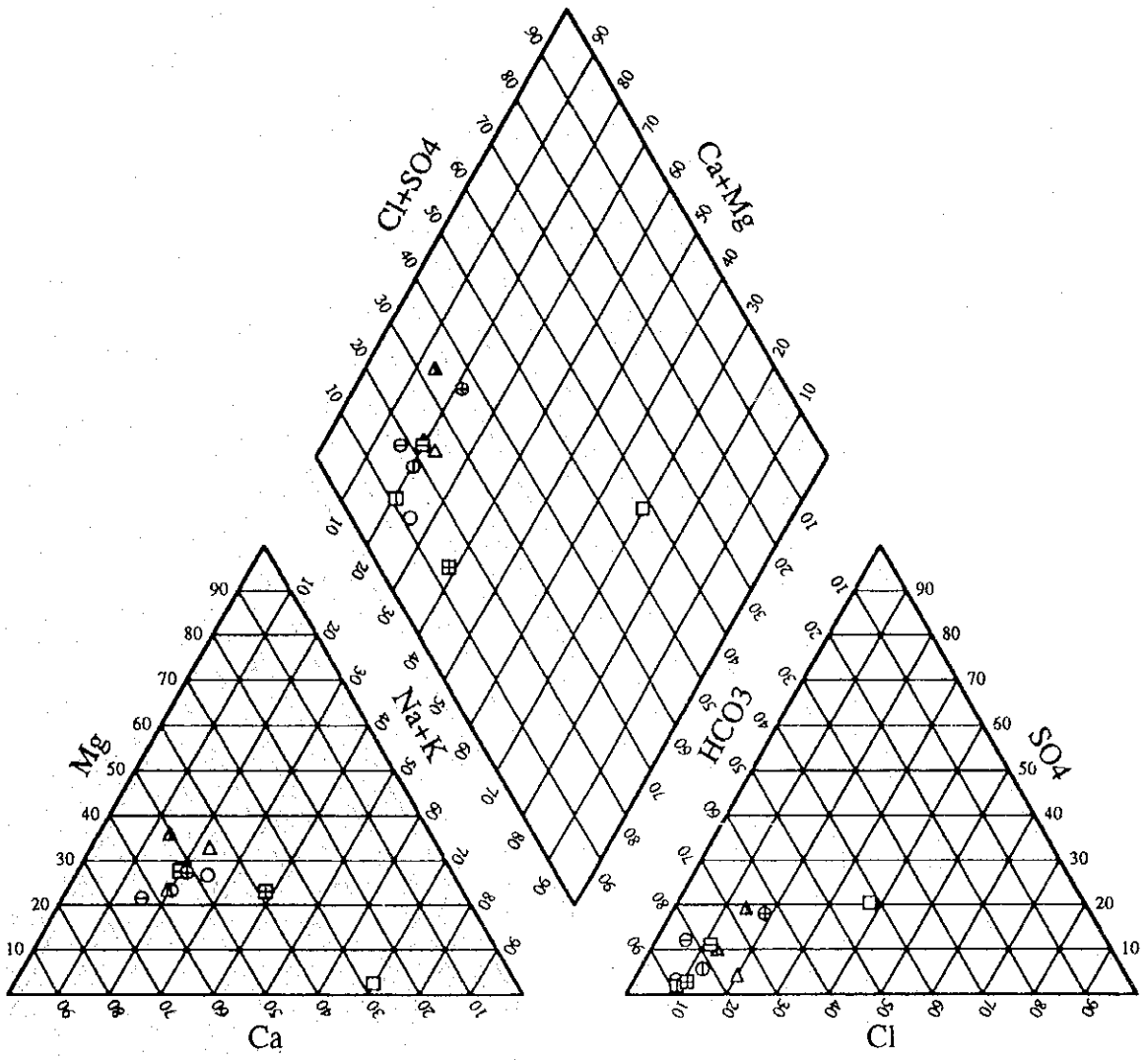
EASTERN AREA

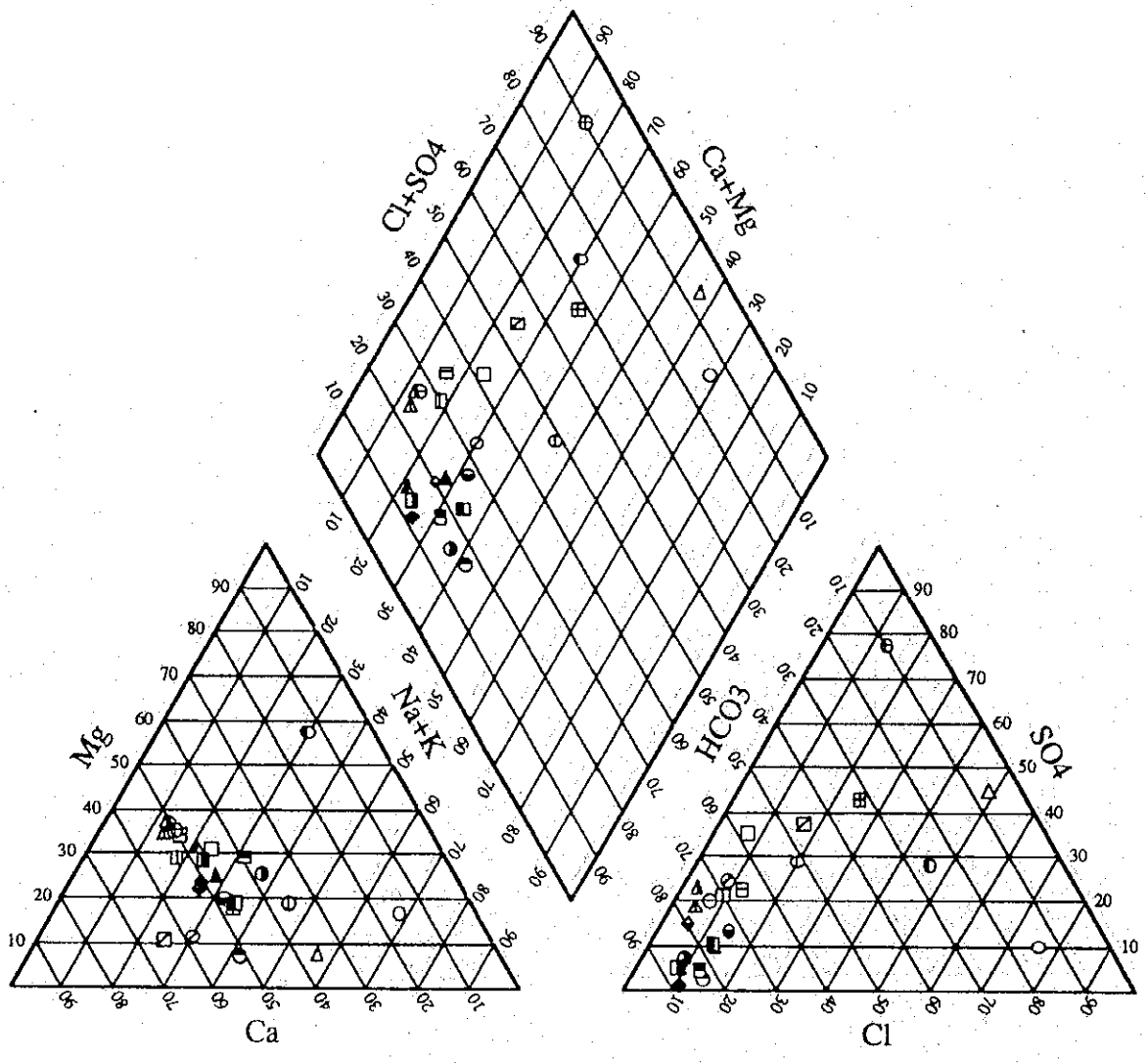


Legend

○ R010	⊖ GW008
□ SP001	⊟ GW009
△ R011	▲ GW510
⦶ R012	⊕ GW012
⊡ R013	⊞ GW014
◬ GW497	

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 3.6.6	TRI-LINEAR DIAGRAM OF NATURAL WATER RAINY SEASON (1)
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	

CENTRAL AREA

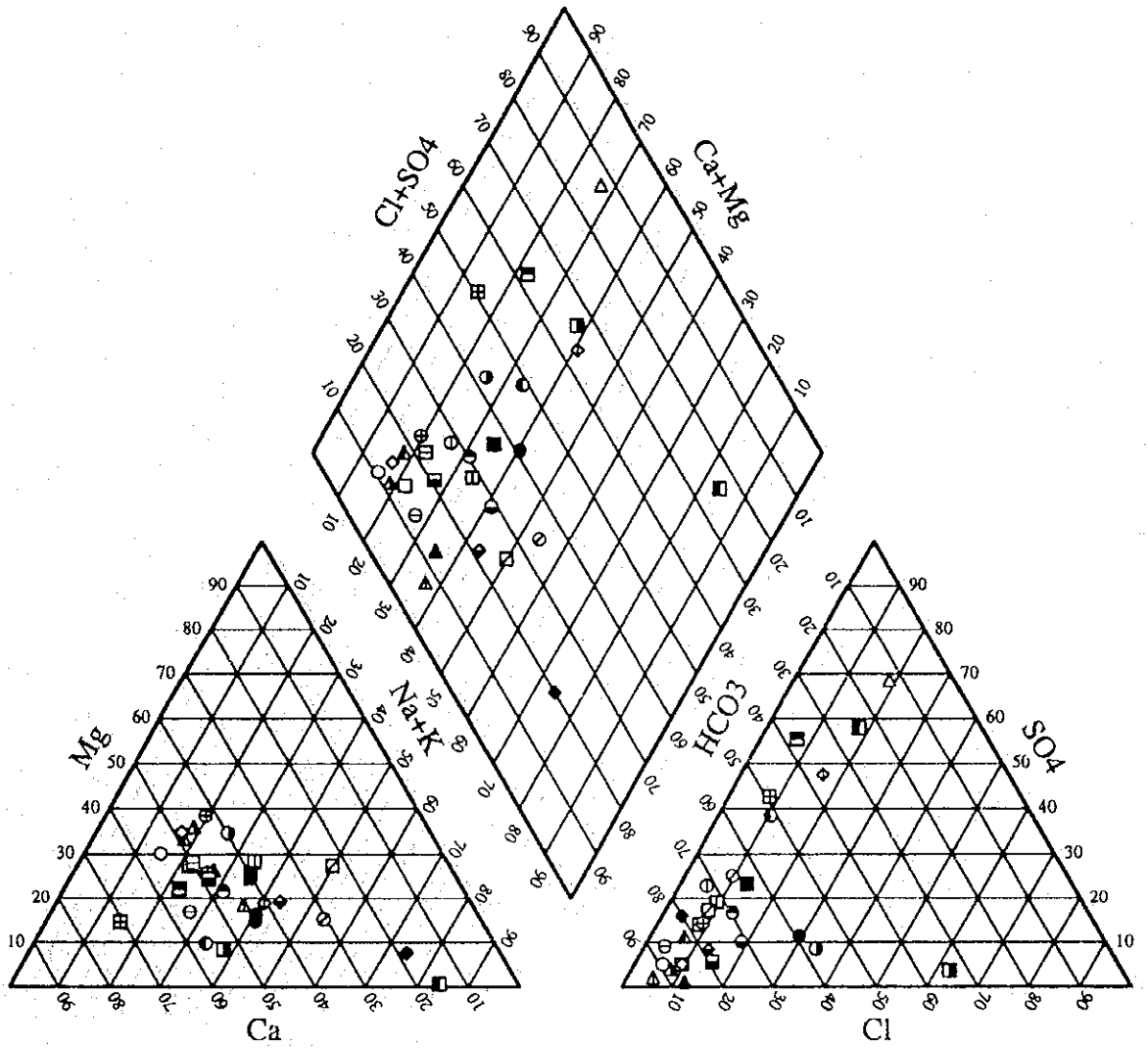


Legend

○ R014	⊖ GW448	⊘ GW020	◐ GW033
□ R015	⊟ GW022	⊠ GW024	◧ GW031
△ SP002	◭ GW023	▲ GW058	◆ GW032
⦶ GW016	⊕ R016	◑ GWO26	◓ GW029
⧈ GW443	⊞ R017	◨ R101	⬒ GW474
◬ GW018	▲ R018	◆ GW028	◒ TW010

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 3.6.6	TRI-LINEAR DIAGRAM OF NATURAL WATER RAINY SEASON (2)
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	

WESTERN AREA



Legend

○ R007	⊖ R001	⊘ GW002	◐ GW007	⬓ GW038
□ R102	⊟ R002	⊠ GW006	◧ GW217	● GW531
△ GW671	◮ R003	▲ GW222	◆ WG213	■ GW036
⦶ R008	⊕ R004	◑ GW003	◓ R009	◇ TW004
◫ R006	⊞ GW001	◨ GW004	⬒ GW044	◇ TW005
◬ GW034	◮ R005	◆ GW224	◒ GW043	

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
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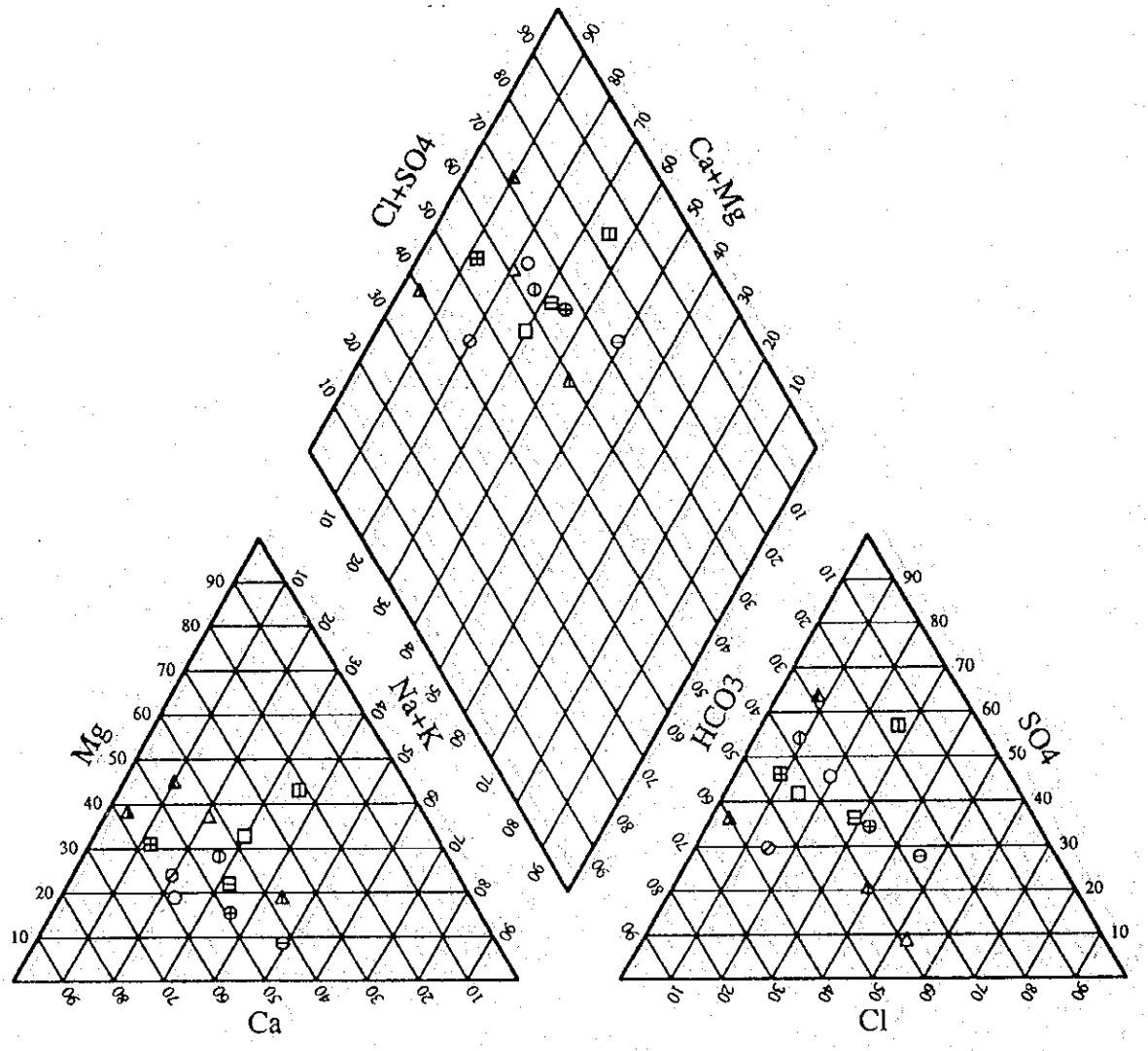
Fig. 3.6.6	TRI-LINEAR DIAGRAM OF NATURAL WATER RAINY SEASON (3)
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	



Legend

○ TW001	⊖ TW006A	⊘ TW012
□ TW002	⊟ TW006S	
△ TW003	▲ TW008	
⦶ TW004	⊕ TW009	
◫ TW005	⊞ TW010	
◬ TW006	◭ TW011	

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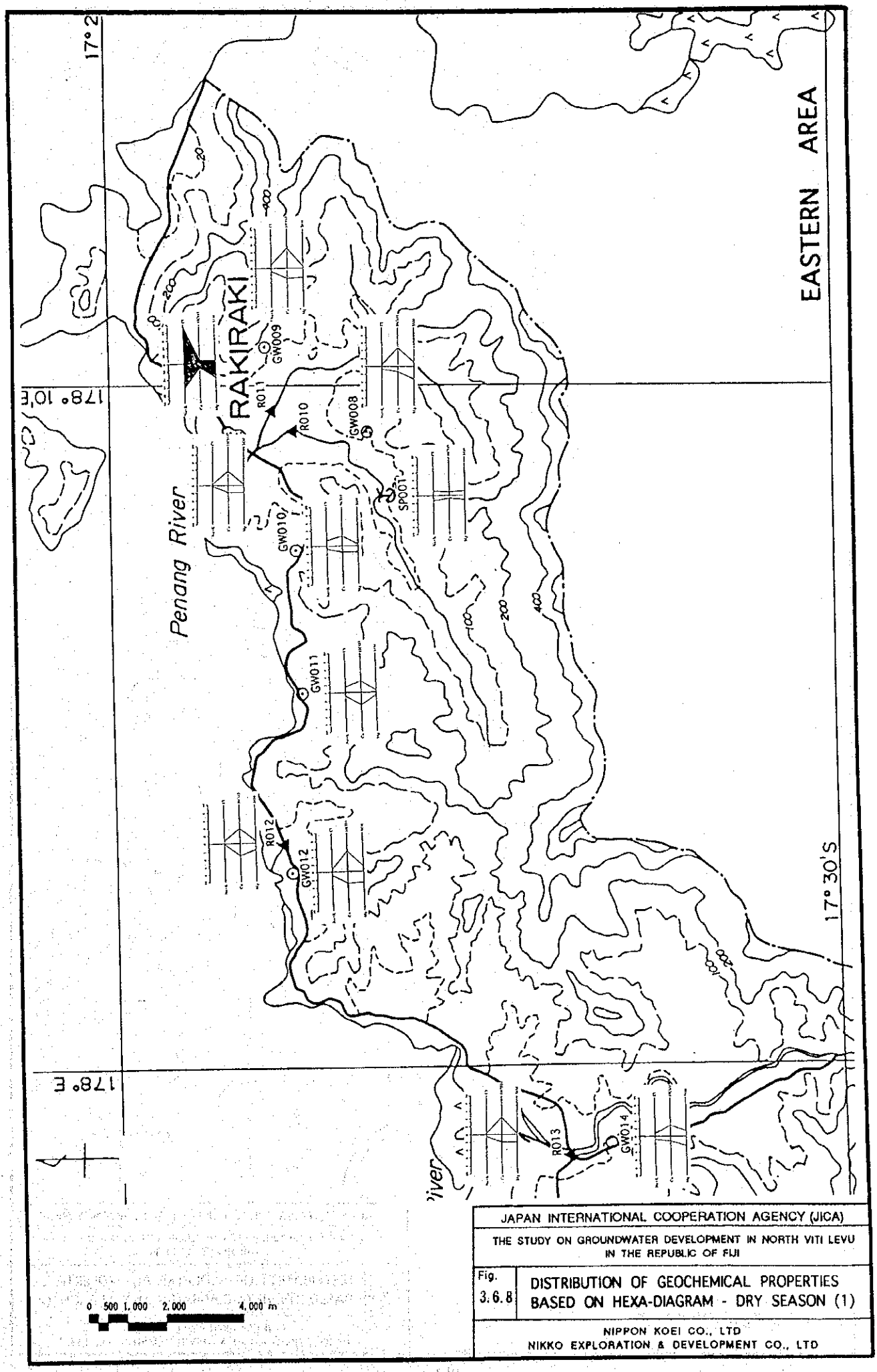
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 3.6.7	TRI-LINEAR DIAGRAM OF NATURAL WATER TEST WELLS
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	

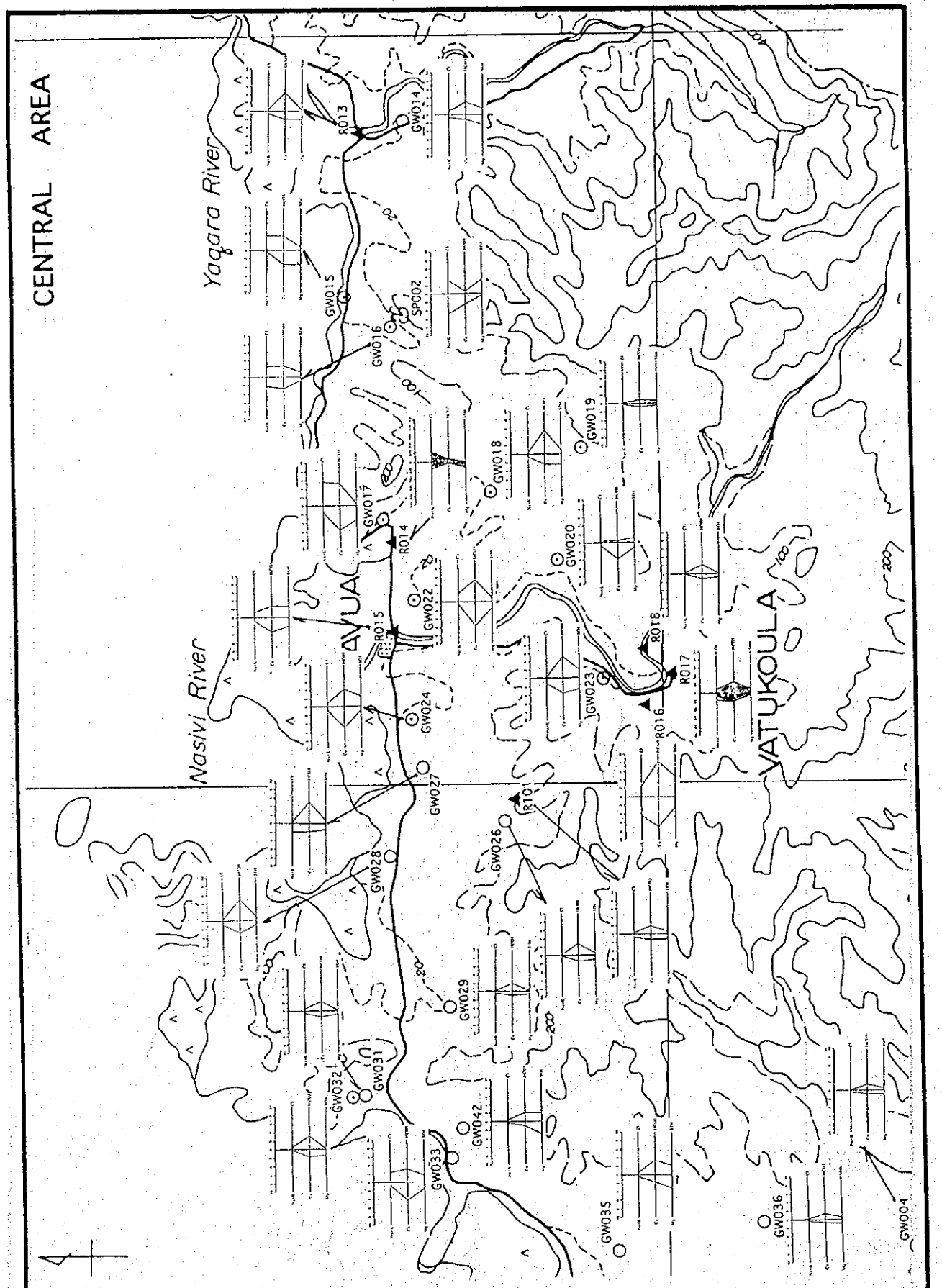


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig. 3.6.8 DISTRIBUTION OF GEOCHEMICAL PROPERTIES BASED ON HEXA-DIAGRAM - DRY SEASON (1)

NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD

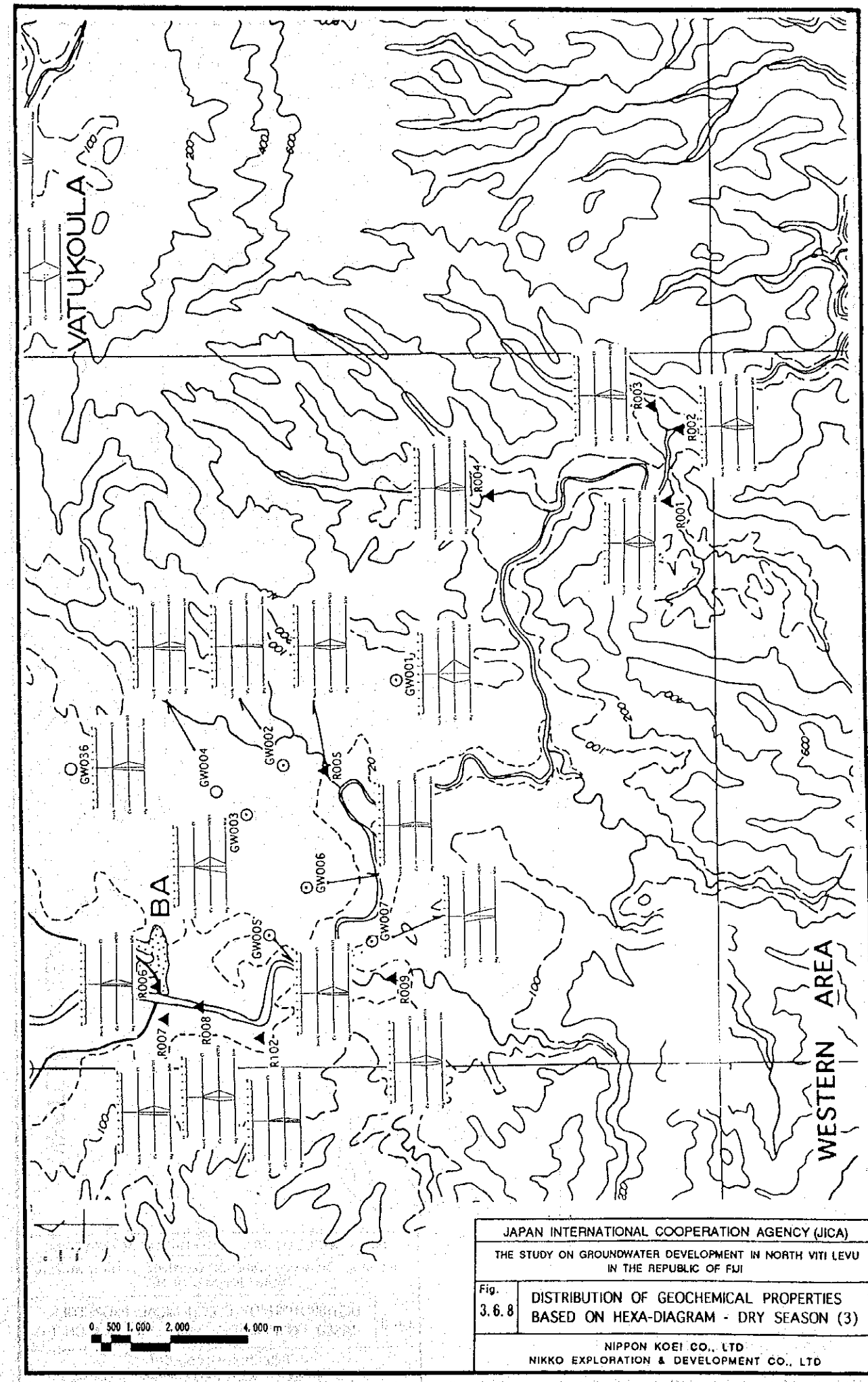


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig. 3.6.8 DISTRIBUTION OF GEOCHEMICAL PROPERTIES BASED ON HEXA-DIAGRAM - DRY SEASON (2)

NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD

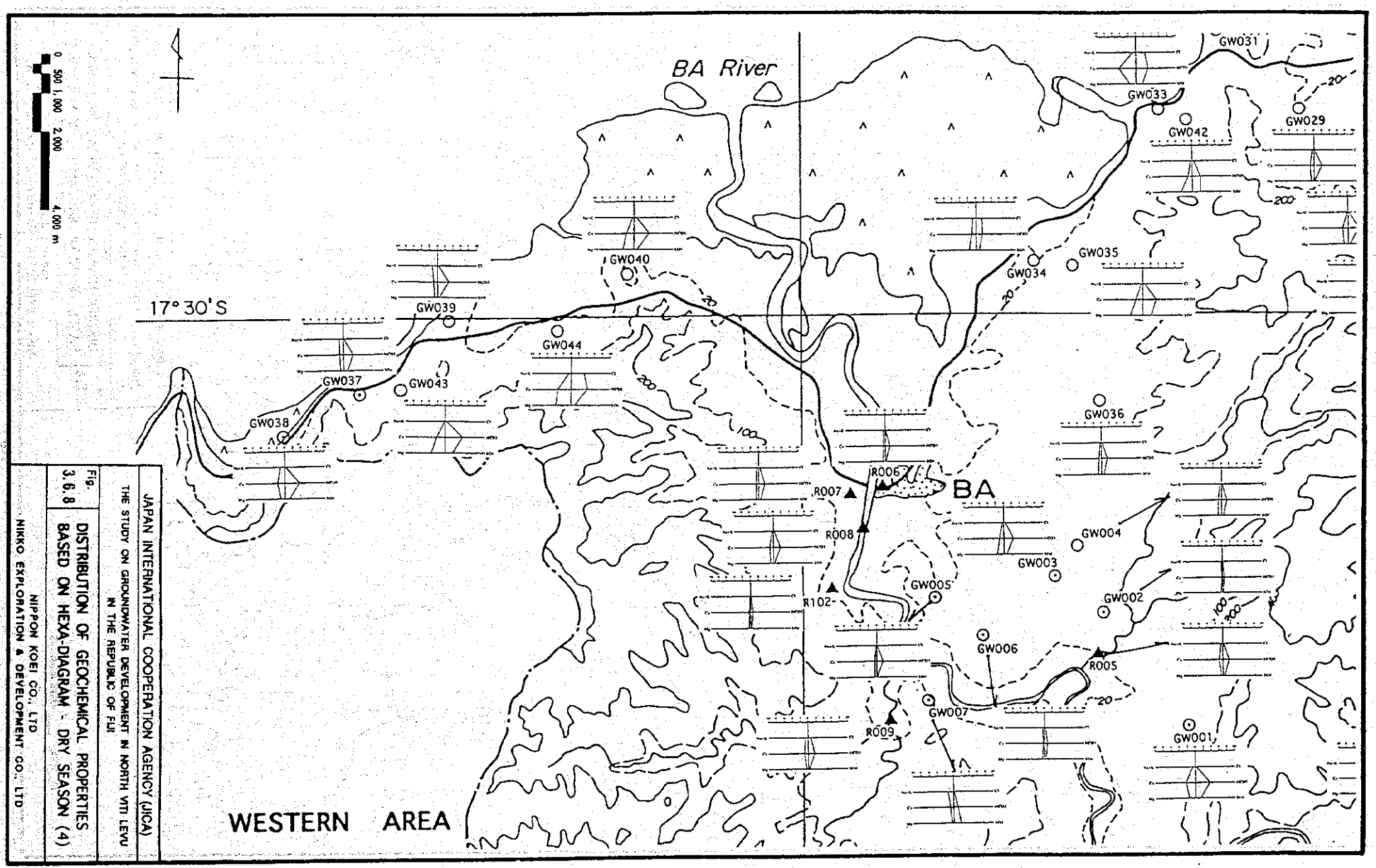


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig. 3.6.8 DISTRIBUTION OF GEOCHEMICAL PROPERTIES BASED ON HEXA-DIAGRAM - DRY SEASON (3)

NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD

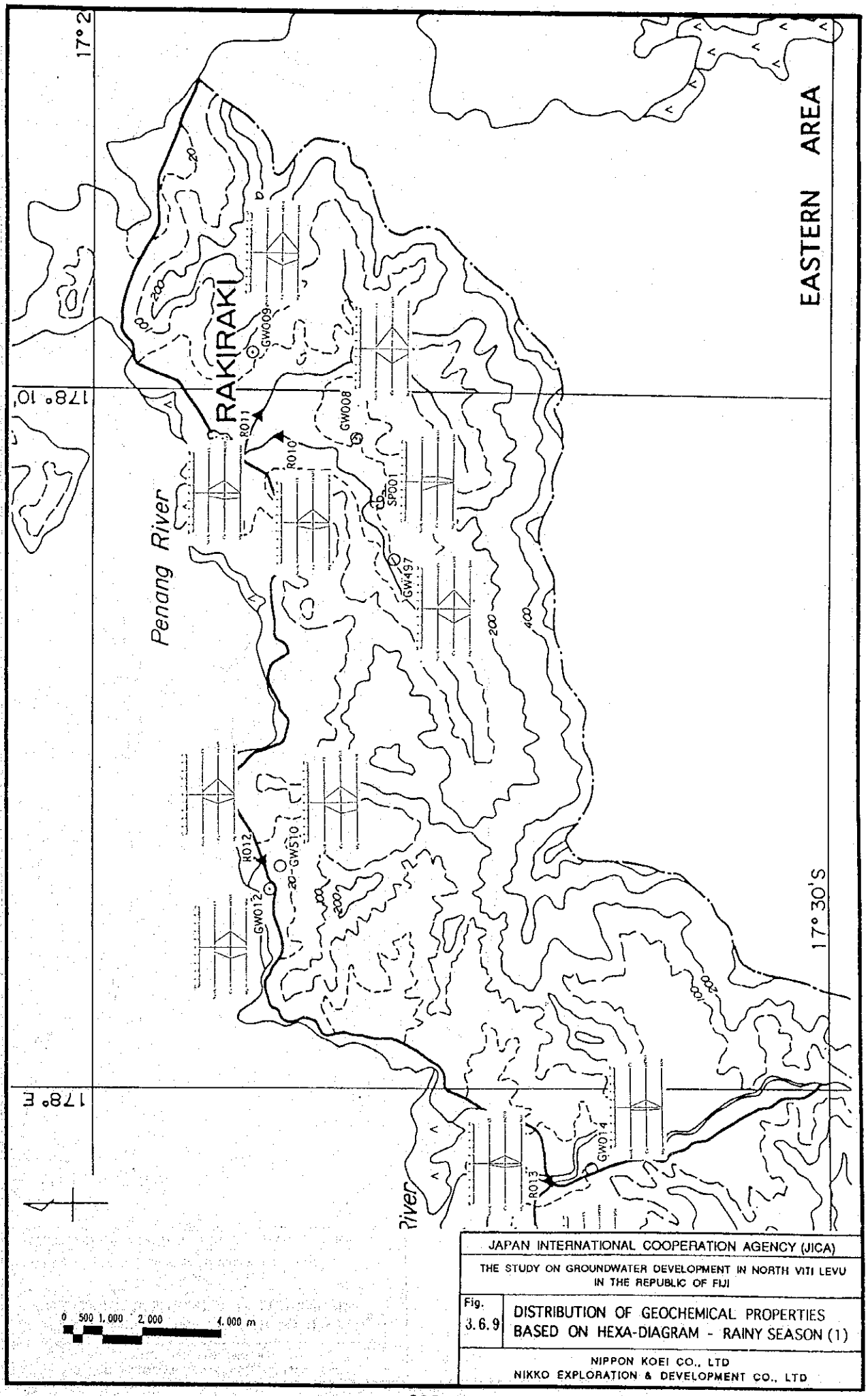


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig. 3.6.8 DISTRIBUTION OF GEOCHEMICAL PROPERTIES BASED ON HEXA-DIAGRAM - DRY SEASON (4)

NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD

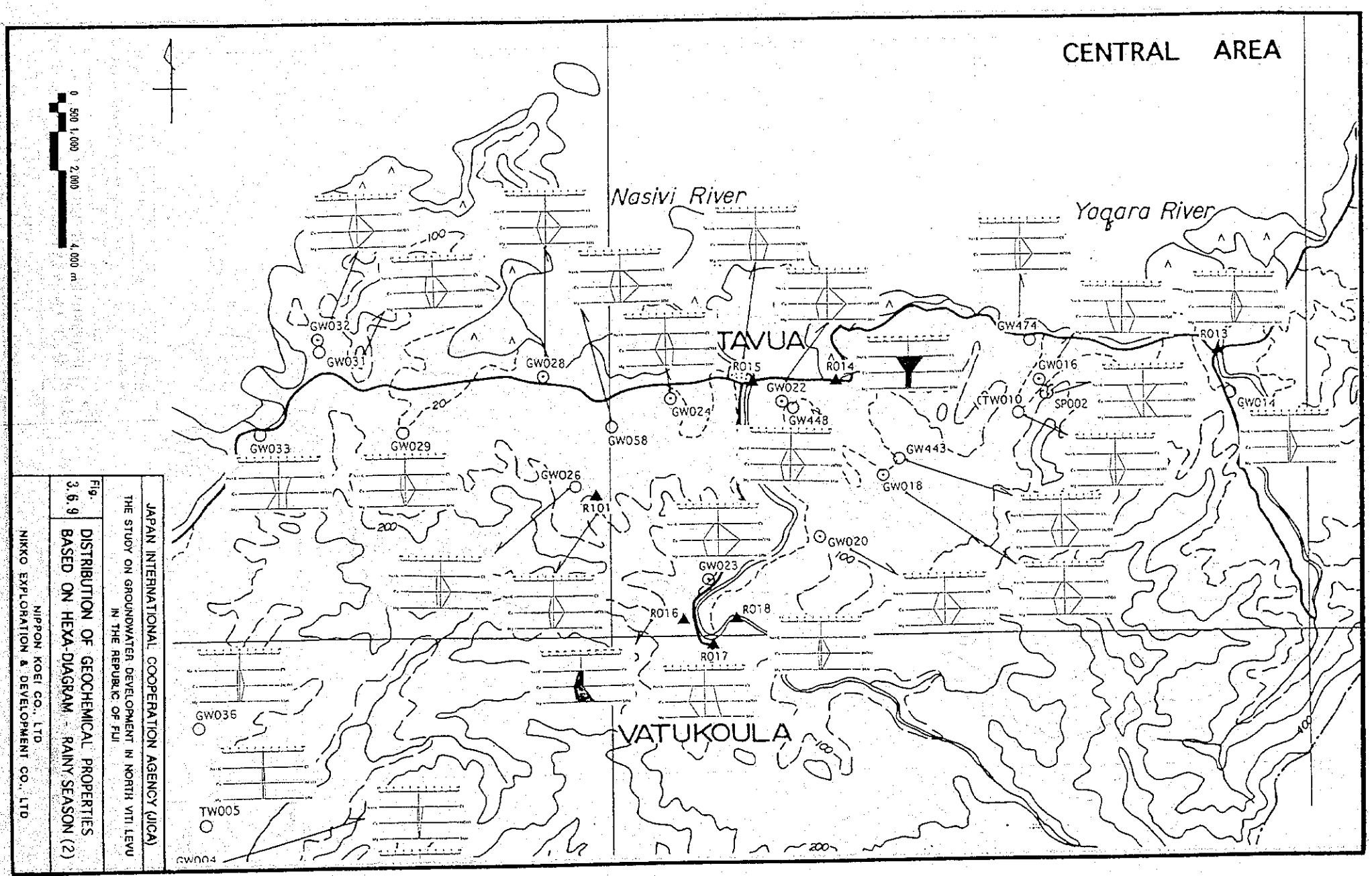


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig. 3.6.9 DISTRIBUTION OF GEOCHEMICAL PROPERTIES BASED ON HEXA-DIAGRAM - RAINY SEASON (1)

NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD

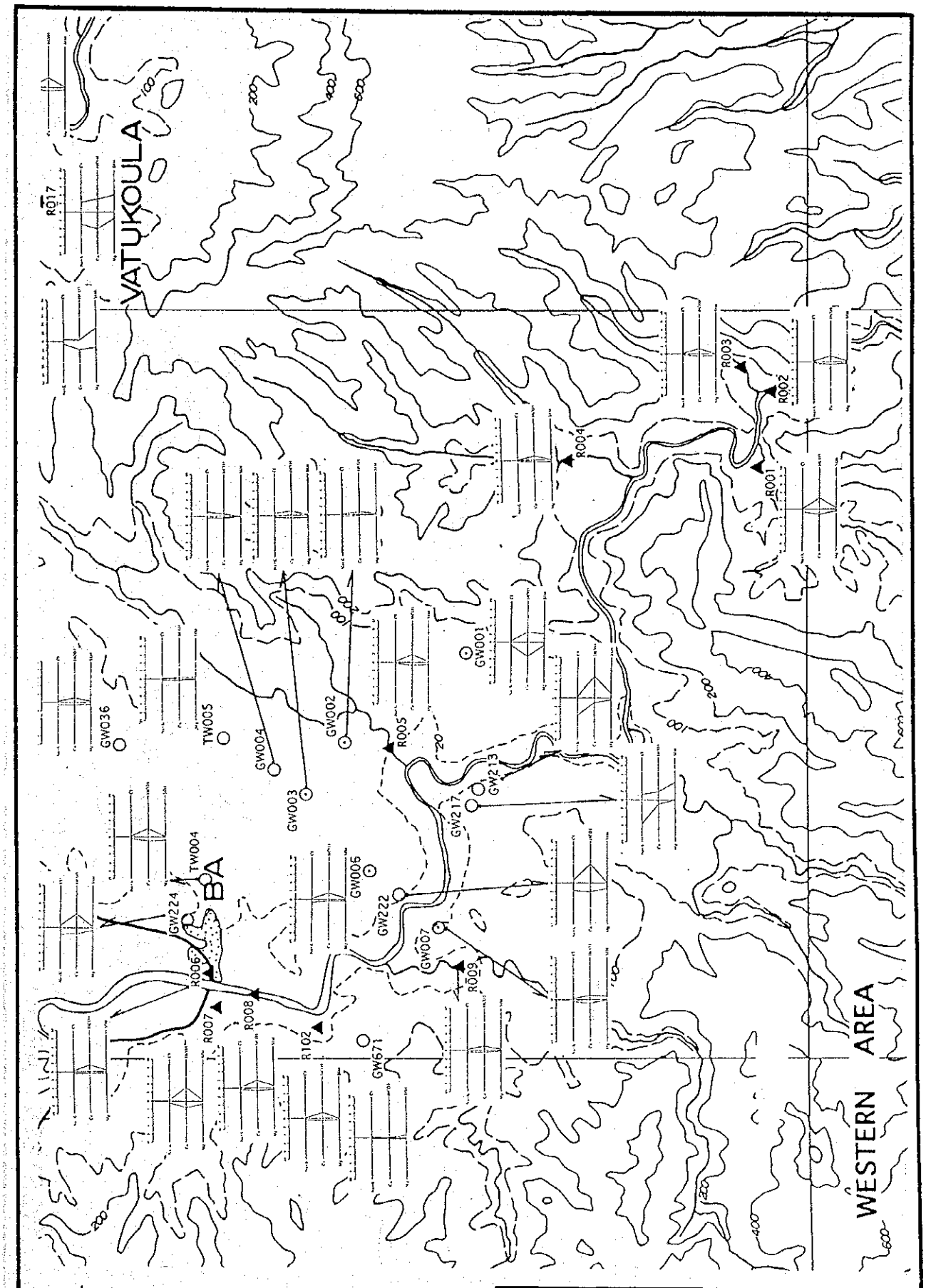


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig. 3.6.9 DISTRIBUTION OF GEOCHEMICAL PROPERTIES BASED ON HEXA-DIAGRAM - RAINY SEASON (2)

NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD

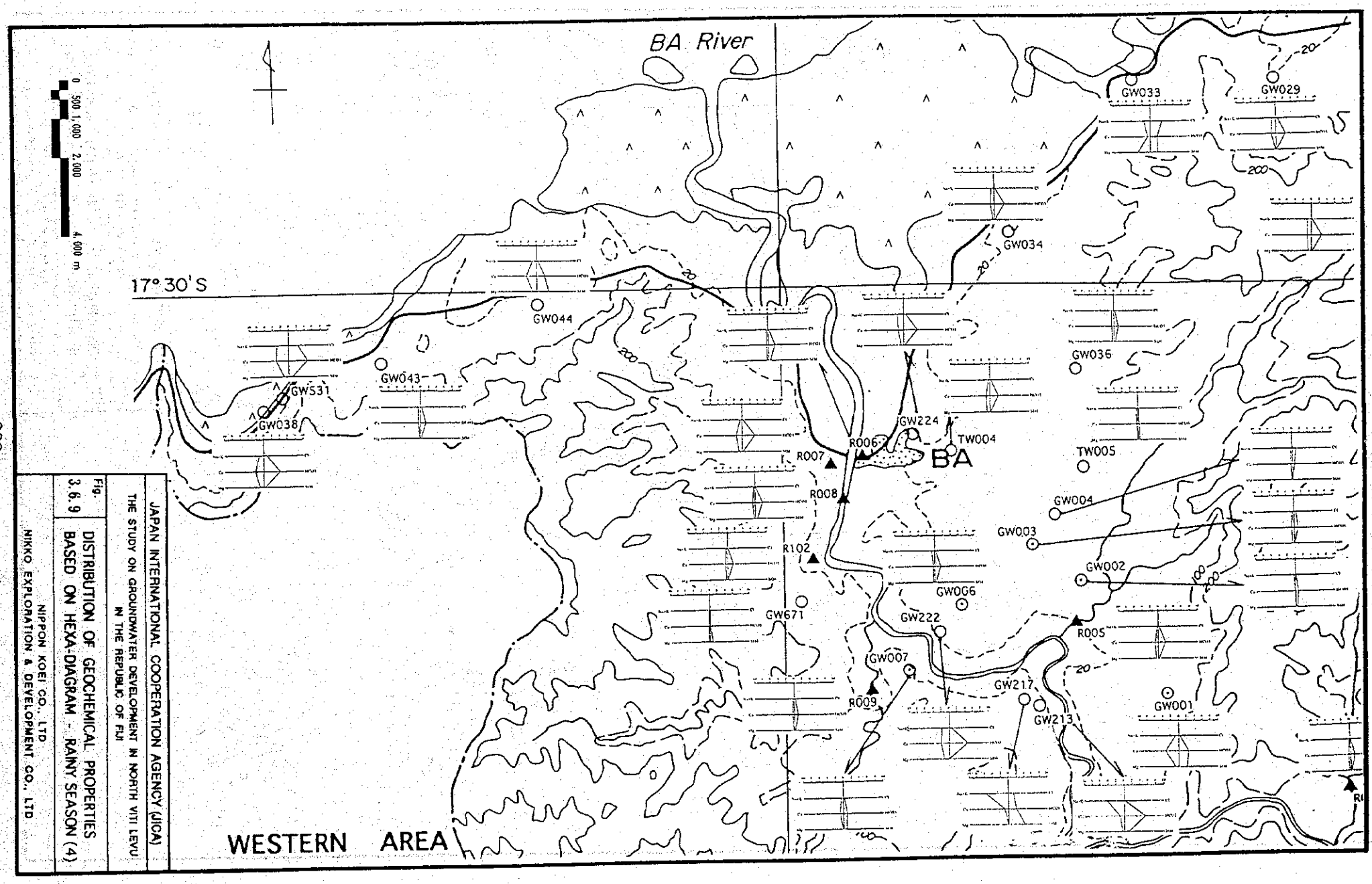


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig. 3.6.9 DISTRIBUTION OF GEOCHEMICAL PROPERTIES BASED ON HEXA-DIAGRAM - RAINY SEASON (3)

NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD

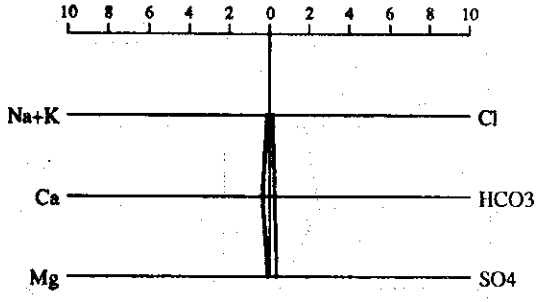


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

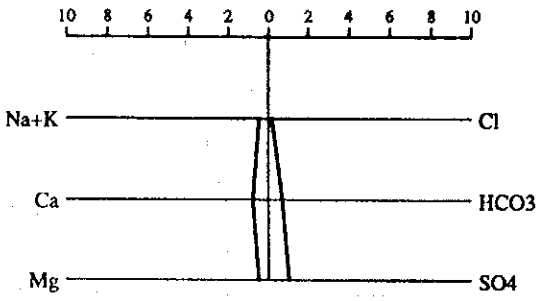
Fig. 3.6.9 DISTRIBUTION OF GEOCHEMICAL PROPERTIES BASED ON HEXA-DIAGRAM - RAINY SEASON (4)

NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD



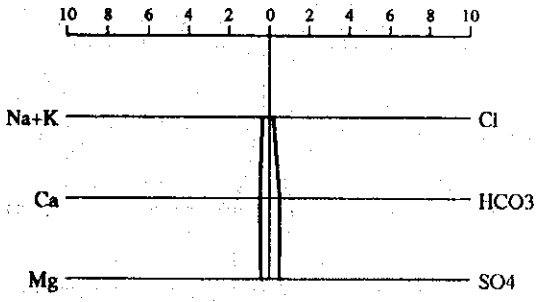
Sample No: 01

Sample Name: TW001



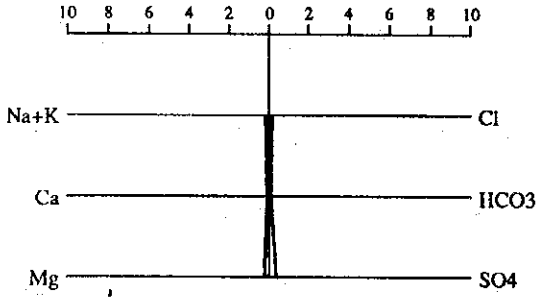
Sample No: 04

Sample Name: TW004



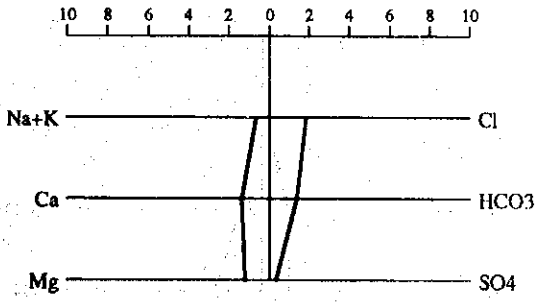
Sample No: 02

Sample Name: TW002



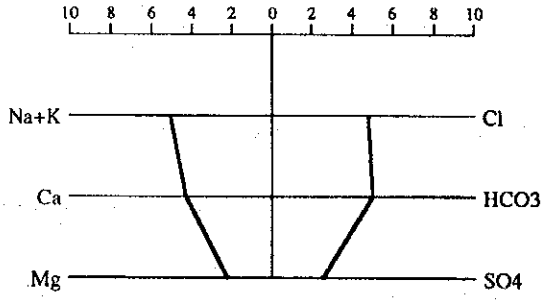
Sample No: 05

Sample Name: TW005



Sample No: 03

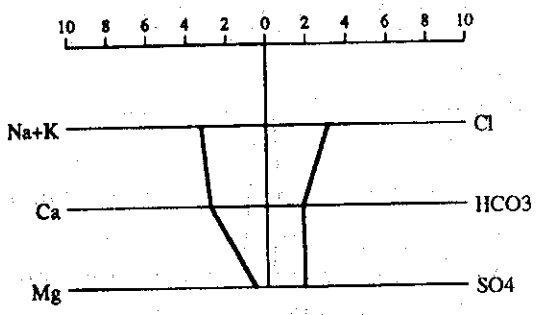
Sample Name: TW003



Sample No: 06

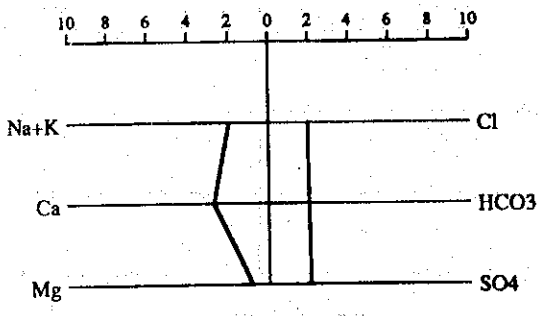
Sample Name: TW006

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 3.6.10	HEXA-DIAGRAM OF THE TEST WELLS (1)
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	



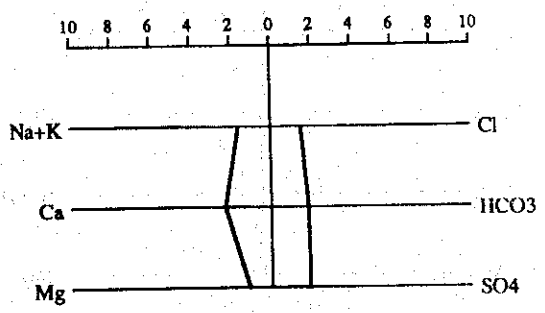
Sample No: 07

Sample Name: TW006A



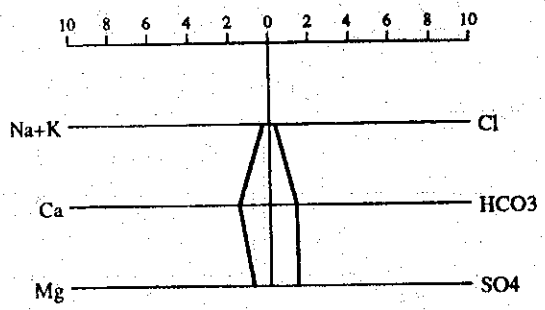
Sample No: 10

Sample Name: TW009



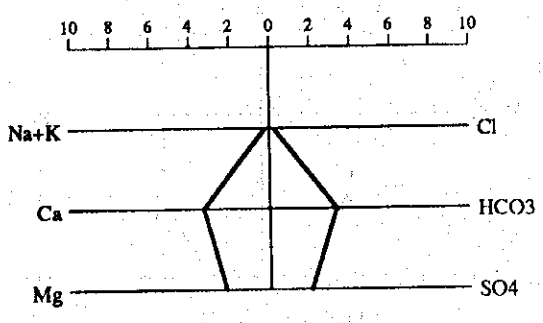
Sample No: 08

Sample Name: TW006S



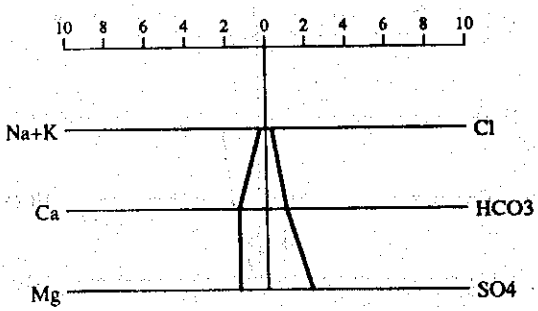
Sample No: 11

Sample Name: TW010



Sample No: 09

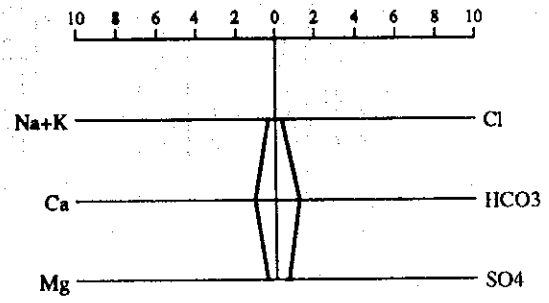
Sample Name: TW008



Sample No: 12

Sample Name: TW011

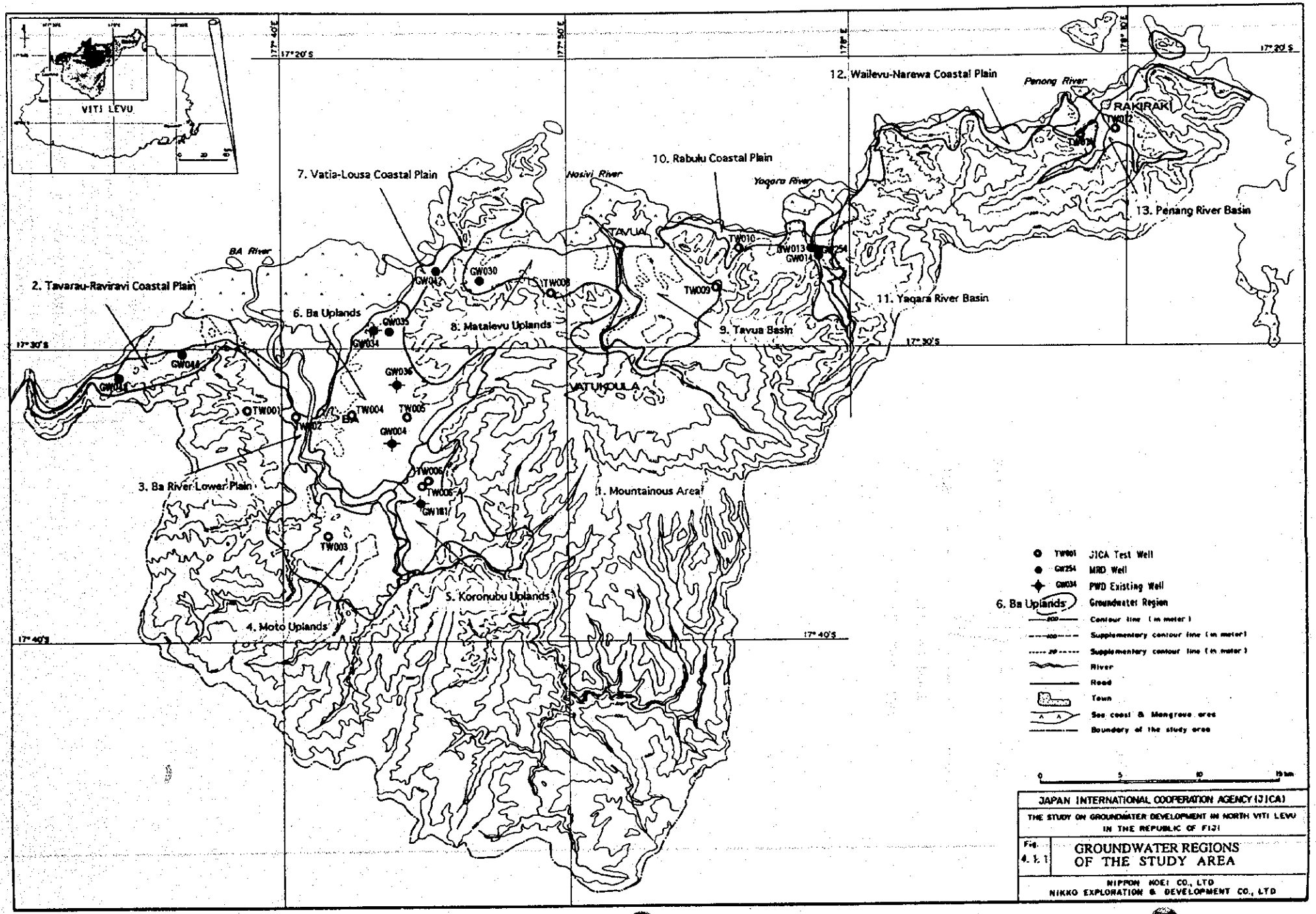
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 3.6.10	HEXA-DIAGRAM OF THE TEST WELLS (2)
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	

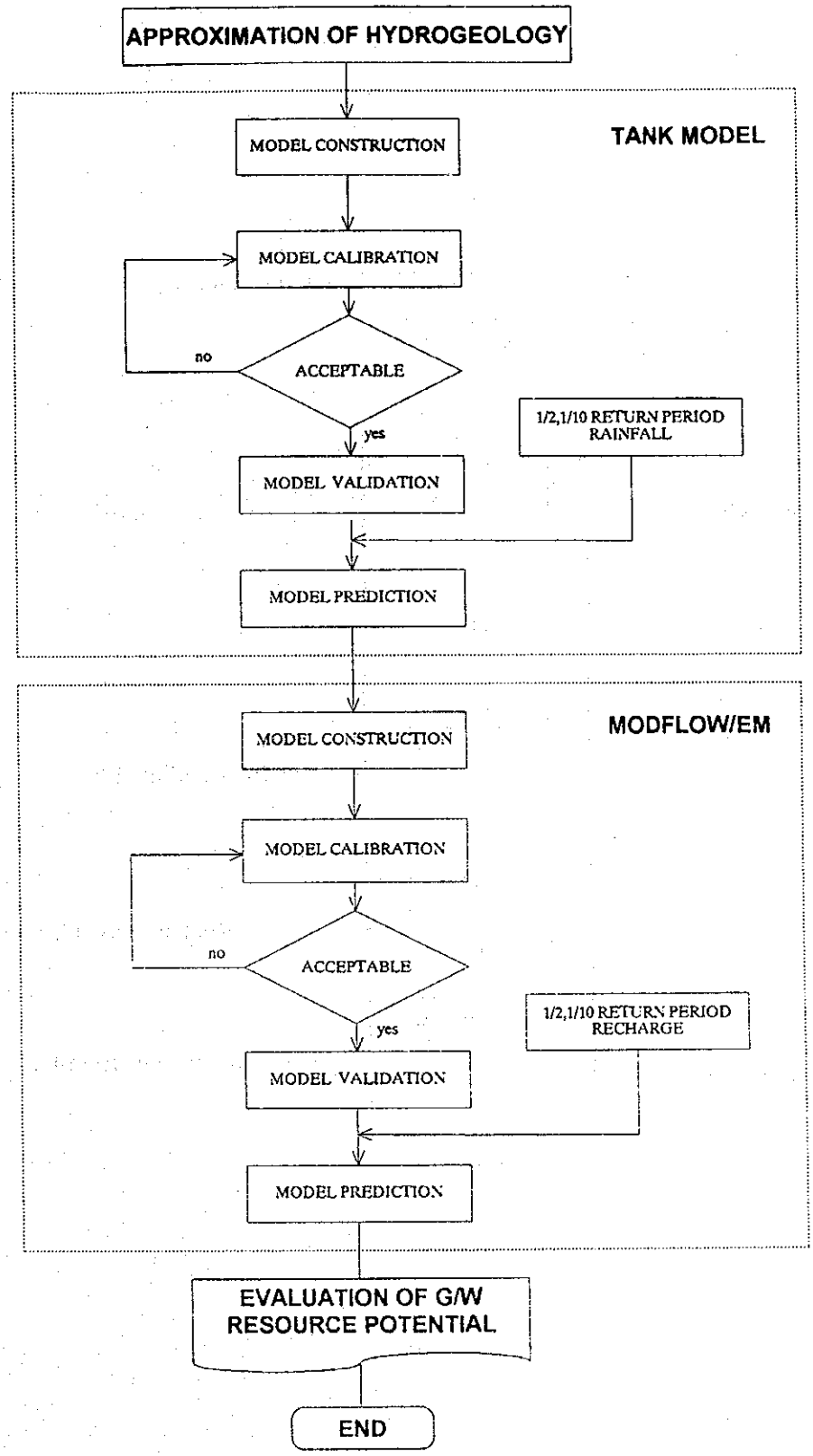


Sample No: 13

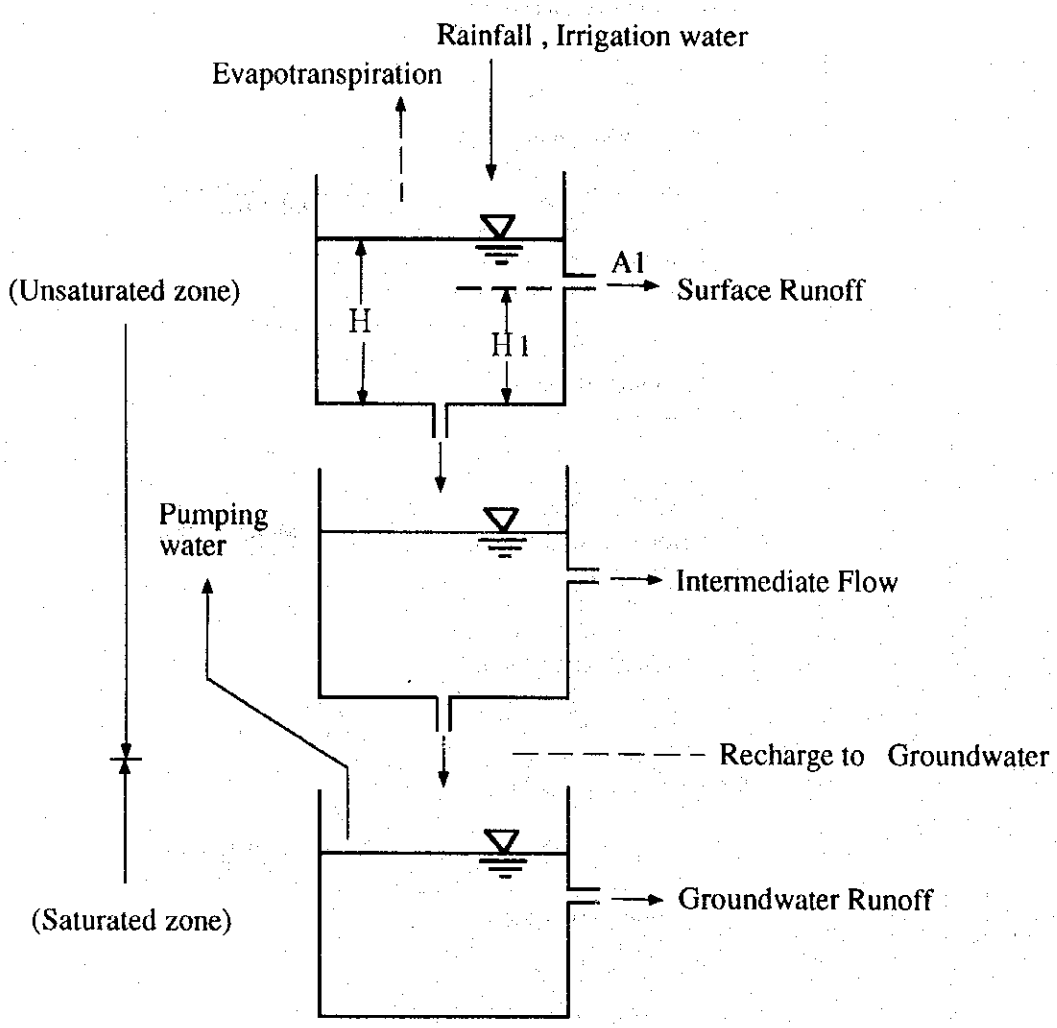
Sample Name: TW012

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 3, 6, 10	HEXA-DIAGRAM OF THE TEST WELLS (3)
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	

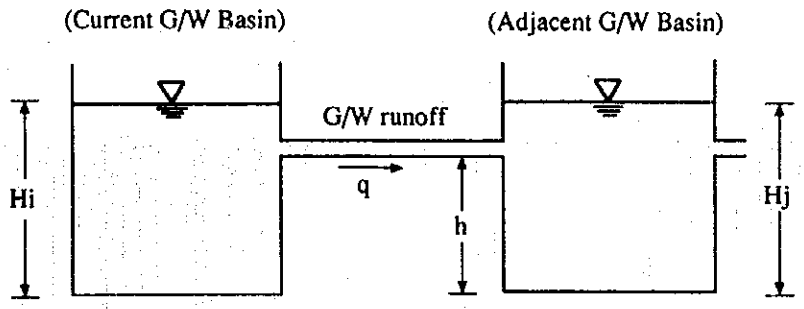

VITI LEVU
17°20'S
17°30'S
17°40'S
177°40'E
177°50'E
178°E
178°10'E
1. Mountainous Area
2. Tavarau-Raviravi Coastal Plain
3. Ba River Lower Plain
4. Moto Uplands
5. Koronubu Uplands
6. Ba Uplands
7. Vatia-Lousa Coastal Plain
8. Matalevu Uplands
9. Tavua Basin
10. Rabulu Coastal Plain
11. Yaqara River Basin
12. Wailevu-Narewa Coastal Plain
13. Penang River Basin
BA River
Nasivi River
Yaqara River
Penang River
TAVUA
VATUKOULA
RAKIRAKI
BA
TW001
TW002
TW003
TW004
TW005
TW006
TW006-A
TW008
TW009
TW010
TW012
GW004
GW030
GW034
GW035
GW036
GW042
GW044
GW181
GW013
GW014
GW254
TW001 JICA Test Well
GW254 MRD Well
GW034 PWD Existing Well
6. Ba Uplands Groundwater Region
Contour line (in meter)
Supplementary contour line (in meter)
Supplementary contour line (in meter)
River
Road
Town
Sea coast & Mangrove area
Boundary of the study area
0 5 10 15 km
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI
Fig. 4.1.1
GROUNDWATER REGIONS OF THE STUDY AREA
NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 4. 3. 1	FLOWCHART OF GROUNDWATER SIMULATION
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	



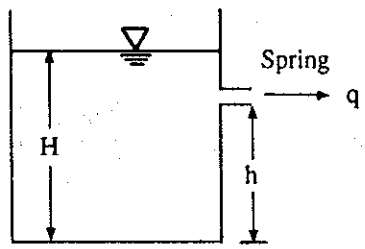
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 4.3.2	OUTLINE OF TANK MODEL
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	



$q = \alpha \cdot (Hi - Hj)$; $Hi > h$ or $Hj > h$

$q = 0$; $Hi \leq h$ and $Hj \leq h$

(a) Figure shows that the case the groundwater flows out depending on the head of the adjacent groundwater basin

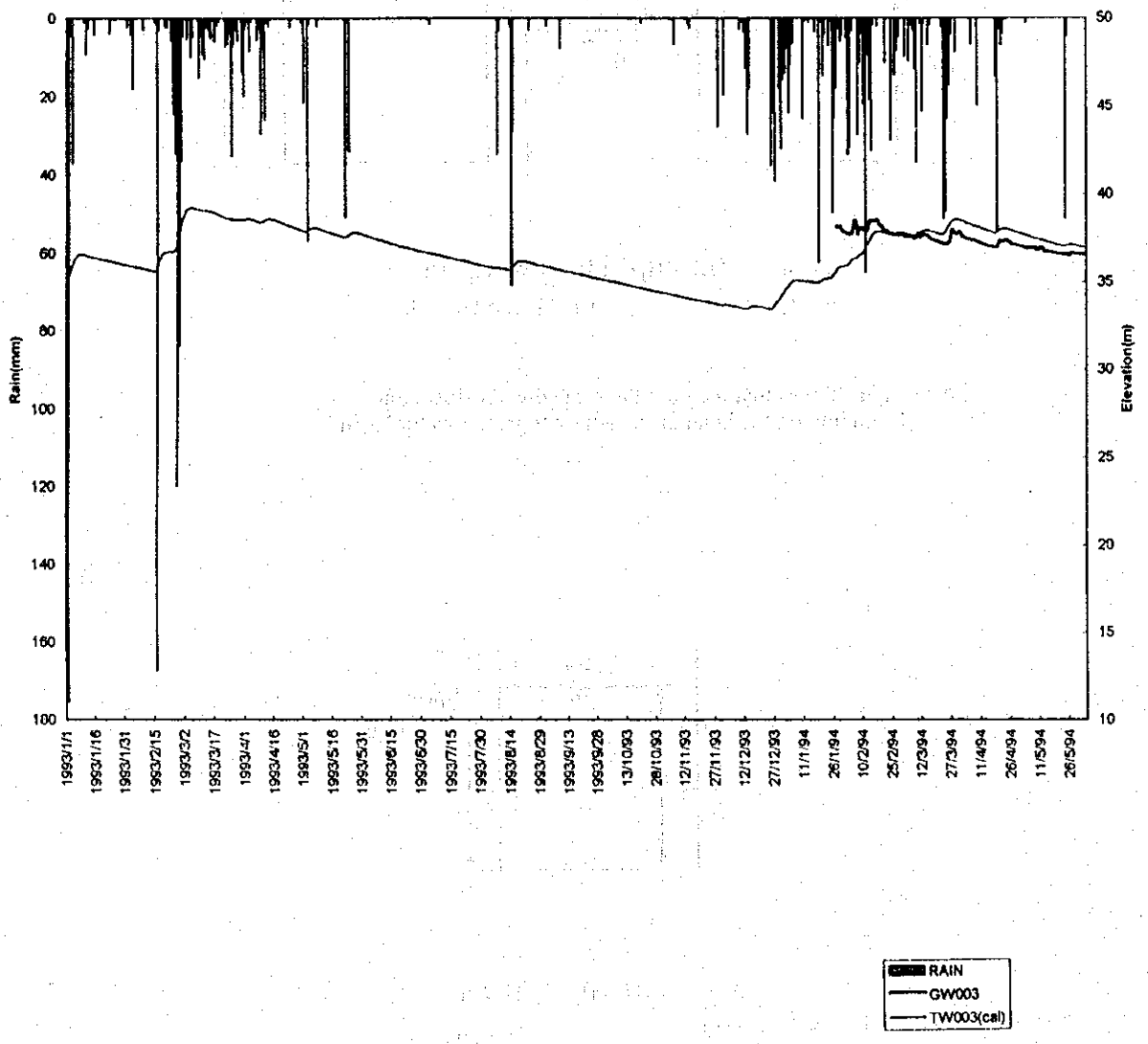


$q = \alpha \cdot (H - h)$: $H > h$

$q = 0$: $H \leq h$

(b) Figure shows that the groundwater independently flow out on the head of reseived groundwater

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 4. 3. 3	CALCULATION METHOD OF THE GROUNDWATER RUNOFF
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	



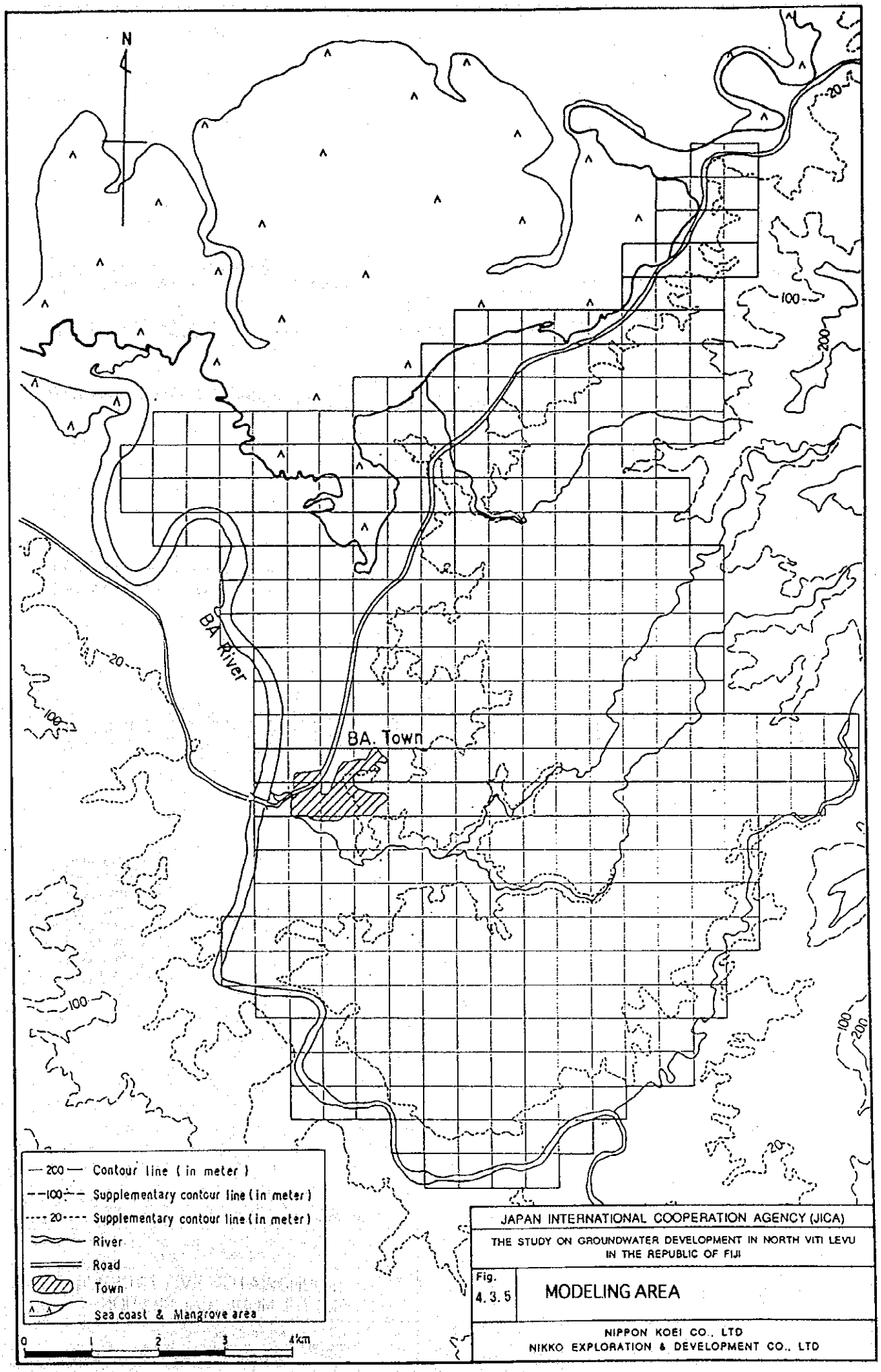
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig. 4.3.4

GROUNDWATER LEVEL HYDROGRAPH FOR THE TANK MODEL CALIBRATION

NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD

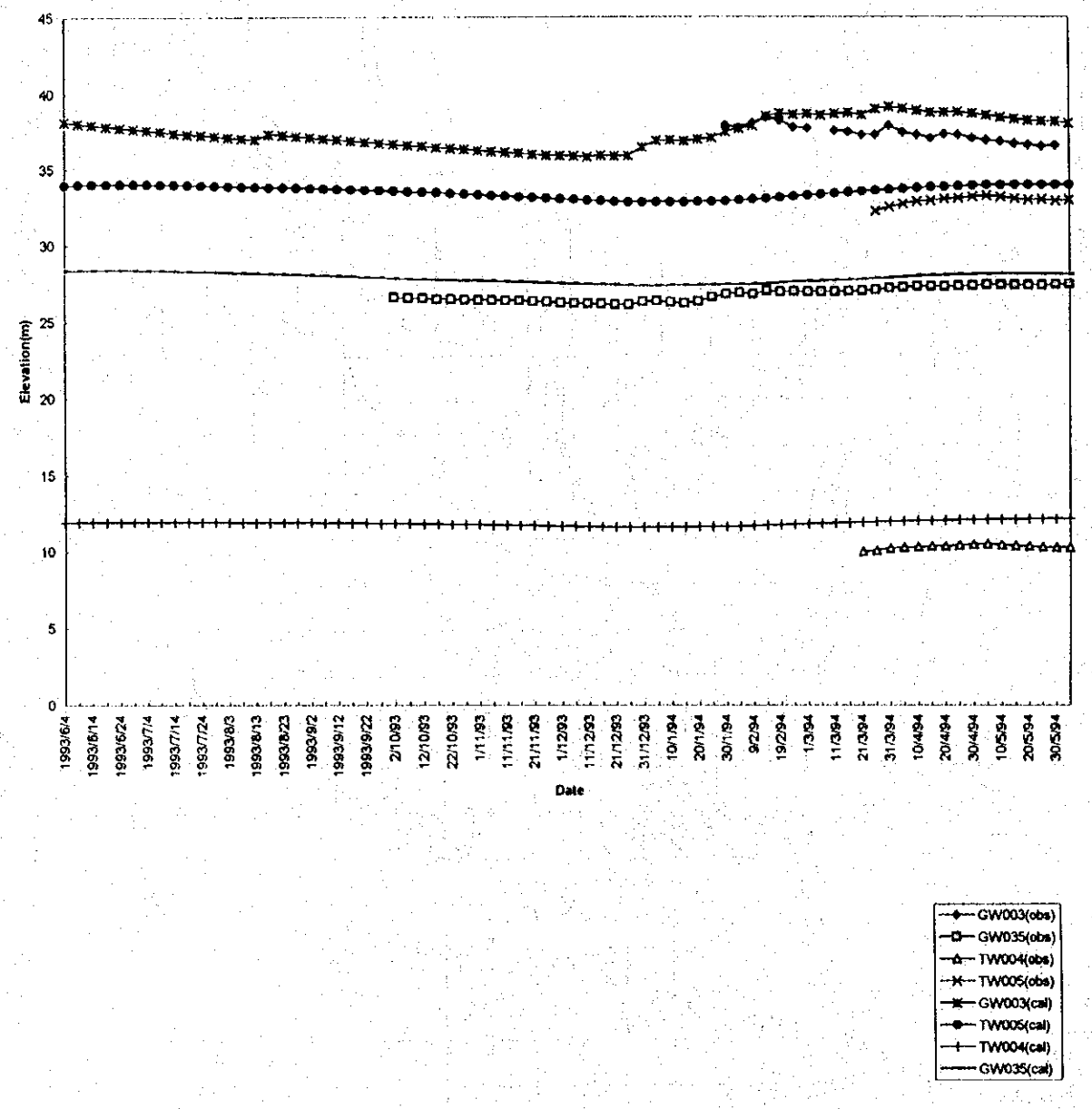


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig. 4.3.5 MODELING AREA

NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD



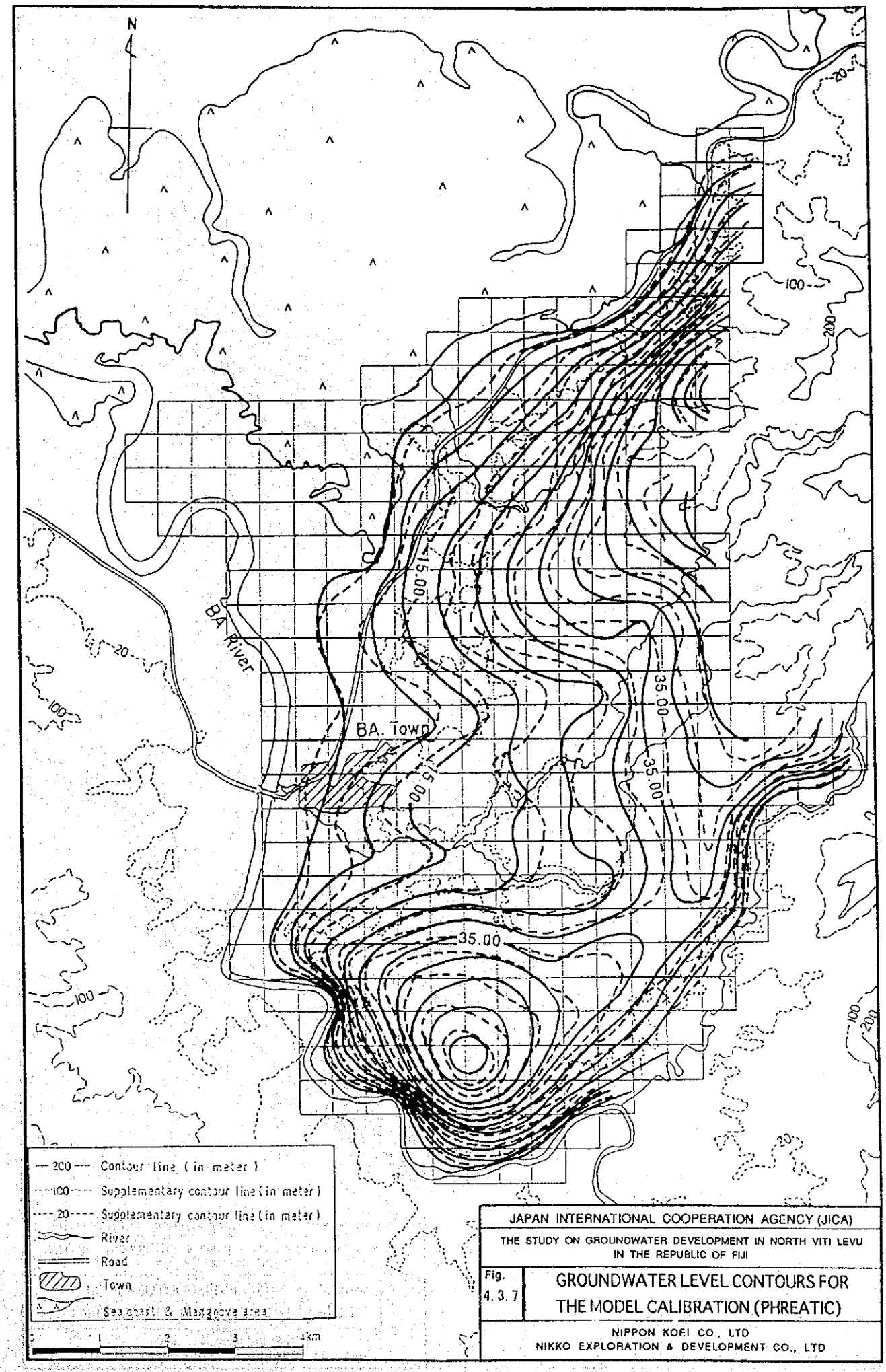
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig. 4.3.6.

GROUNDWATER LEVEL HYDROGRAPH FOR THE MODEL CALIBRATION

NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD

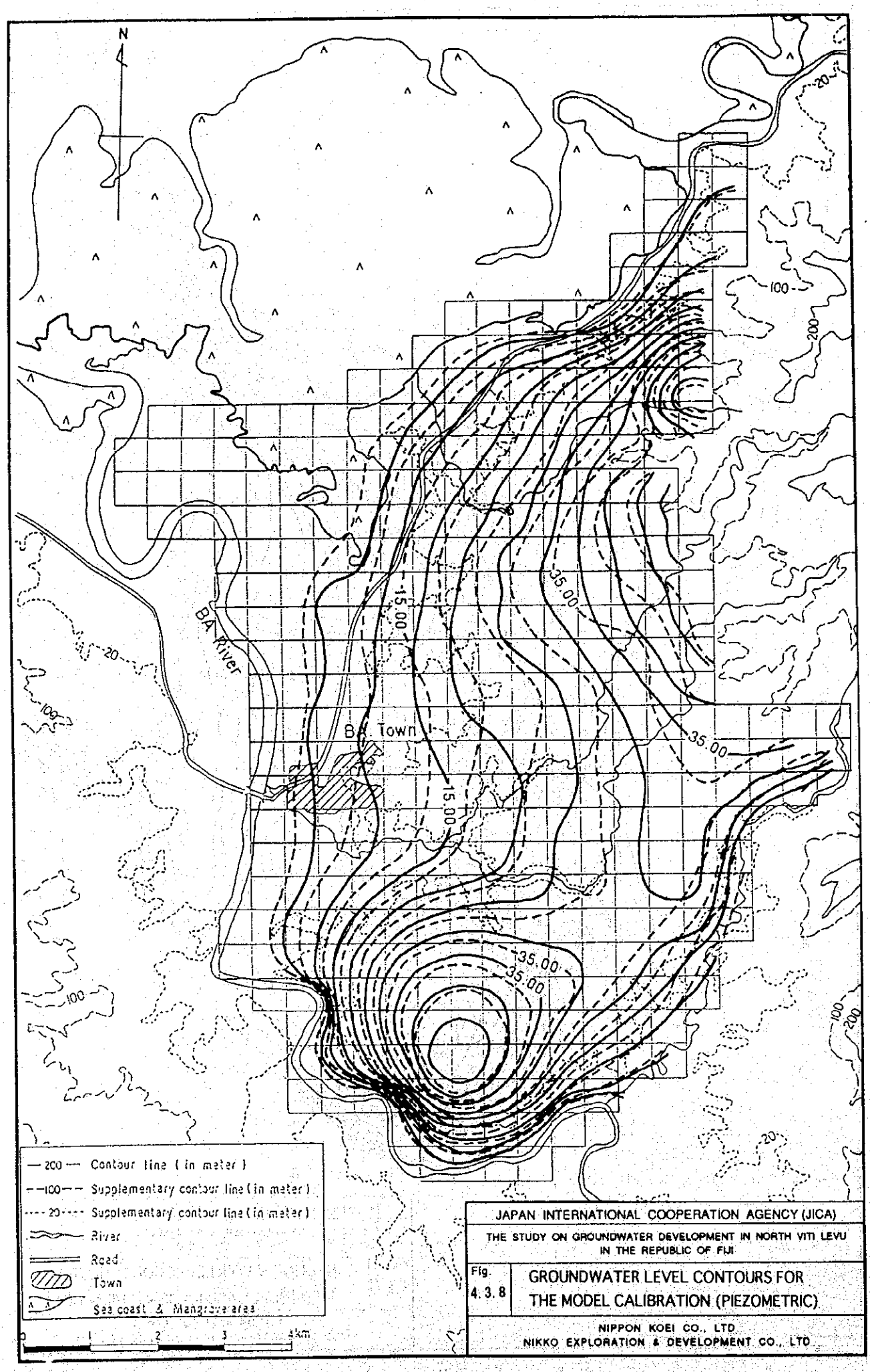


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig. 4.3.7 GROUNDWATER LEVEL CONTOURS FOR THE MODEL CALIBRATION (PHREATIC)

NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD

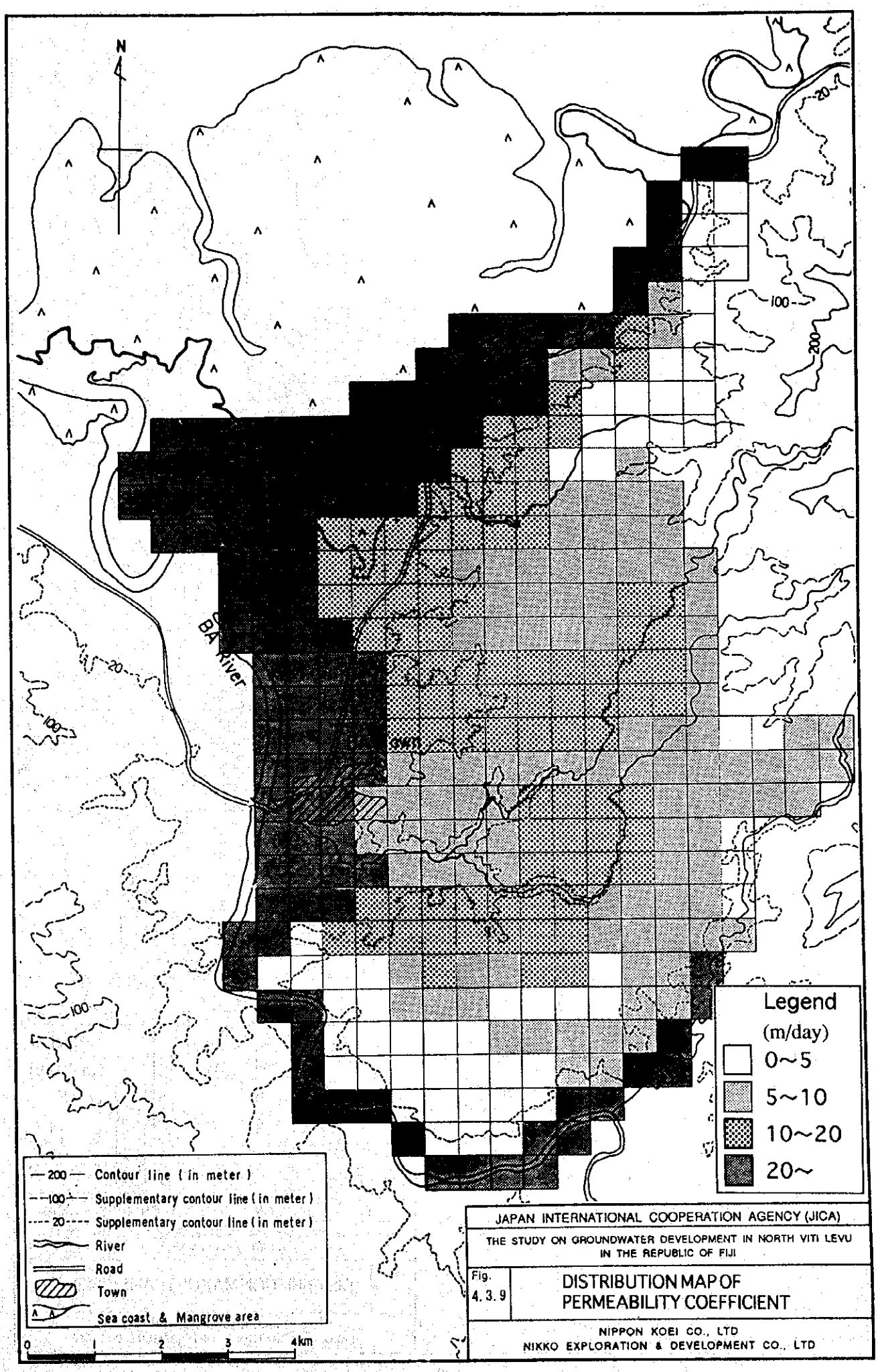


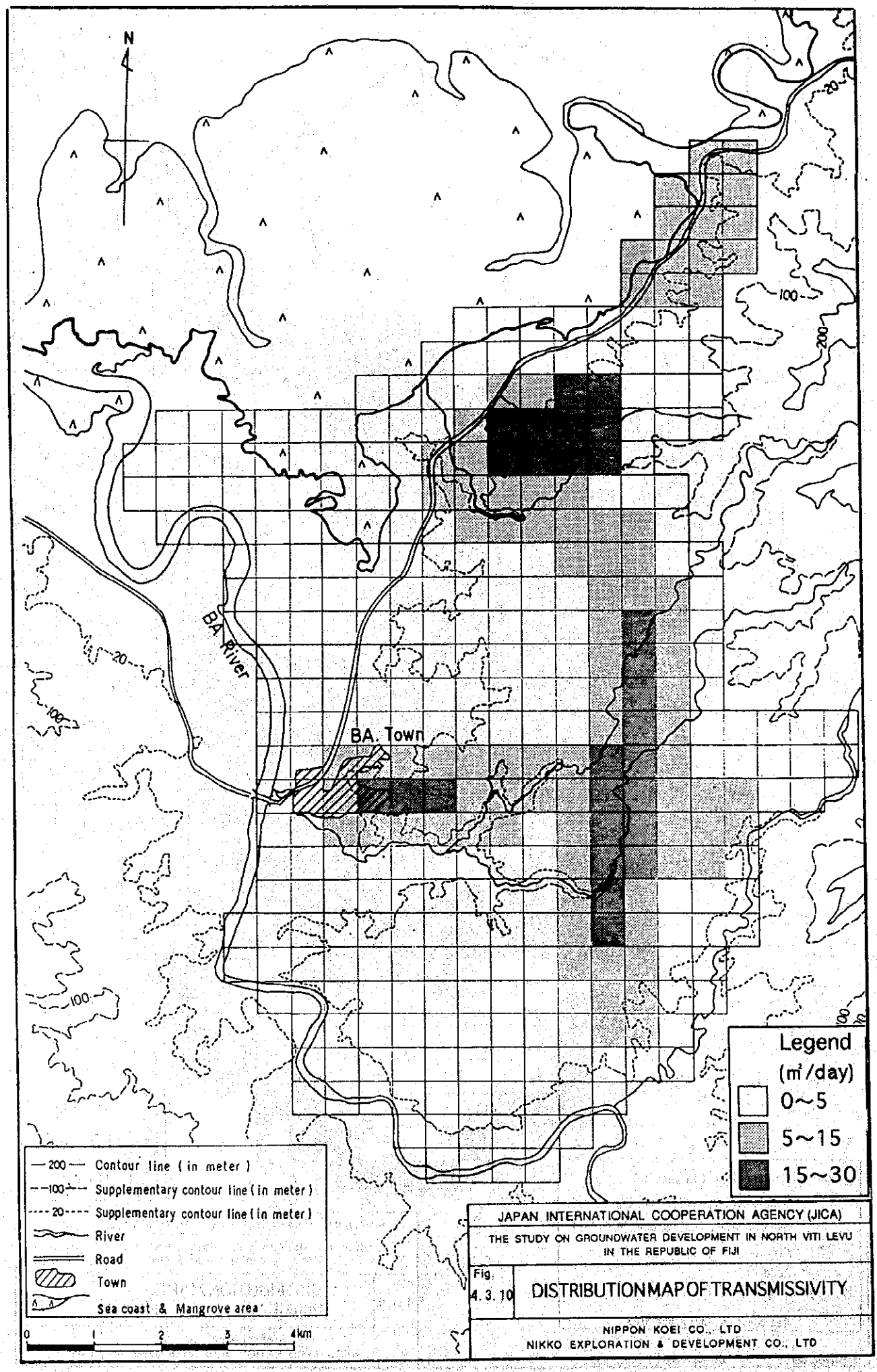
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

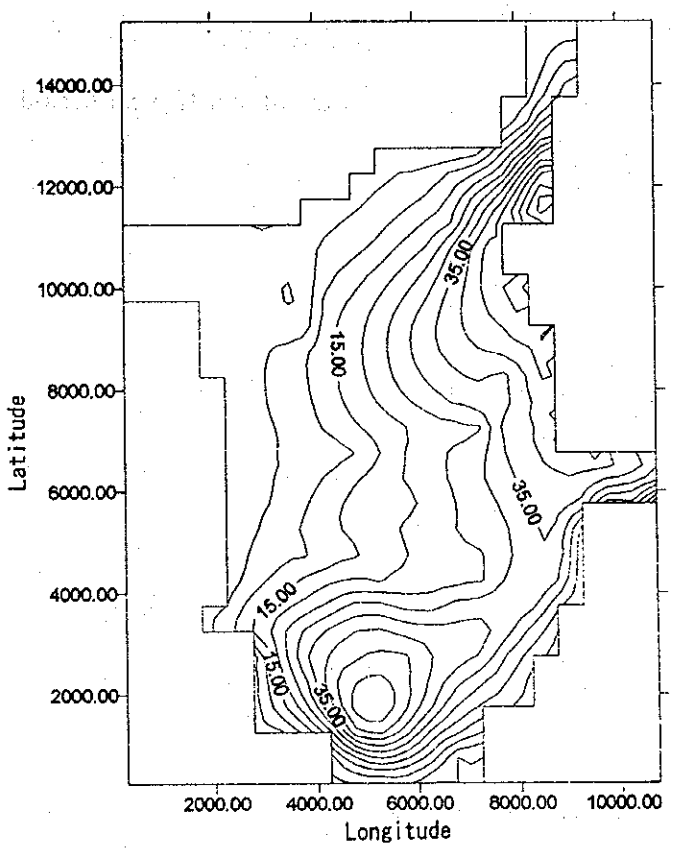
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig. 4.3.8 GROUNDWATER LEVEL CONTOURS FOR THE MODEL CALIBRATION (PIEZOMETRIC)

NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD

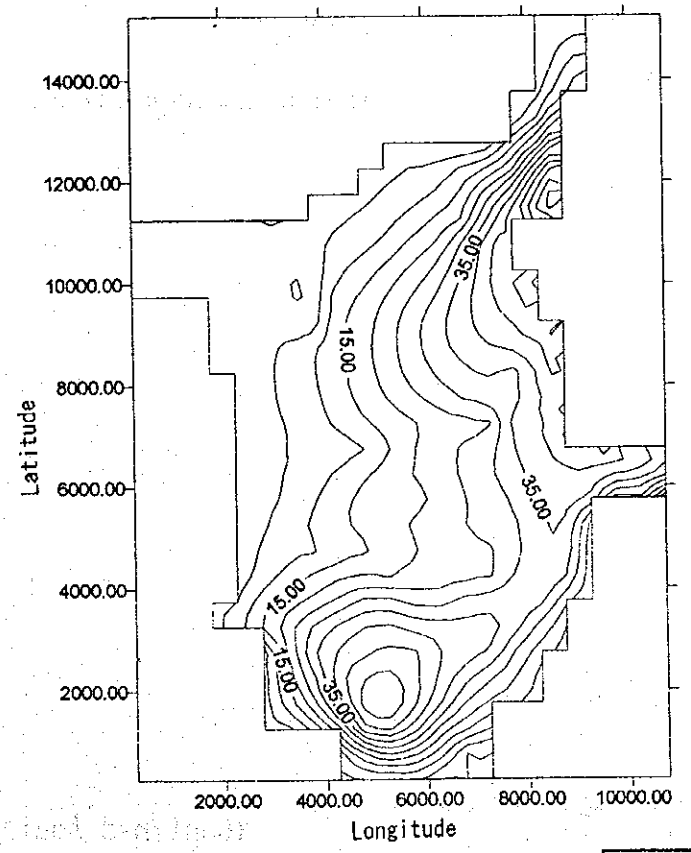

N
BA River
SWT
20
100
200
Legend
(m/day)
0~5
5~10
10~20
20~
200 Contour line (in meter)
100 Supplementary contour line (in meter)
20 Supplementary contour line (in meter)
River
Road
Town
Sea coast & Mangrove area
0 1 2 3 4km
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI
Fig. 4.3.9
DISTRIBUTION MAP OF PERMEABILITY COEFFICIENT
NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD


N
BA River
BA Town
20
100
200
Legend
(m²/day)
0~5
5~15
15~30
200 Contour line (in meter)
100 Supplementary contour line (in meter)
20 Supplementary contour line (in meter)
River
Road
Town
Sea coast & Mangrove area
0 1 2 3 4km
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI
Fig. 4.3.10
DISTRIBUTION MAP OF TRANSMISSIVITY
NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD



(CASE8)

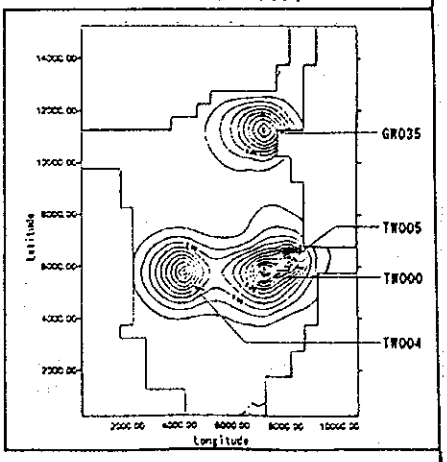
Draught in a 10-year period



(CASE9)

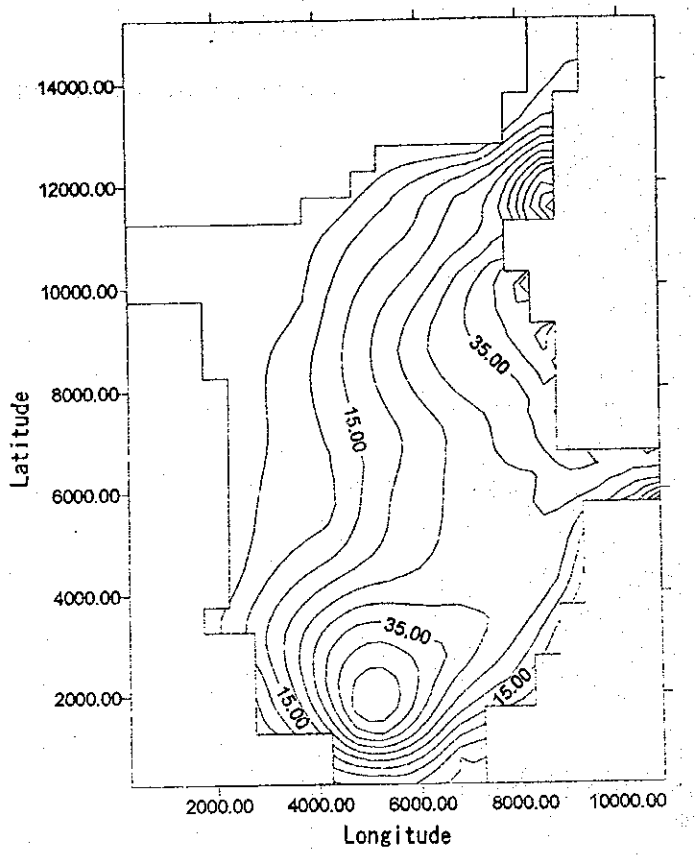
Draught in a 10-year period

WELL POINT



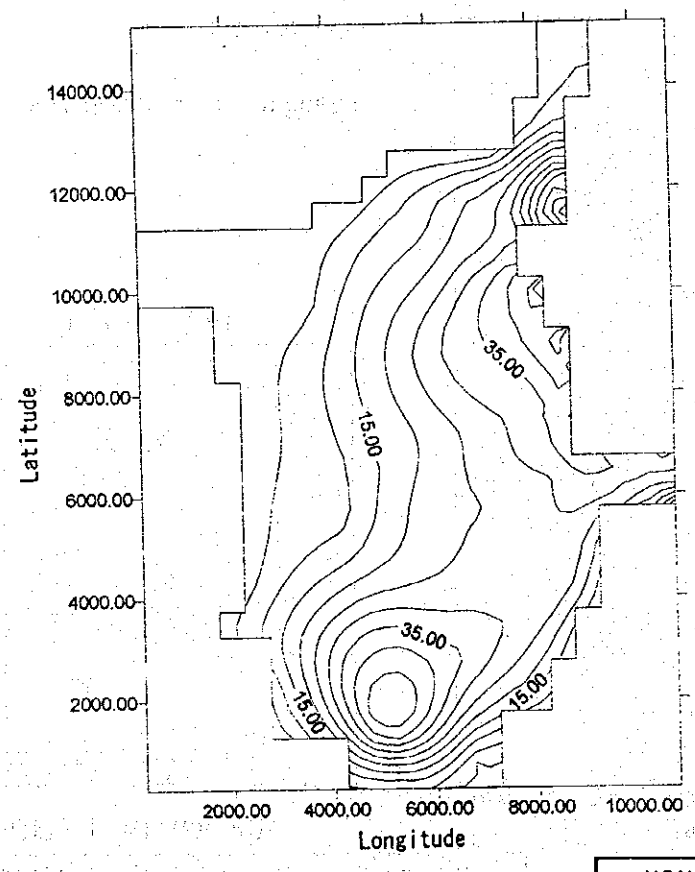
(Unconfined Aquifer)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 4.3.11	PREDICTION OF GROUNDWATER CONTOURS AT DECEMBER- UNCONFINED AQUIFER
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	



(CASE8)

Draught in a 10-year period

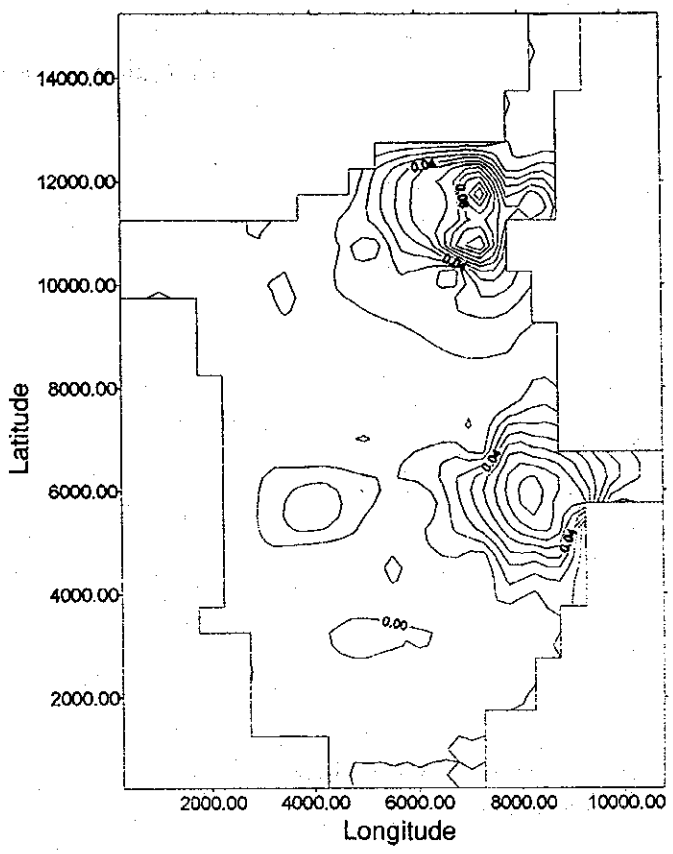


(CASE9)

Draught in a 10-year period

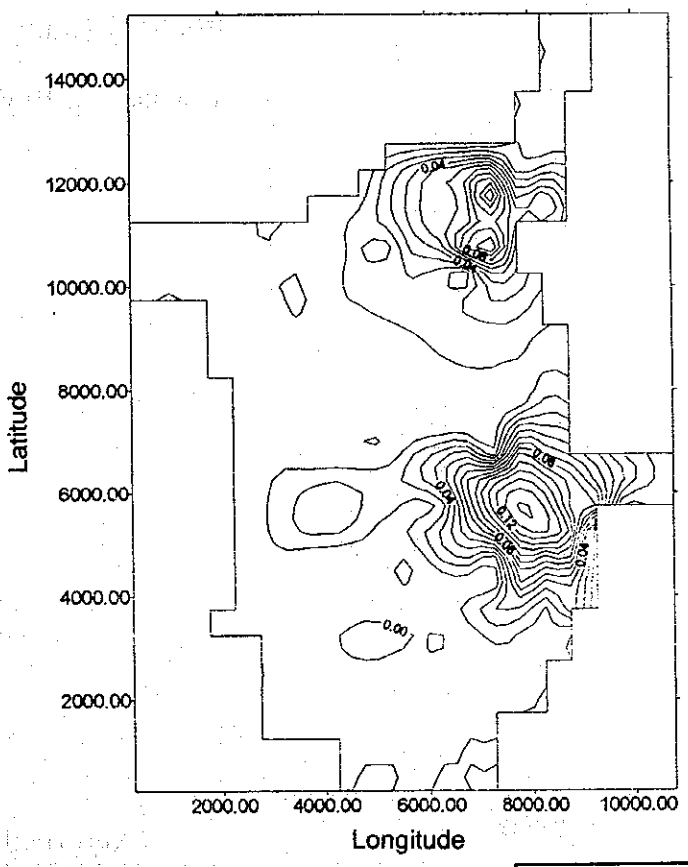
(Confined Aquifer)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 4. 3. 12	PREDICTION OF GROUNDWATER LEVEL CONTOURS AT DECEMBER - CONFINED AQUIFER
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	



(case1)-(case8)

Draught in a 10-year period

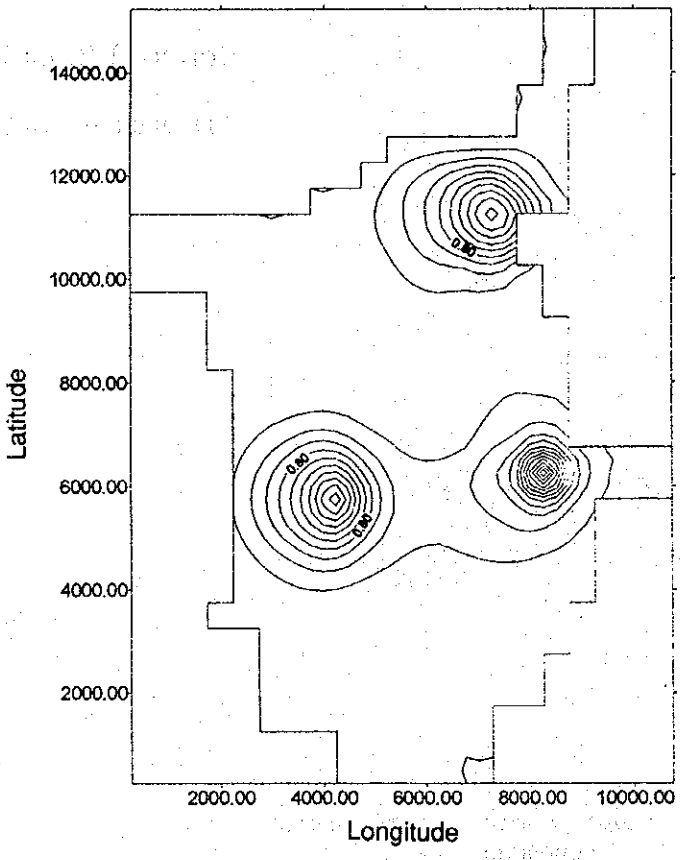


(case1)-(case9)

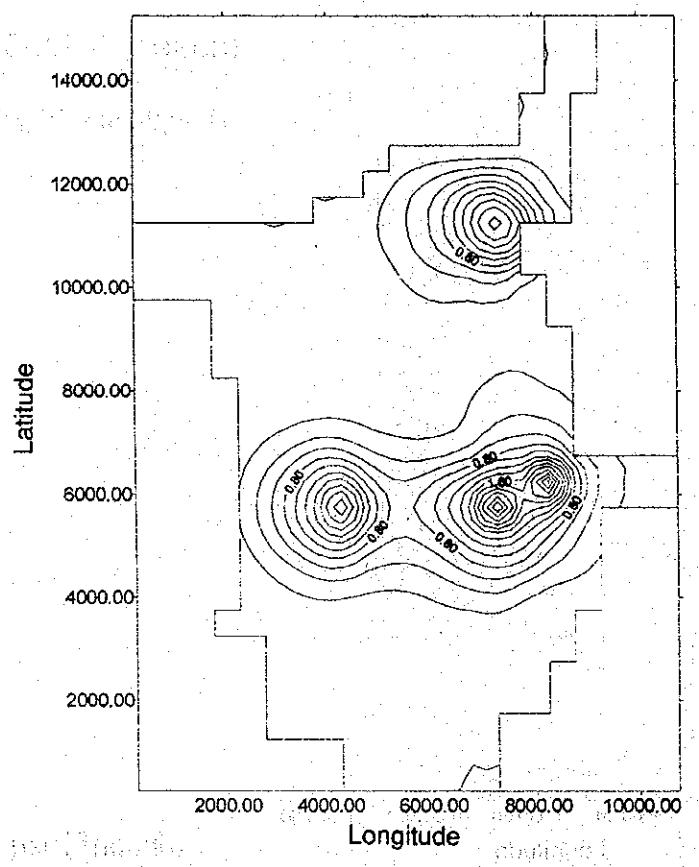
Draught in a 10-year period

(Unconfined Aquifer)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 4. 3. 13	PREDICTION OF DRAWDOWN CONTOURS AT DECEMBER - UNCONFINED AQUIFER
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	



Draught in a 10-year period



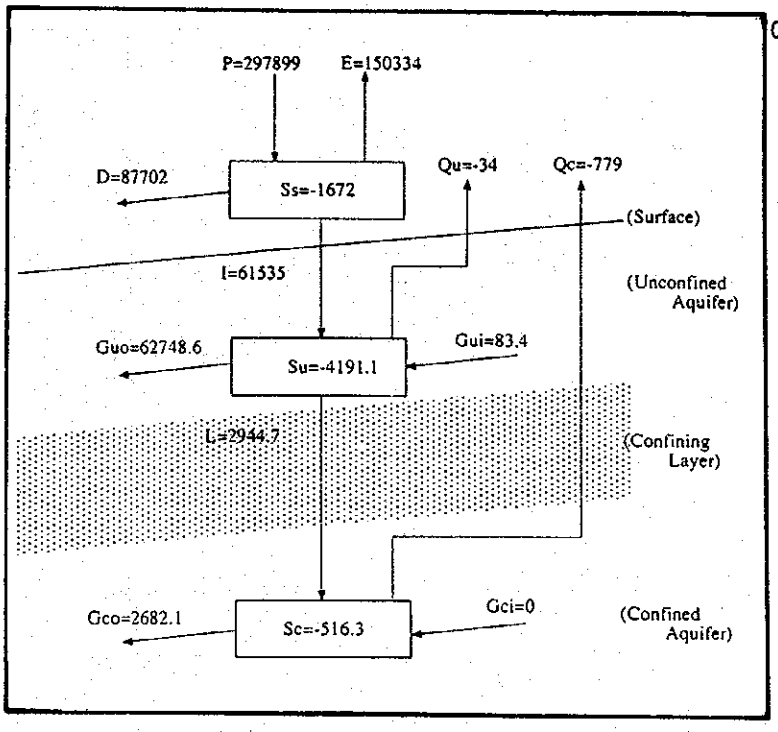
(case1)-(case9)

Draught in a 10-year period

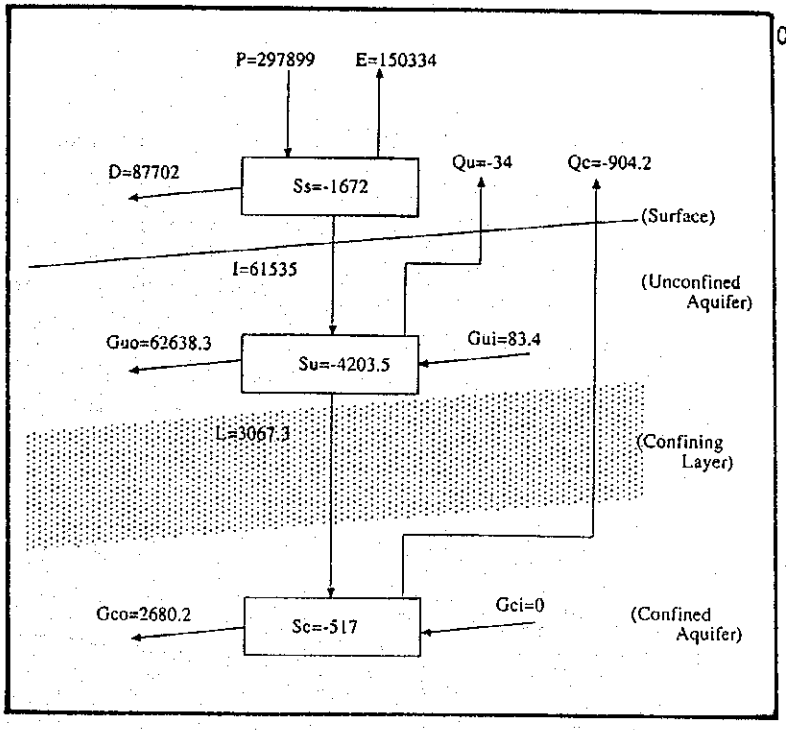
(Confined Aquifer)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 4. 3. 14	PREDICTION OF DRAWDOWN CONTOURS AT DECEMBER - CONFINED AQUIFER
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	

CASE 8



CASE 9



Legend

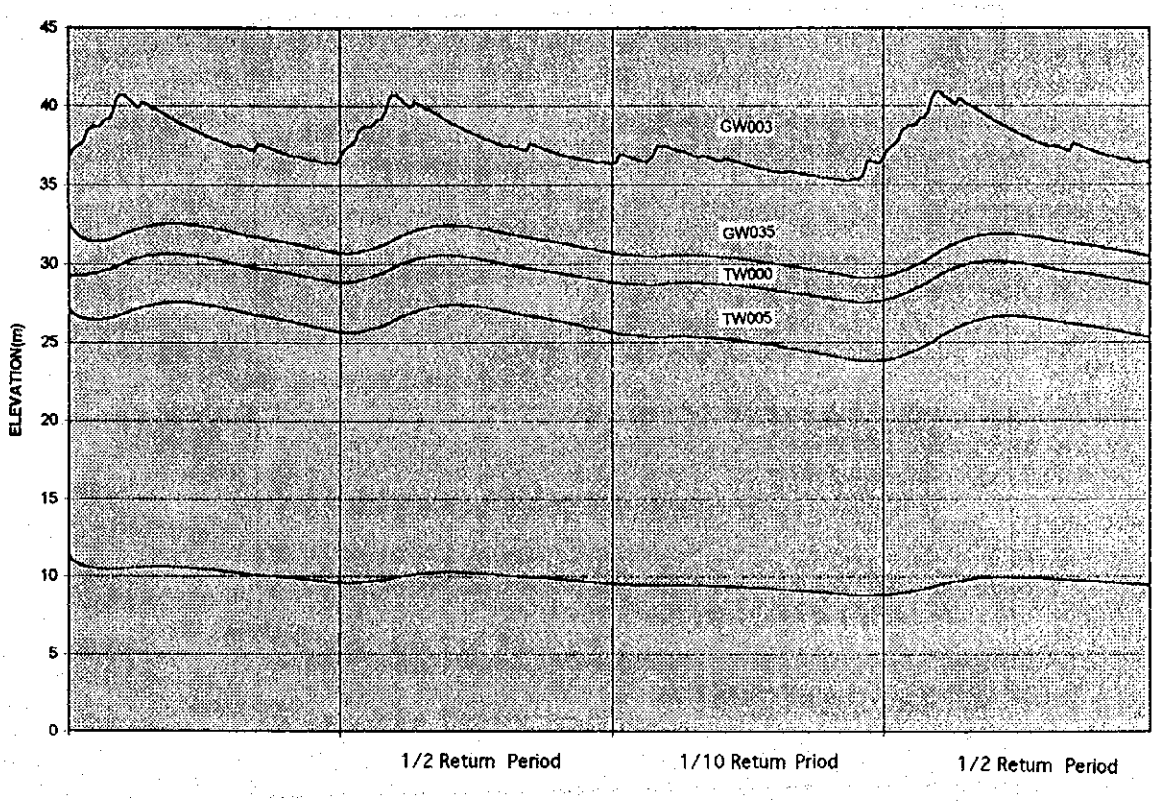
P : Precipitation
E : Evapotranspiration
D : Surface Runoff
I : Groundwater Recharge
L : Leakage
Ss : Change of Surface Storage
Su : Change of Unconfined Water Storage
Sc : Change of Confined Water Storage

Gui : Unconfined Wa
Guo : Unconfined Wa
Qu : Unconfined Wa
Gci : Confined Water
Gco : Confined Water Outflow
Qc : Confined Water Pumpage

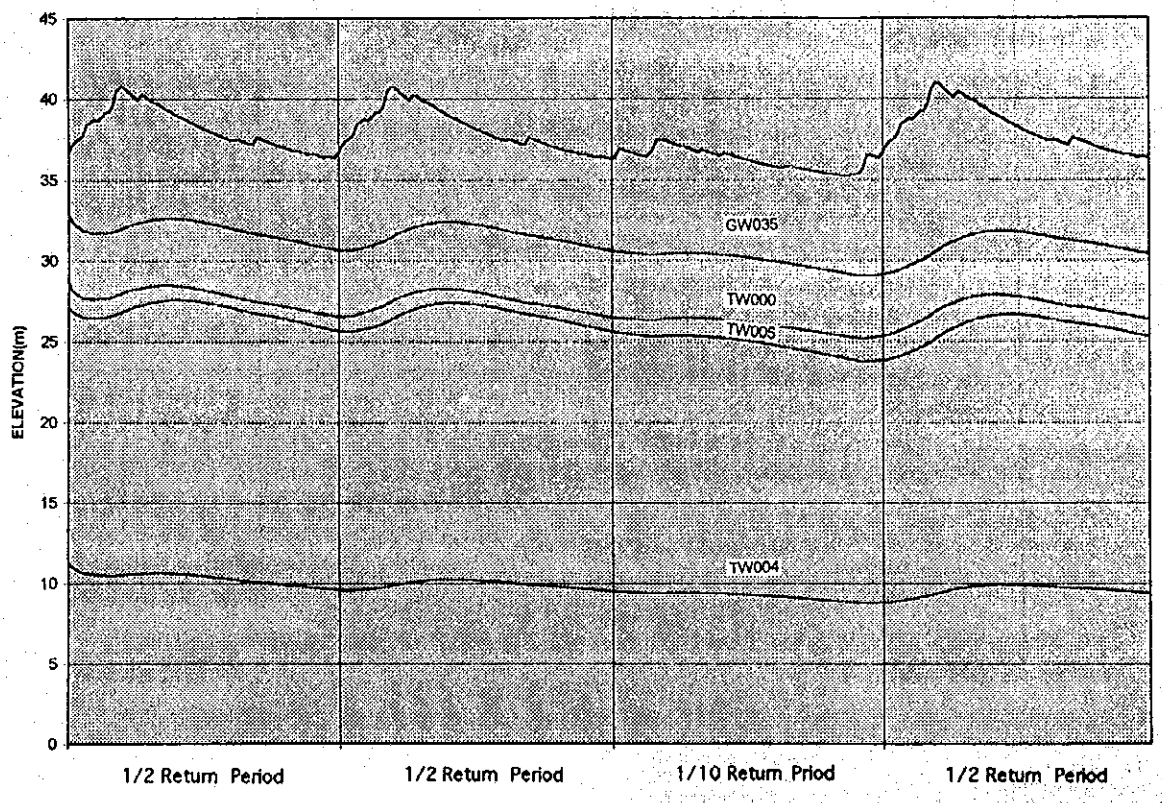
(Unit : m3/day)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 4. 3. 15	ANNUAL WATER BALANCE FOR THE TRANSIENT SIMULATION
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	

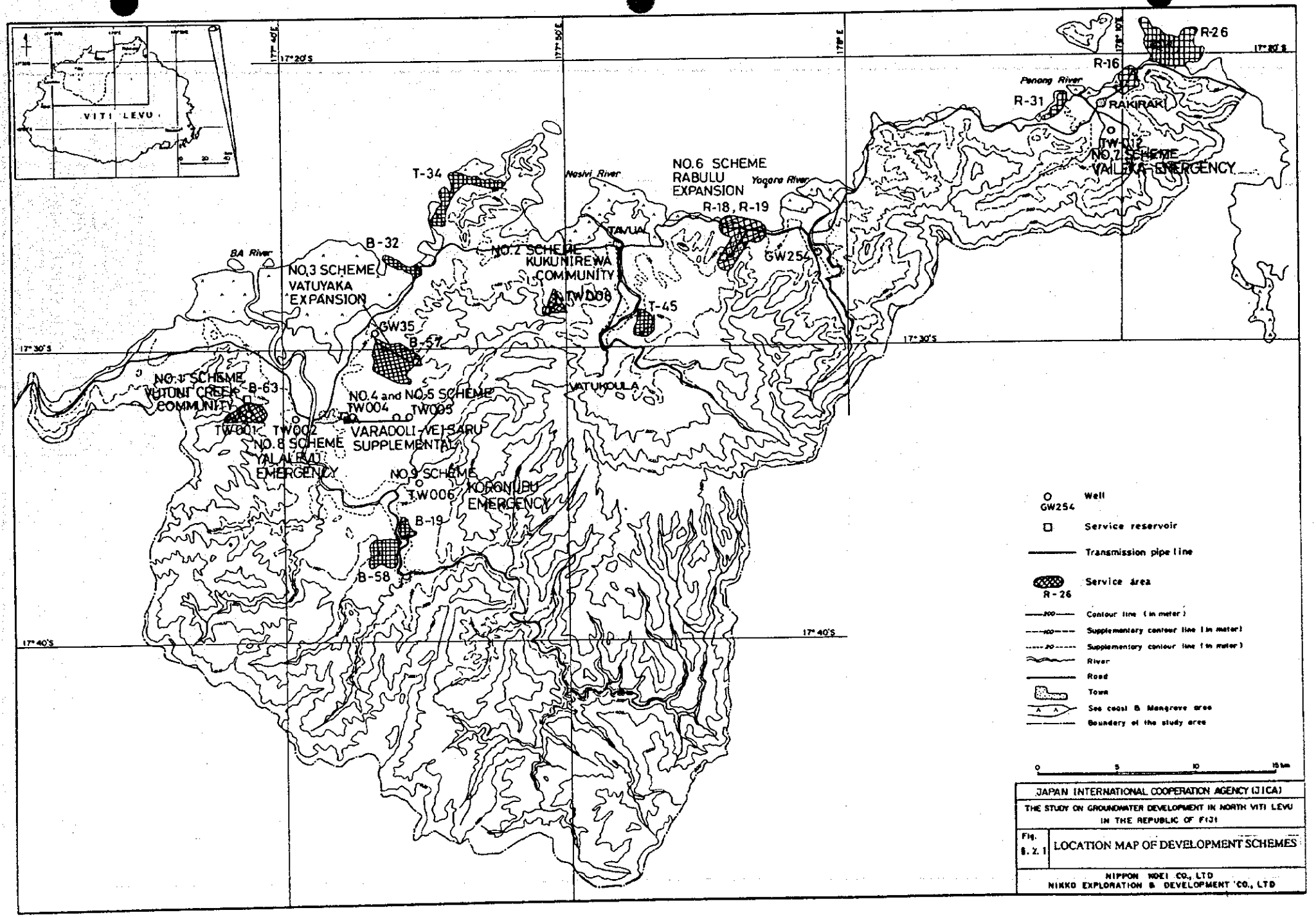
CASE 8

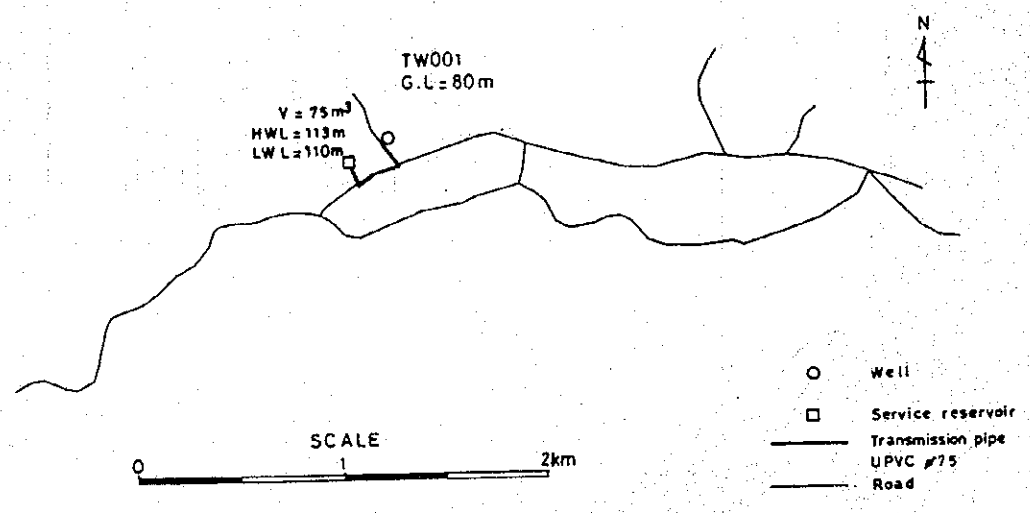


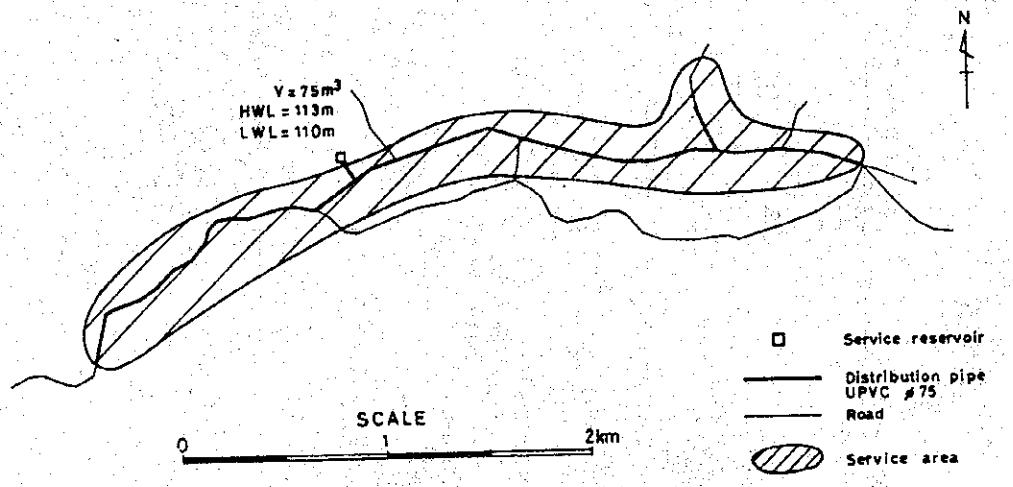
CASE 9



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 4.3.16	GROUNDWATER LEVEL HYDROGRAPH FOR THE TRANSIENT SIMULATION
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	

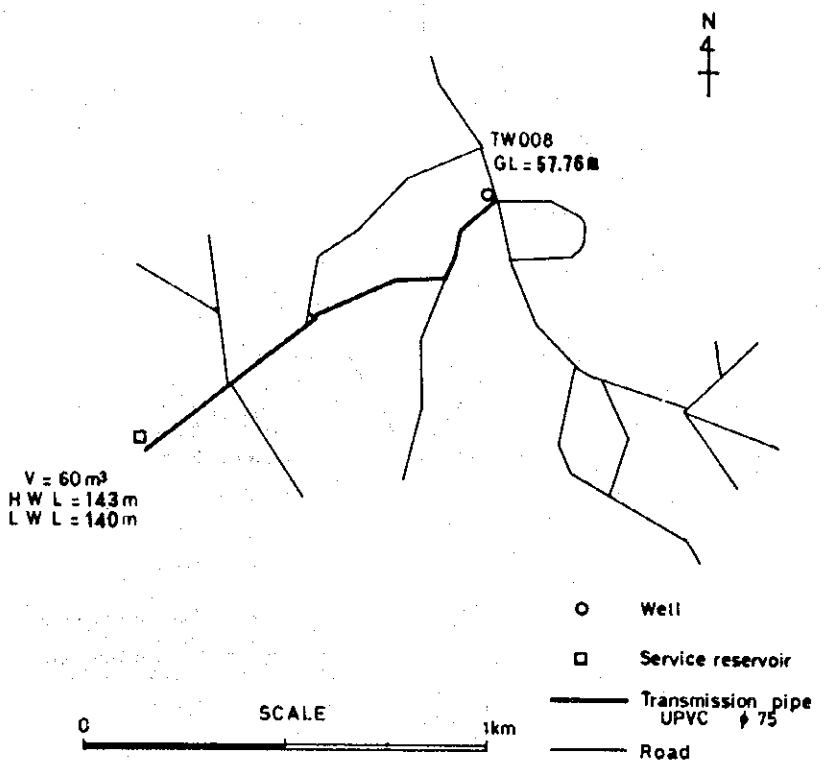

VITI LEVU
17°20'S
17°30'S
17°40'S
17°45'E
17°50'E
178°E
178°10'E
17°10'S
R-26
R-16
Panang River
R-31
RAKIRAKI
TW012
NO.7 SCHEME
VAILEKA EMERGENCY
T-34
Nasivi River
NO.6 SCHEME
RABULU
EXPANSION
Yagara River
R-18, R-19
TAVUA
GW254
B-32
BA River
NO.3 SCHEME
VATUYAKA
EXPANSION
NO.2 SCHEME
KUKUNIREWA
COMMUNITY
TW008
T-45
GW35
B-57
NO.1 SCHEME
VUTUNI CREEK
COMMUNITY
B-63
TW001
TW002
NO.4 and NO.5 SCHEME
TW004
TW005
VARADOLI-VEISARU
SUPPLEMENTAL
VATUKOULA
NO.8 SCHEME
YALALEVU
EMERGENCY
NO.9 SCHEME
TW006
KORONIBU
EMERGENCY
B-19
B-58
Well
GW254
Service reservoir
Transmission pipe line
Service area
R-26
Contour line (in meter)
Supplementary contour line (in meter)
Supplementary contour line (in meter)
River
Road
Town
Sea coast & Mangrove area
Boundary of the study area
0
5
10
15 km
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU
IN THE REPUBLIC OF FIJI
Fig. 8.2.1
LOCATION MAP OF DEVELOPMENT SCHEMES
NIPPON NOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD

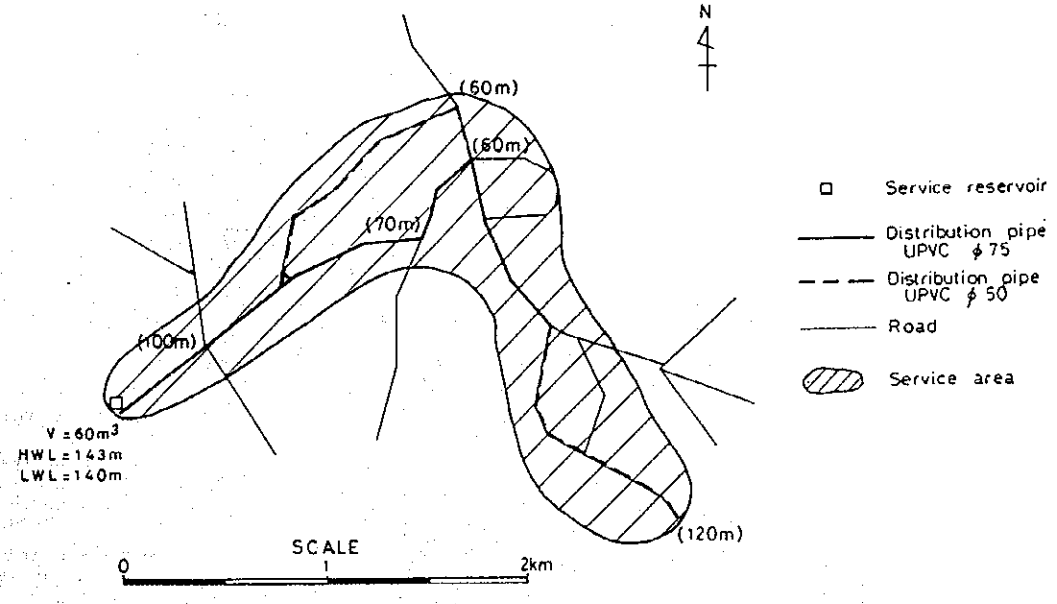




No.1 VUTUNI CREEK COMMUNITY SCHEME

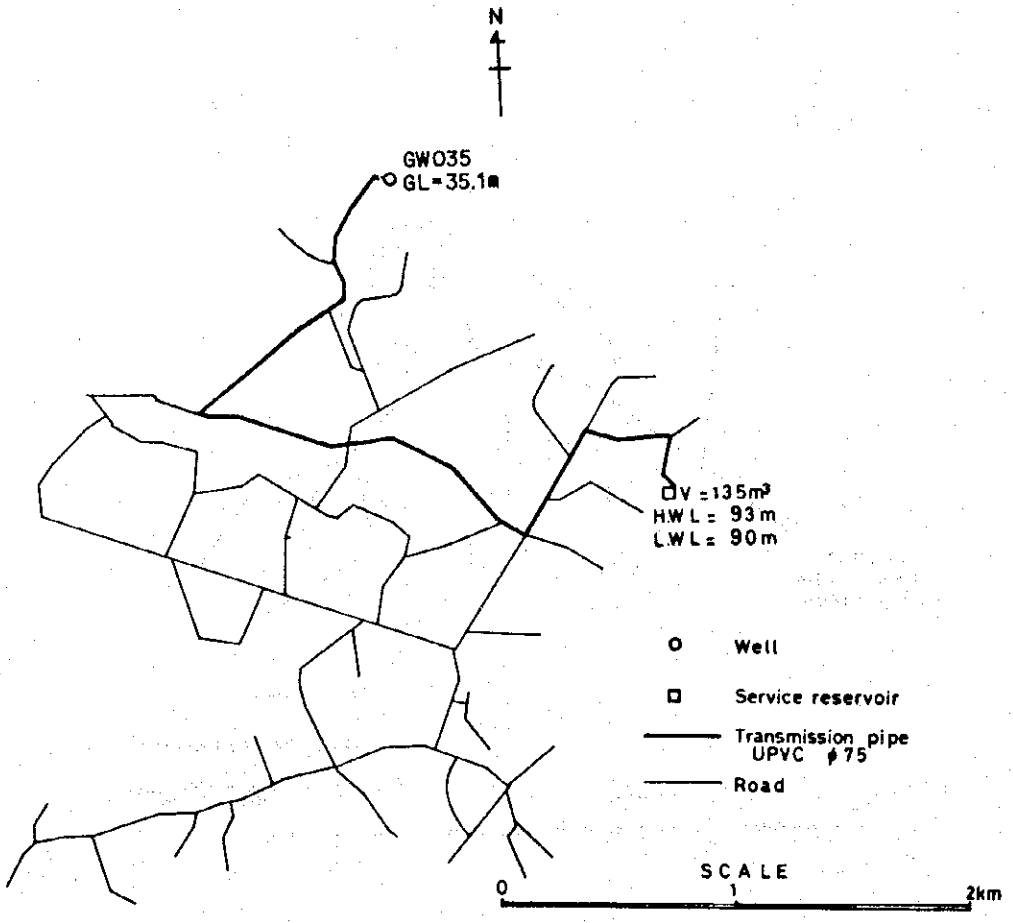
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 6.2.2	LAYOUT OF PROPOSED WATER SUPPLY SCHEME (1)
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	

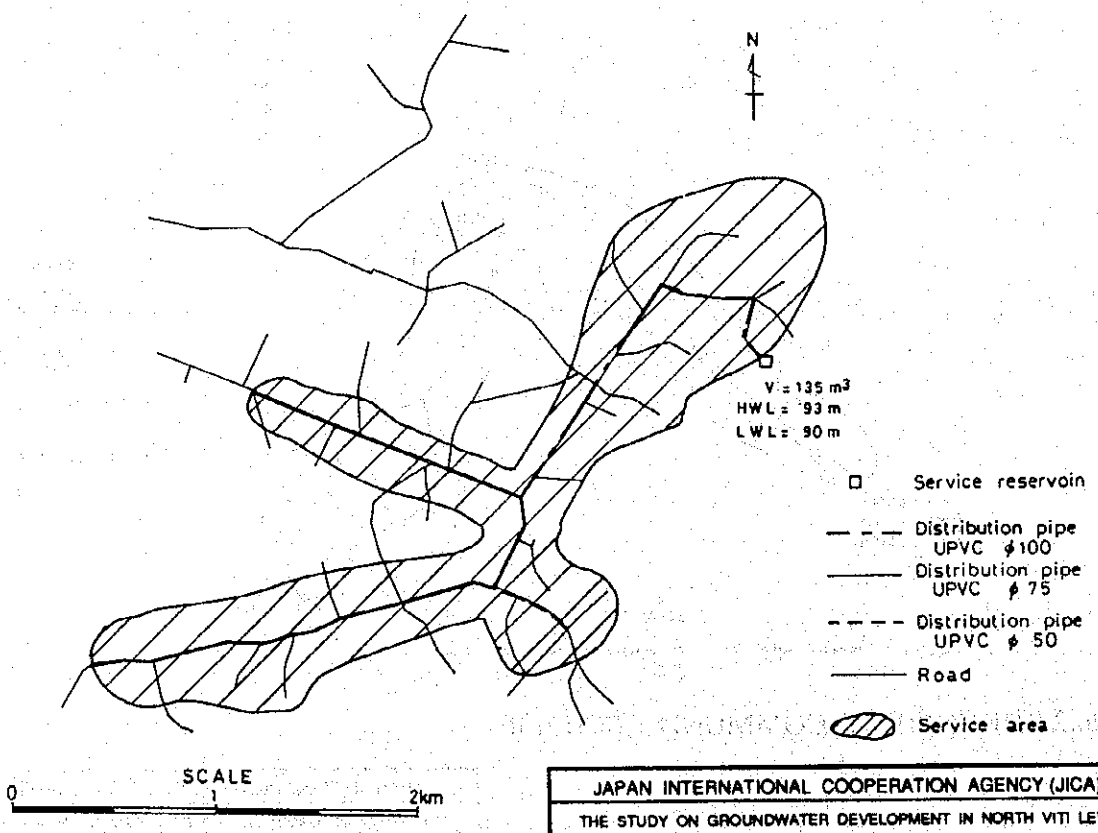




No.2 KUKUNIREWA COMMUNITY SCHEME

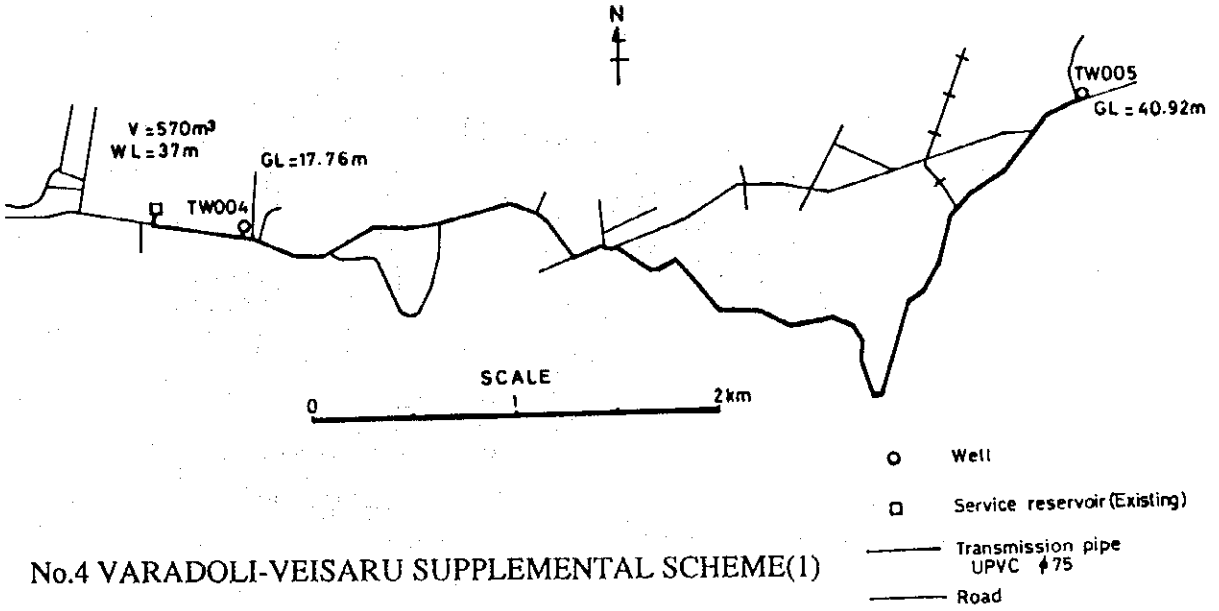
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 6.2.2	LAYOUT OF PROPOSED WATER SUPPLY SCHEME (2)
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	



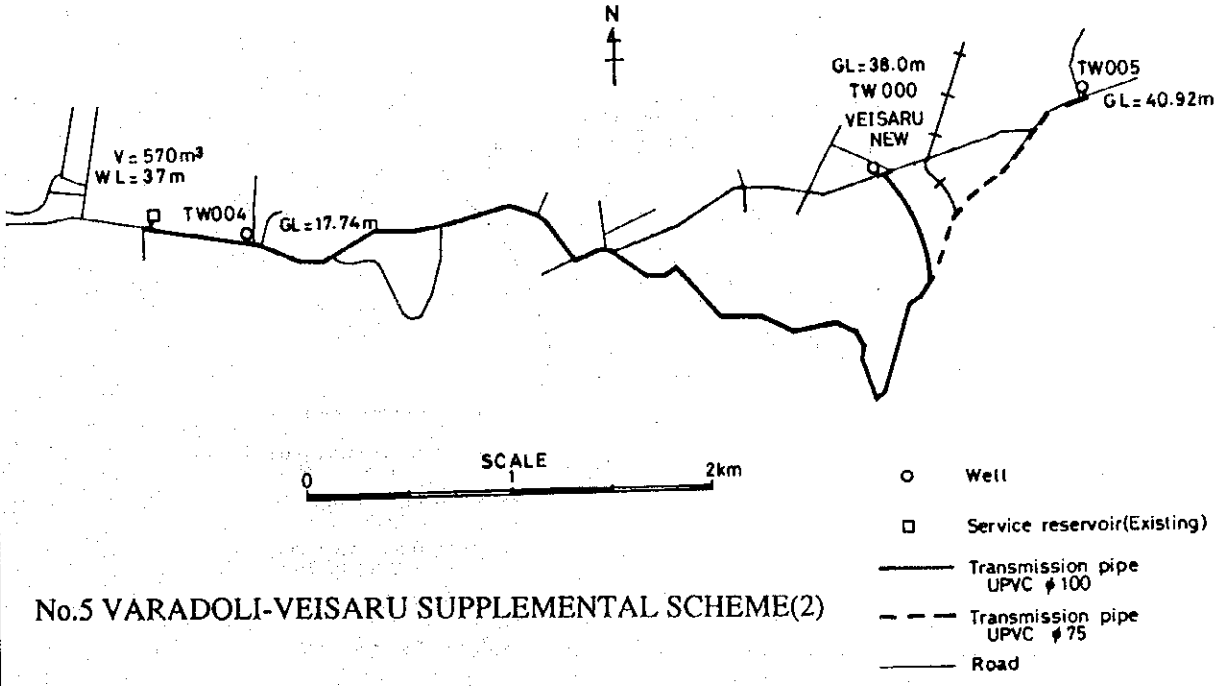


No.3 VATUYAKA EXPANSION SCHEME

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 6. 2. 2	LAYOUT OF PROPOSED WATER SUPPLY SCHEME (3)
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	

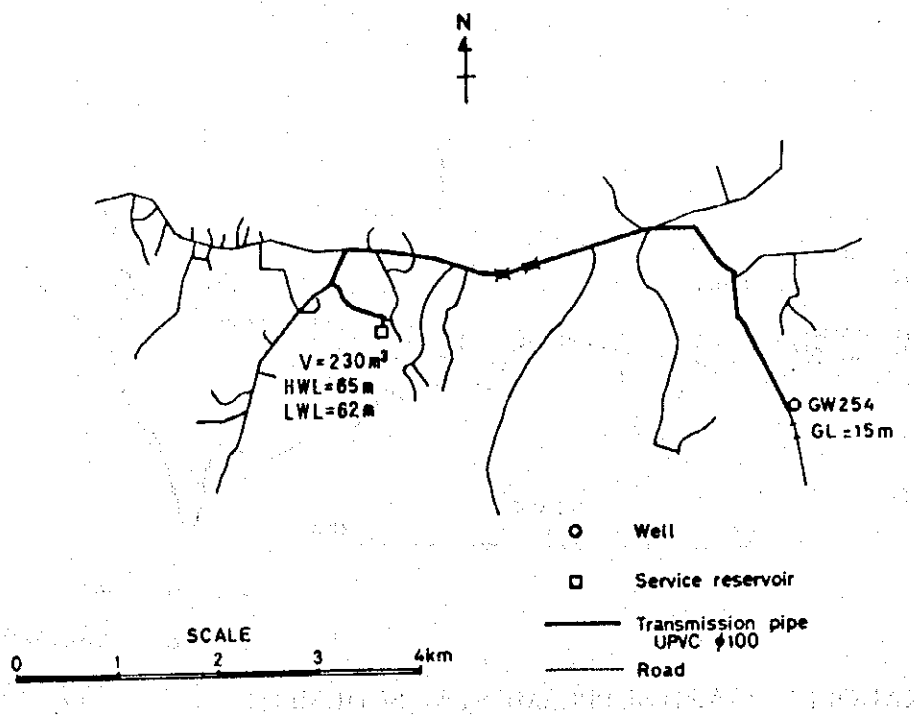


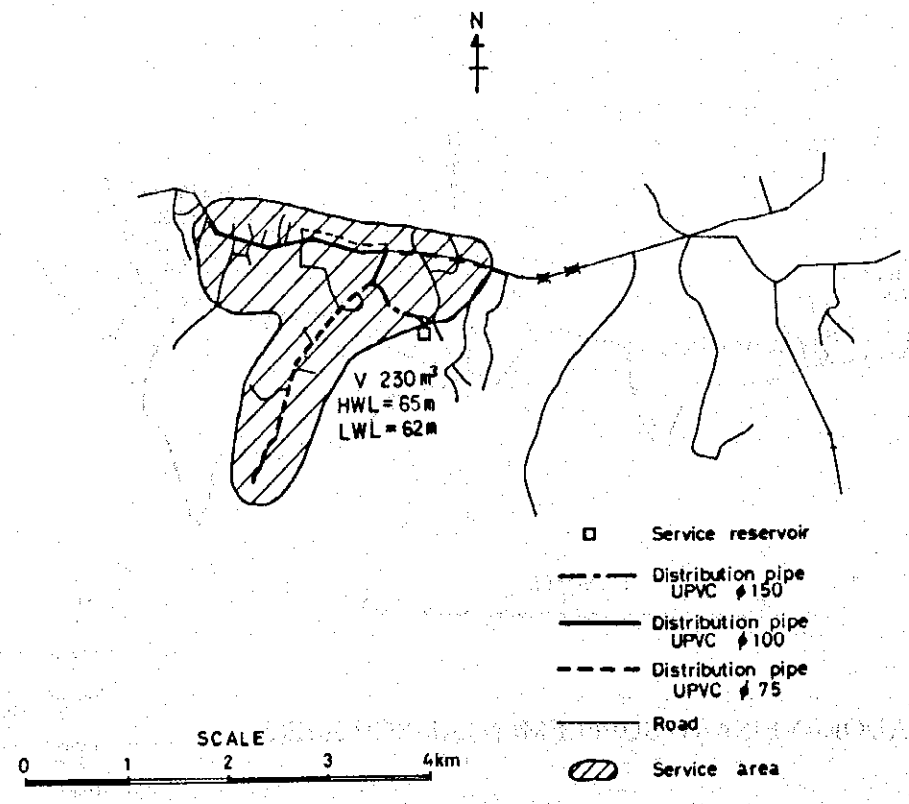
No.4 VARADOLI-VEISARU SUPPLEMENTAL SCHEME(1)



No.5 VARADOLI-VEISARU SUPPLEMENTAL SCHEME(2)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 6. 2. 2	LAYOUT OF PROPOSED WATER SUPPLY SCHEME (4)
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	

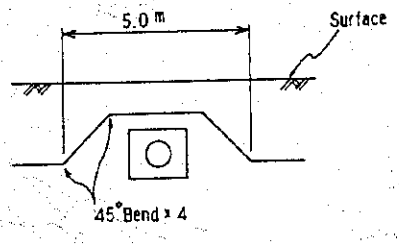




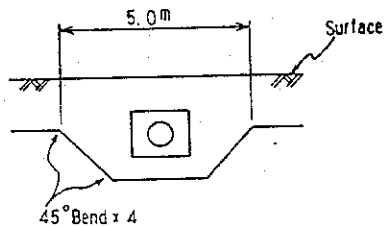
No.6 RABULU EXPANSION SCHEME

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 8.2.2	LAYOUT OF PROPOSED WATER SUPPLY SCHEME (5)
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	

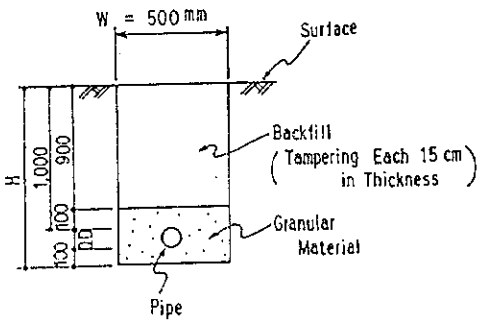
C-1. Overcrossing Culvert-1



C-2. Undercrossing Culvert

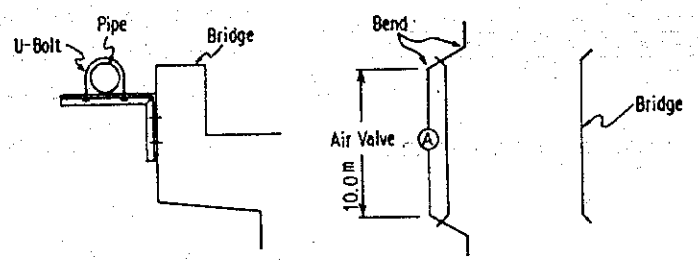


Typical Section of Pipe Installation

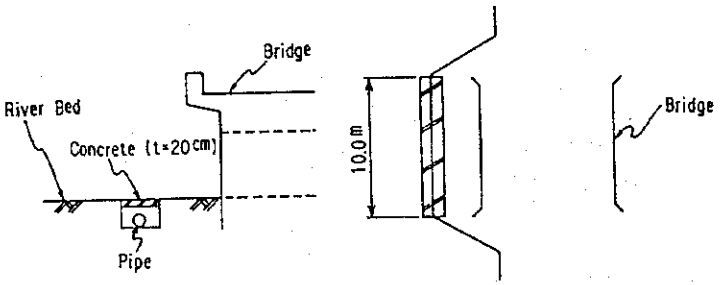


Pipe	W mm	H mm
ø 50mm	500	1,160
ø 75mm	500	1,190
ø 100mm	500	1,214
ø 150mm	500	1,265

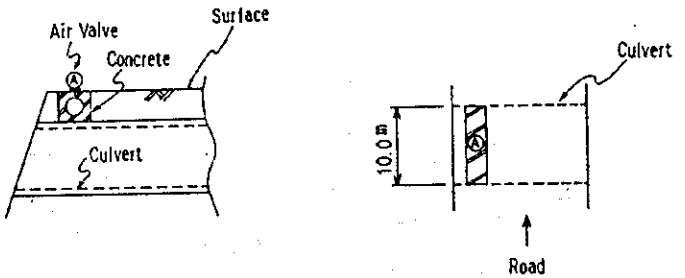
B-1. Attached Bridge



B-2. Undercrossing Bridge



C-3. Road Crossing (Overcrossing Culvert-2)

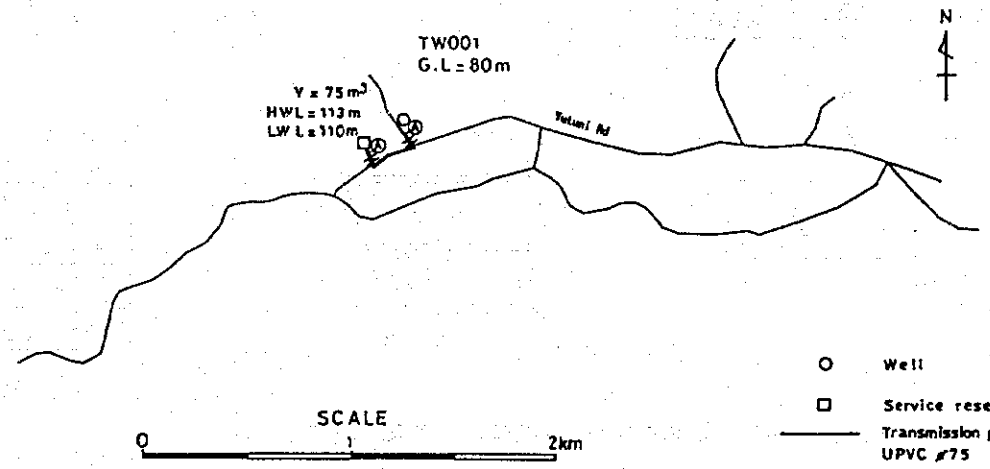


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig 7.2.1 STANDARD DESIGNS

NIPPON KOEI CO., LTD
NIKKO EXPLORATION & DEVELOPMENT CO., LTD



Well

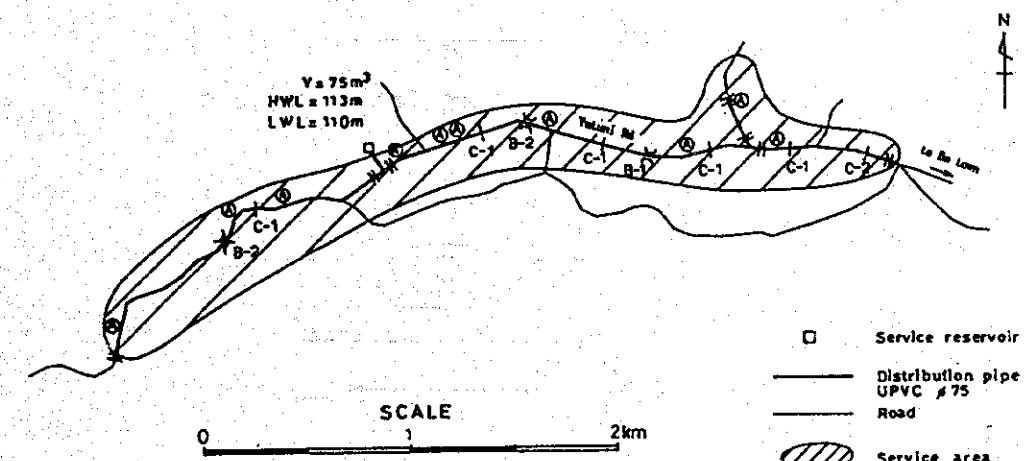
Service reservoir

Transmission pipe UPVC φ75

Road

Air Valve

Sluce Valve



Service reservoir

Distribution pipe UPVC φ75

Road

Service area

Air Valve

Sluce Valve

C-1 Overcrossing Culvert-1

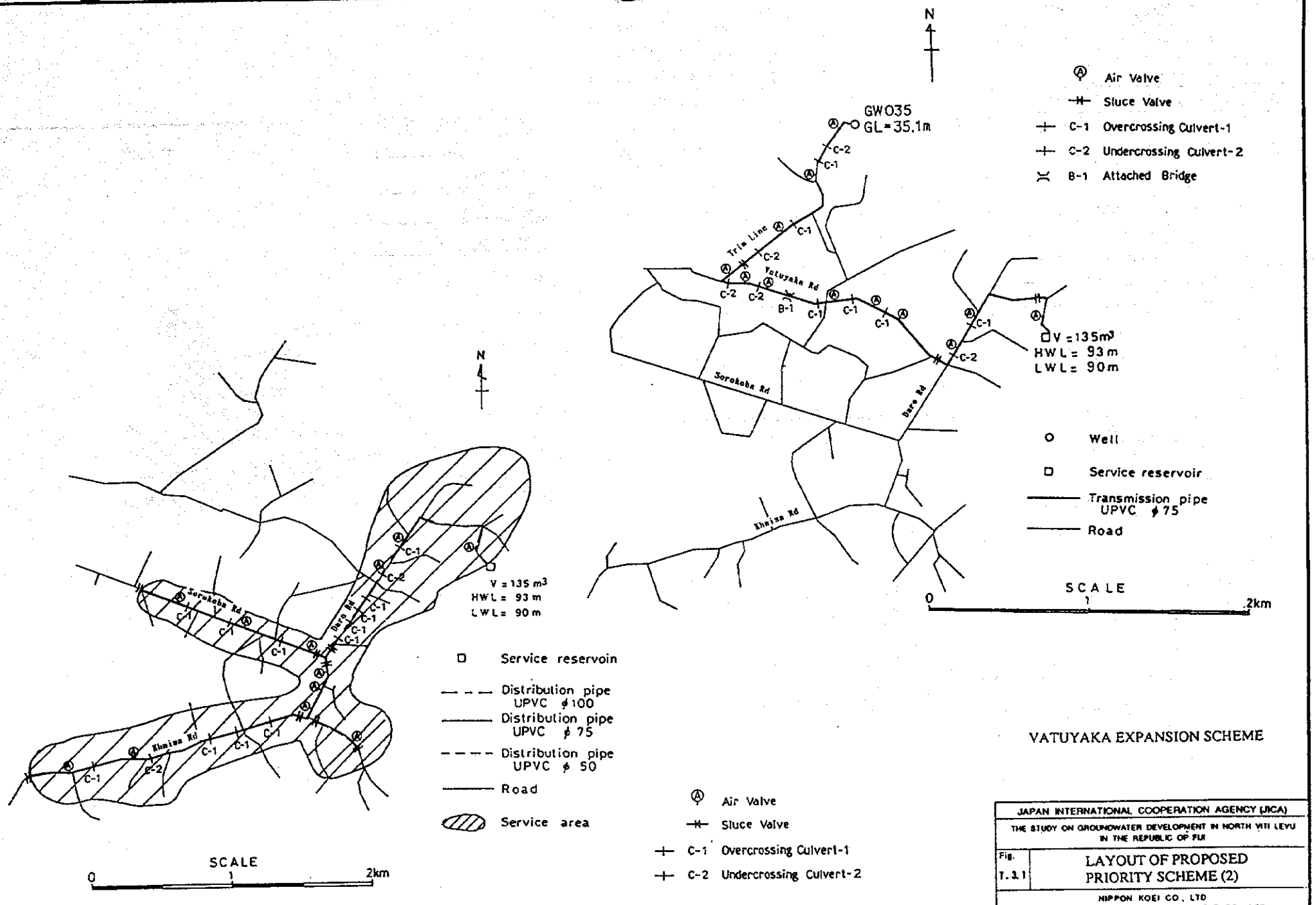
C-2 Undercrossing Culvert-2

B-1 Attached Bridge

B-2 Undercrossing Bridge

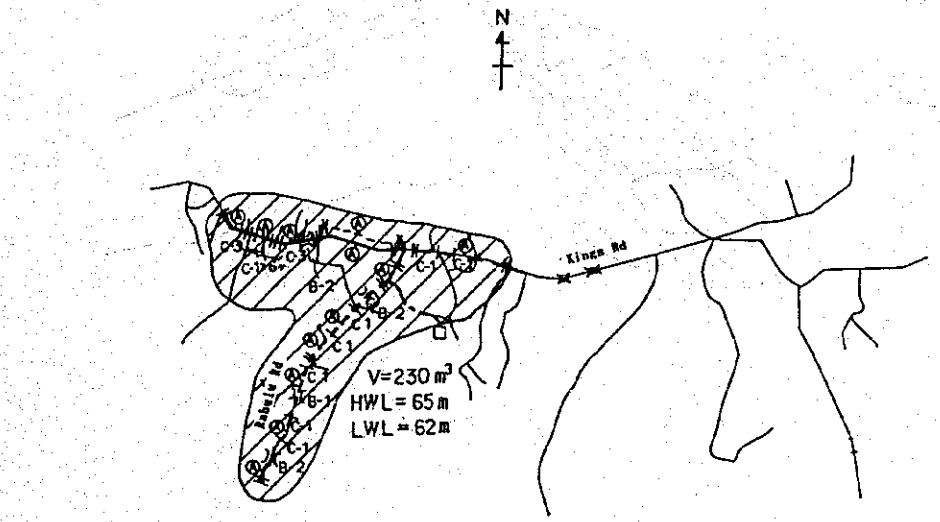
VUTUNI CREEK COMMUNITY SCHEME

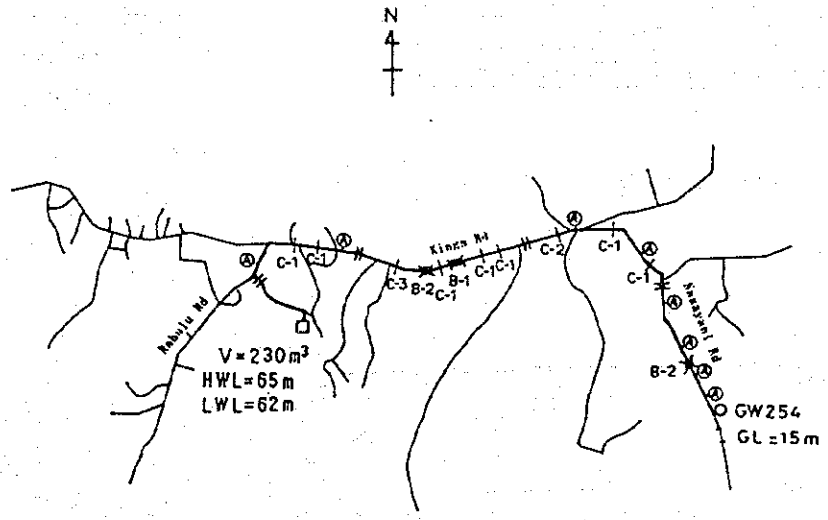
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. 7.3.1	LAYOUT OF PROPOSED PRIORITY SCHEME (1)
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	



VATUYAKA EXPANSION SCHEME

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI	
Fig. T.3.1	LAYOUT OF PROPOSED PRIORITY SCHEME (2)
NIPPON KOEI CO., LTD NIKKO EXPLORATION & DEVELOPMENT CO., LTD	





SCALE

0 1 2 3 4km

- Service reservoir
- Distribution pipe UPVC ϕ150
- Distribution pipe UPVC ϕ100
- Distribution pipe UPVC ϕ75
- Road
- Service area
- Air Valve
- Sluce Valve
- C-1 Overcrossing Culvert-1
- C-3 Overcrossing Culvert-3
- B-1 Attached Bridge
- B-2 Undercrossing Bridge

SCALE

0 1 2 3 4km

- Well
- Service reservoir
- Transmission pipe UPVC ϕ100
- Road
- Air Valve
- Sluce Valve
- C-1 Overcrossing Culvert-1
- C-2 Undercrossing Culvert-2
- C-3 Road Crossing
- B-1 Attached Bridge
- B-2 Undercrossing Bridge

RABULU EXPANSION SCHEME

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THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig 7.3.1

LAYOUT OF PROPOSED PRIORITY SCHEME (3)

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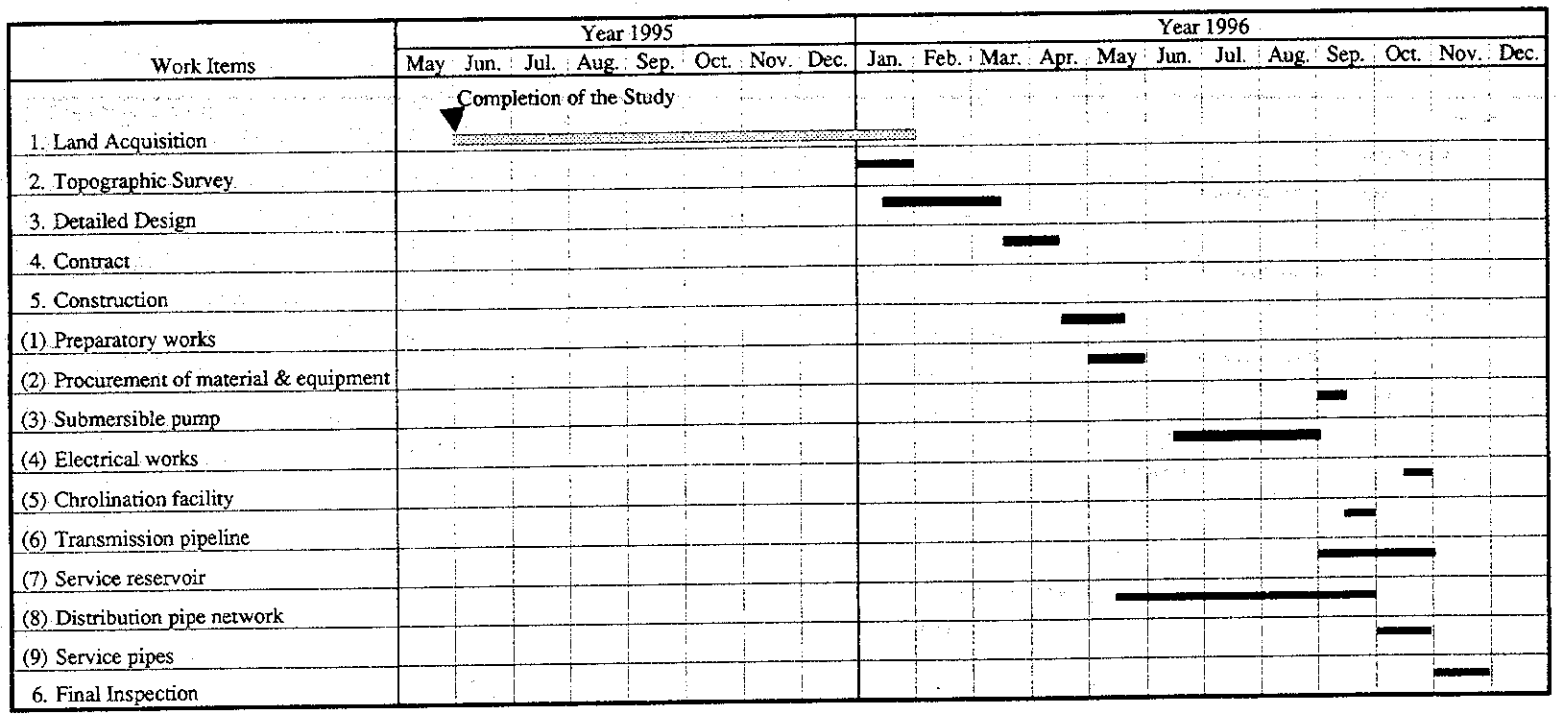

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Fig. 7.4.1 IMPLEMENTATION PROGRAMME OF VUTUNI CREEK COMMUNITY SCHEME

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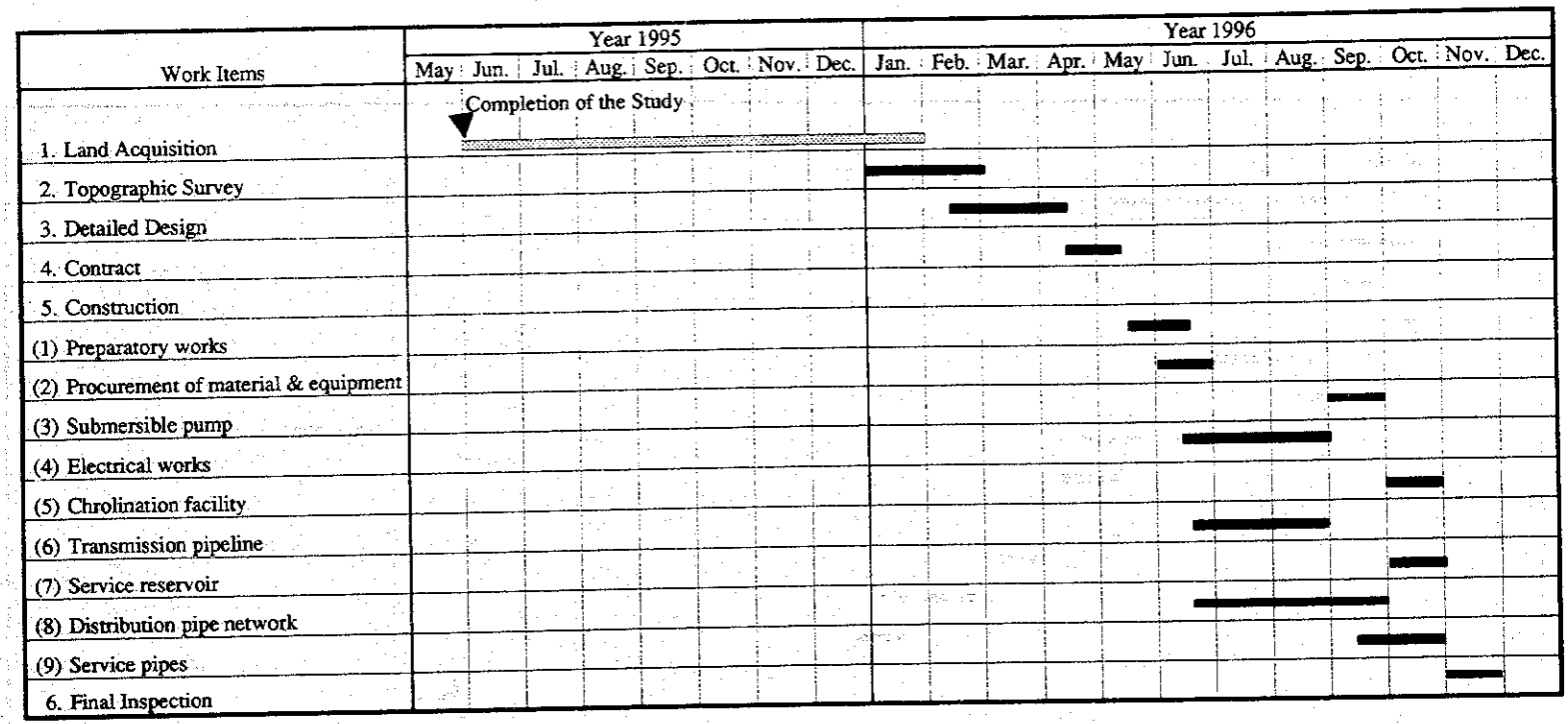

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THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig. 7.4.2 IMPLEMENTATION PROGRAMME OF VATUYAKA EXPANSION SCHEME

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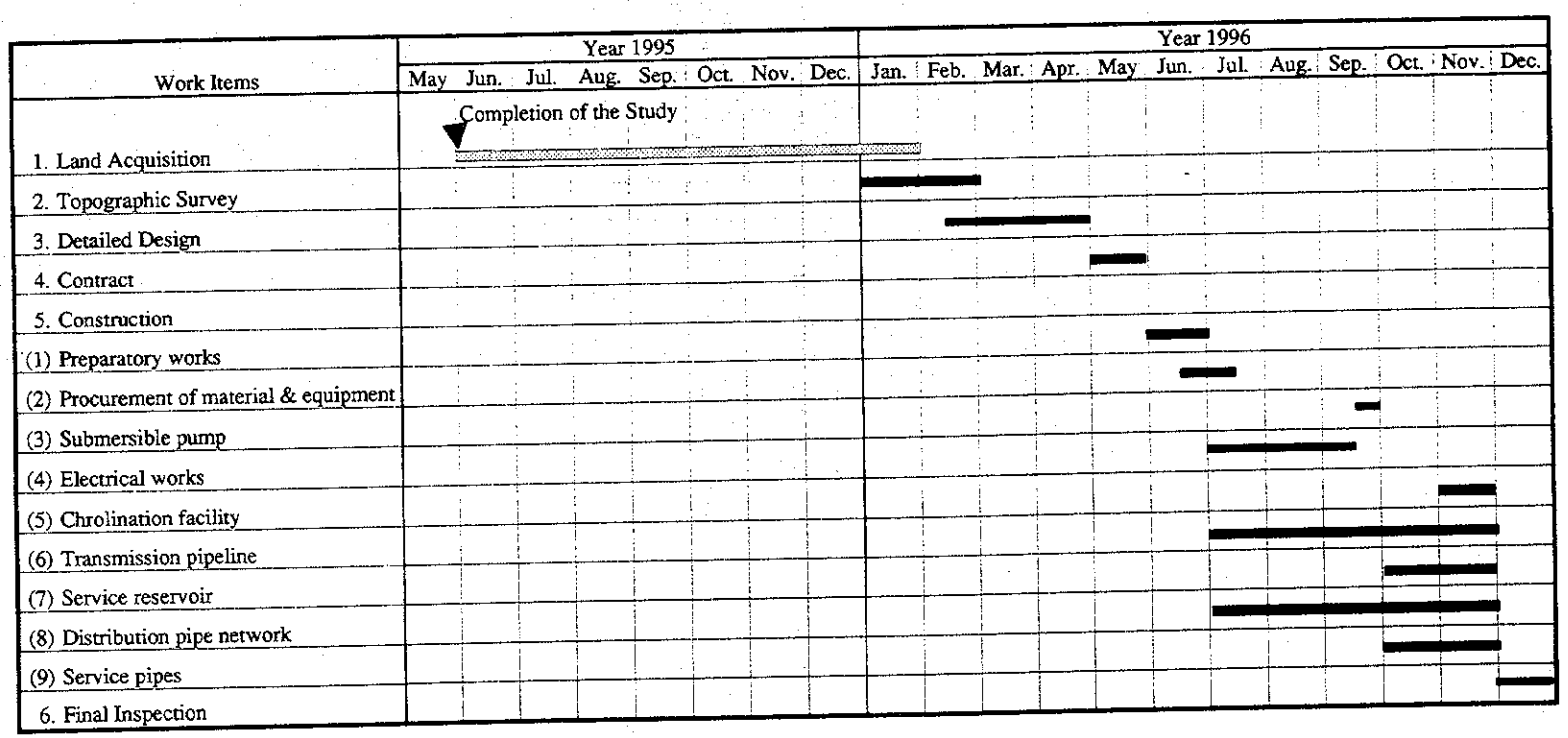

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THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig. 7.4.3

IMPLEMENTATION PROGRAMME OF RABULU EXPANSION SCHEME

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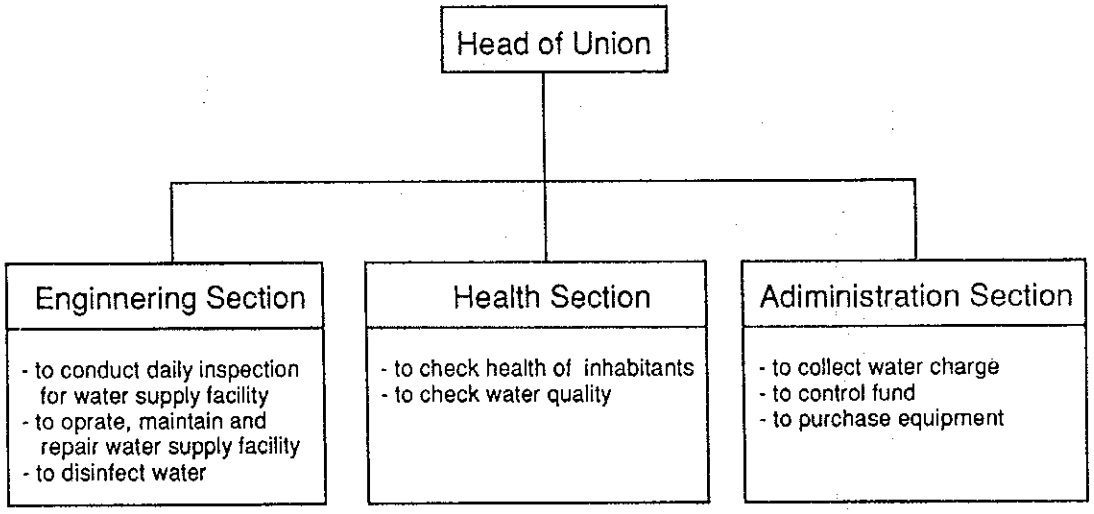

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THE STUDY ON GROUNDWATER DEVELOPMENT IN NORTH VITI LEVU IN THE REPUBLIC OF FIJI

Fig. 7.5.1 WATER SUPPLY UNION OF SINGLE COMMUNITY SYSTEM

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ANNEX

ANNEX

RECOMMENDATIONS ON WATER SUPPLY PLAN

Notwithstanding the relatively low economic and financial returns, it is recognized that the water supply development is one of the important basic needs for insuring the subsistence in the Study Area, especially in the areas faced with water shortage problems. It has been confirmed that a safe and stable water supply will greatly contribute to preserving public health and hygiene and promoting sustained economic growth.

However, it is evident that the groundwater resources are unable to fulfill all of the future water demands in the whole Study Area. Moreover, since the present water supply for urban areas mainly depends on surface water sources of small rivers, serious water shortage repeatedly occur in the dry season. It is supposed that a groundwater development is not superior to a surface water development in the major river basins. The results of the meteorological and hydrological analyses conducted in the course of this study indicates the possibility of a surface water resource development in some major river basins.

There are four major river basins in the Study Area, the Penang, the Yaqara, the Nasivi, and the Ba . The Penang river basin is located in the Rakiraki area where there is limited water demand at present and it is not expected to rapidly increase. The river runoff is observed as low. The Yaqara river basin has a relatively ample river runoff, however a small extent of water demand is expected in and around the river basin. The Nasivi river has been developed for the Tavua/Vatukoula regional water supply system by PWD and a future stage wise development plan has been established.

The Ba river originates in the Naloto Range and forms the boundary of the Study Area in the south, flowing into the sea through Ba town. Ba town, located in the lower reaches of the river, is one of the major water demand centers, as economic activity in the Study Area is concentrated here. In the tributaries of the Ba river basin, several surface water intakes were constructed for the PWD water supply systems (the Ba regional system) and private companies. However, water abstraction facilities have not been constructed on the main river course, and water shortages have been recurrently encountered during periods of severe drought.

Taking account of the present and future conditions of the four river basins described above, the Ba river basin has the greatest potential for water resource development. The water

demand in and around the area will also increase in the future as the economic activities also increase.

According to the preliminary site reconnaissance conducted during the study periods, three possible sites for the development of water source facilities are identified in the upper and middle reaches of the Ba river. Judging from the topographic conditions, a 10 m high dam/weir is possibly to be produced at the three sites. The topographical and geological aspects of the three site, however the details such as permeability and soundness of the foundation rocks, etc. are not clarified, are briefly explained below:

(1) The first site is located about 2 km upstream of Toge where the river forms a narrow gorge. The site seems to be underlain by the intercalation of andesitic breccia and sandstone. The right bank is a narrow straight ridge extending from north to south. A small creek parallel to this narrow ridge is estimated as a fault line according to the existing geological map.

(2) The second site is selected at about 2 km upstream of the first site in order to avoid the fault discovered at the first site. This is also a gorge but slightly gentler than the first site. Almost the same type of andesitic lavas and sandstone underlie the site and these rocks crop out at both abutments. However, a landslide is evident in the left abutment, just downstream of the site.

(3) The third site is identified about 2 km upstream of the second site. The right abutment slope is very steep but the left abutment is relatively gentle, creating an unsymmetrical shape. Foundation rocks are assumed to be an intercalation of andesitic lavas and sandstone or sandstone and conglomerate in the Mio-Pliocene age.

The meteorological and hydrological aspects of the Ba river were evaluated at the Toge gauging station, the nearest runoff gauging station of the possible sites, as follows:

<u>at the Toge gauging station</u>

Catchment area	: 578.7 km^2
Drought standard year	: 1983
Recorded minimum discharge	: 2.443 m^3/sec
(assumed as river maintenance flow)	
95 % discharge in 1983	: 2.836 m^3/sec
Possible development yield	: 0.393 m^3/sec = 33,960 m^3/day

Incidentally, in case 200 lpcd is applied to a per capita water consumption, the development yield can supply about 170,000 people without regulating the river runoff in a dam reservoir or using a run-of-river type water intake.

In due consideration, it is recommended that a water resource study on the Ba river basin be conducted to encourage regional development in terms of water supply for domestic, industrial, tourism, and agricultural uses, This Study should cover the Northwest Viti Levu including the Ba area.