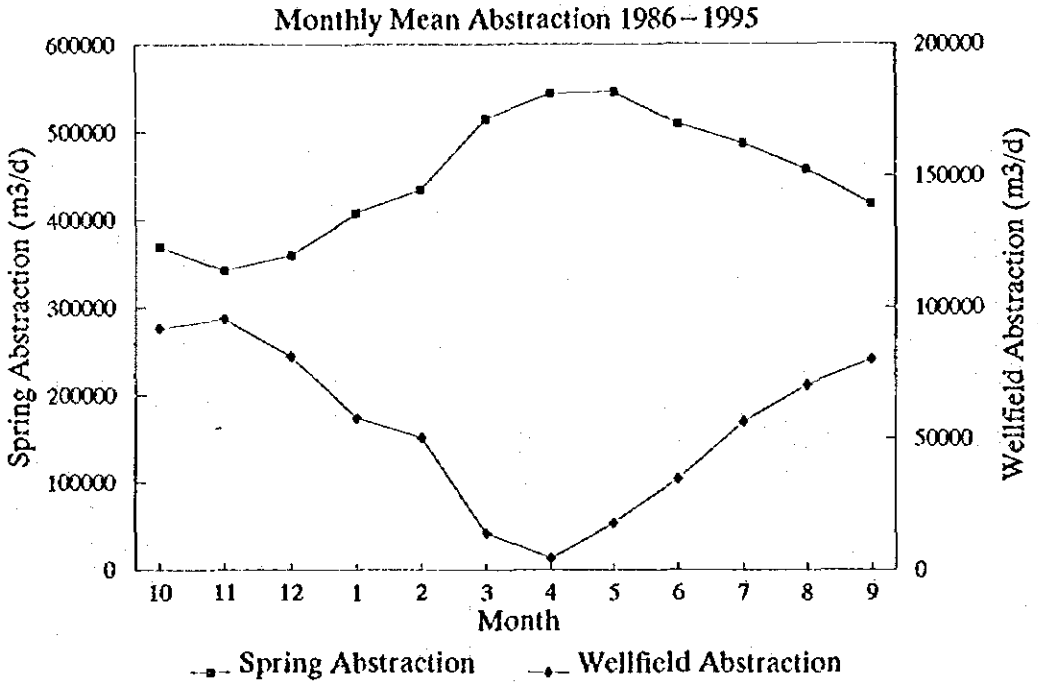
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

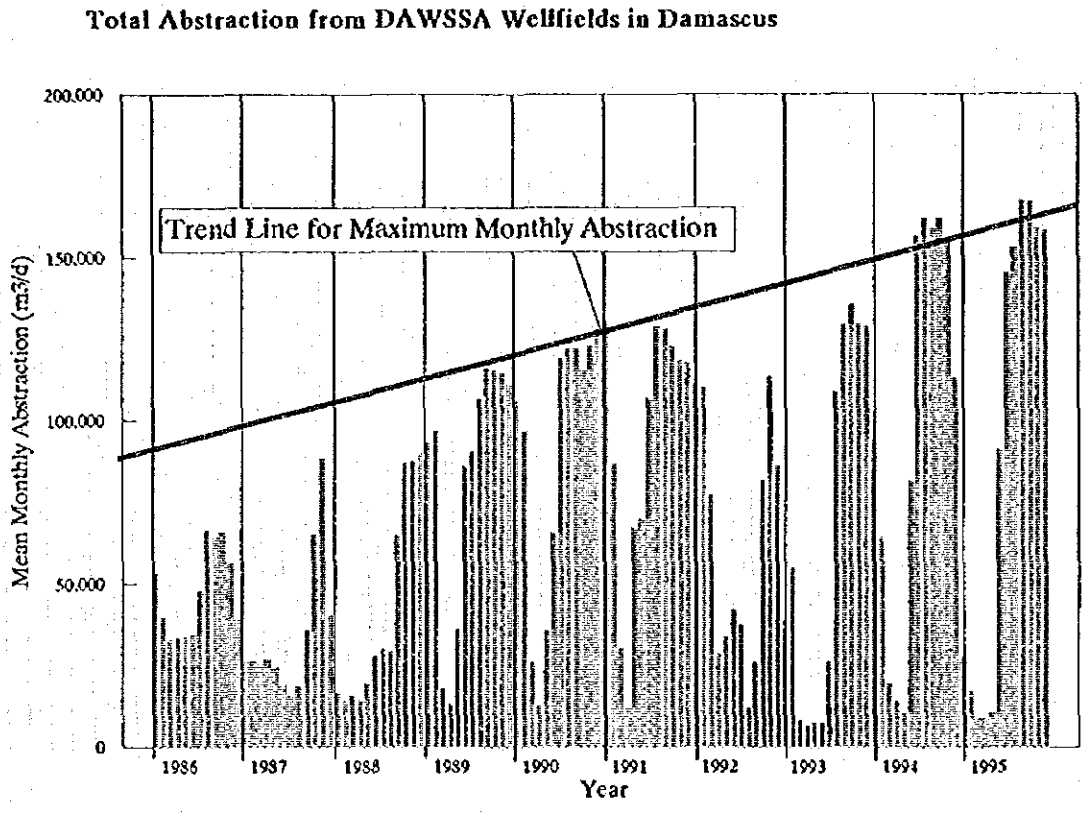
Figure C-3.2
Map of EDWSSR Sources

NIPPON KOEI CO., LTD.

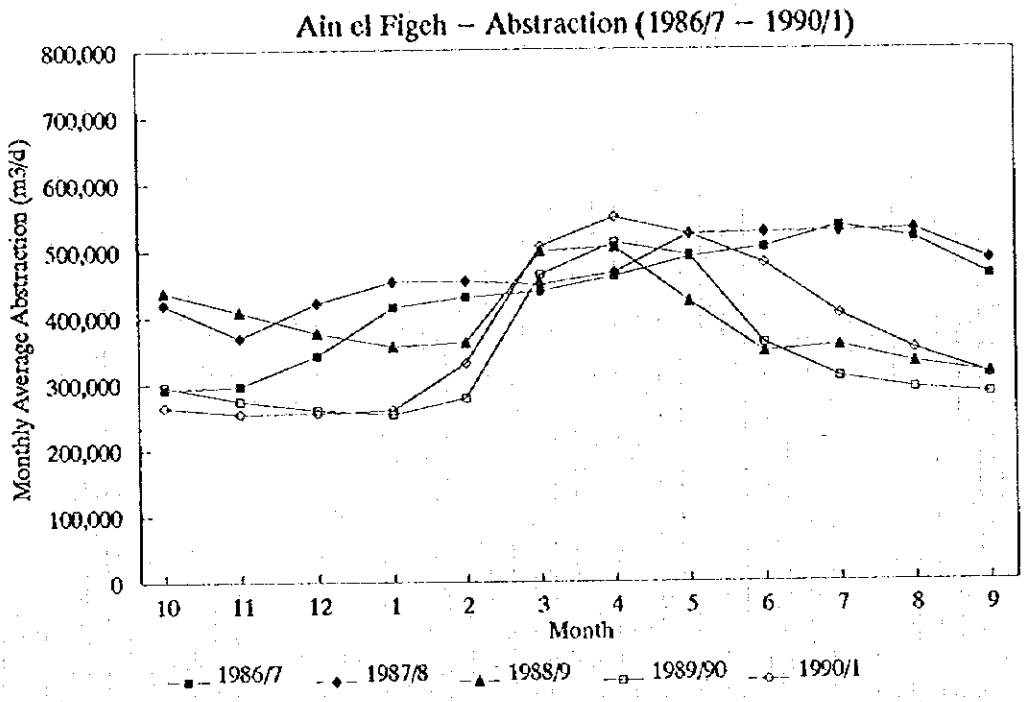


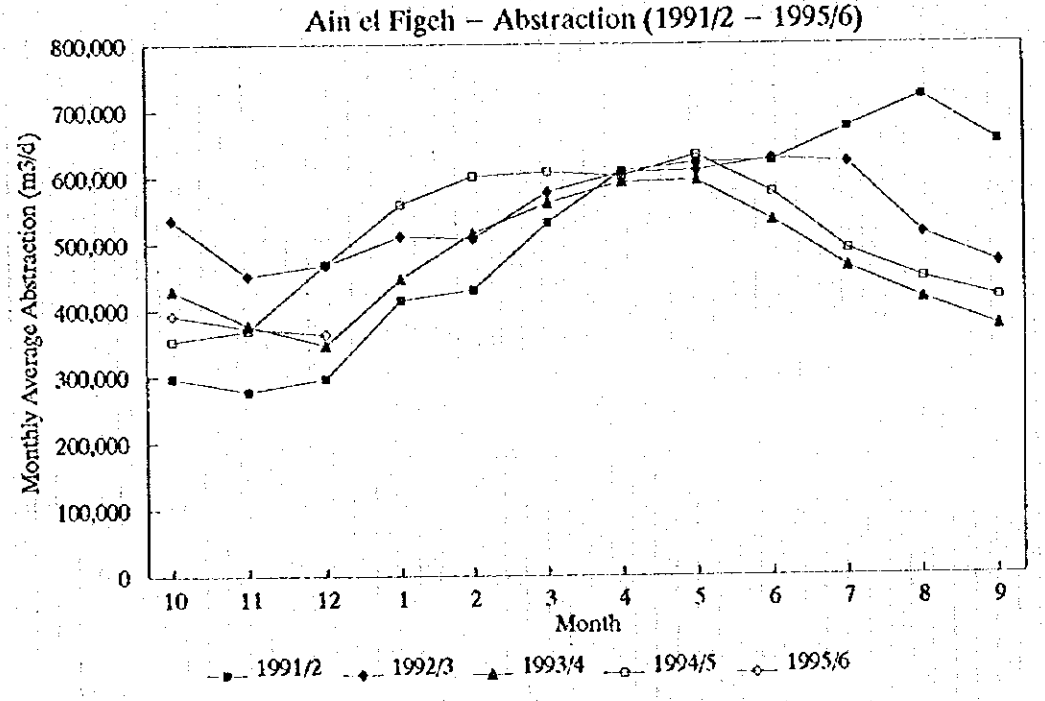
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-4.1 Monthly Production 1986-95
NIPPON KOEI CO., LTD.



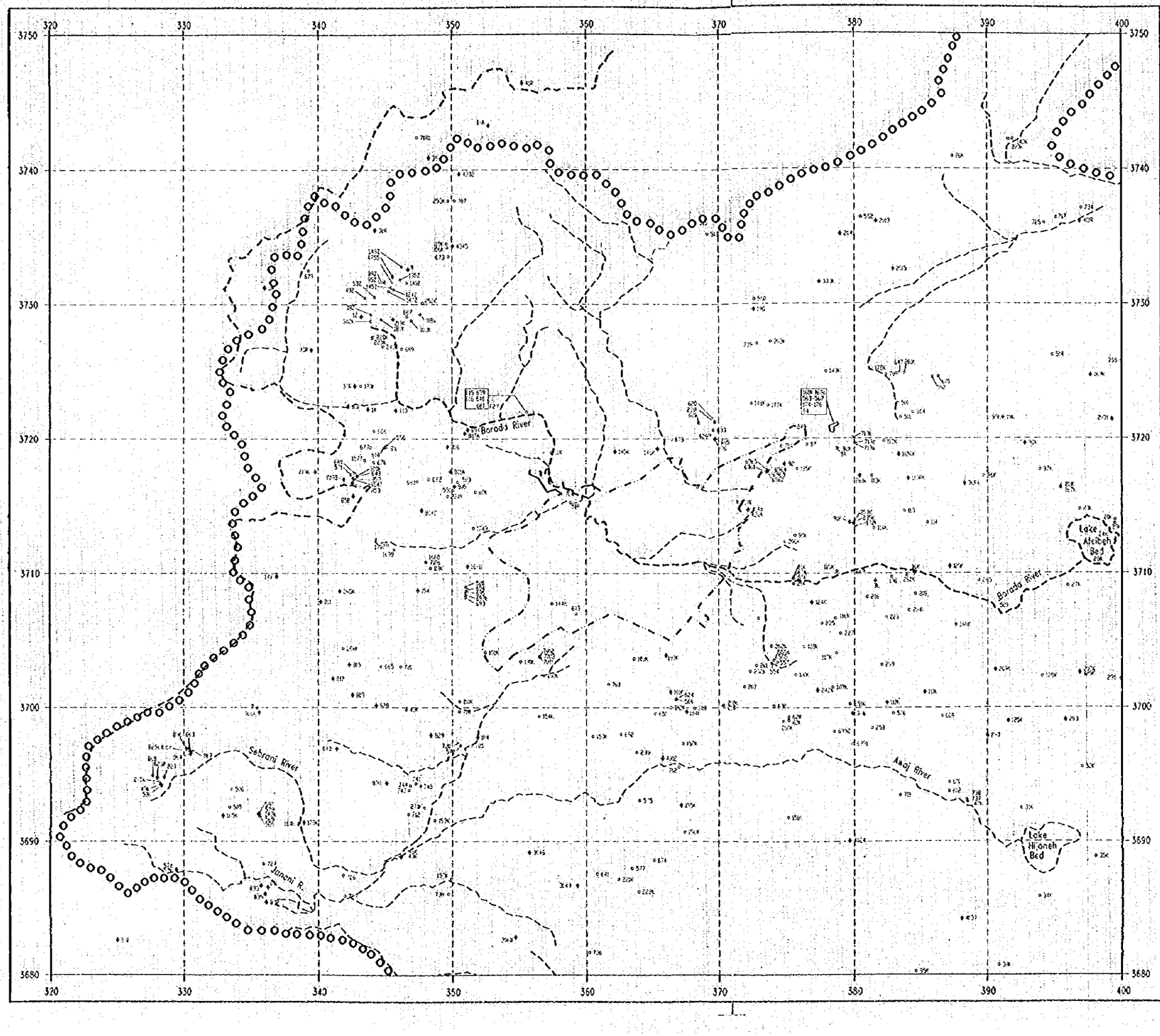


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-4.2 Mean Month Abstraction Figure C-4.3 Monthly Wellfield Abstraction 1986-95
NIPPON KOEI CO., LTD.





JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY
Figure C-4.4 Monthly Spring Abstraction 1986-95
NIPPON KOEI CO., LTD.



Location Map for Investigation Wells

O MOI Investigation Well
⊕ MOI Monitoring Well

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure C-5.1
Map of Investigation Wells

NIPPON KOEI CO., LTD.