

JAPAN INTERNATIONAL COOPERATION AGENCY  
THE PAPUA NEW GUINEA WATERBOARD

THE STUDY  
ON  
GROUNDWATER DEVELOPMENT  
FOR  
WATER SUPPLY SYSTEMS  
IN  
PAPUA NEW GUINEA

FINAL REPORT  
DATA BOOK

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FEBRUARY 2002

JAPAN TECHNICAL CO., LTD.

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FOR WATER SUPPLY SYSTEMS IN PAPUA NEW GUINEA

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- 1) National Water Supply and Sewerage Act 1986, Declaration of Town of Kwikila
- 2) Minutes of Understanding between Central Provincial Government and Papua New Guinea Waterboard Regarding Implementation of the Pilot Project in Bereina and Kwikila
- 3) Minutes of Understanding between Morobe Provincial Government and Papua New Guinea Waterboard Regarding Implementation of the Pilot Project in Mutzing
- 4) Minutes of Agreement between Central Provincial Government and Papua New Guinea Waterboard Regarding Operation, Management & Maintenance of the Water Supply System in Bereina and Kwikila
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- 6) Minutes of Agreement between Fly River Provincial Administration, Daru Urban Local-Level Government, Bobby Sampson and Papua New Guinea Waterboard Regarding Operation, Management & Maintenance of the Water Vending Unit at Frog Town Compound in Daru Town Western Province
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- 8) Minutes of Agreement between Water Management Committee in Kwikila, Rigo District Administration, Rigo Central Local Level Government, and

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  - 10) Minutes of Agreement between Water Management Committee in Toorena Village, Kairuku district Administration, Kairuku Central Local-Level Government, and Papua New Guinea Waterboard Regarding the Public Faucet Project in Toorena Village
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  - 15) Financial and economic evaluation
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### 3. SOCIAL SURVEY DATA

- 1) Problem Trees PCM Workshop (Bereina, Kwikila, Kupiano)
- 2) Result of Selection of Site for Pilot Project Execution Evaluation(Bereina, Kupiano, Kwikila, Finschhafen, Mutzing, Oro Bay, Daru, Binaturi river)

- 3) Pre-Registration Form for New Water Supply Services
- 4) Pre-Registration Result (Bereina, Kwikila, Mutzing)

#### 4. SEMINAR ON JICA'S DEVELOPMENT STUDY WITH PNG WATERBOARD

- 1) Materials of Seminar
- 2) List of Attendants of JPCM held in Port Moresby (19<sup>th</sup> & 21<sup>st</sup> August 2000)
- 3) List of Attendants of JPCM held in Kwikila (23<sup>rd</sup> & 24<sup>th</sup> August 2000)
- 4) List of Attendants for "PCM WORKSHOP" at Bereina" (13<sup>th</sup> & 14<sup>th</sup> February 2001)
- 5) List of Attendants for "PCM WORKSHOP" at Mutzing" (20<sup>th</sup> & 21<sup>st</sup> February 2001)
- 6) List of Attendants for "PCM WORKSHOP" at Kwikila" (27<sup>th</sup> & 28<sup>th</sup> February 2001)
- 7) List of Attendants for "PCM WORKSHOP" at POM" (8<sup>th</sup> June 2001)
- 8) Workshop on Operation, Management and Maintenance of Water Supply Systems at District Centres under the Pilot Project (29<sup>th</sup> June 2001)
- 9) List of Participants to Seminar at Daru (4<sup>th</sup> October 2001)
- 10) List of Participants to Seminar at Lae (9<sup>th</sup> October 2001)
- 11) List of Participants to Seminar at POM (16<sup>th</sup> October 2001)

#### 5. WATER RESOURCES & WATER QUALITY DATA

- 1) Stream Flow Measurement
- 2) Water Quality of Existing Water Sources from the Eight Sites in the Study Area
- 3) Characteristics of Water Samples
- 4) Qualities of Binaturi River Water
- 5) Qualities of Shallow Wells in Binaturi Area
- 6) Water Qualities of Drilled Boreholes in the Eight Sites
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#### 6. GROUNDWATER DEVELOPMENT BOREHOLE DATA

- 1) Electrical Well Logging of Test Boreholes
- 2) Borehole Completion Data
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  - Popondetta #2
  - Finschhafen #2
  - Mutzing



Daru #1  
Daru #2  
Bereina #1  
Kwikila #1  
Kwikila #2  
Kupiano

## **7. MINUTES OF MEETINGS**

- 1) Scope of Work (December 20, 1999)
- 2) Minutes of Meetings (December 20, 1999)
- 3) Amendments of Scope of Work (November 9, 2000)
- 4) Minutes of Discussions on Inception Report (May 4, 2000)
- 5) Minutes of Discussions on Progress Report (1) (September 14, 2000)
- 6) Minutes of Discussions on Progress Report (2) (July 13, 2001)
- 7) Minutes of Discussions on Draft Final Report Explanation and Progress Report (3) (October 24, 2001)

## **8. LIST OF CONCERNED PERSONS**

## **1. GROUNDWATER DEVELOPMENT SURVEY DATA**



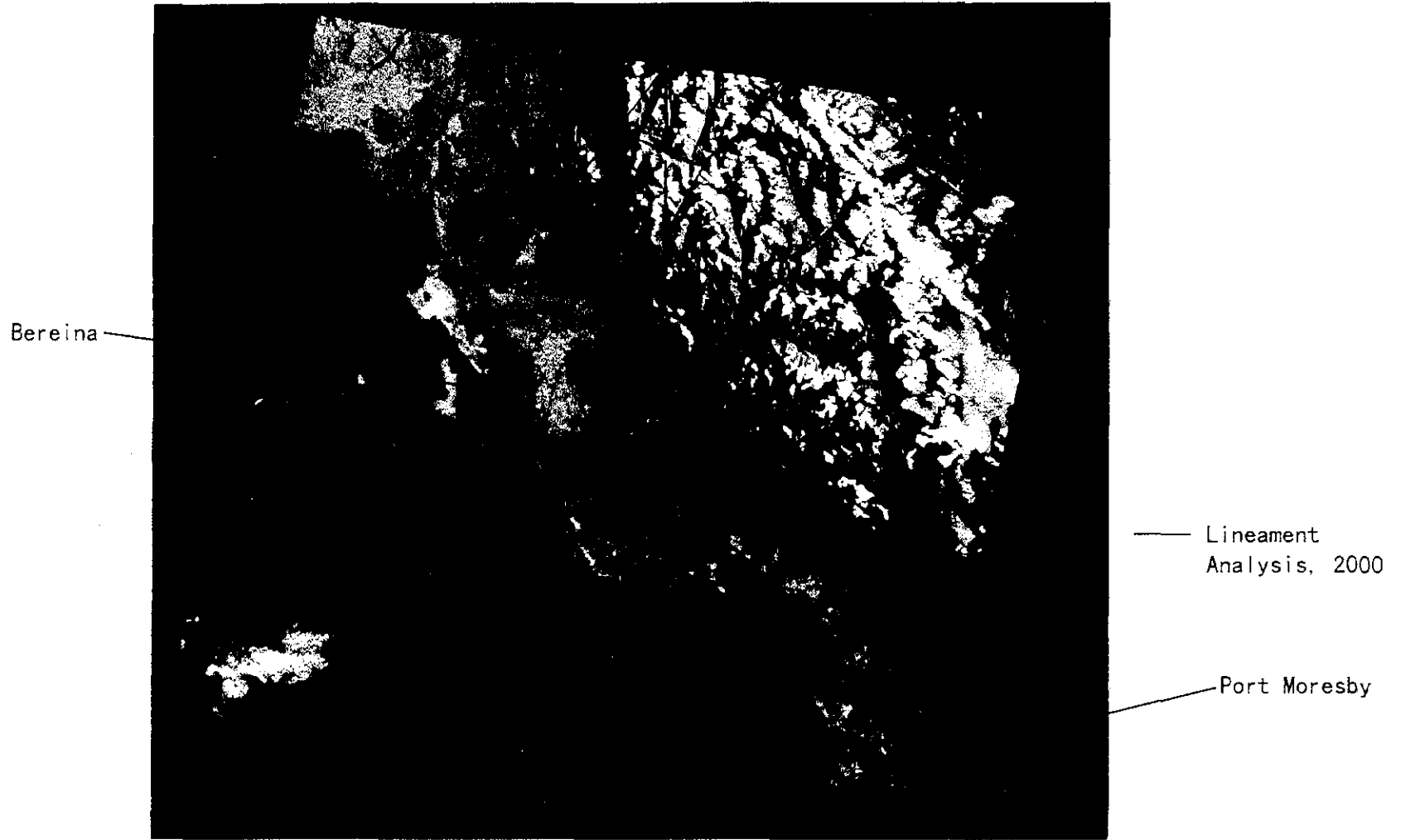
Lineament Analysis, 2000

Spot XS Color Image in Popondetta & Oro Bay

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**Figure D1-1**

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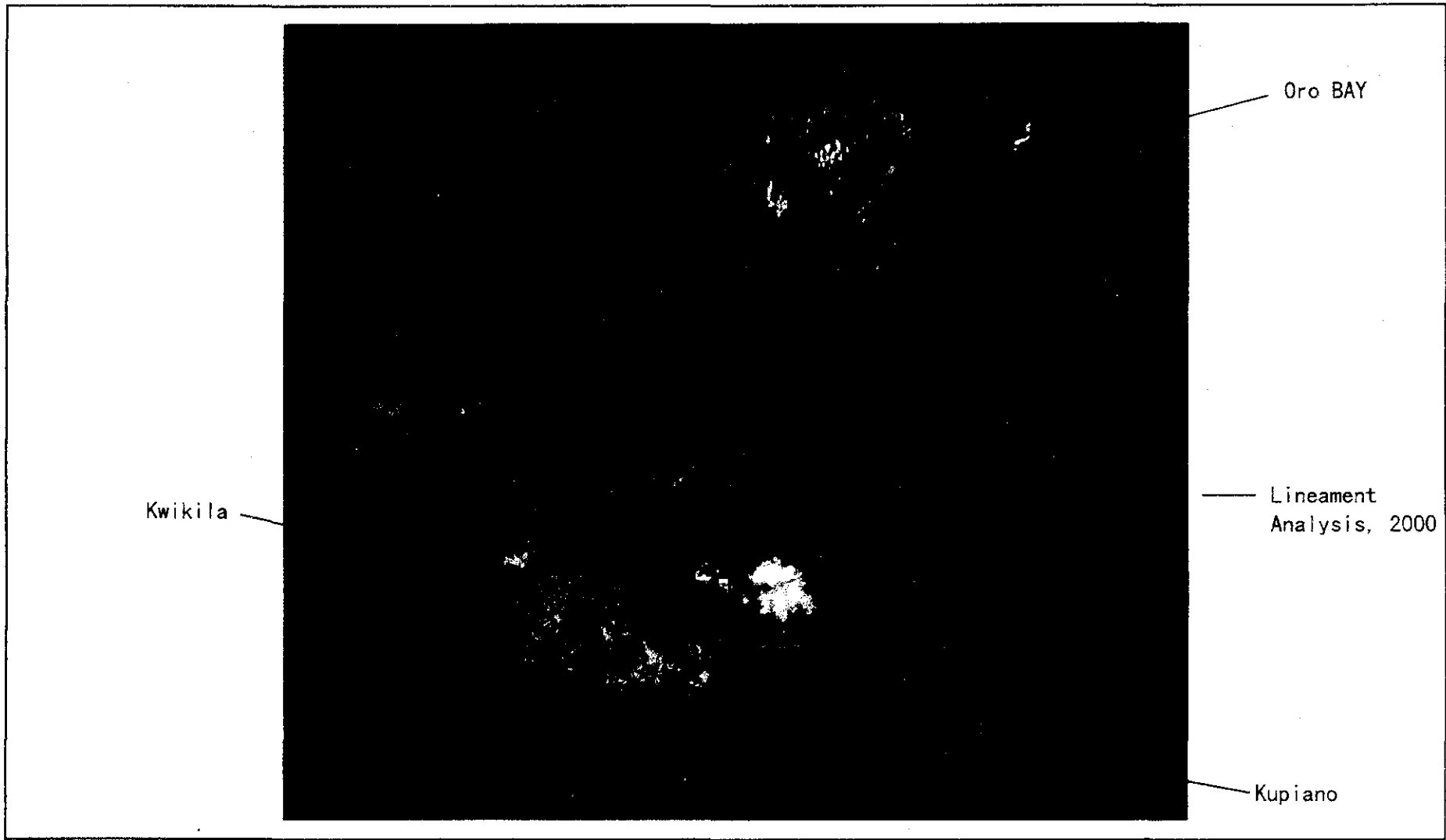


LandsatTM False Color Image in Bereina and PortMoresby

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**Figure D1-2**

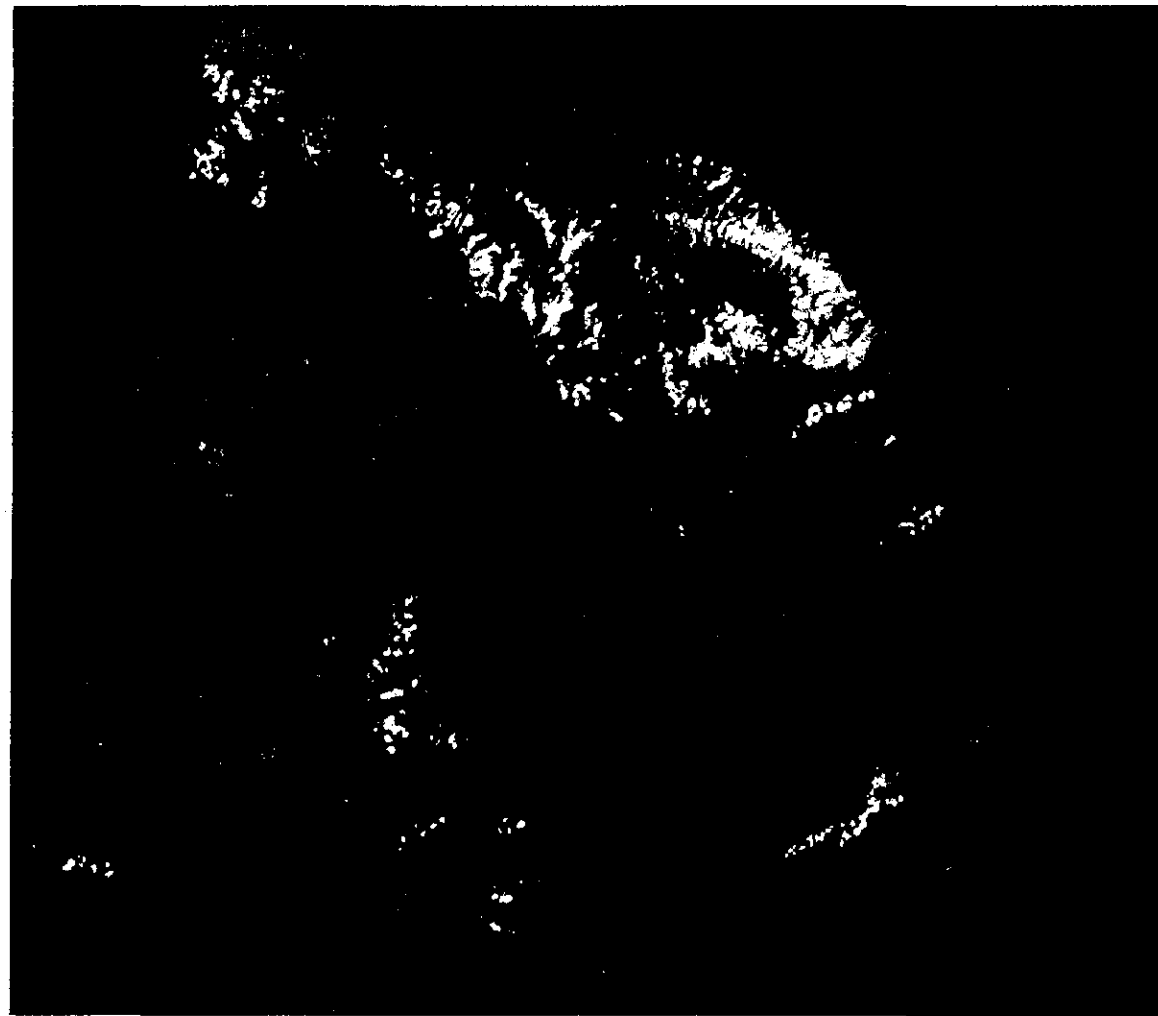


Landsat TM False Color Image in Kwikila, Kupiano & Oro Bay

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**Figure D1-3**



Finschhafen

Lae

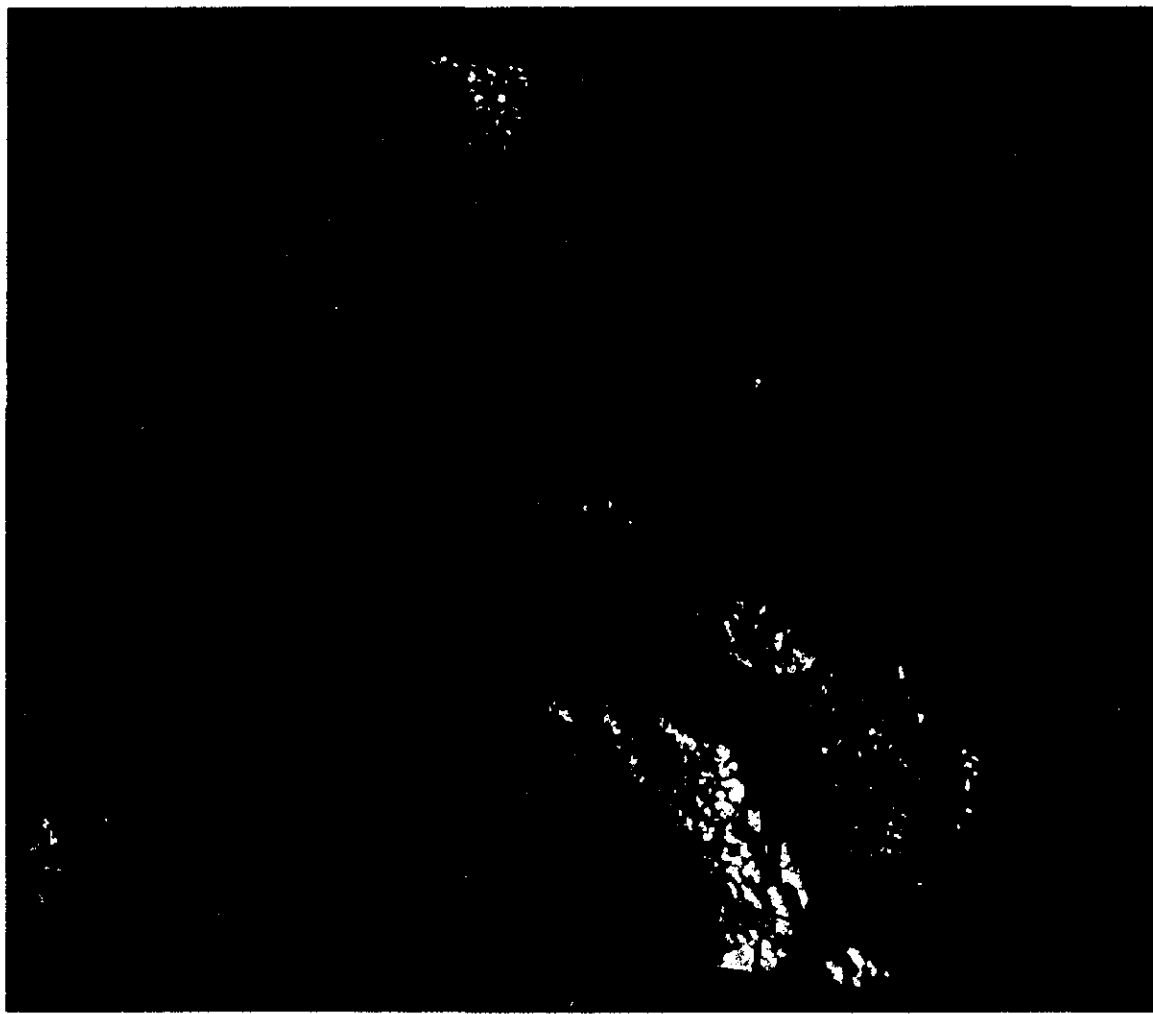
— Lineament  
Analysis, 2000

Landsat TM False Color Image in Lae & Finschhafen

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**Figure D1-4**



— Lineament  
Analysis, 2000

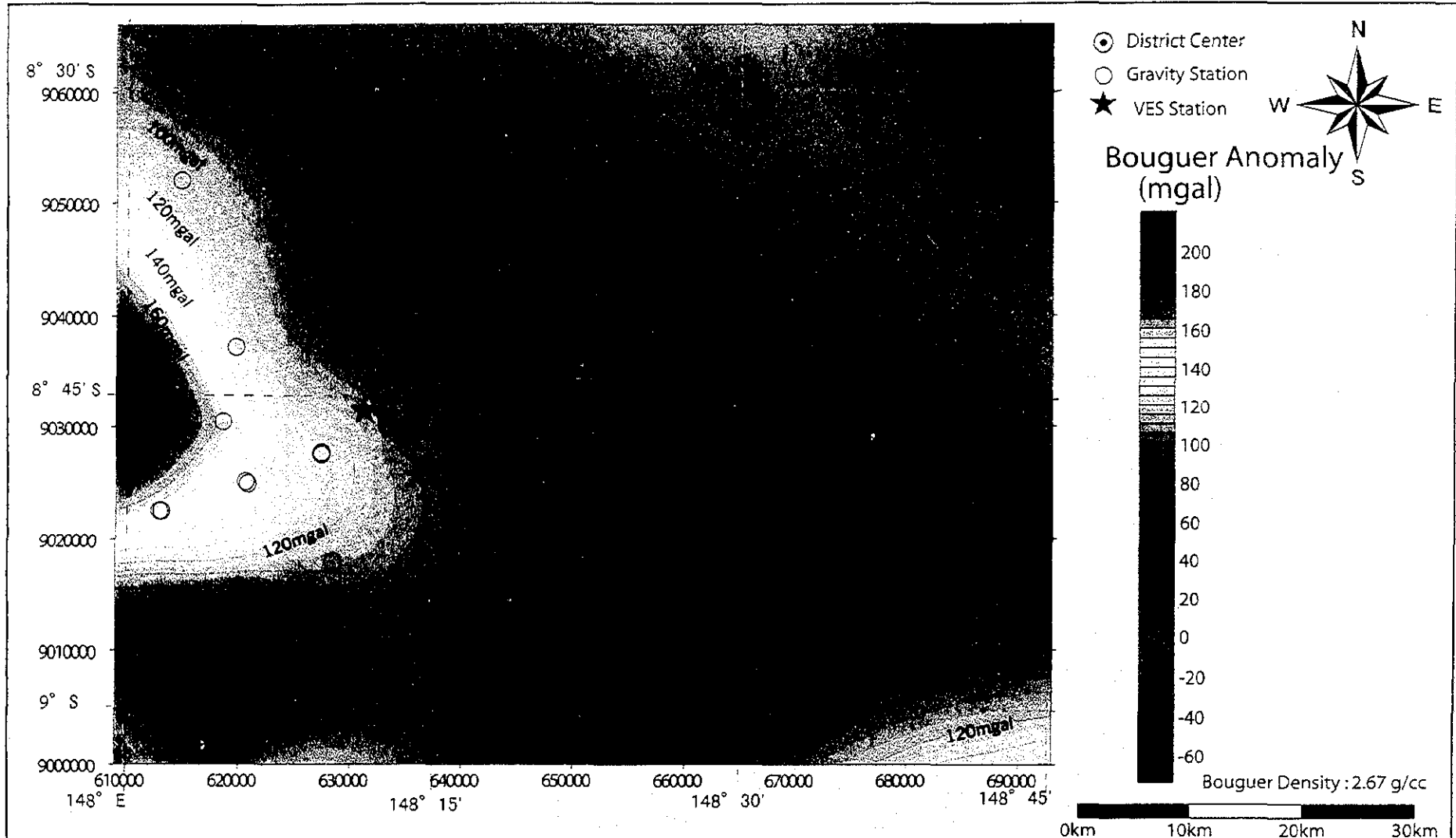
— Mutzing

Landsat TM False Color Image in Markham Valley (Mutzing)

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**Figure D1-5**



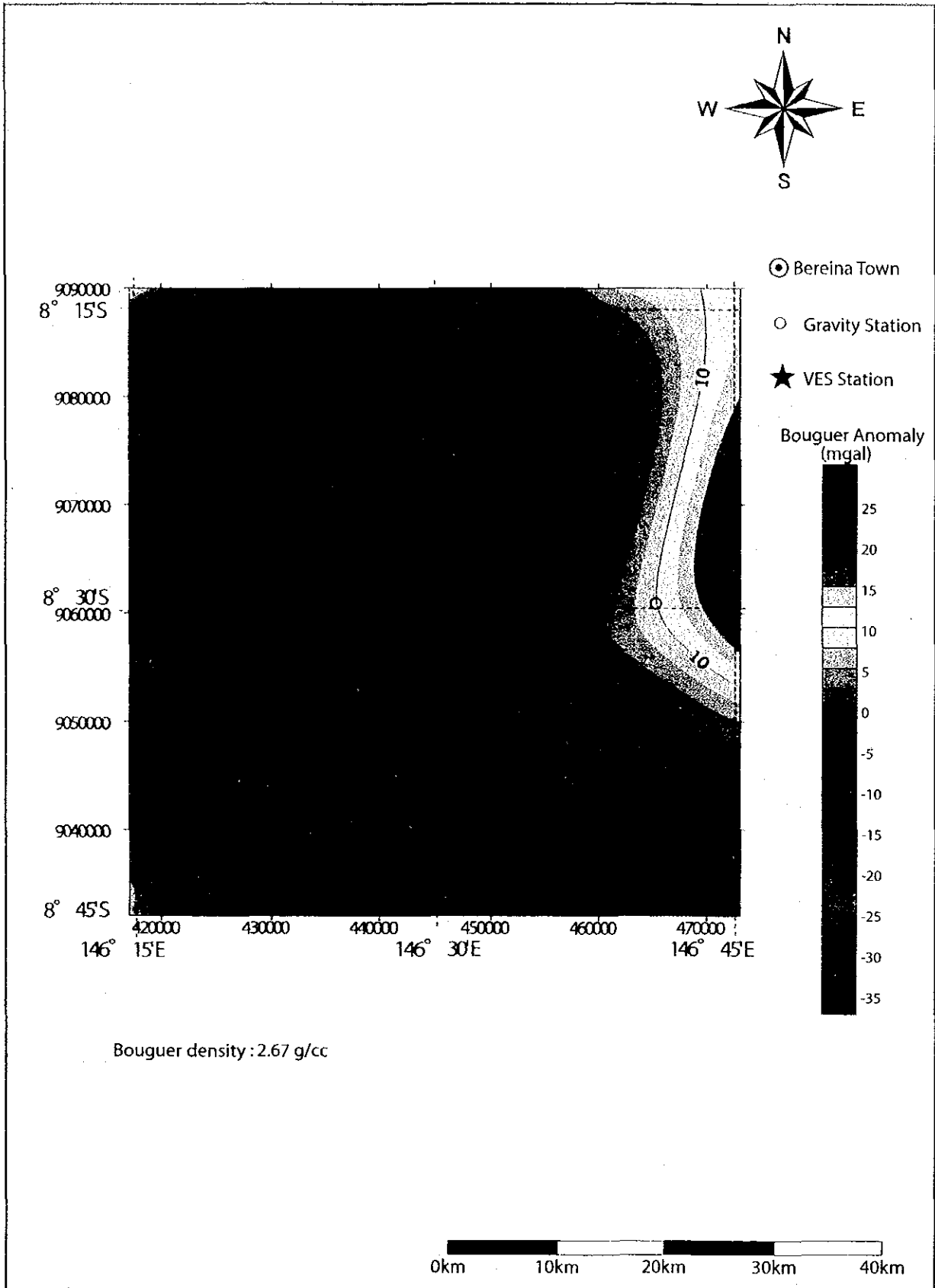
Bouguer Anomaly Map in Popondetta and Oro Bay

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Figure D2-1





**Figure D2-2**

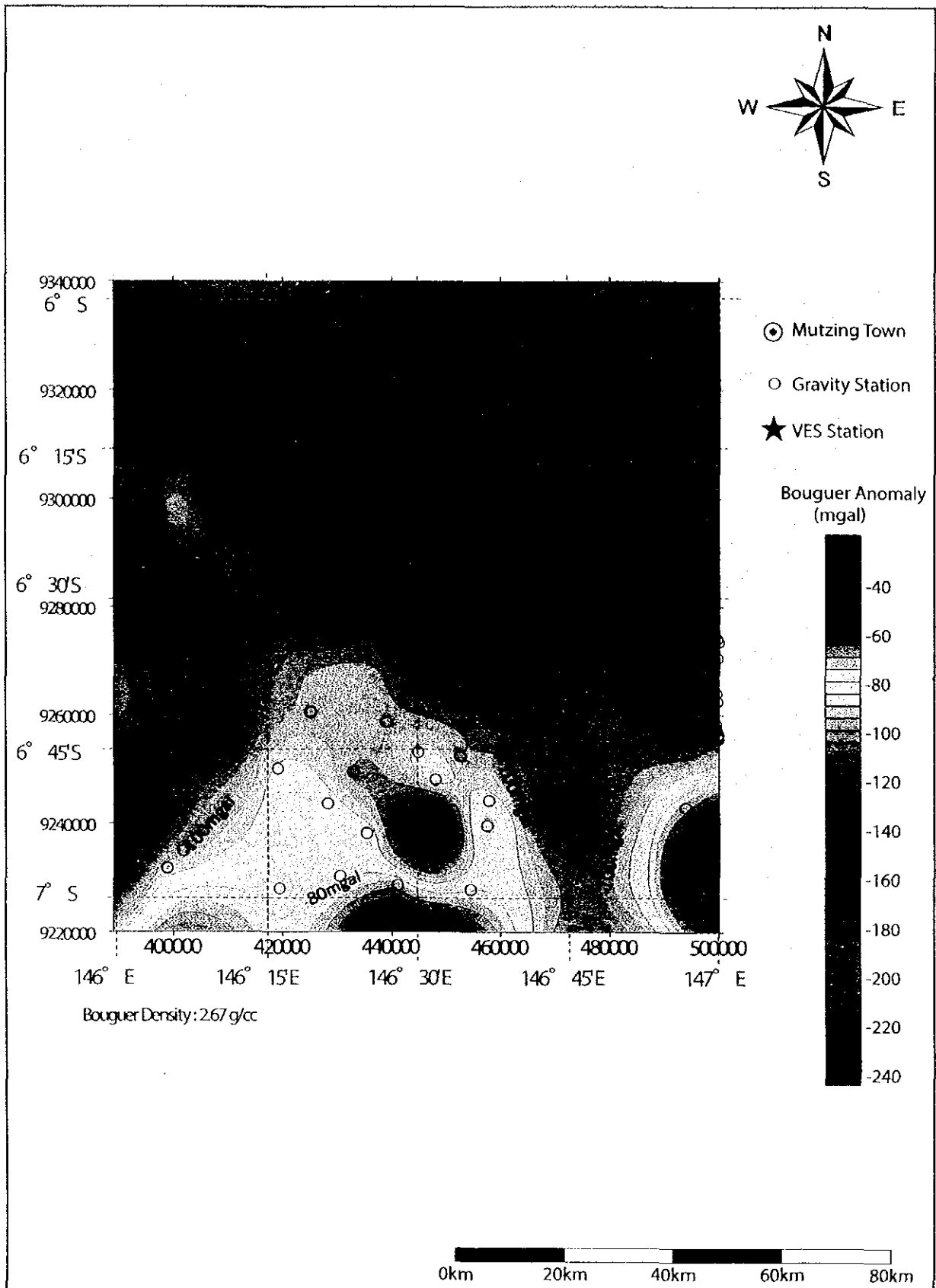
**Bouguer Anomaly Map in and around Bereina**

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for Water Supply Systems in Papua New Guinea

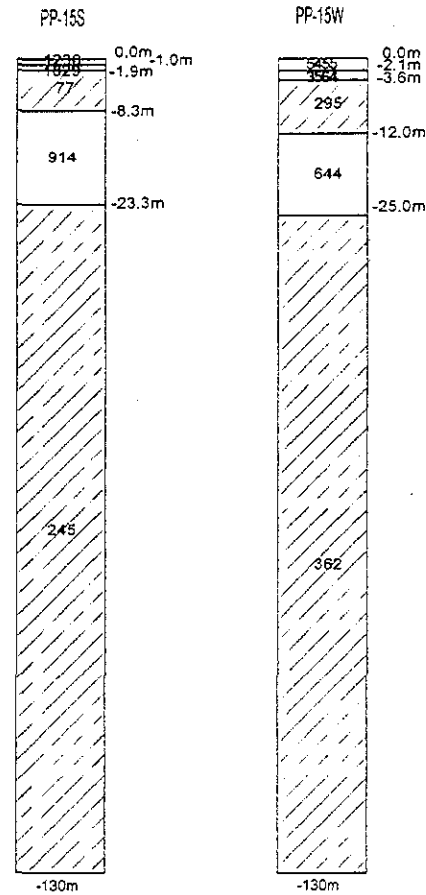
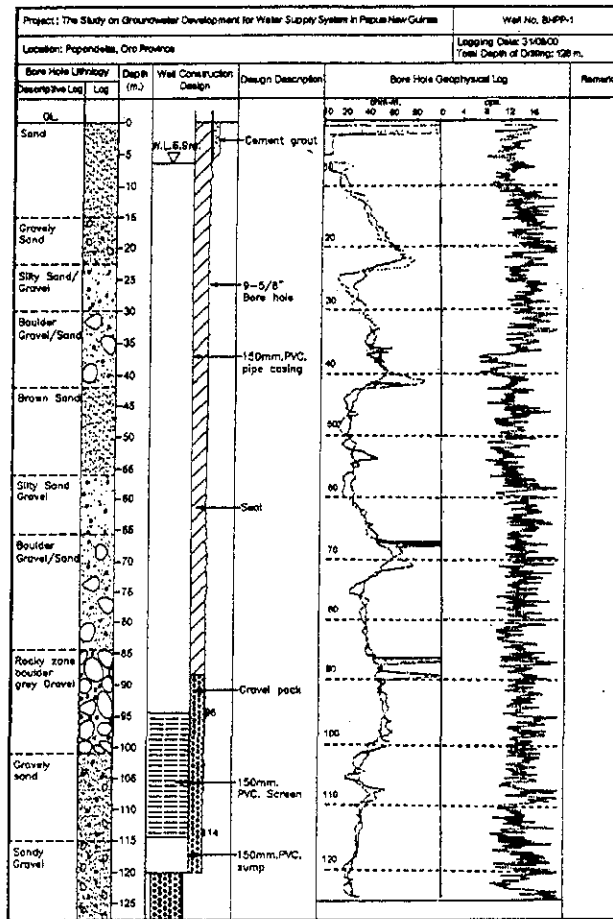
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<b>Figure D2-3</b>		<b>JICA</b> JAPAN TECHNO Co., Ltd <b>TOKYO JAPAN</b>
Bouguer Anomaly Map in Markham Valley (Mutzing)		
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Borehole Log and Resistivity Sounding in Popondetta-1

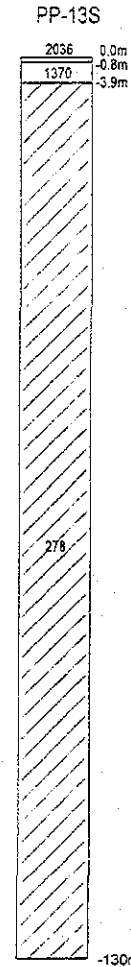
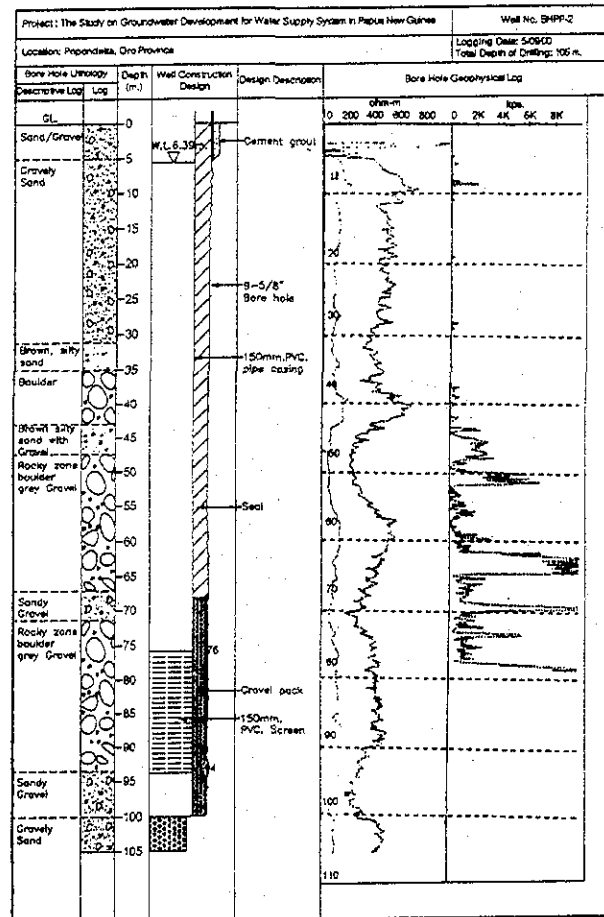
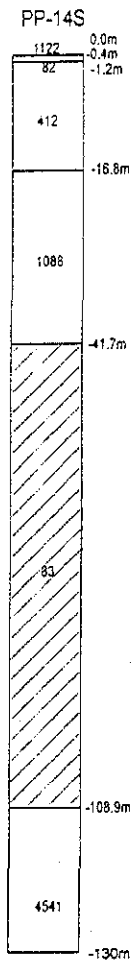
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Figure D3-1

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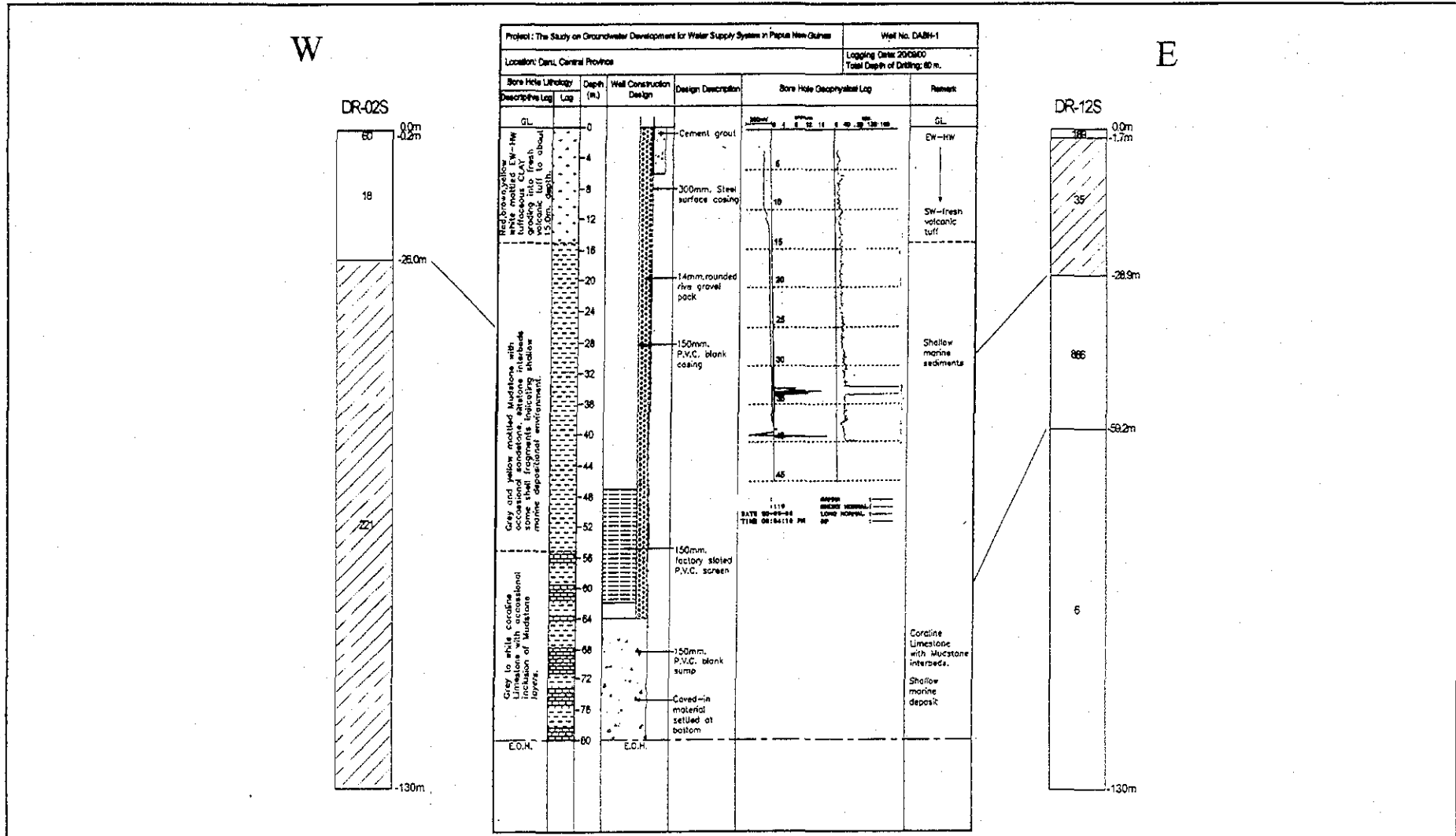


Borehole Log and Resistivity Sounding in Popondetta-2

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Figure D3-2

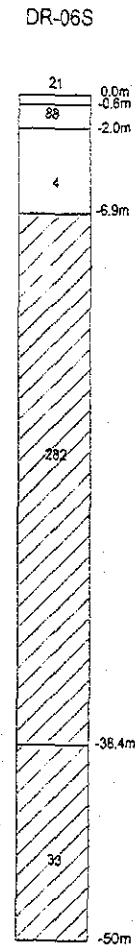
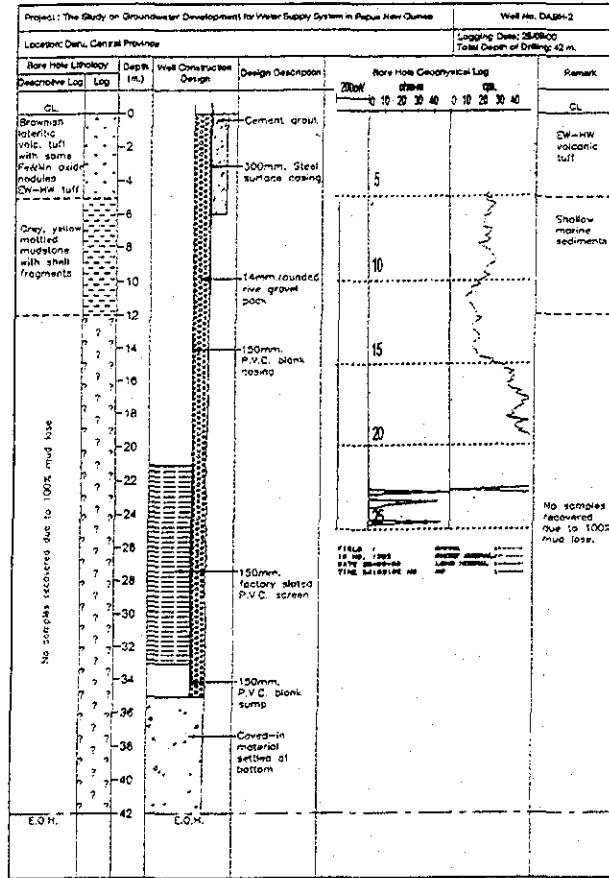


Borehole Log and Resistivity-Sounding in Daru-1

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Figure D3-3

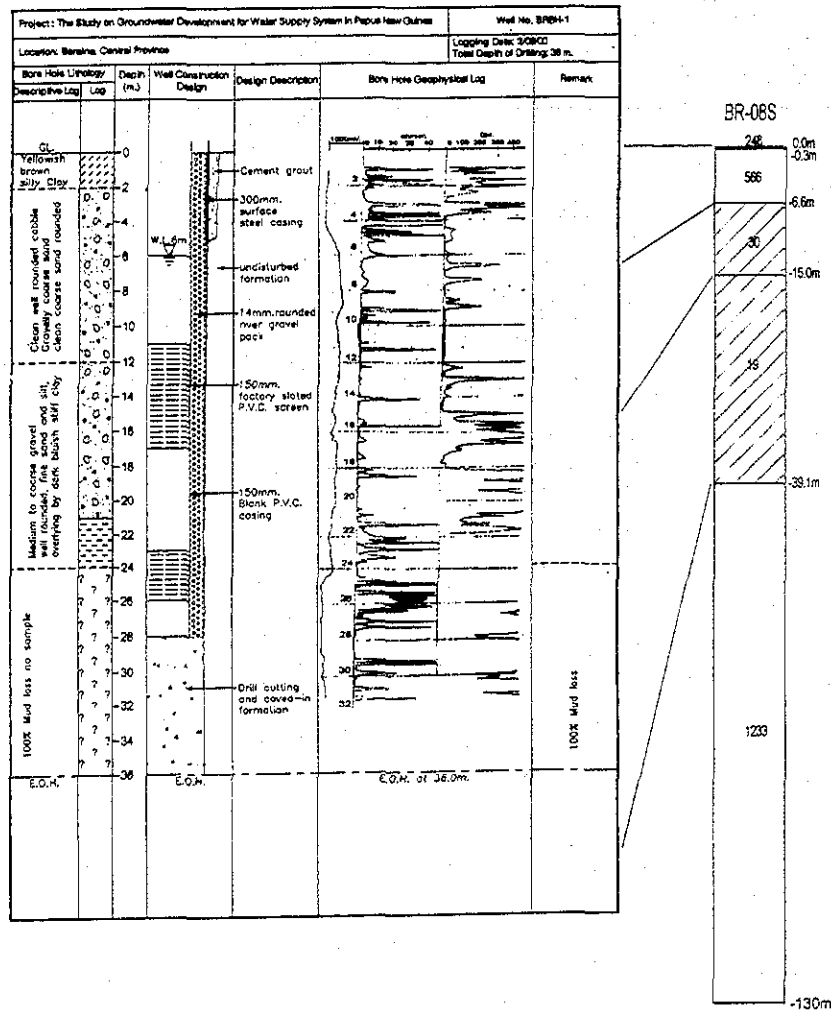


Borehole Log and Resistivity Sounding in Daru-2

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Figure D3-4

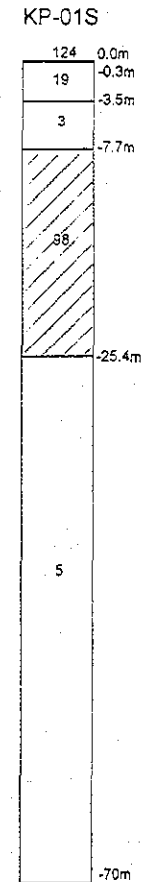
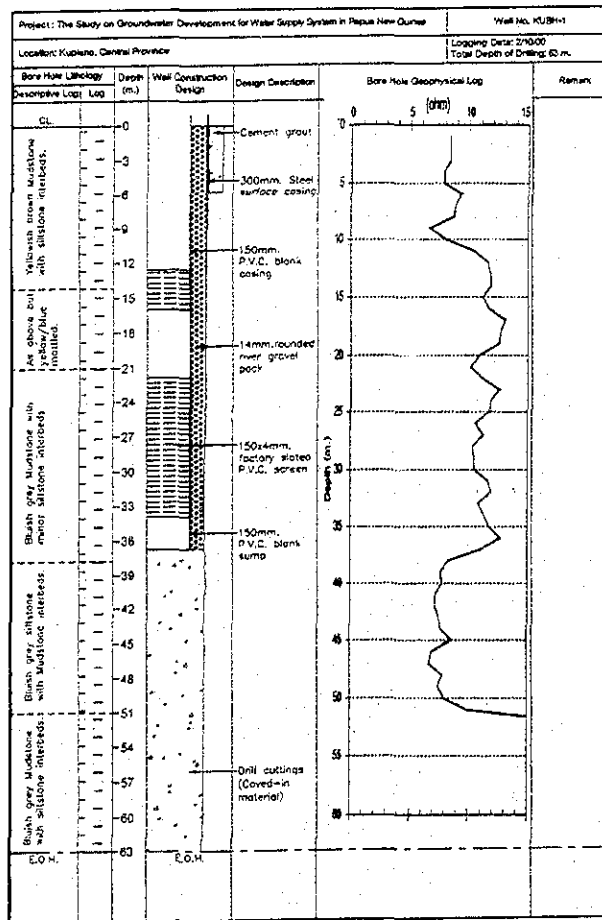


Borehole Log and Resistivity Sounding in Bereina

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Figure D3-5



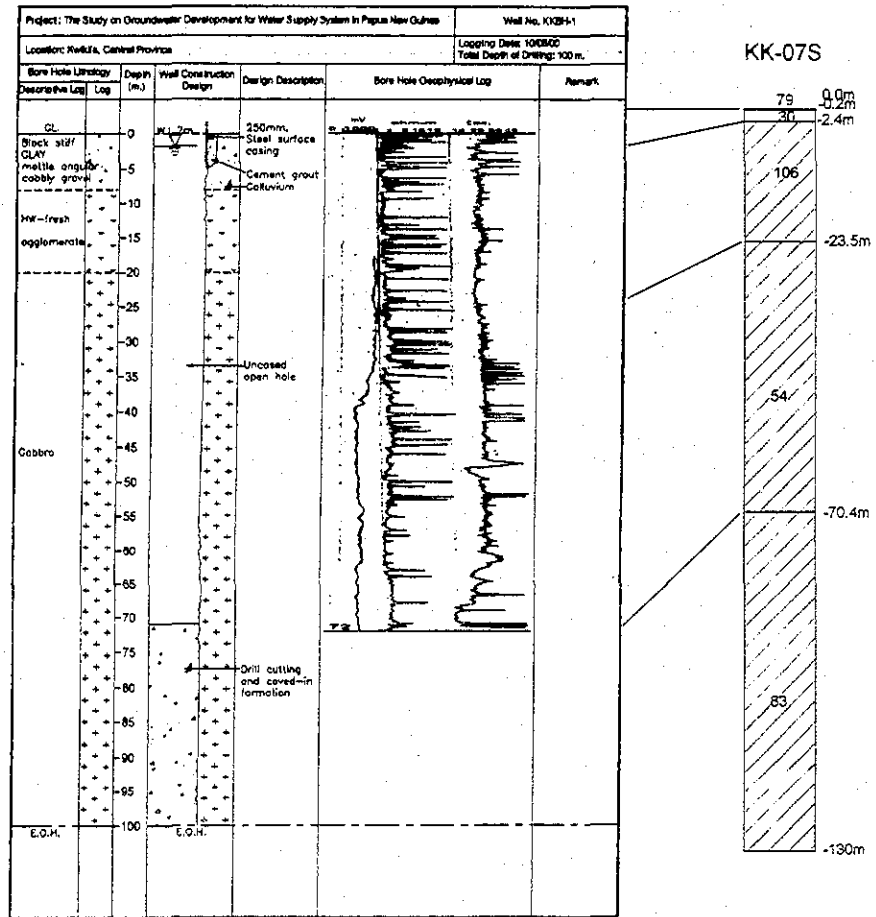
Borehole Log and Resistivity Sounding in Kupiano

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Figure D3-6



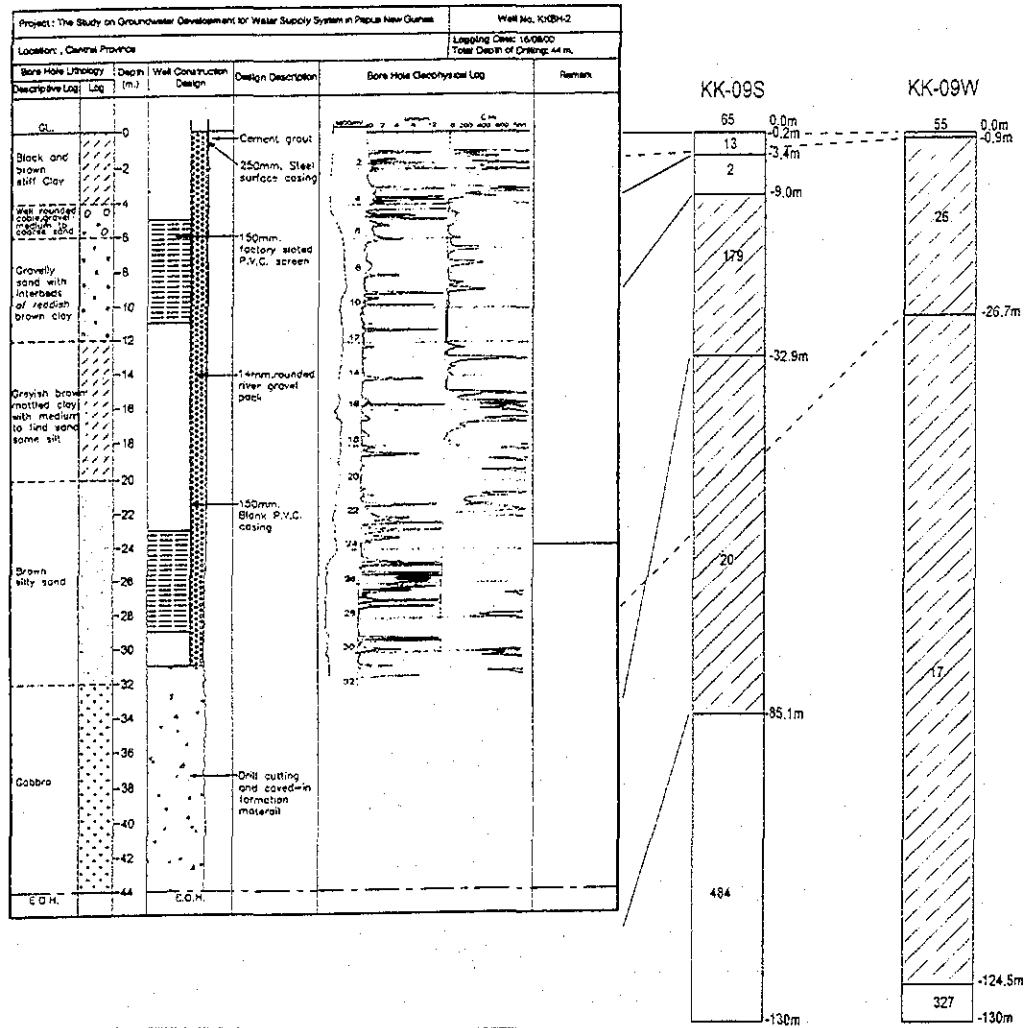


Borehole Log and Resistivity Sounding in Kwikila KKBH-1

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Figure D3-7



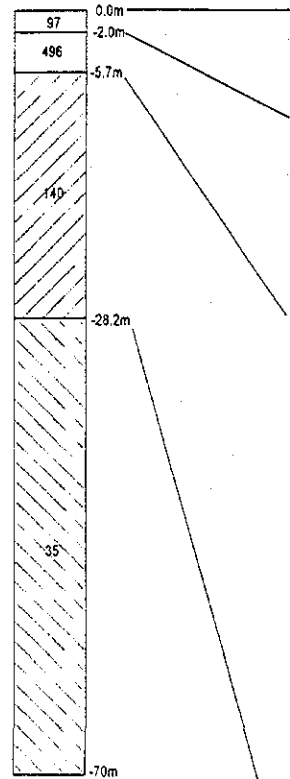
Borehole Log and Resistivity Sounding in Kwikila KKBH-2

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Figure D3-8

FN-10S



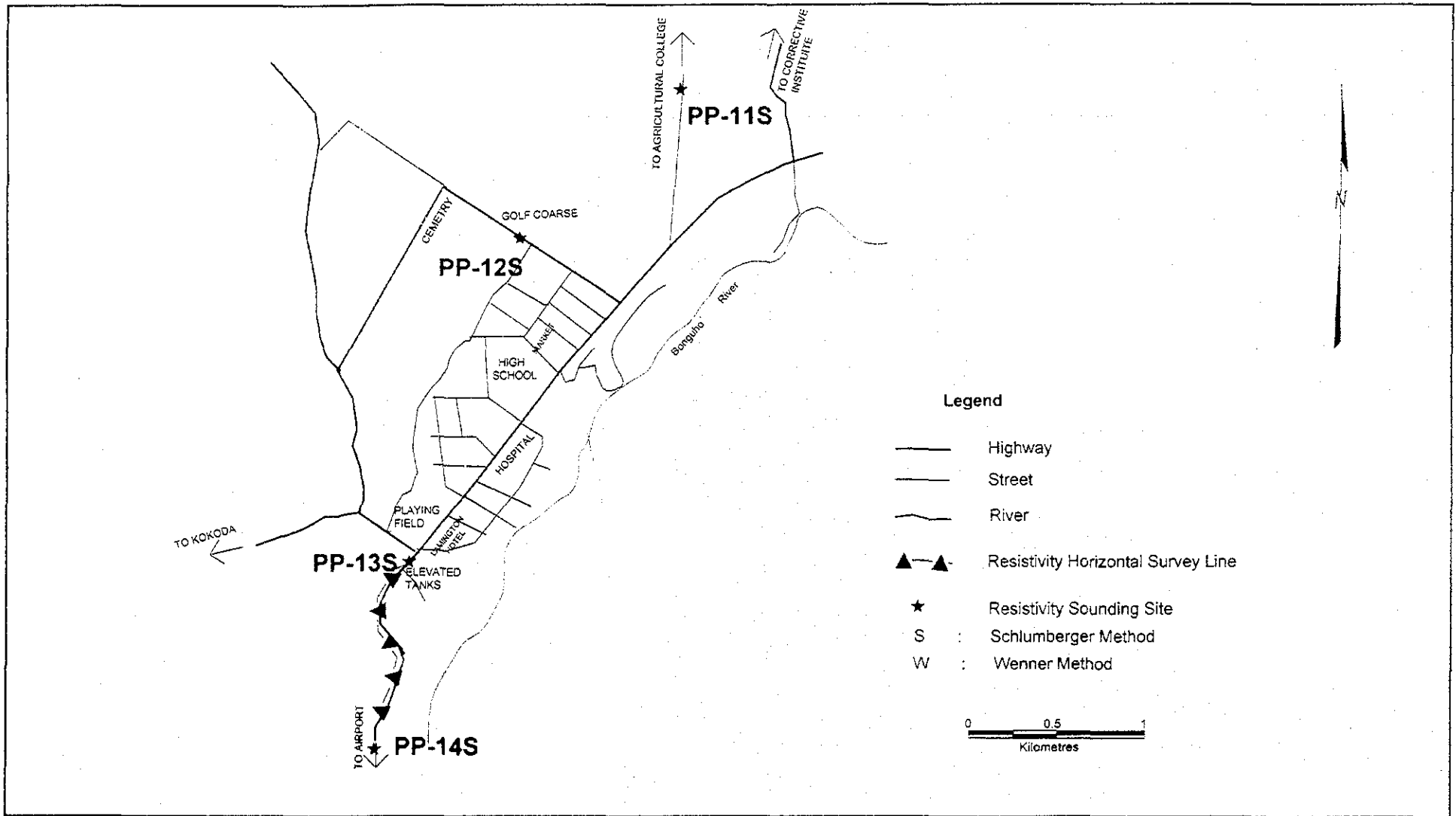
Bore Hole Lithology		Depth (M)	Well Construction Design	Design Description	Bore Hole Geophysical Log	Remarks
Descriptive Log	Log					
GL		0	Surface			
Over burden		0-1		Backfilled to surface		
		1-4		Blank P.V.C. Bentonite seal S.W.L. 4 m.		
		4-7		Gravel pack (3-5mm.)		
		7-9		3m. Stainless steel screen		
		9-11		Blank P.V.C.		
		11-12		Class 18 Bottom cap		
		12-13		13m. B.G.L.		
E.O.M.		13				

Borehole Log and Resistivity Sounding in Finschhafen

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Figure D3-9

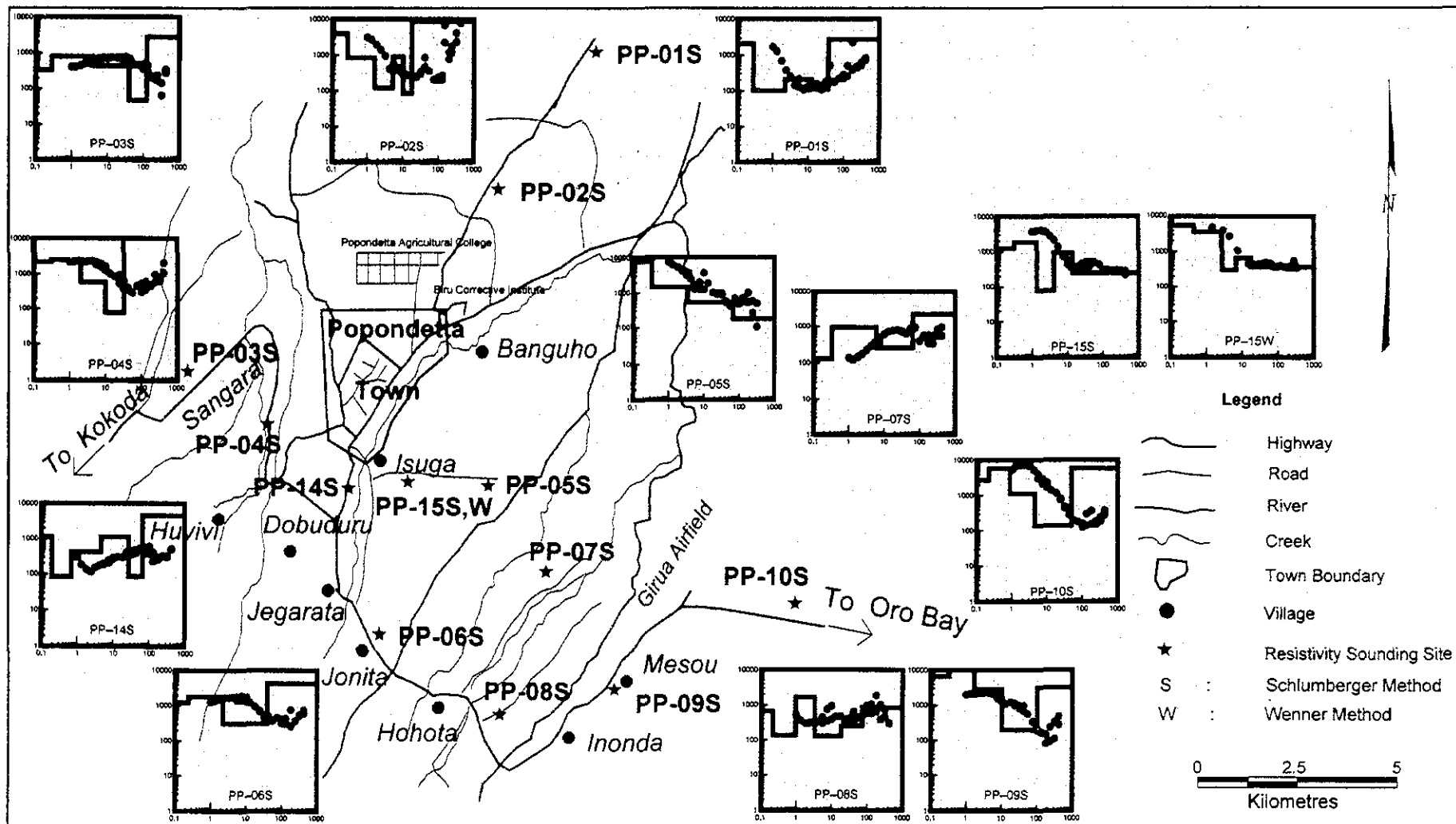


Location Map of Resistivity Sounding in Popondetta

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Figure D4-1

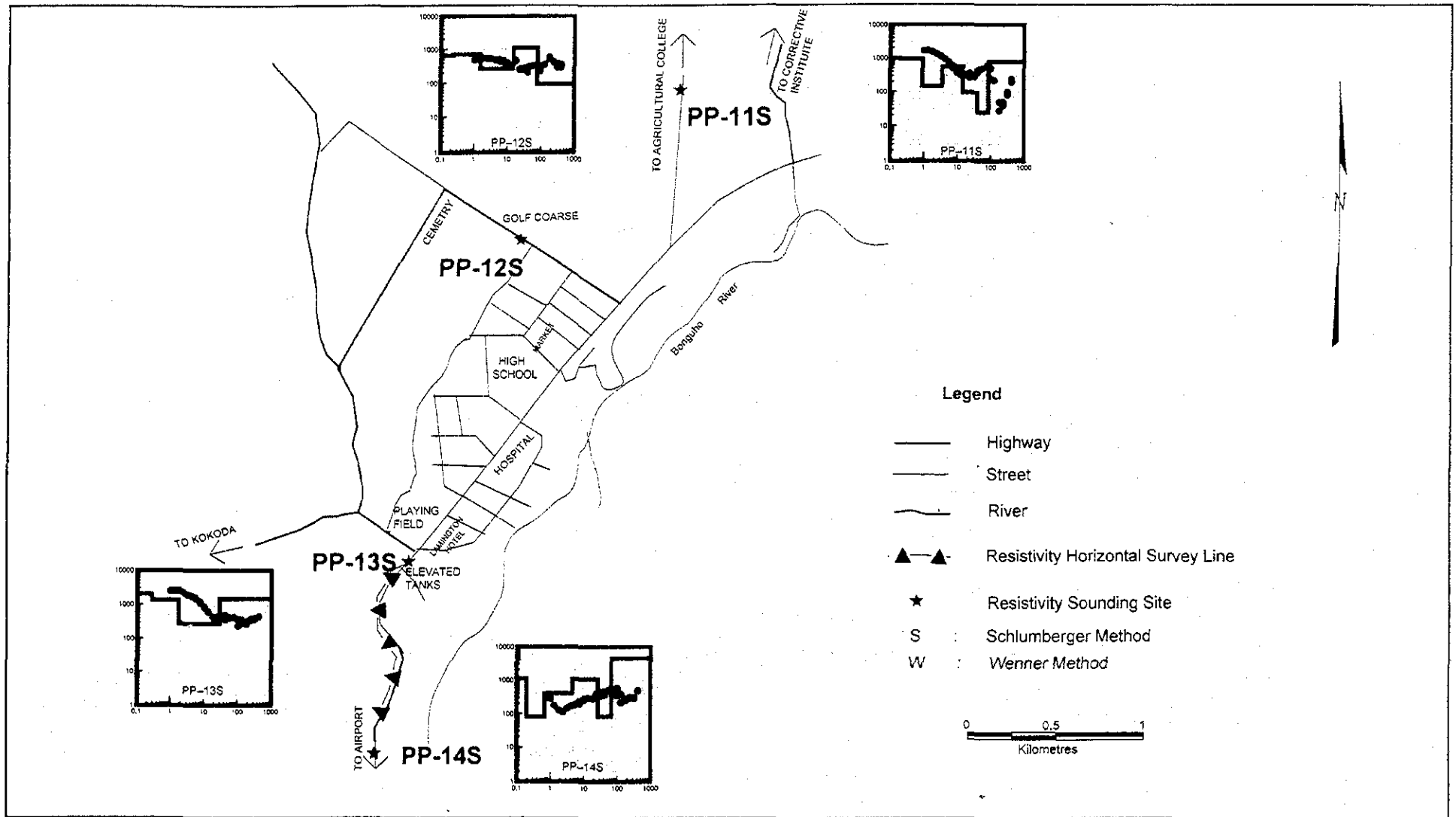


VES Curves of Resistivity Sounding in Popondetta

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**Figure D4-2**

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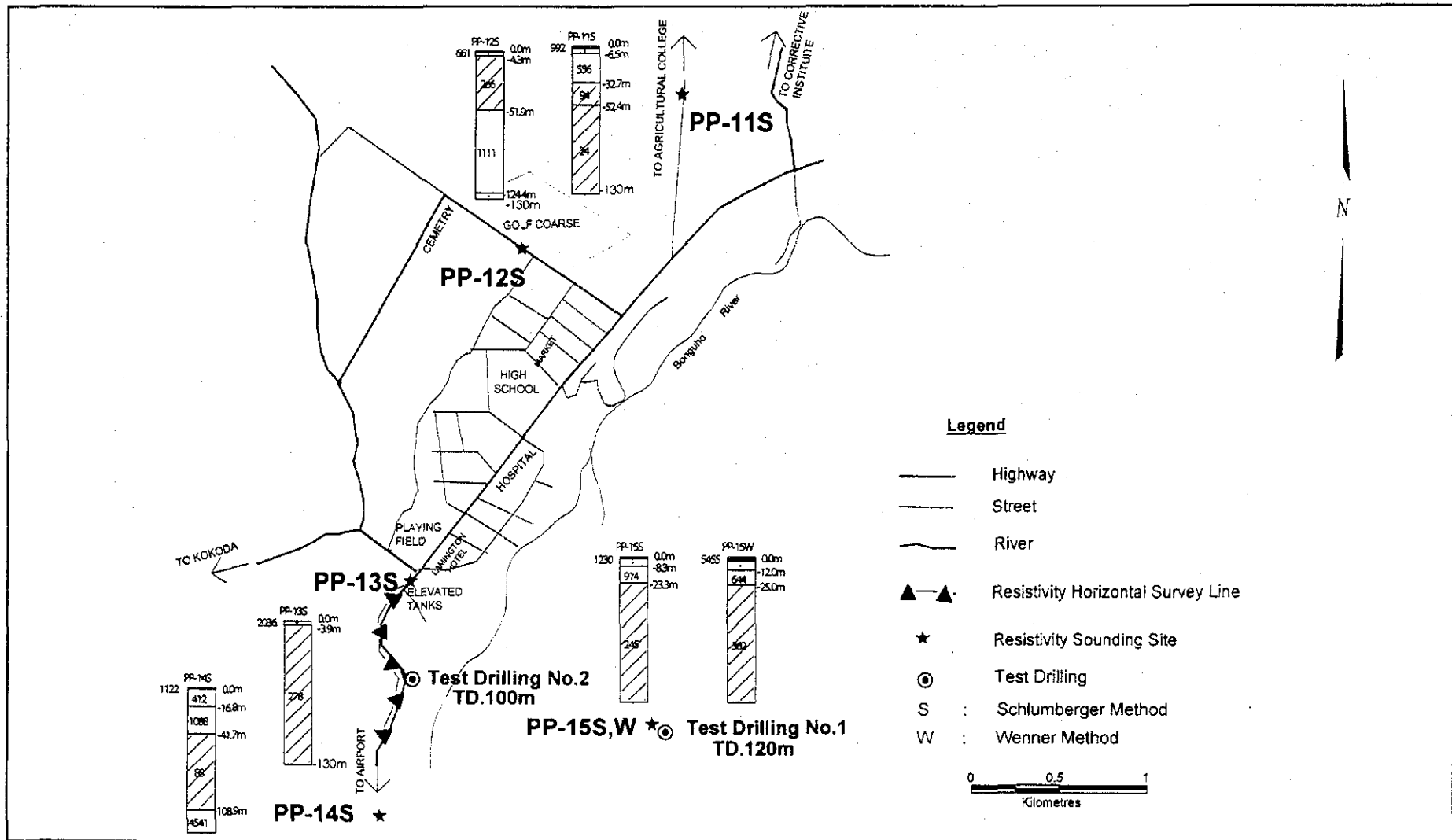


VES Curves of Resistivity Sounding in Popondetta

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Figure D4-3

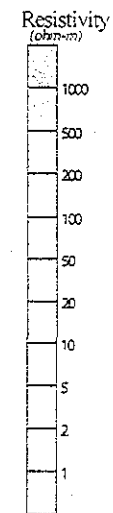
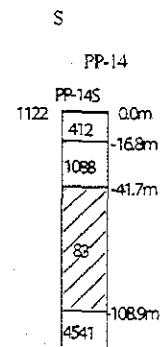
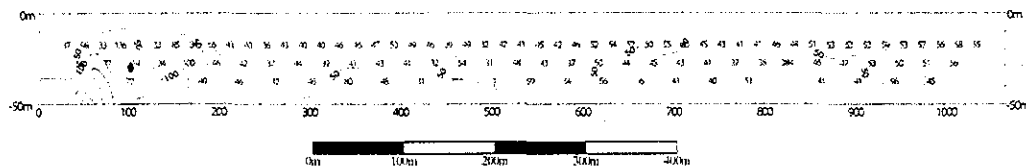
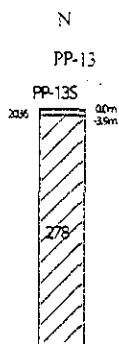
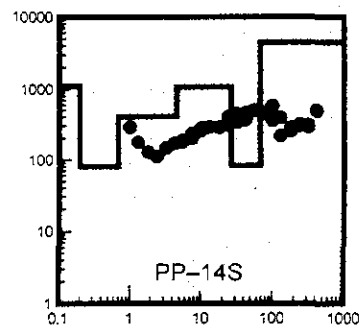
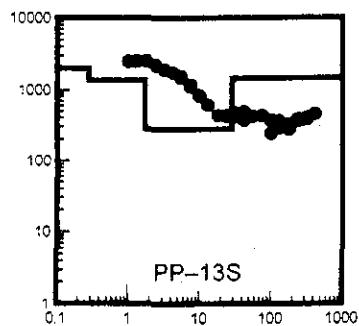


Interpreted Resistivity Sounding in Popondetta (2)

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

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Figure 4-5



Resistivity Horizontal Survey Wenner Method ( $\Omega$ -m)

S : Schlumberger Method

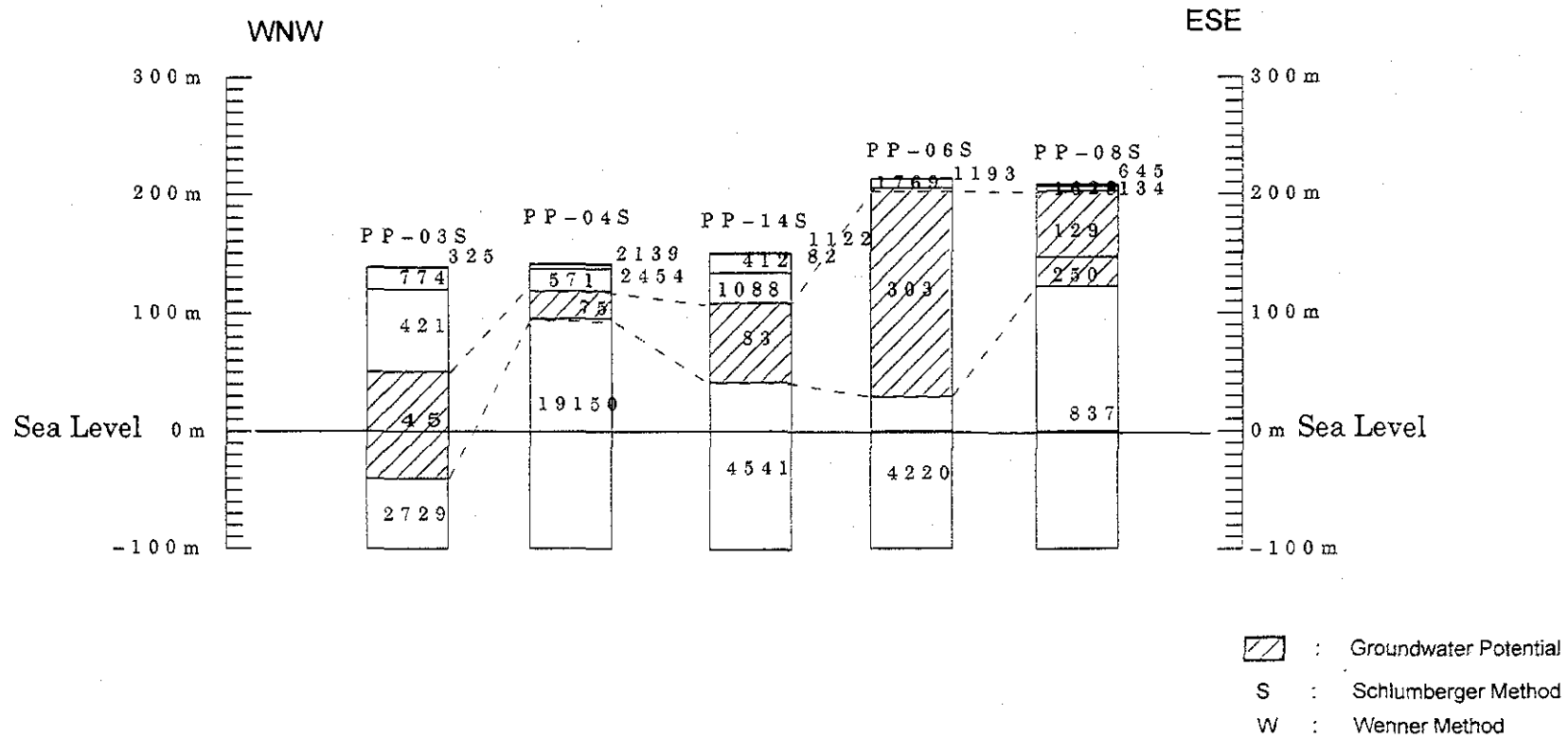
Resistivity Profile in Wenner Array on Popondetta between No.13 and No.14

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**Figure D4-6**

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea



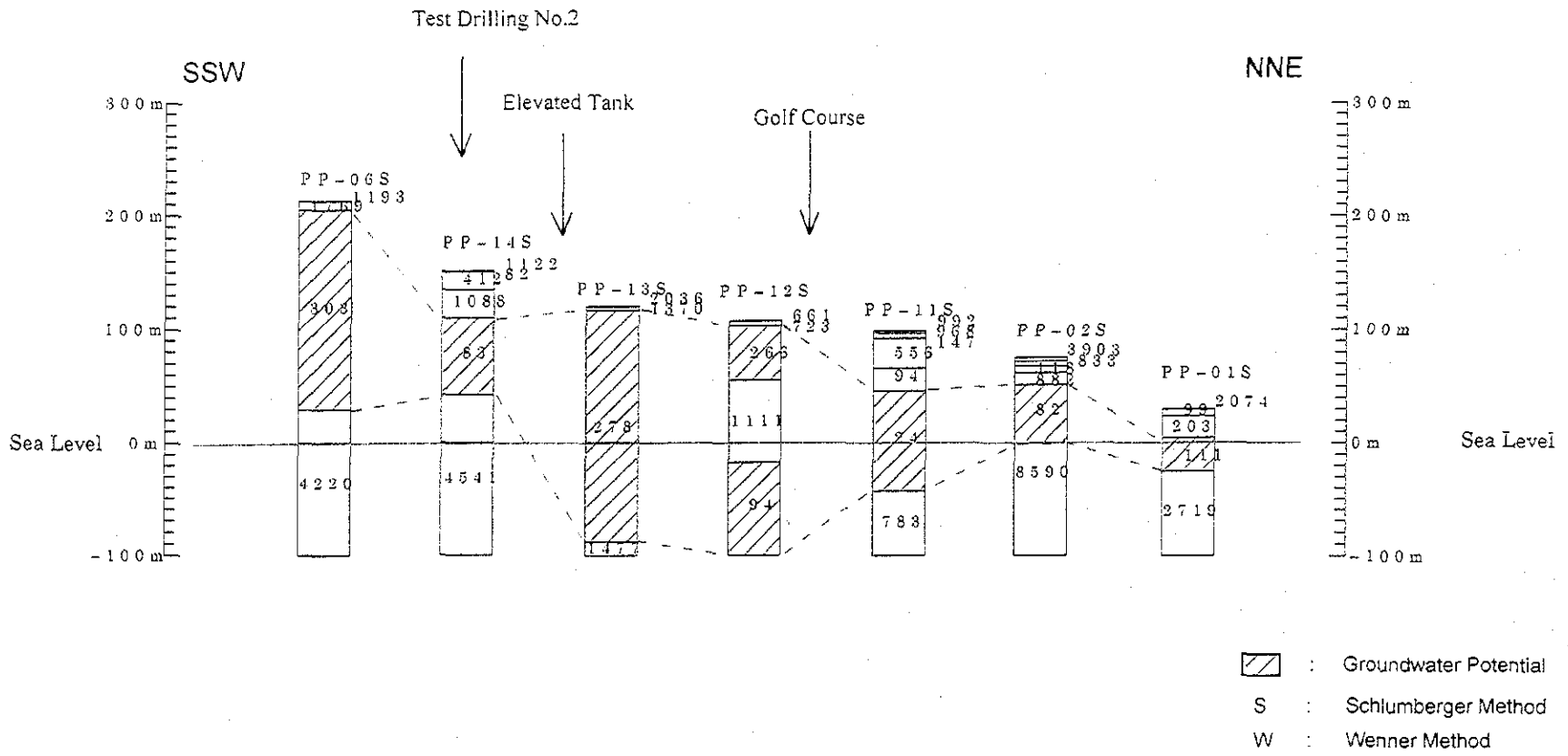


Interpreted Resistivity Sounding of WNW-ESE Direction in Popondetta

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**Figure D4-8**

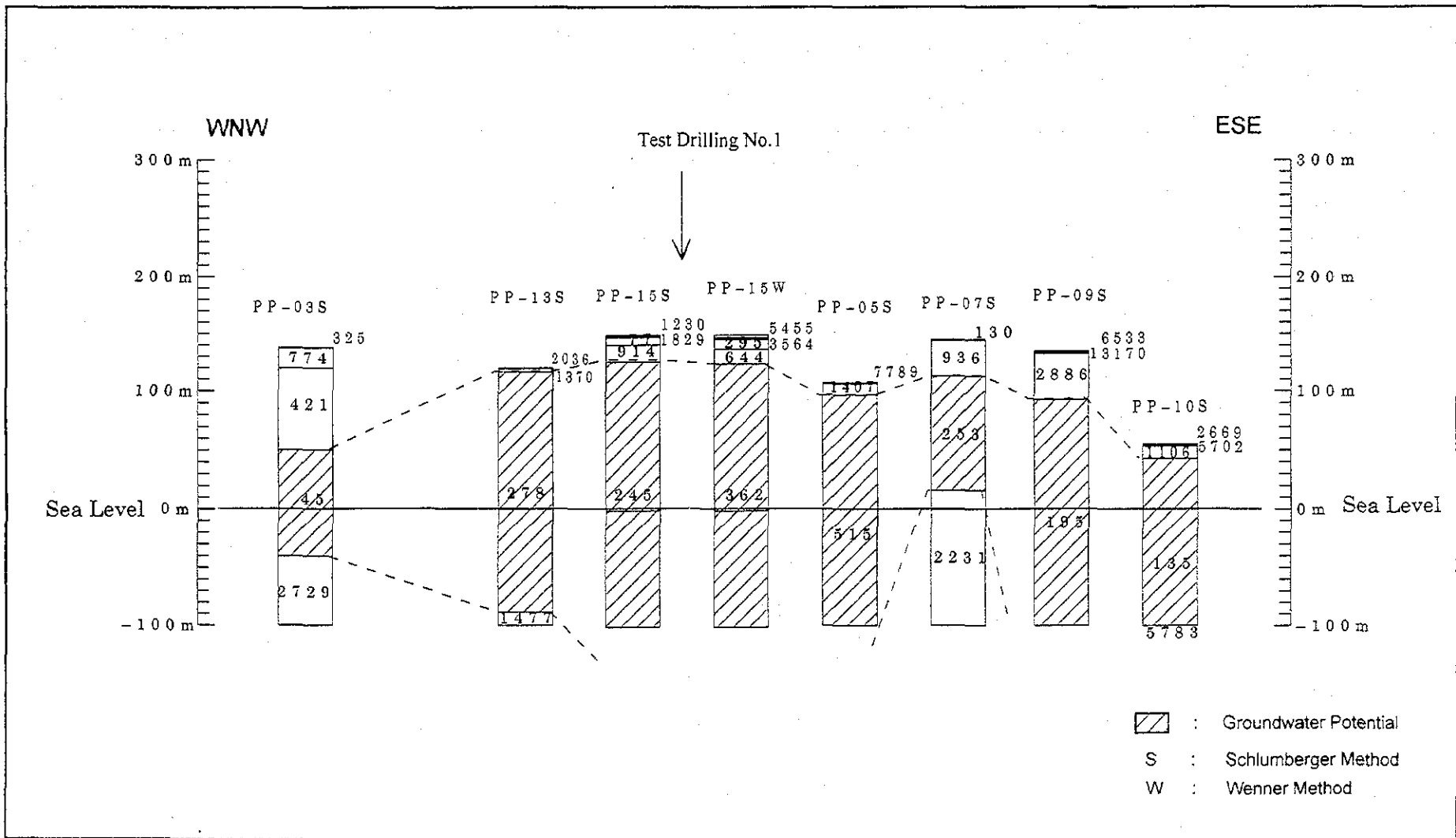


Interpreted Resistivity Sounding of SSW-NNE Direction in Popondetta

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Figure D4-9

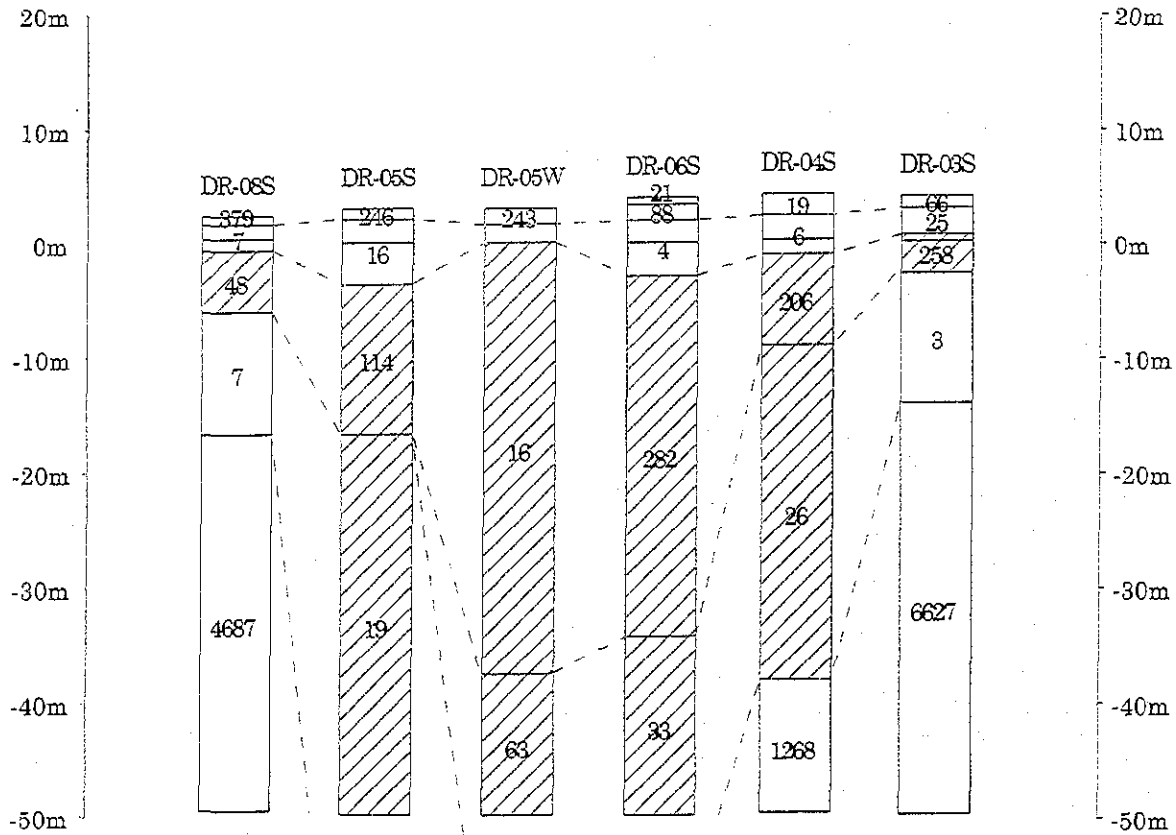



Interpreted Resistivity Sounding of WNW-ESE Direction in Popondetta

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Figure D4-10



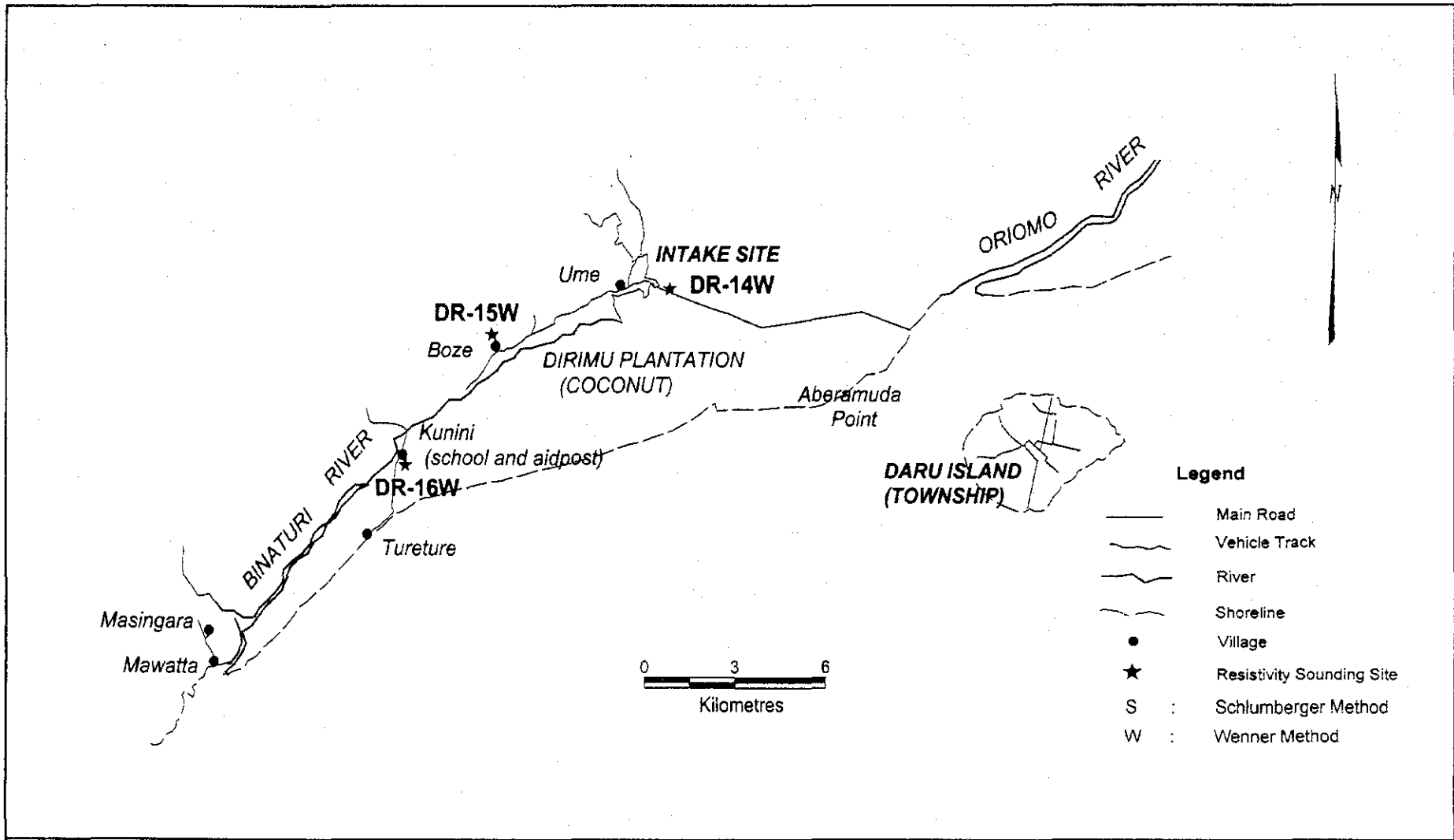
 : Groundwater Potential  
 S : Schlumberger Method  
 W : Wenner Method

Interpreted Resistivity Sounding in Popondetta

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

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**Figure D4-11**

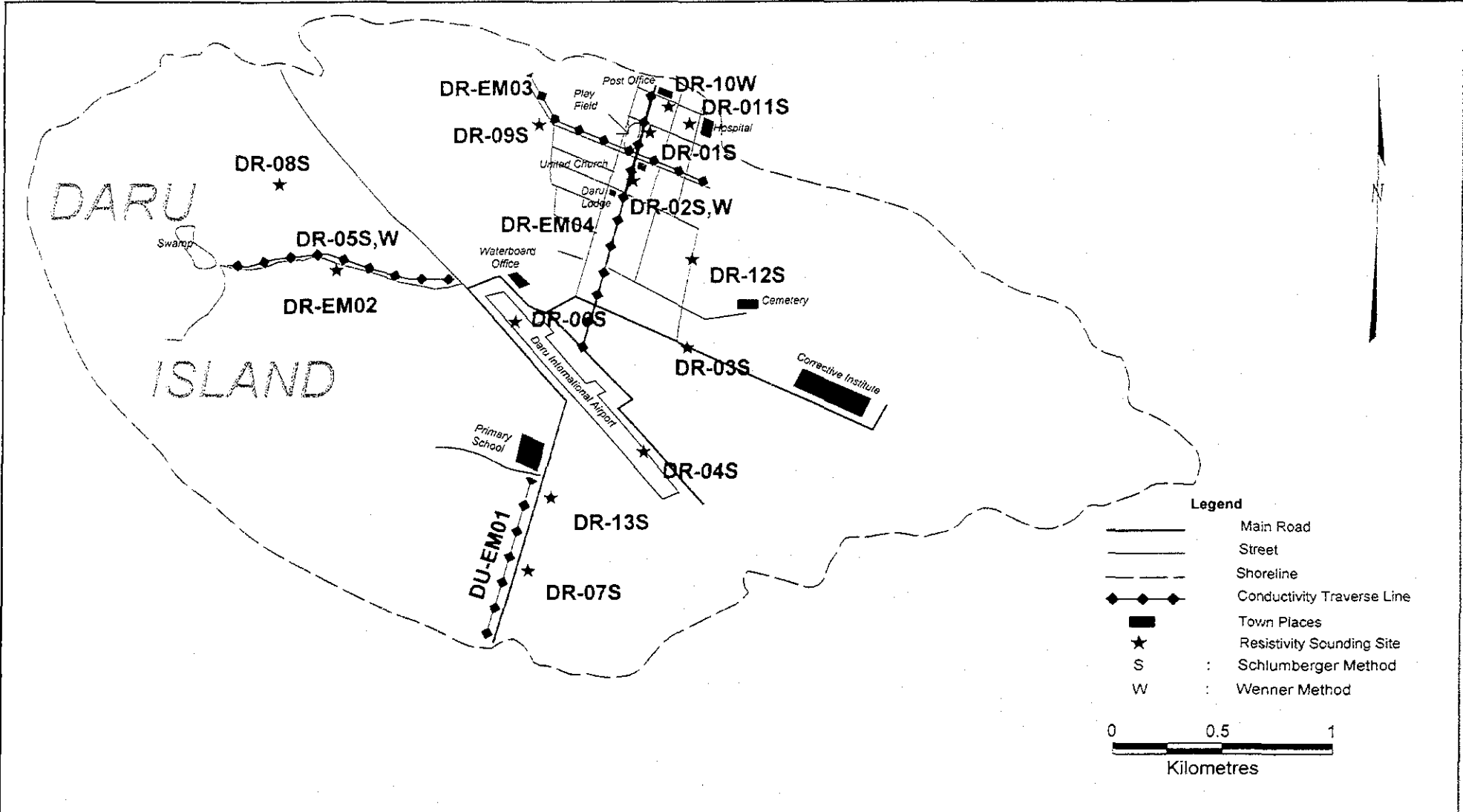


Location Map of Resistivity Sounding in Daru

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**Figure D5-1**

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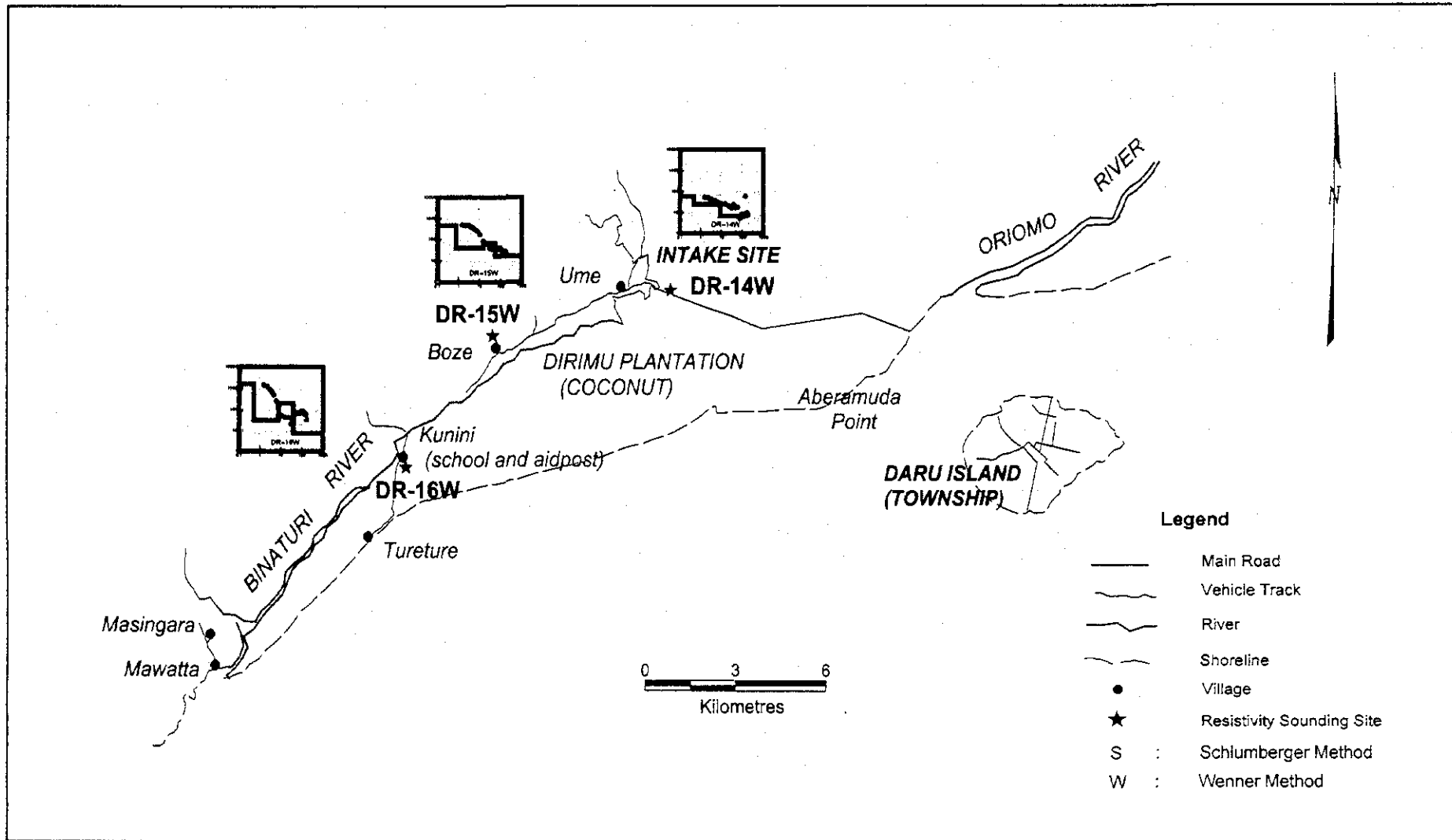


Location Map of Resistivity and Conductivity Soundings in Daru Town

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**Figure D5-2**

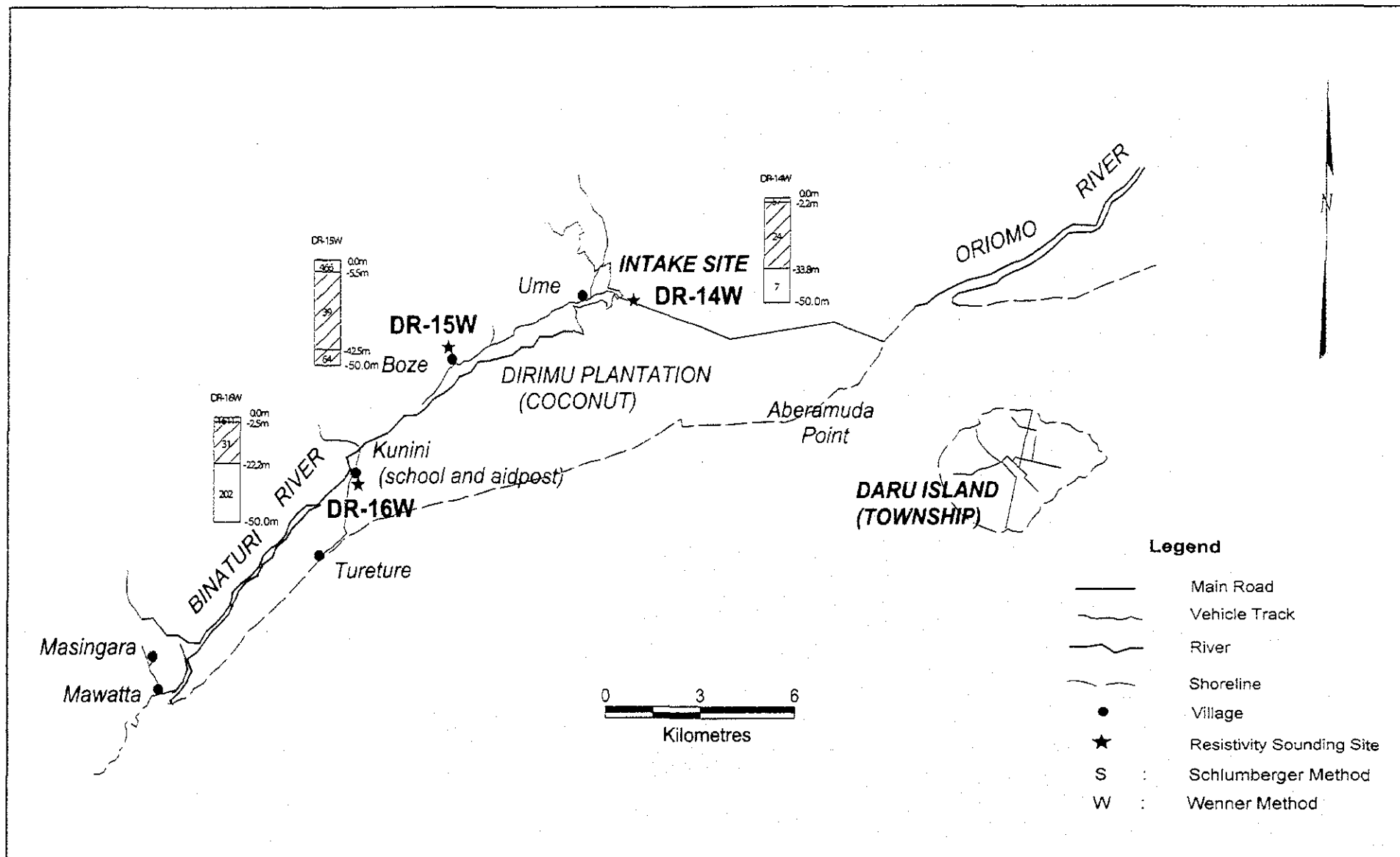


VES Curves of Resistivity Sounding in Daru

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**Figure D5-3**



Interpreted Resistivity Sounding in Daru

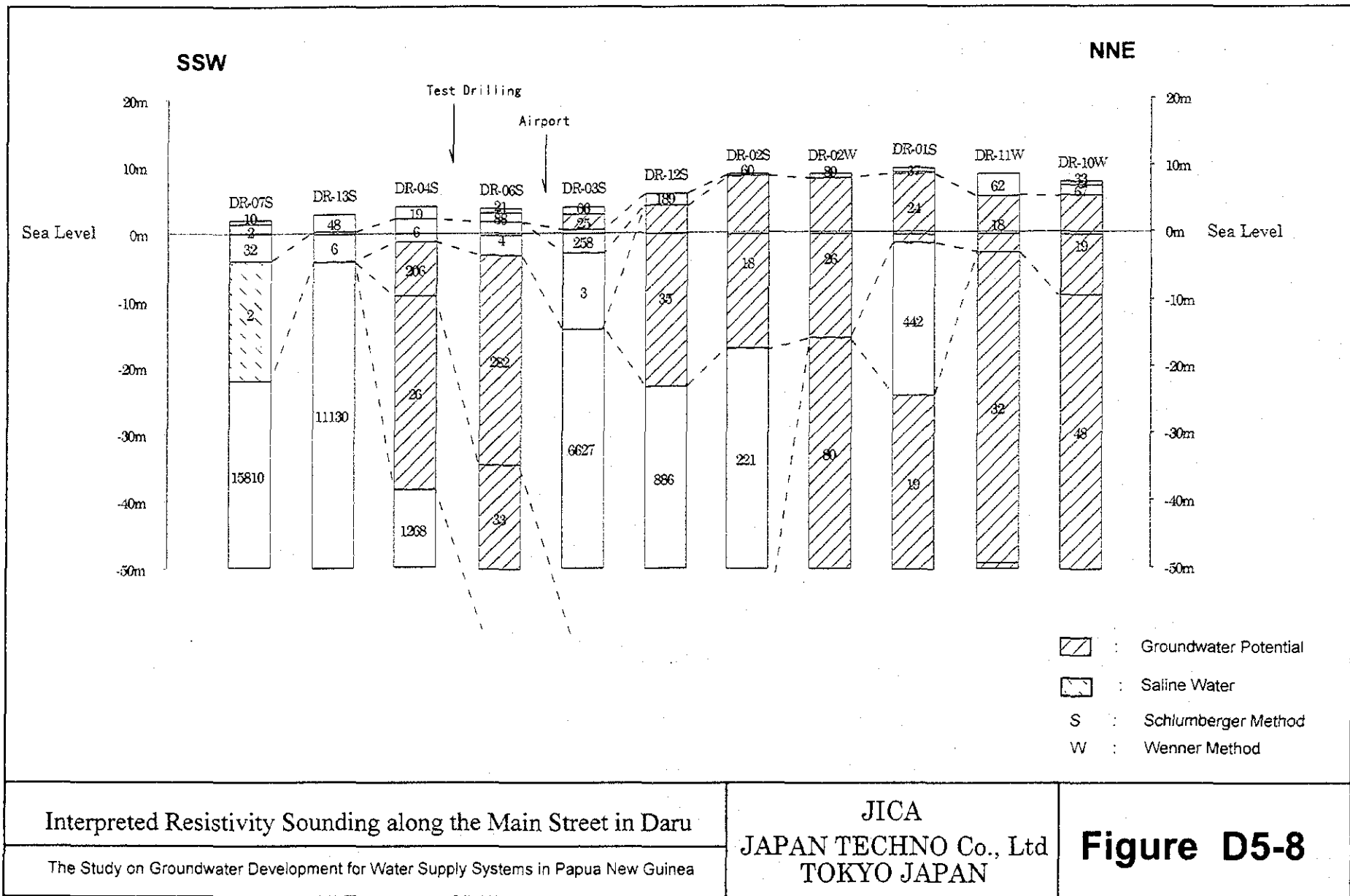
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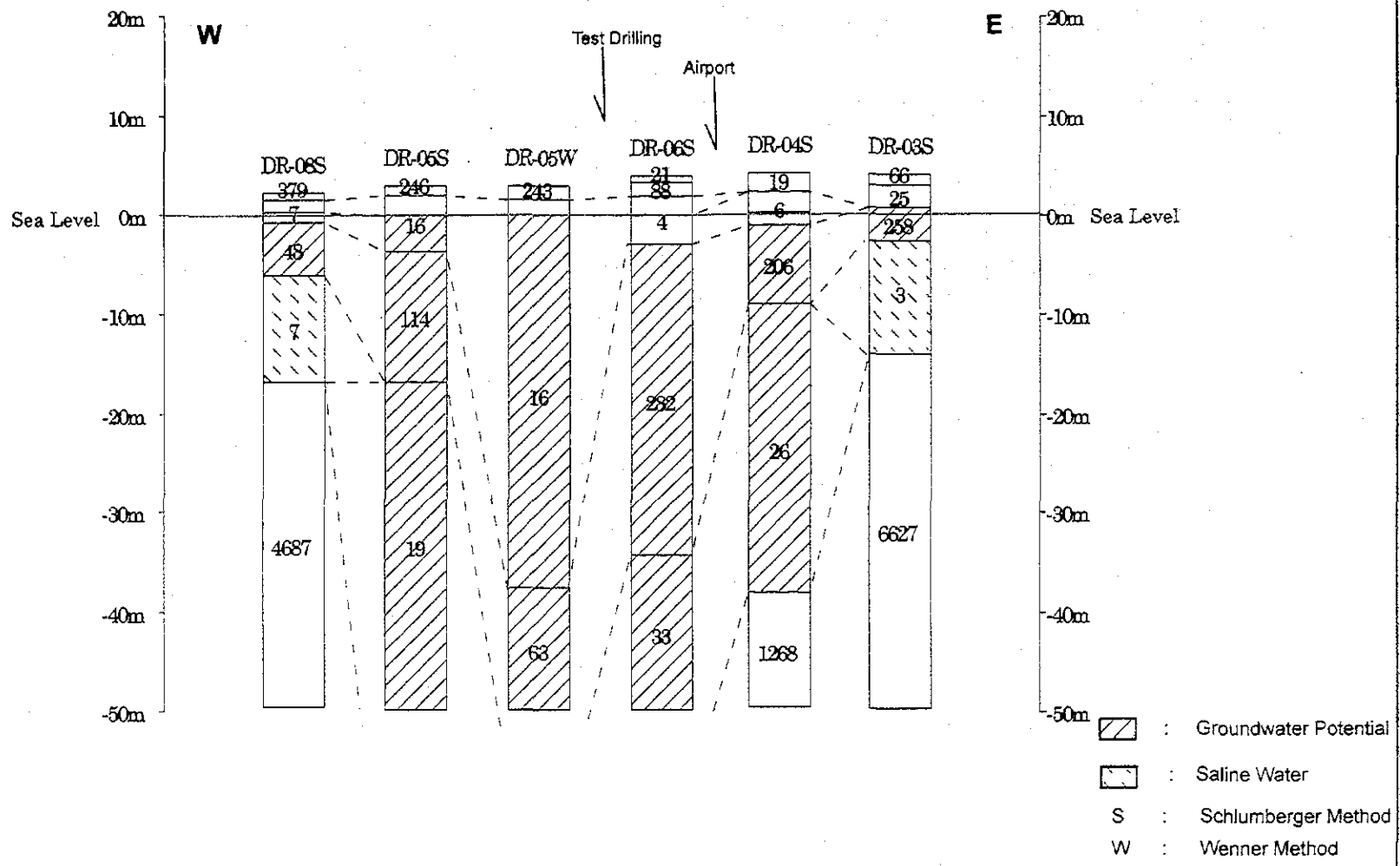
**Figure D5-5**

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea







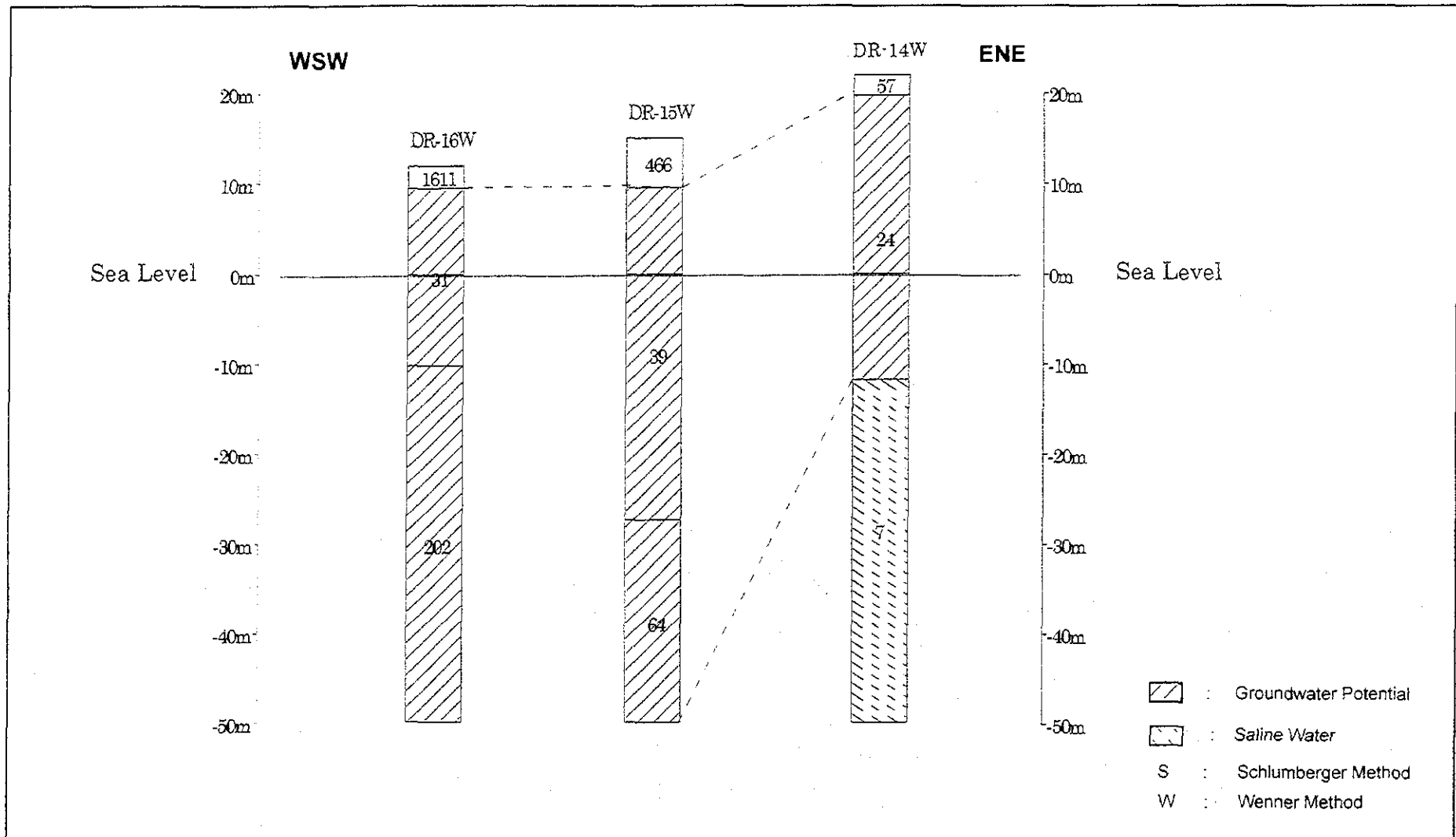


Interpreted Resistivity Sounding along the Airport in Daru

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**Figure D5-9**

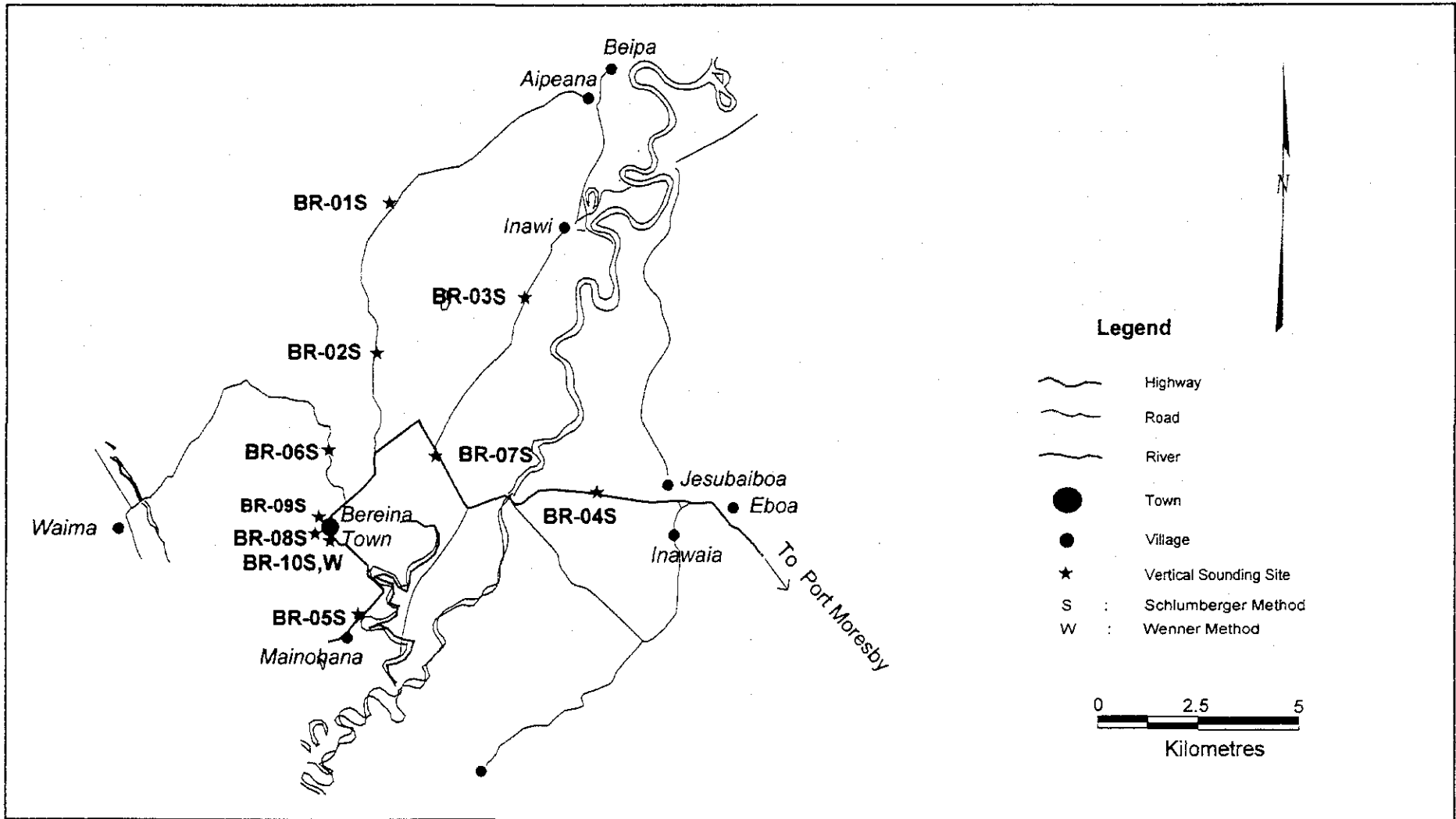


Interpreted Resistivity Sounding along Binaturi River

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**Figure D5-10**

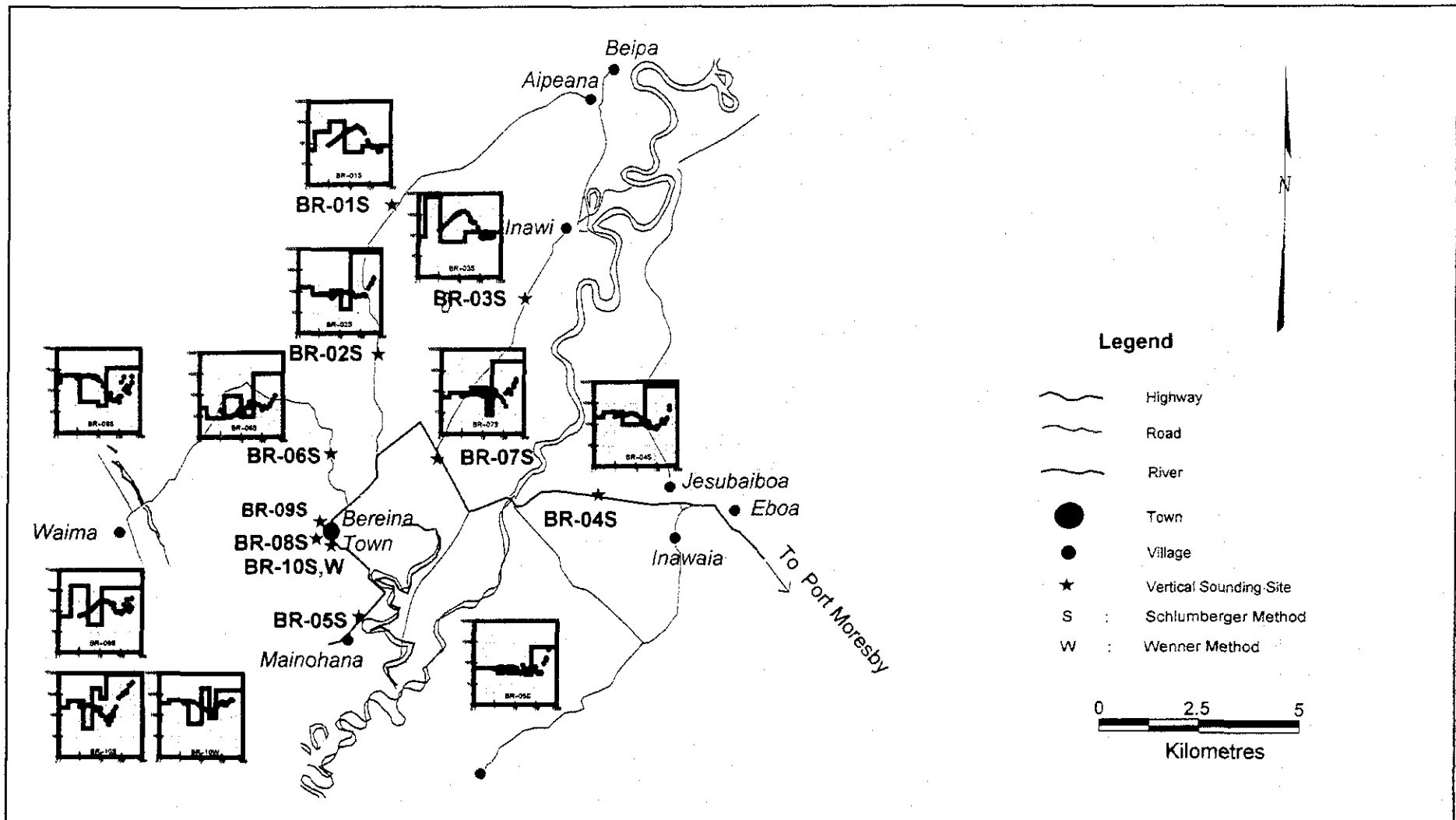


Location Map of Resistivity Sounding in Bereina

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**Figure D6-1**

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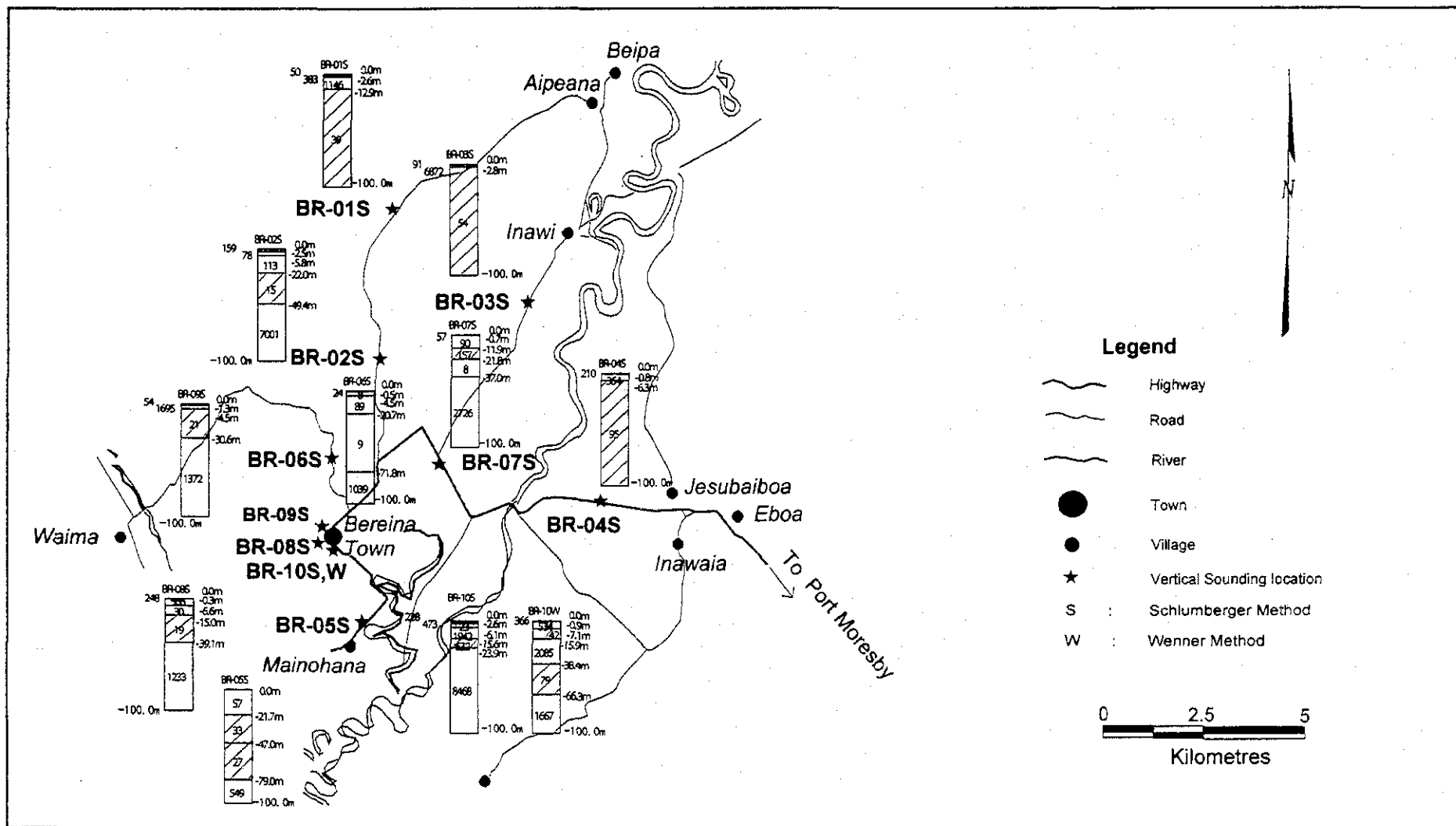


VES Curves of Resistivity Sounding in Bereina

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

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**Figure D6-2**

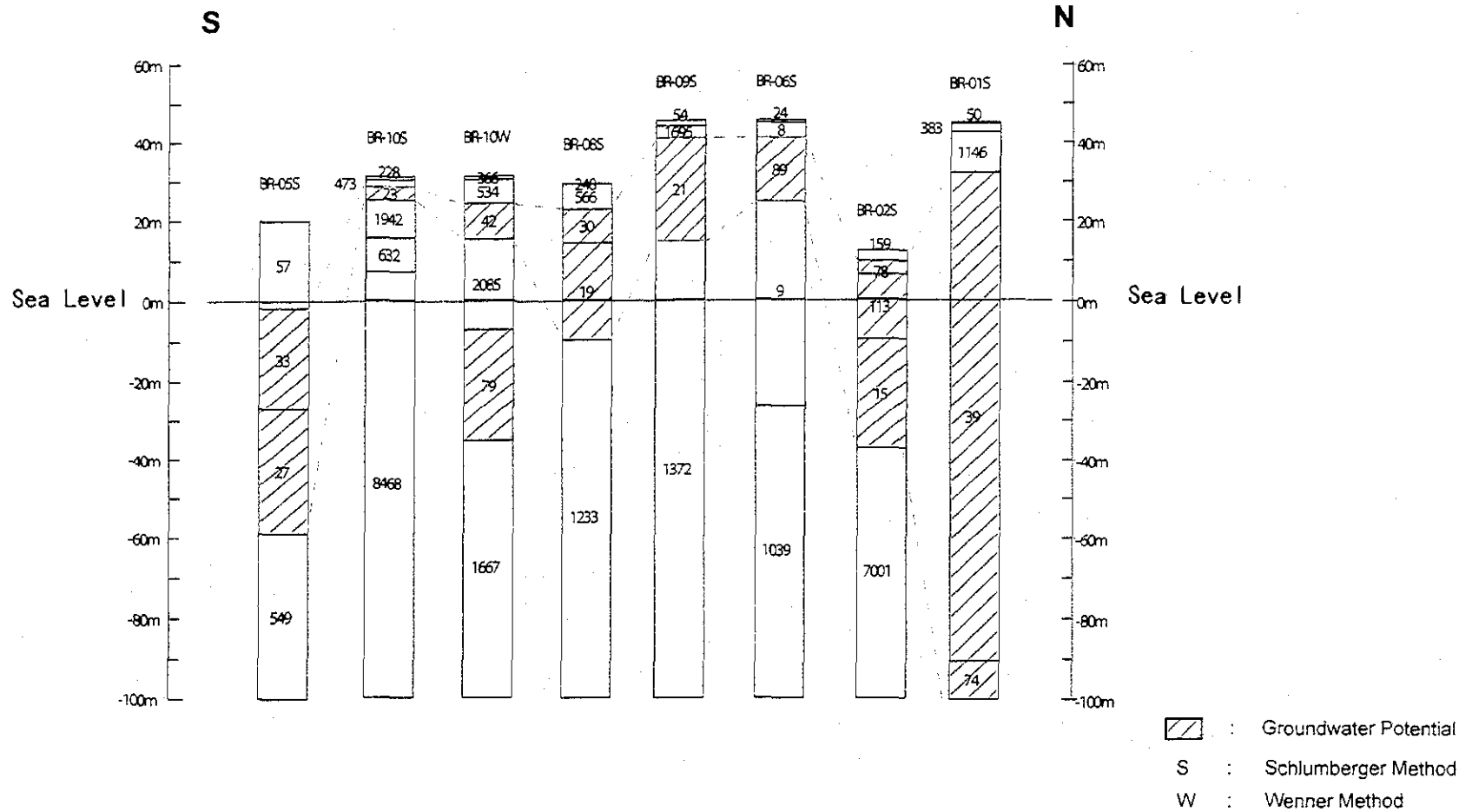


Interpreted Resistivity Sounding in Bereina

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

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**Figure D6-3**



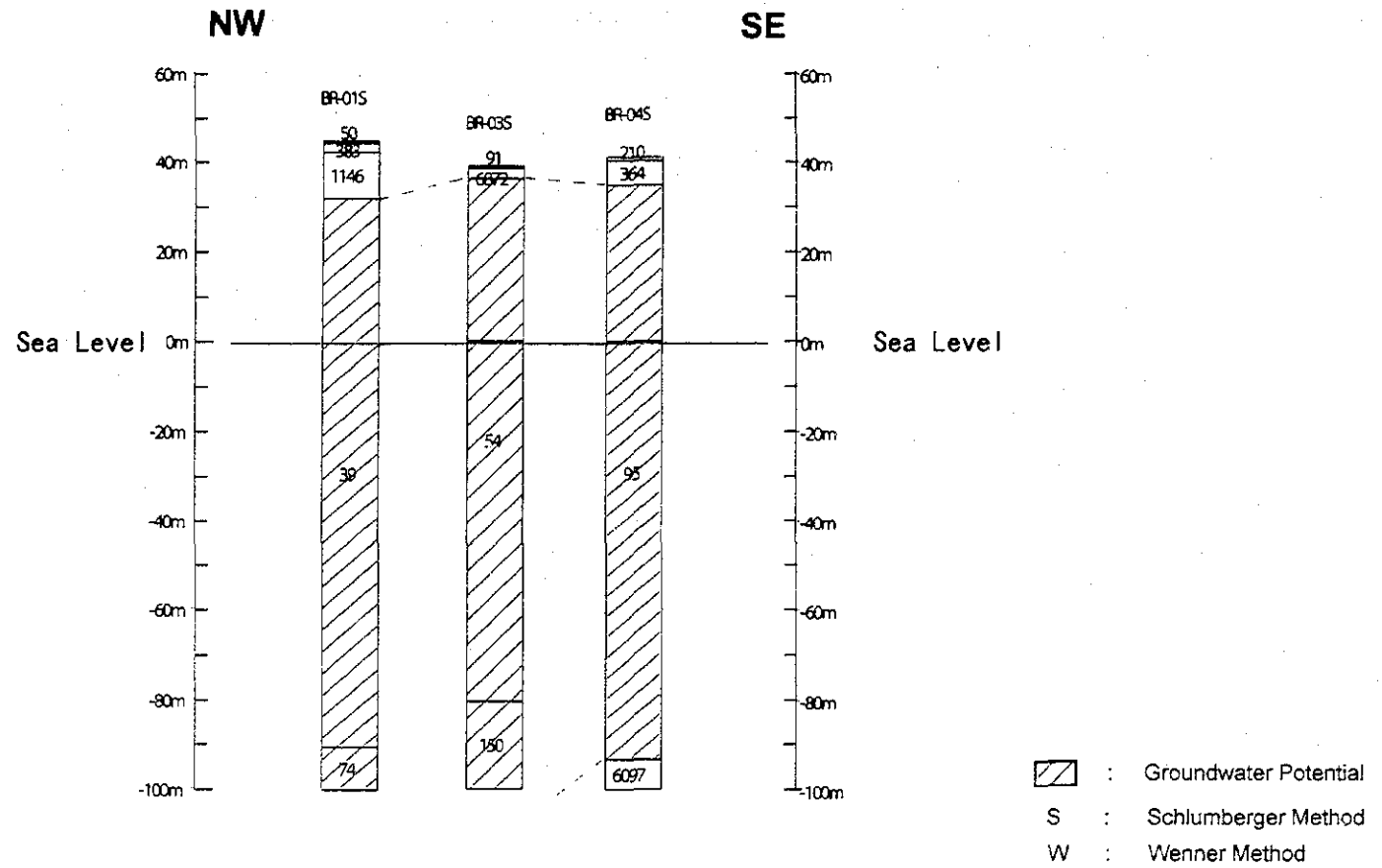
Interpreted Resistivity Sounding of N-S Direction in Bereina

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

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**Figure D6-4**



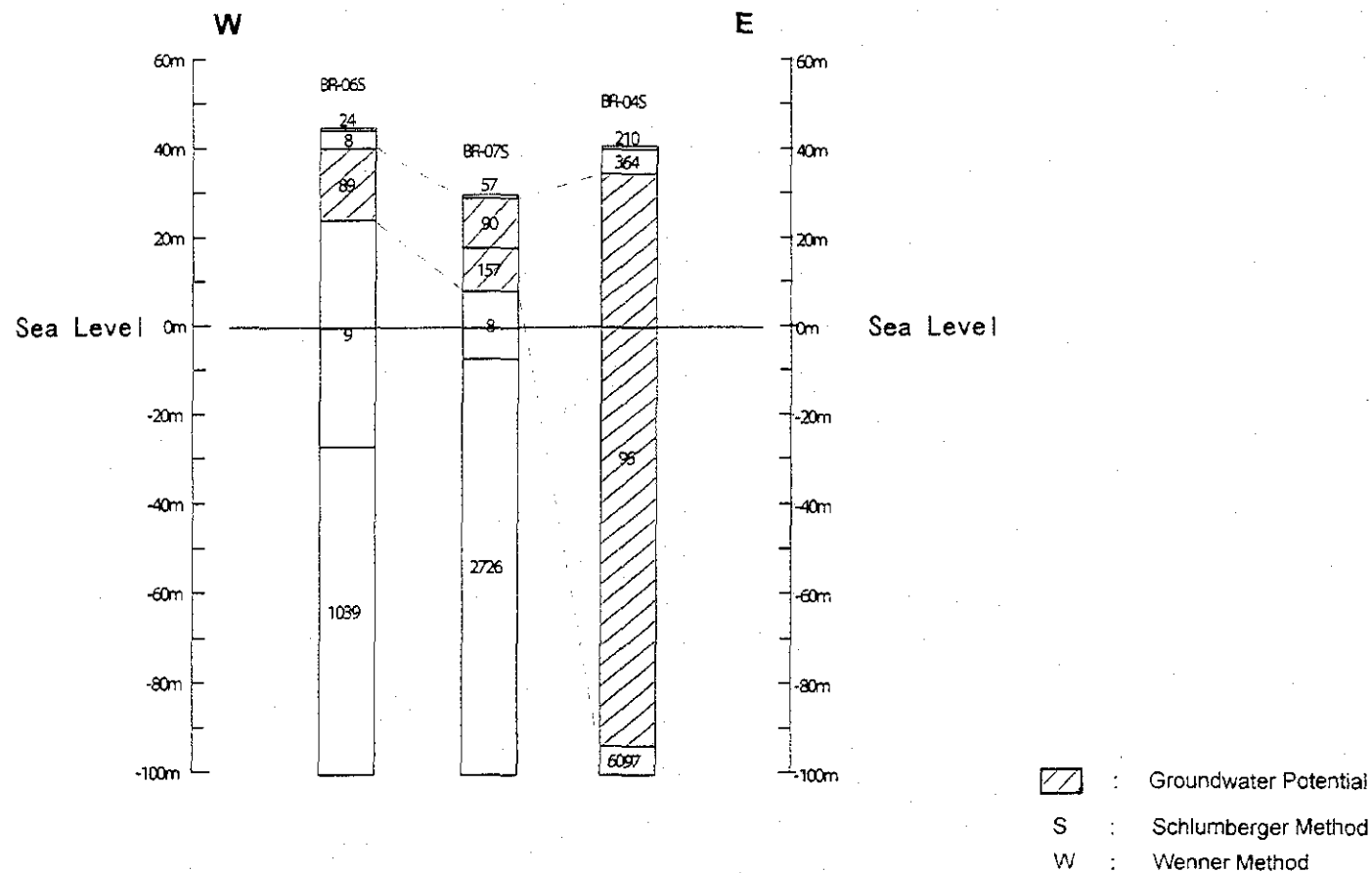


Interpreted Resistivity Sounding of NW-SE Direction in Bereina

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**Figure D6-5**

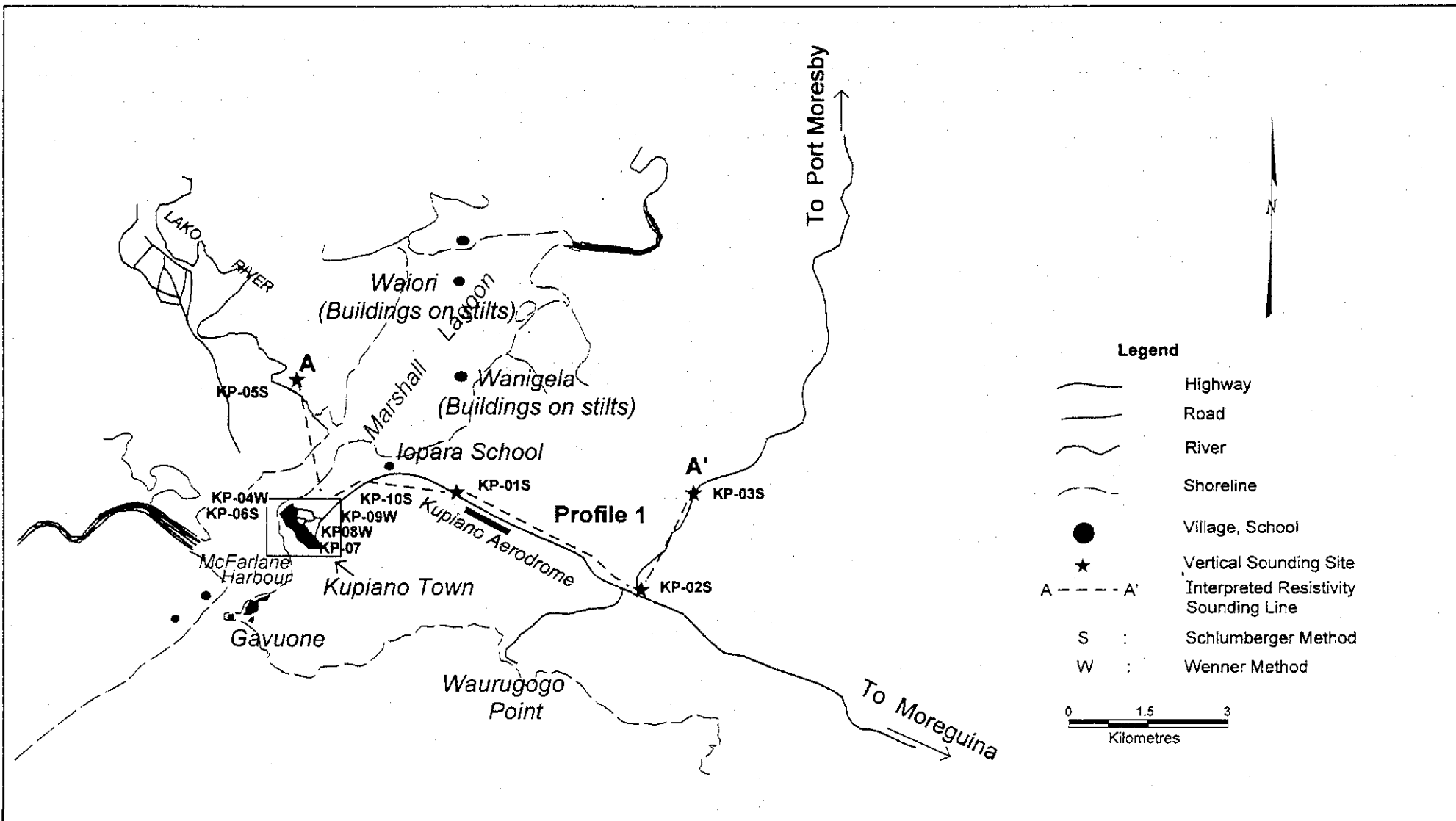


Interpreted Resistivity Sounding of E-W Direction in Bereina

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**Figure D6-6**

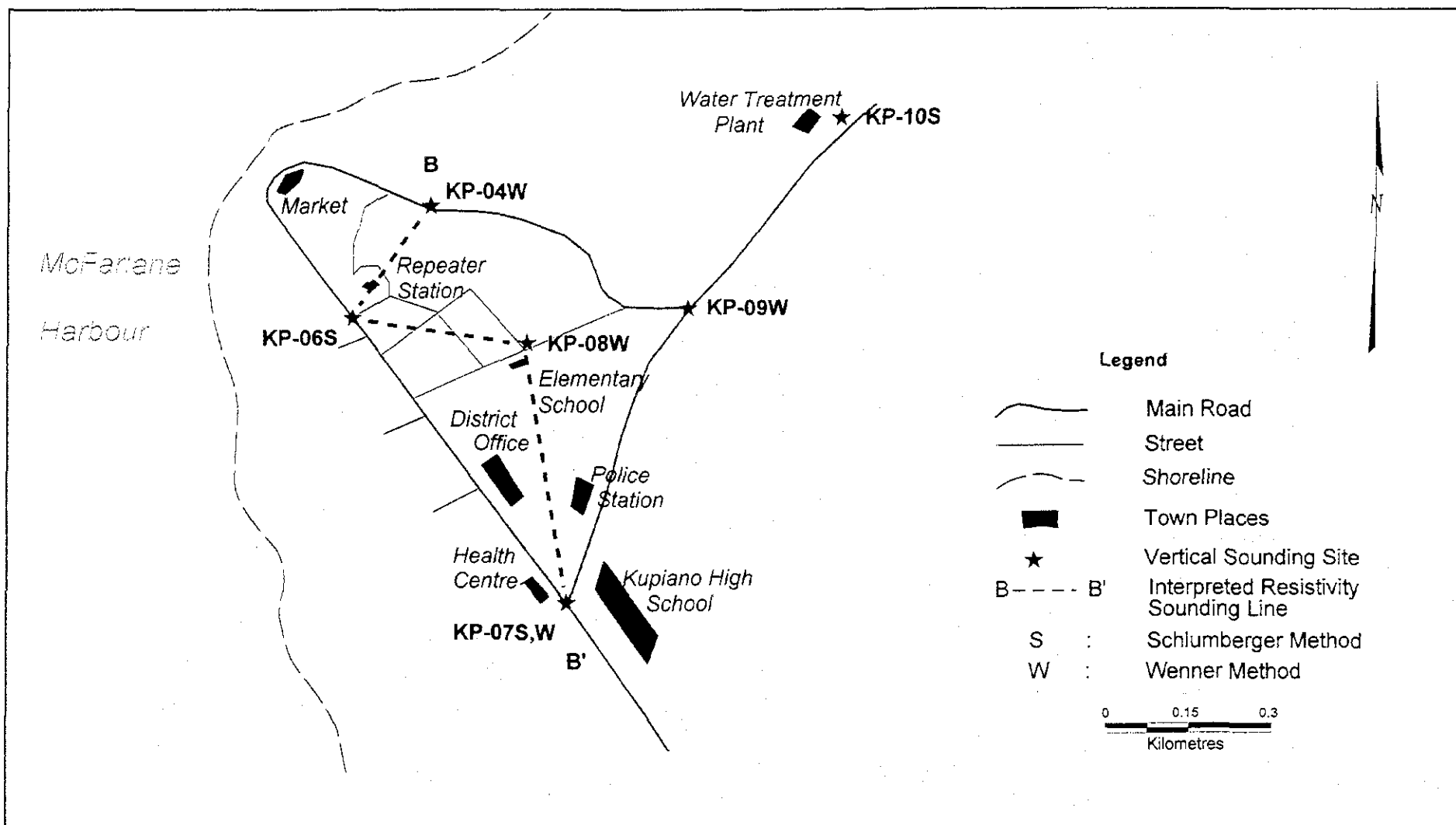


Location Map of Resistivity Sounding in Kupiano

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

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Figure D7-1

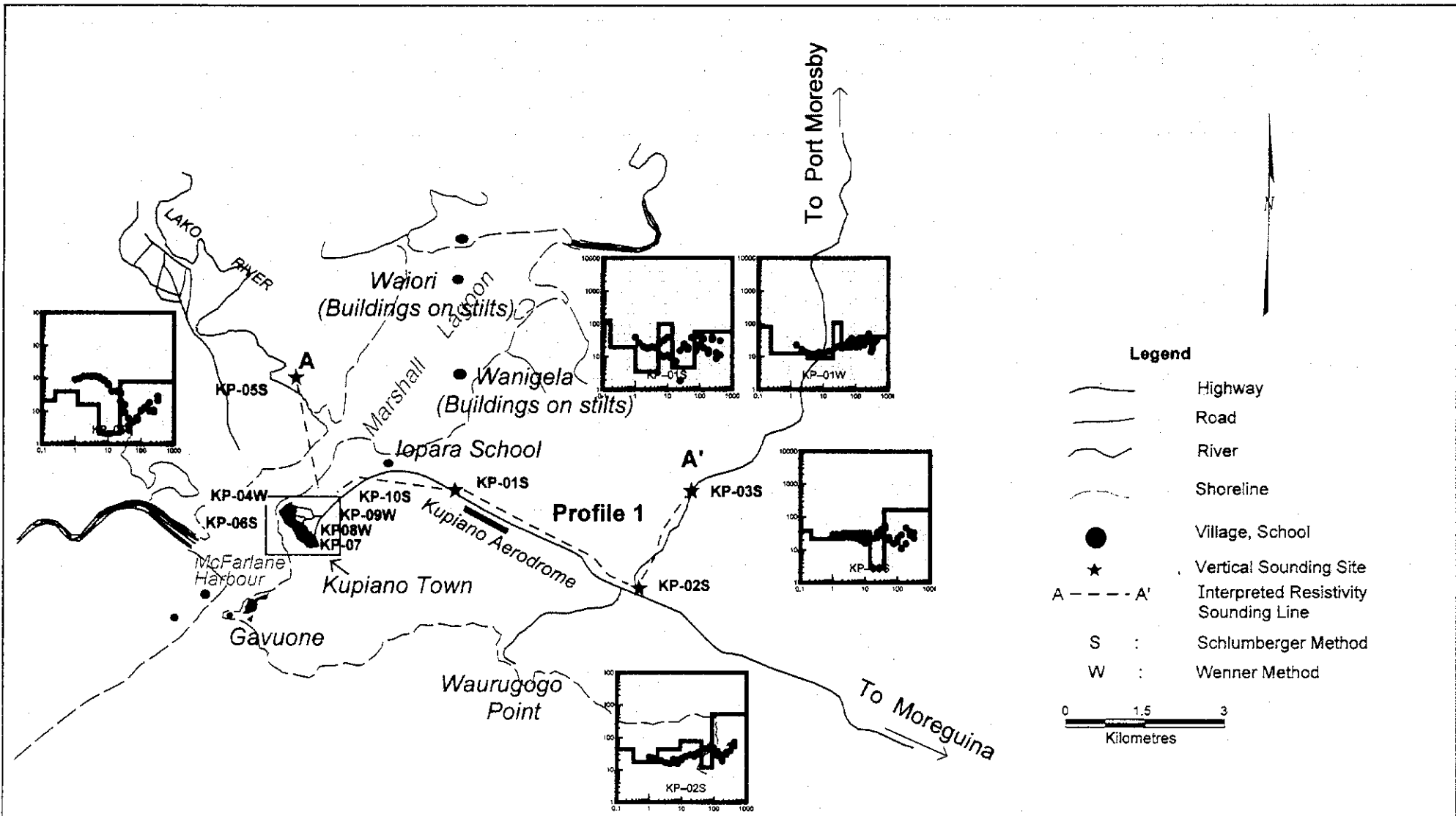


Location Map of Resistivity Sounding in Kupiano

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

JICA  
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**Figure D7-2**

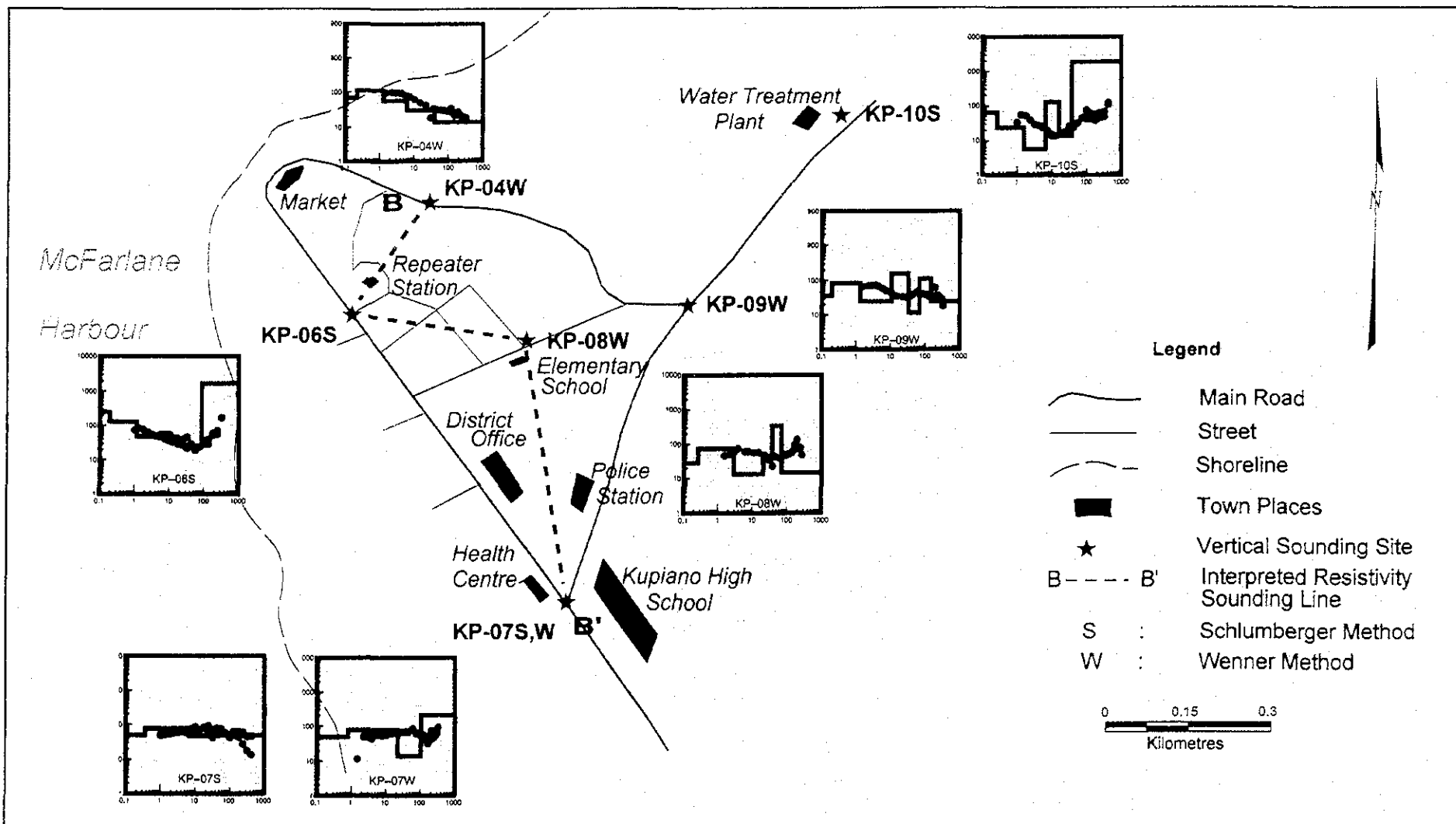


VES Curves of Resistivity Sounding in Kupiano

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

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**Figure D7-3**

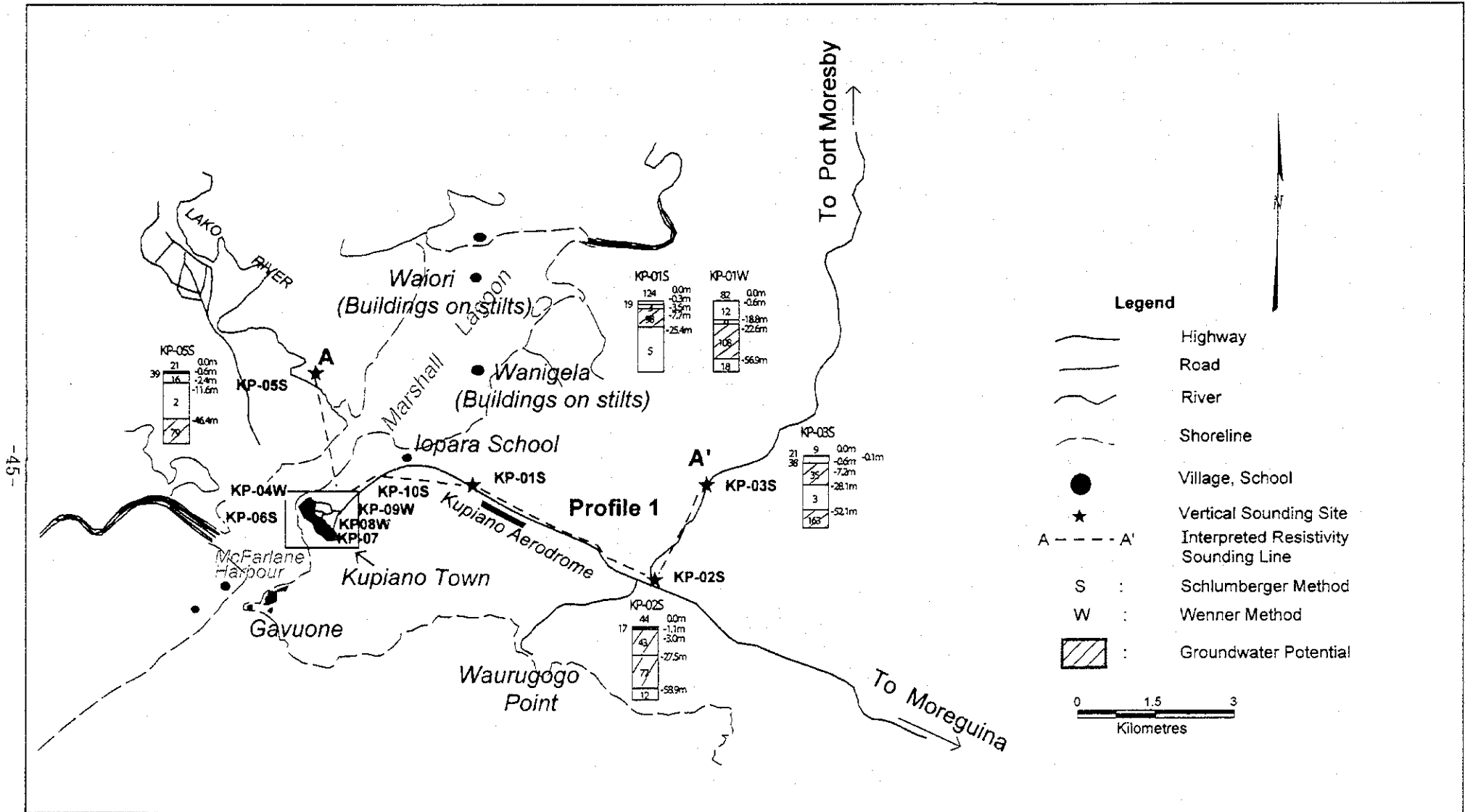


VES Curves of Resistivity Sounding in Kupiano

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

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**Figure D7-4**

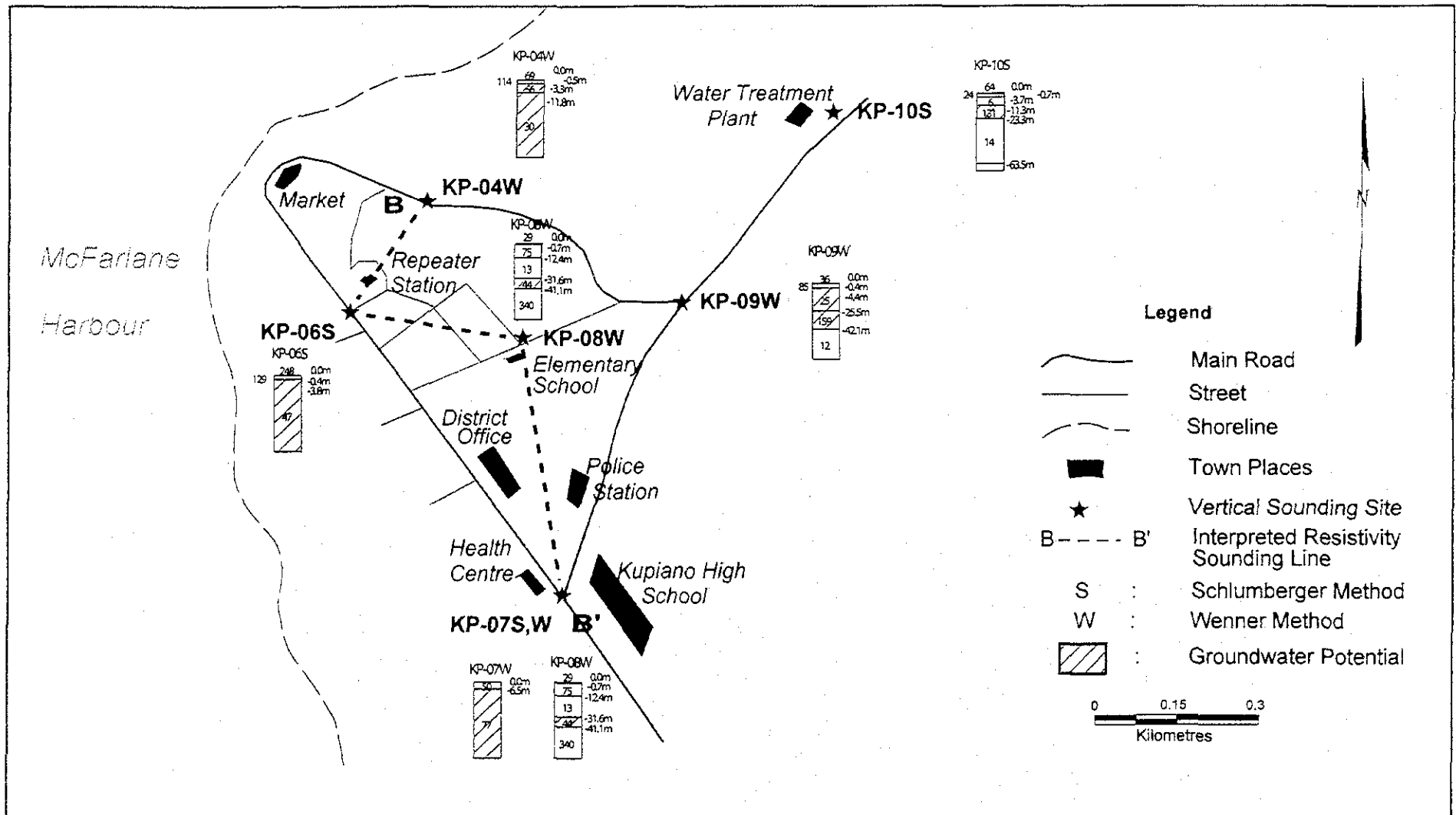


Interpreted Resistivity Sounding in Kupiano

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**Figure D7-5**

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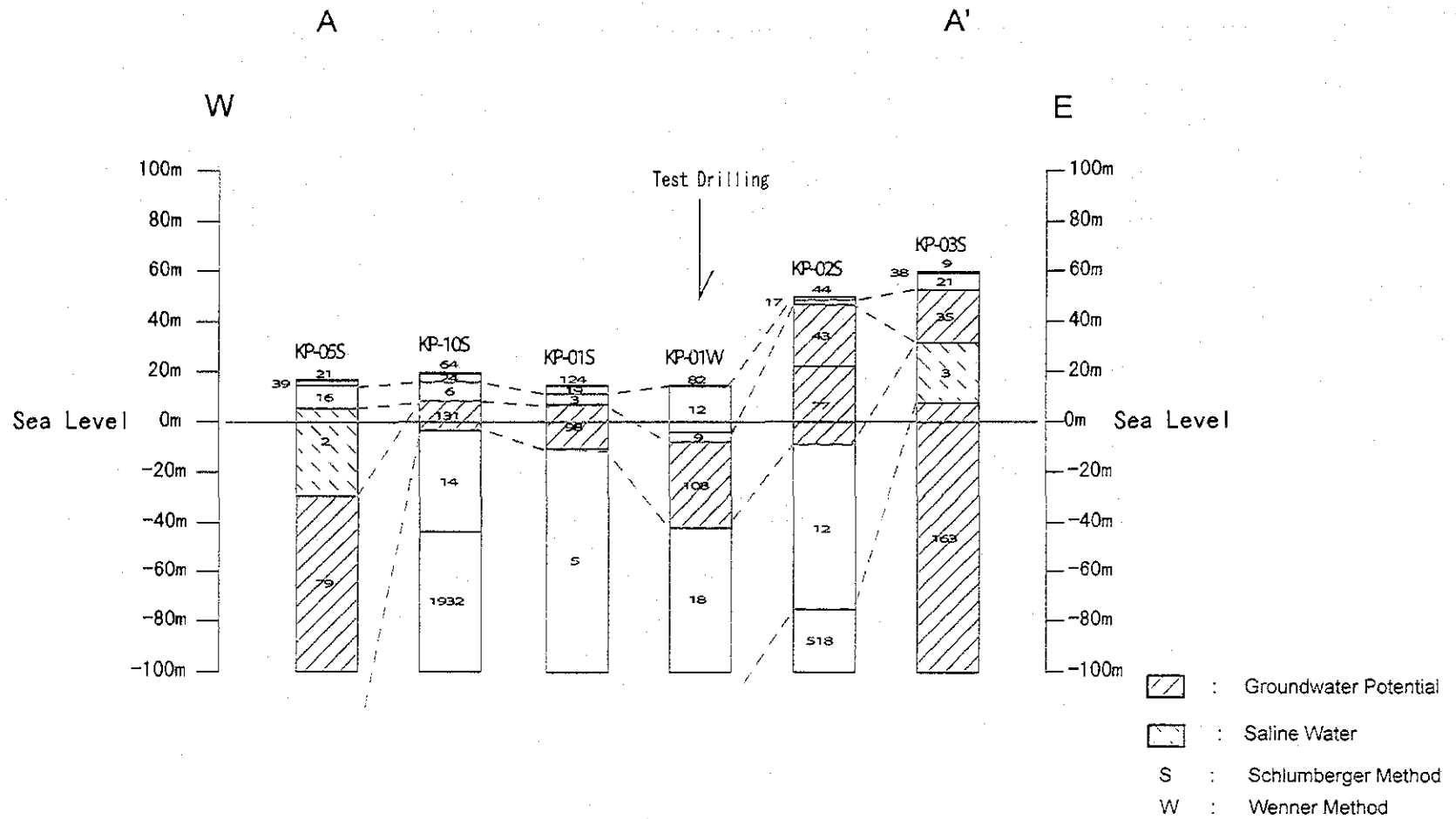
Interpreted Resistivity Sounding in Kupiano

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

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**Figure D7-6**



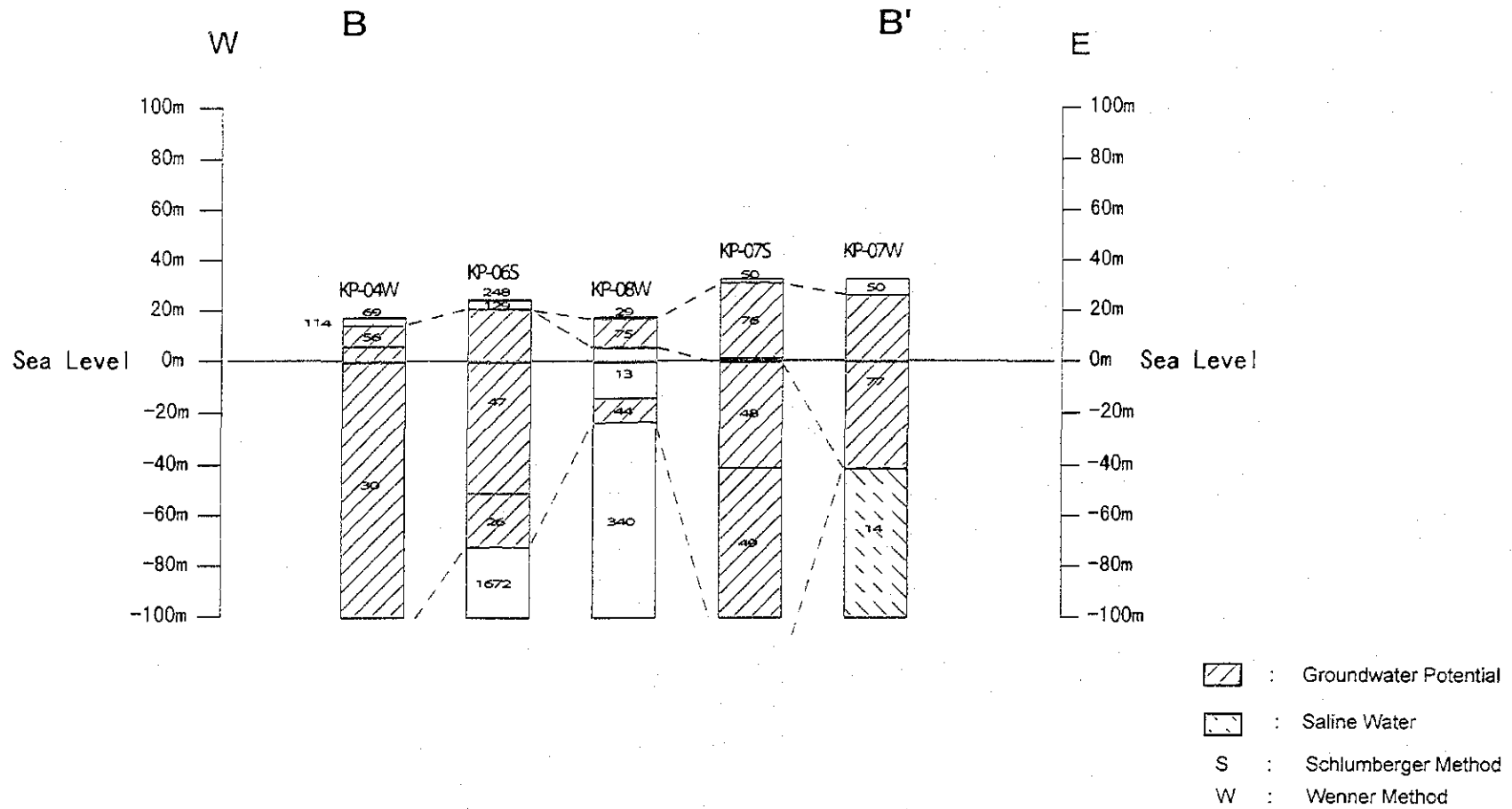


Interpreted Resistivity Sounding of E-W Direction in Kupiano

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**Figure D7-7**

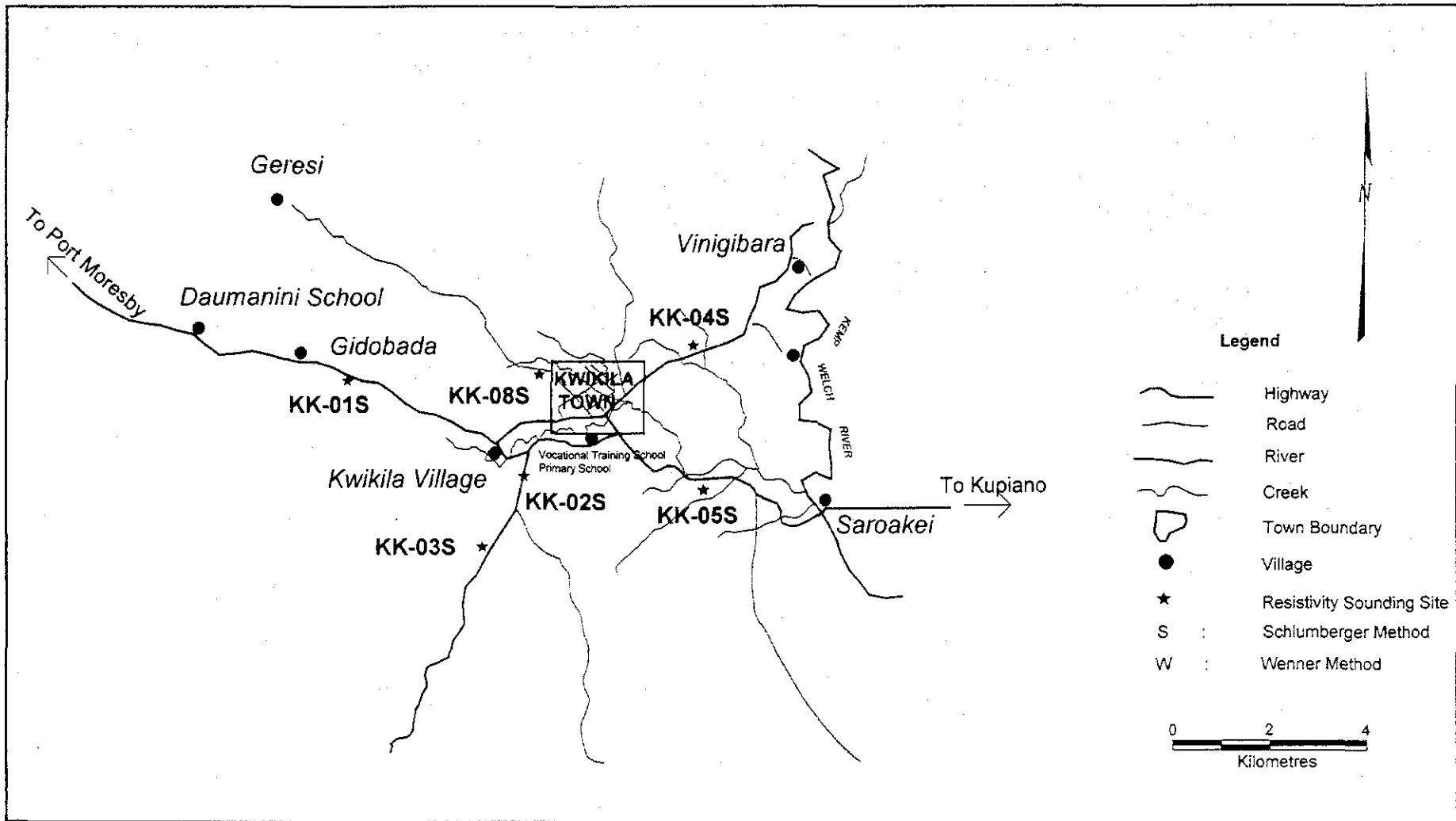


Interpreted Resistivity Sounding of E-W Direction in Kupiano

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**Figure D7-8**

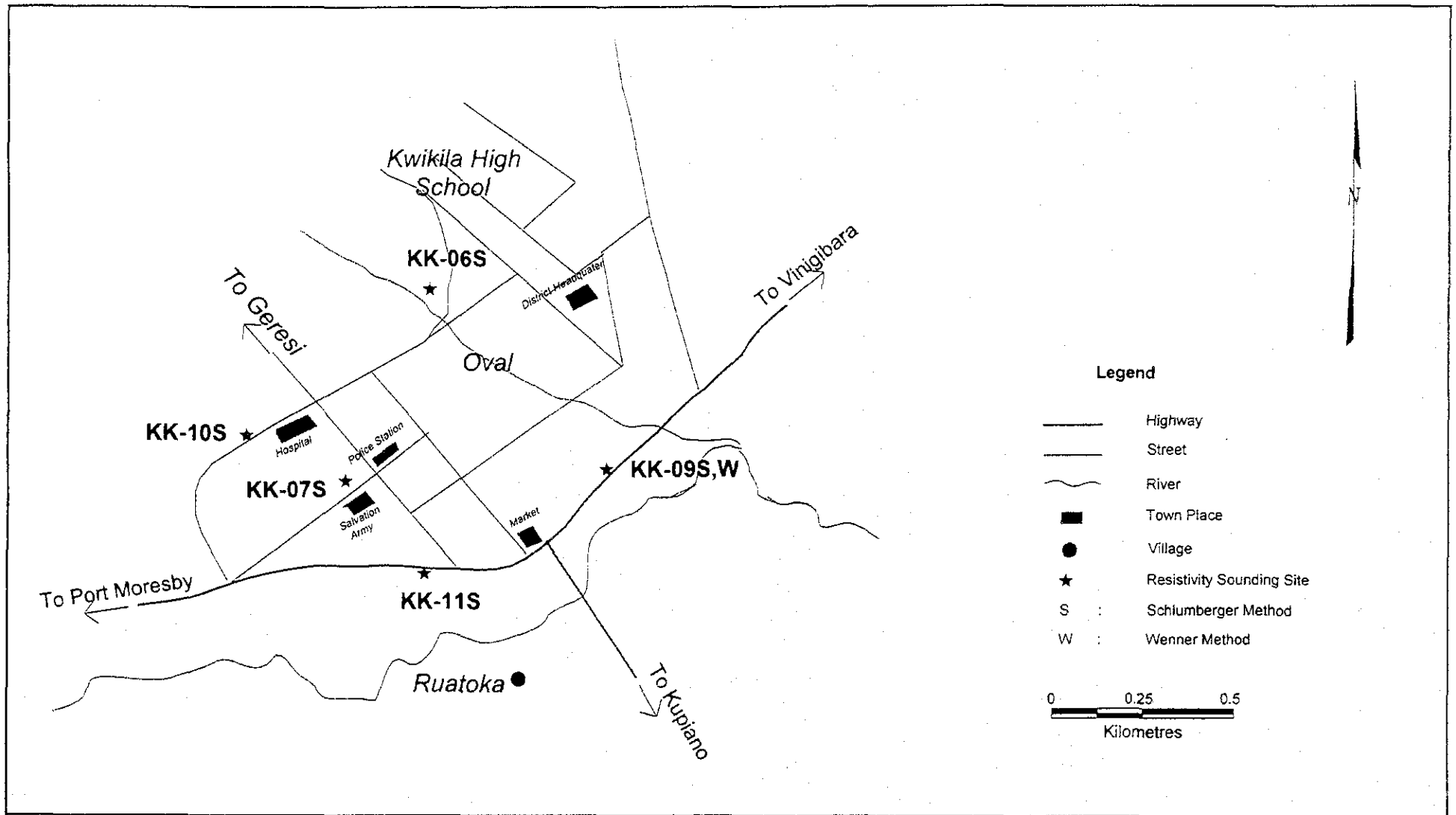


Location Map of Resistivity Sounding in Kwikila

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**Figure D8-1**

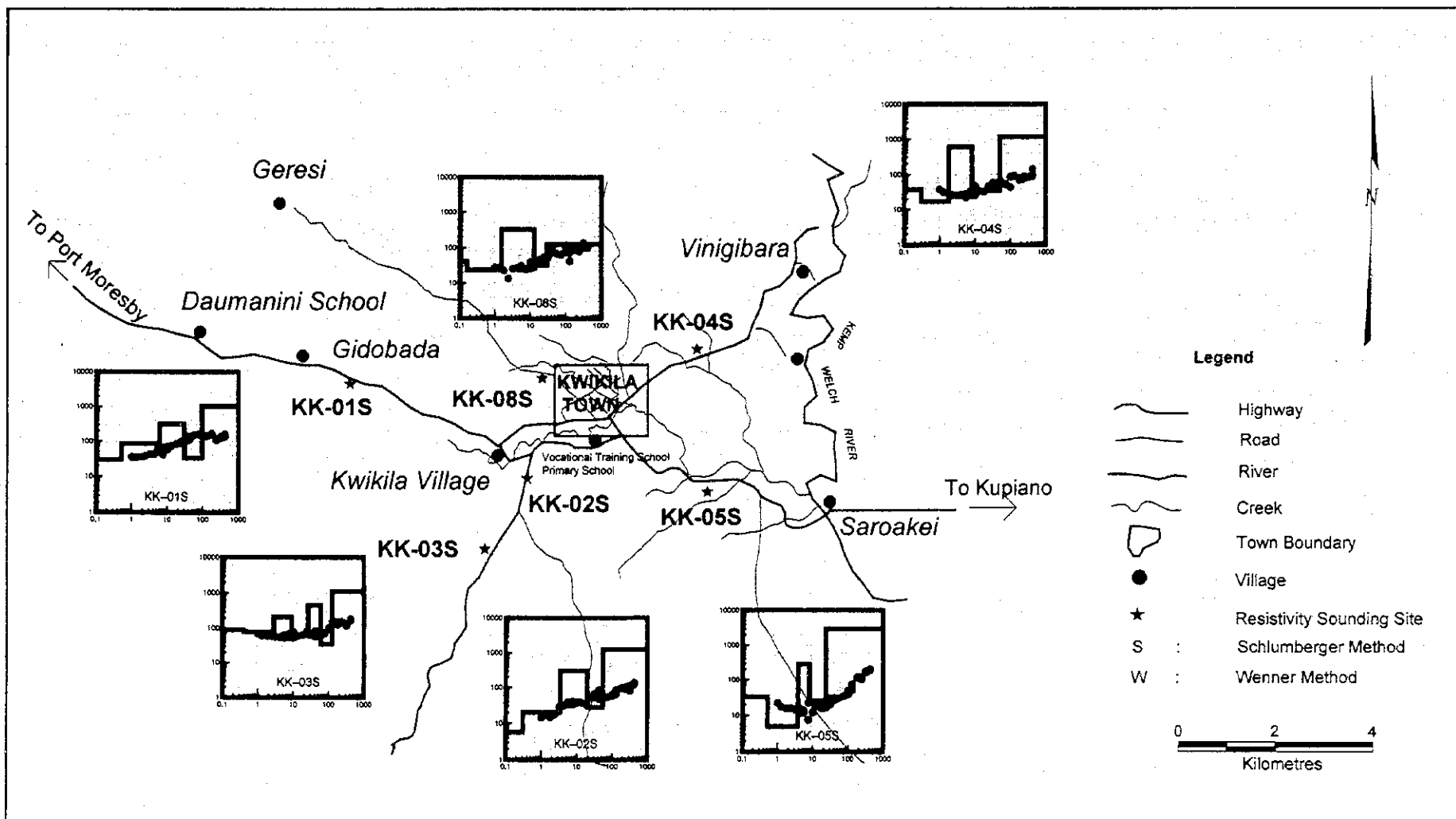


Location Map of Resistivity Sounding in Kwikila

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

JICA  
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Figure D8-2

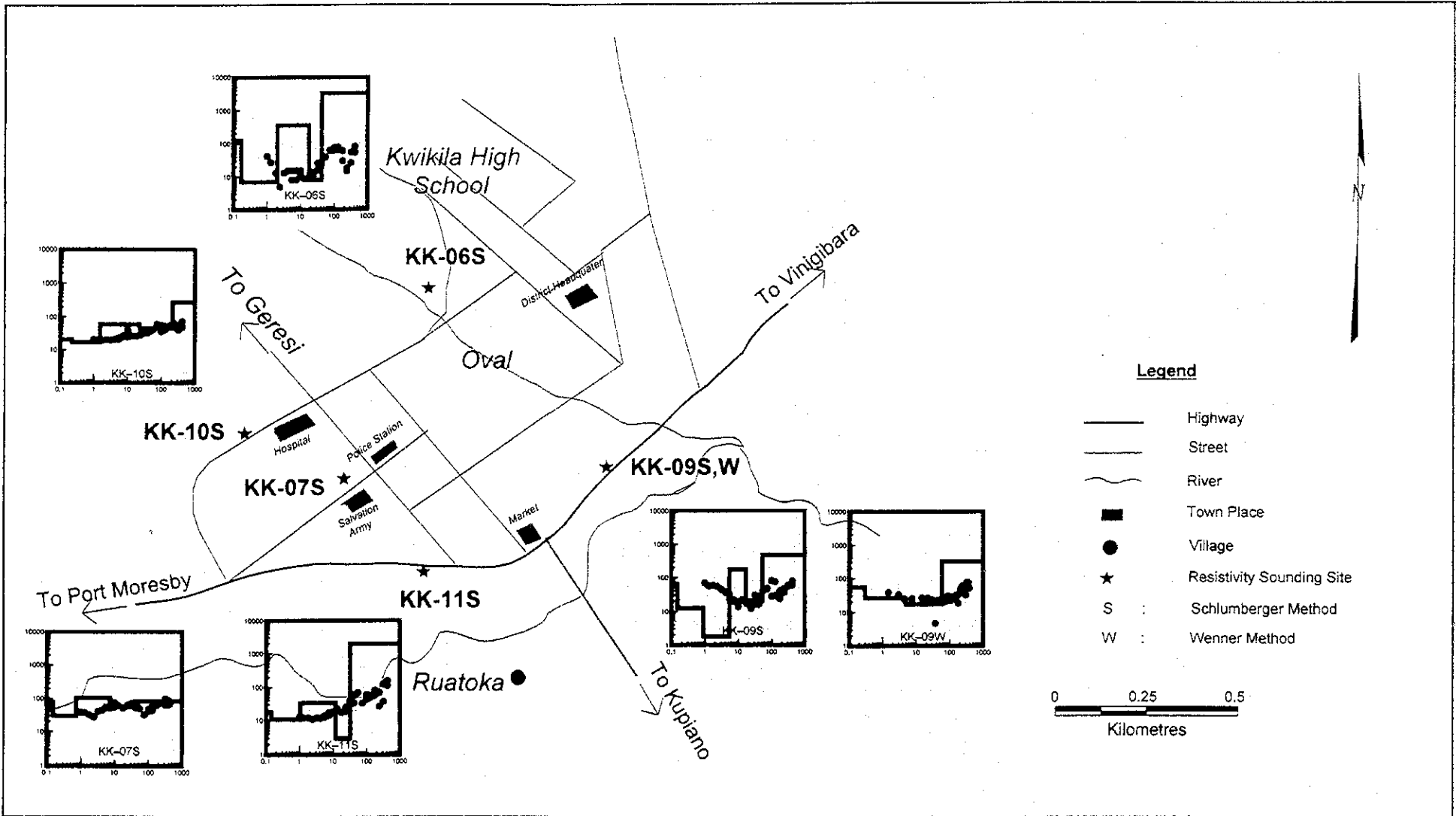


VES Curves of Resistivity Sounding in Kwikila

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

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**Figure D8-3**

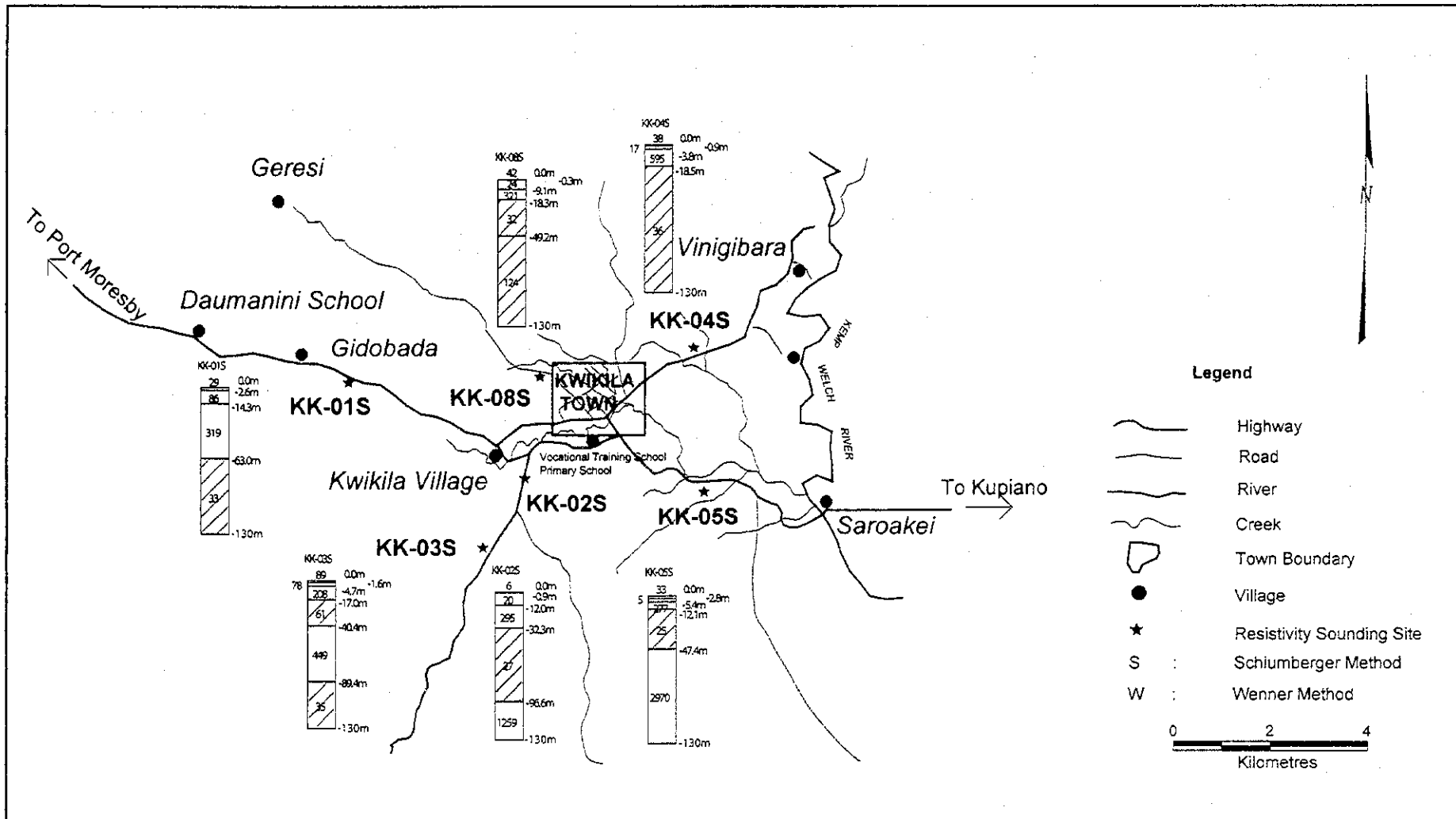


VES Curves of Resistivity Sounding in Kwikila

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

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**Figure D8-4**

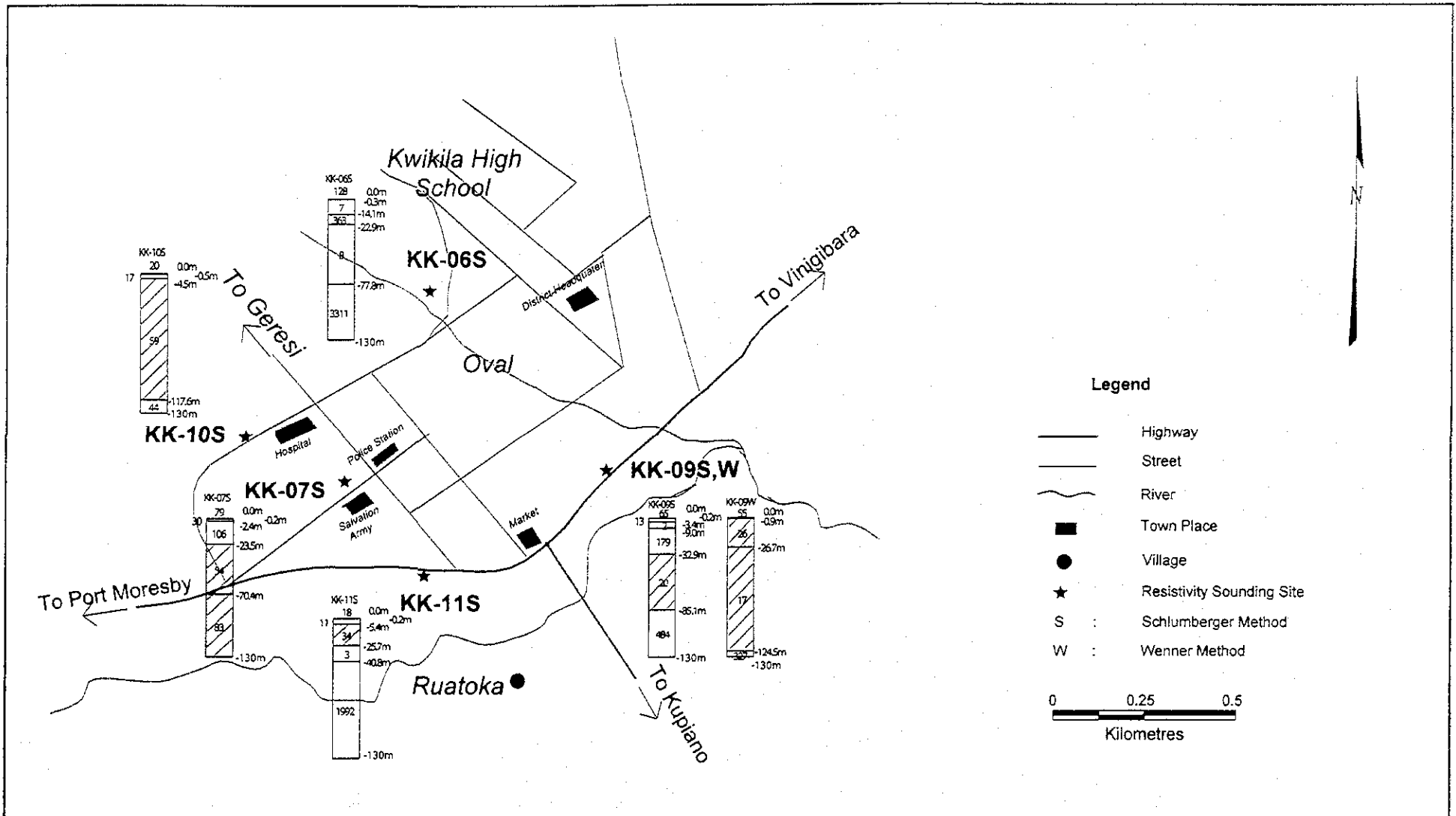


Interpreted Resistivity Sounding in Kwikila

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**Figure D8-5**



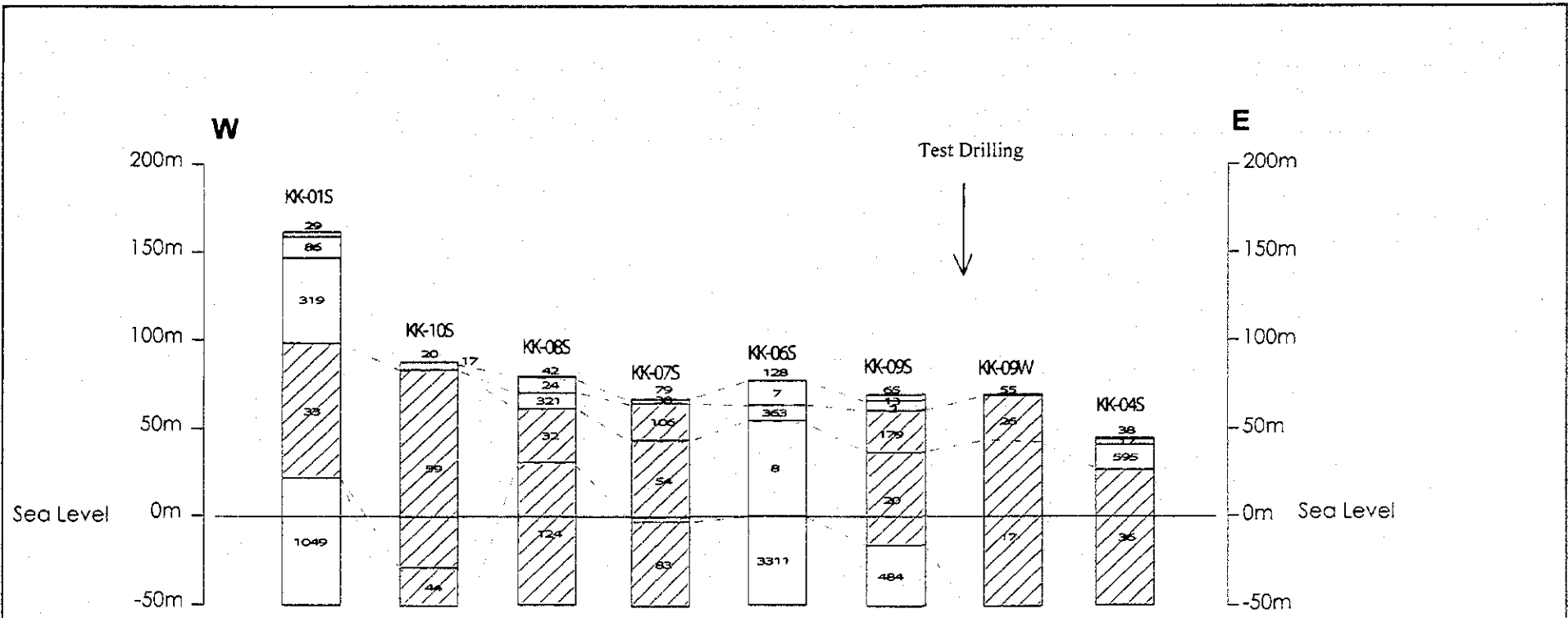
Interpreted Resistivity Sounding in Kwikila

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Figure D8-6





Unconfined aquifer may be easy to collapse and and contaminated with surface water and dried up in dry season.  
 Confined aquifer is the target of groundwater development.

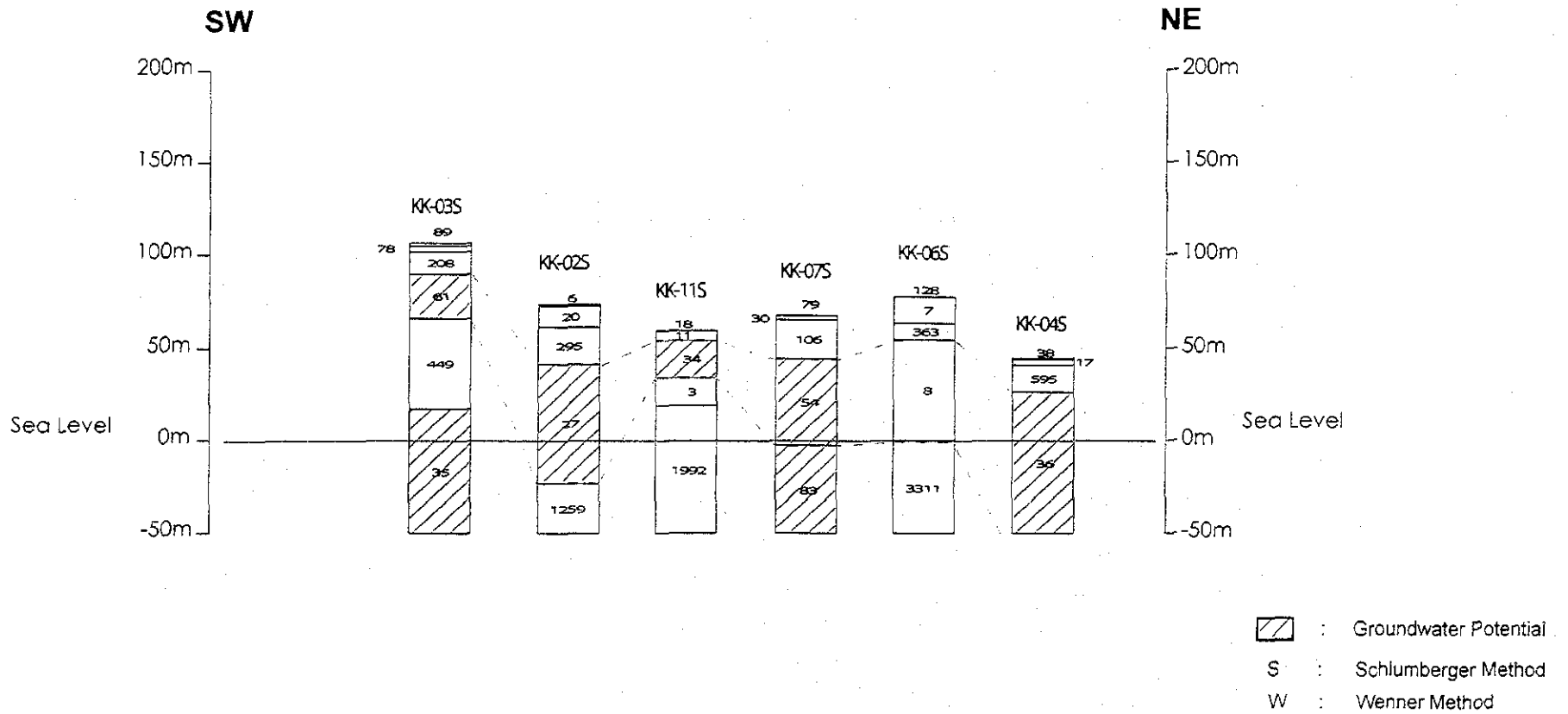
- : Groundwater Potential
- S : Schlumberger Method
- W : Wenner Method

Interpreted Resistivity Sounding of E-W Direction in Kwikila

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**Figure D8-7**

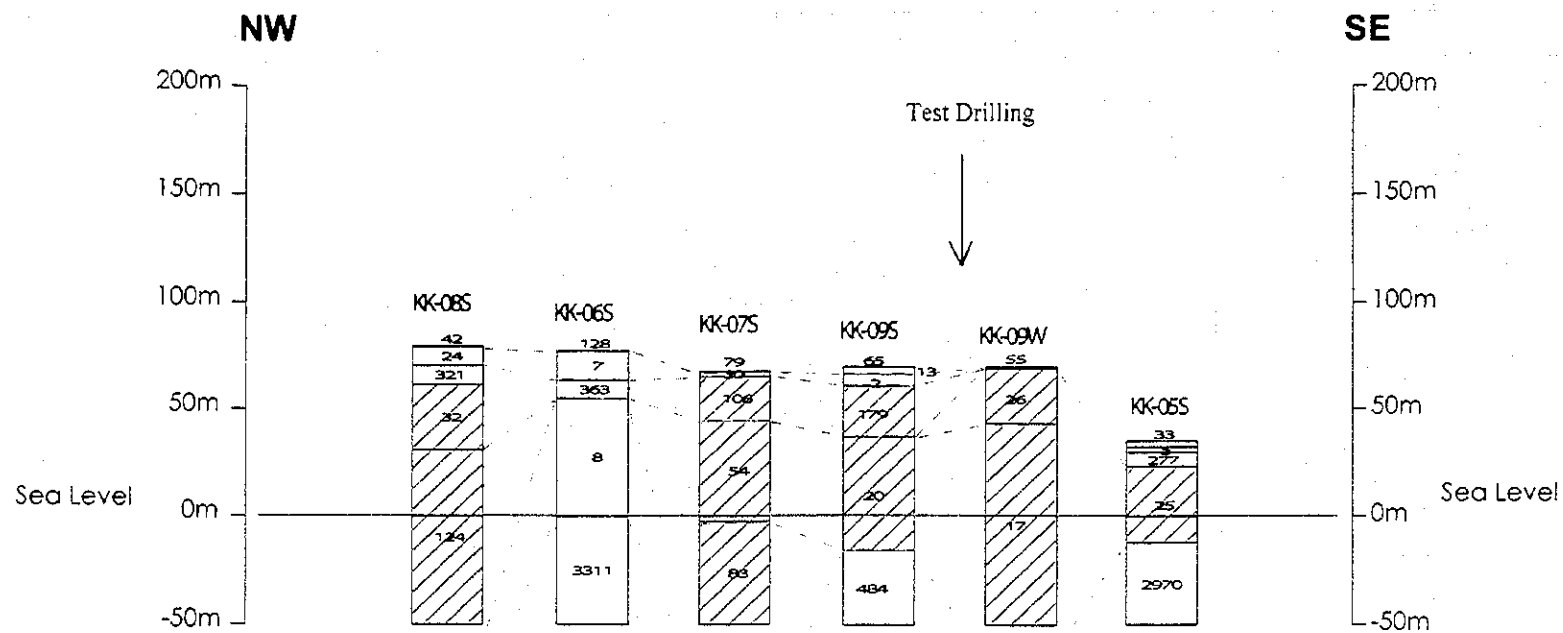



Interpreted Resistivity Sounding of SW-NE Direction in Kwikila

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**Figure D8-8**



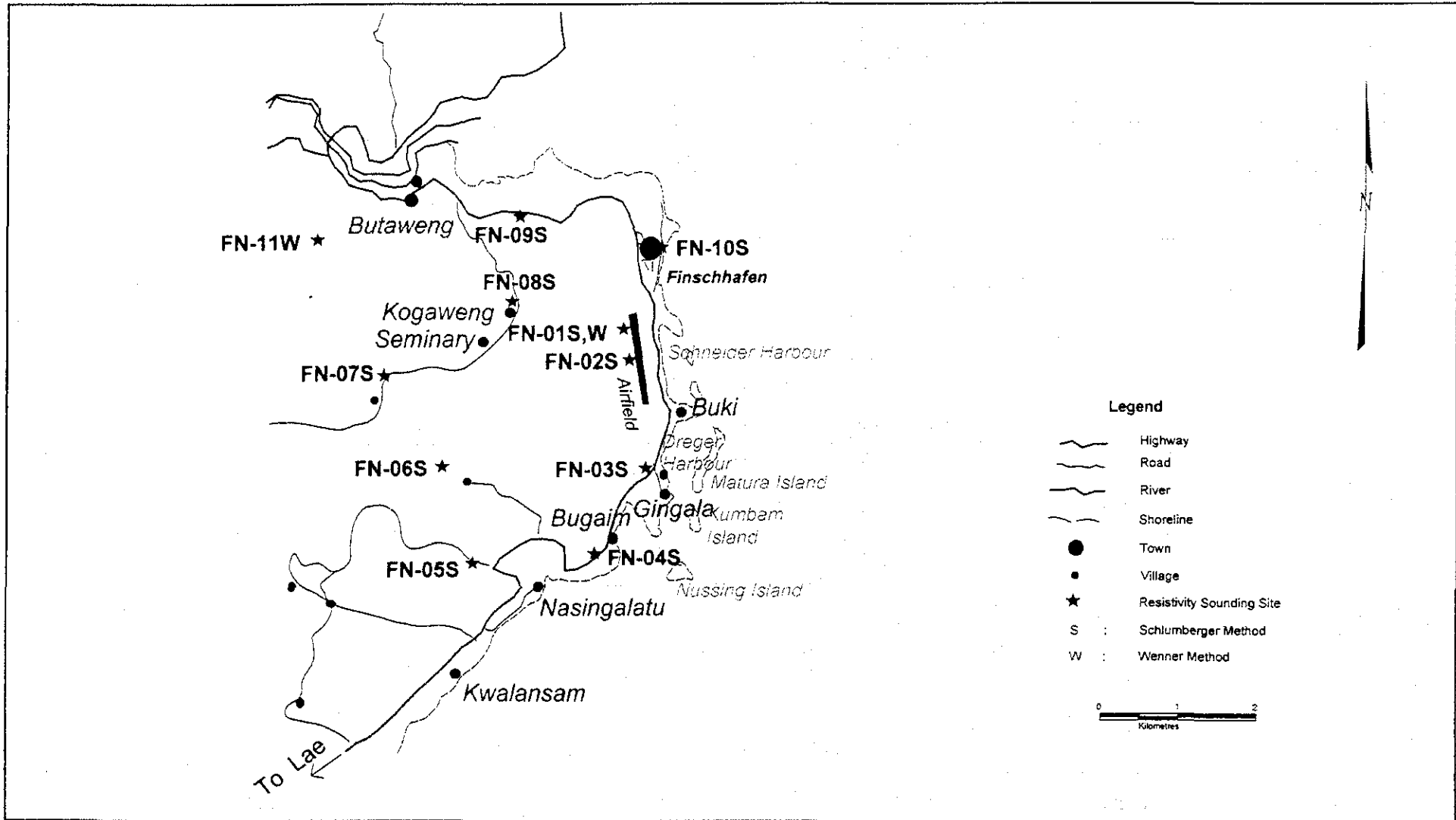
 : Groundwater Potential  
 S : Schlumberger Method  
 W : Wenner Method

Interpreted Resistivity Sounding of NW-SE Direction in Kwikila

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**Figure D8-9**

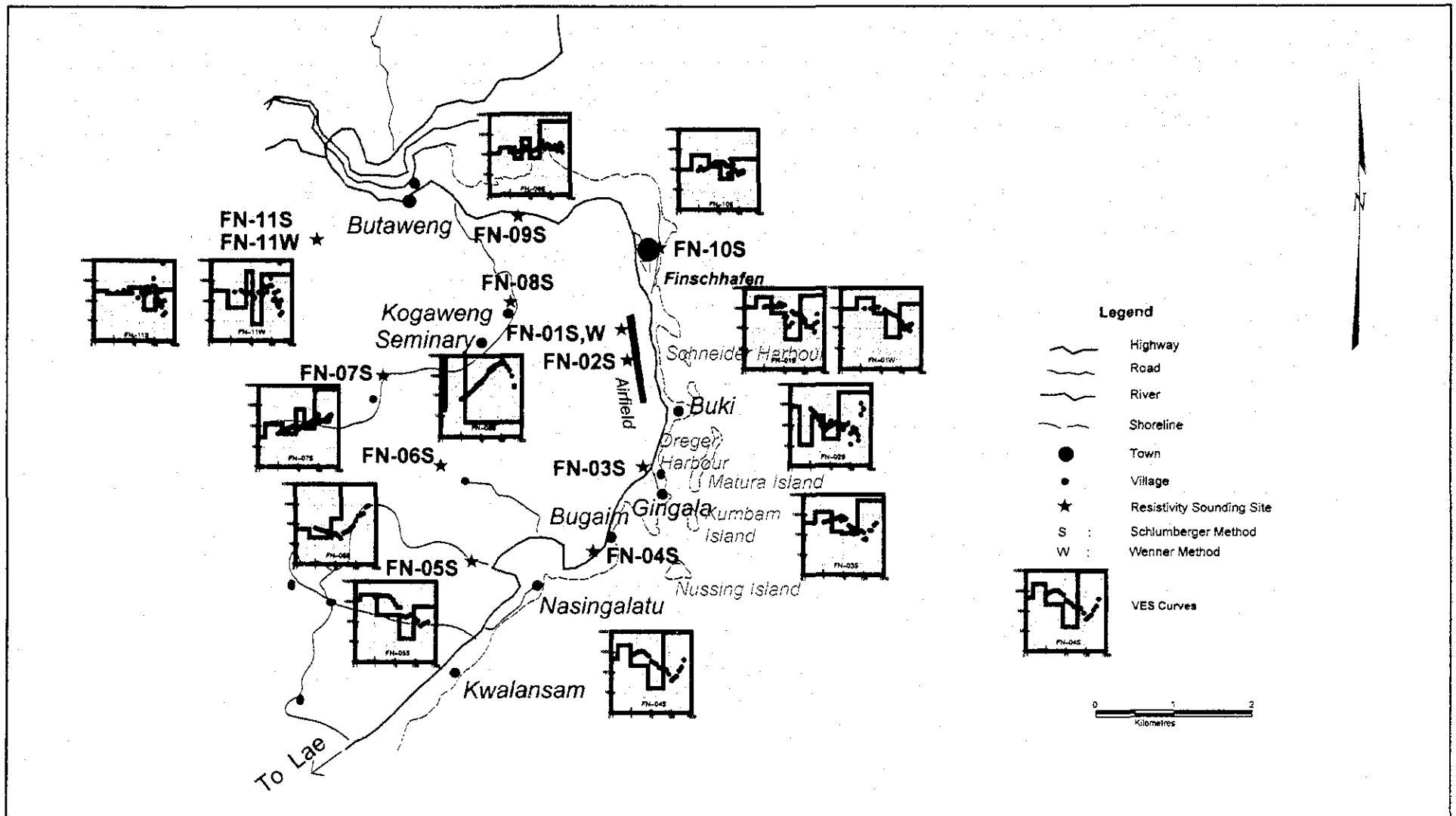


Location Map of Resistivity Sounding in Finschhafen

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Figure D9-1

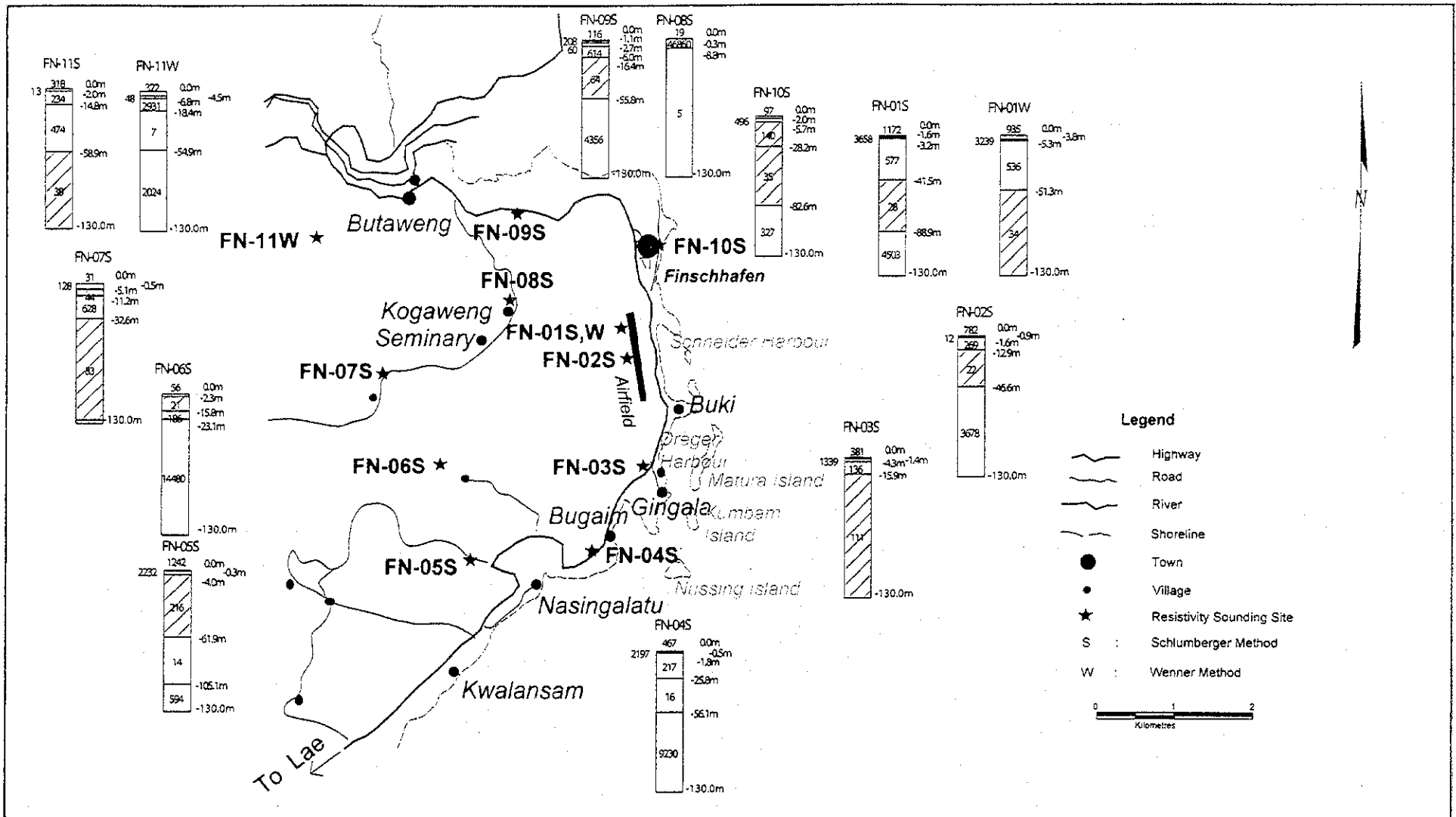


VES Curves of Resistivity Sounding in Finschhafen

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Figure D9-2

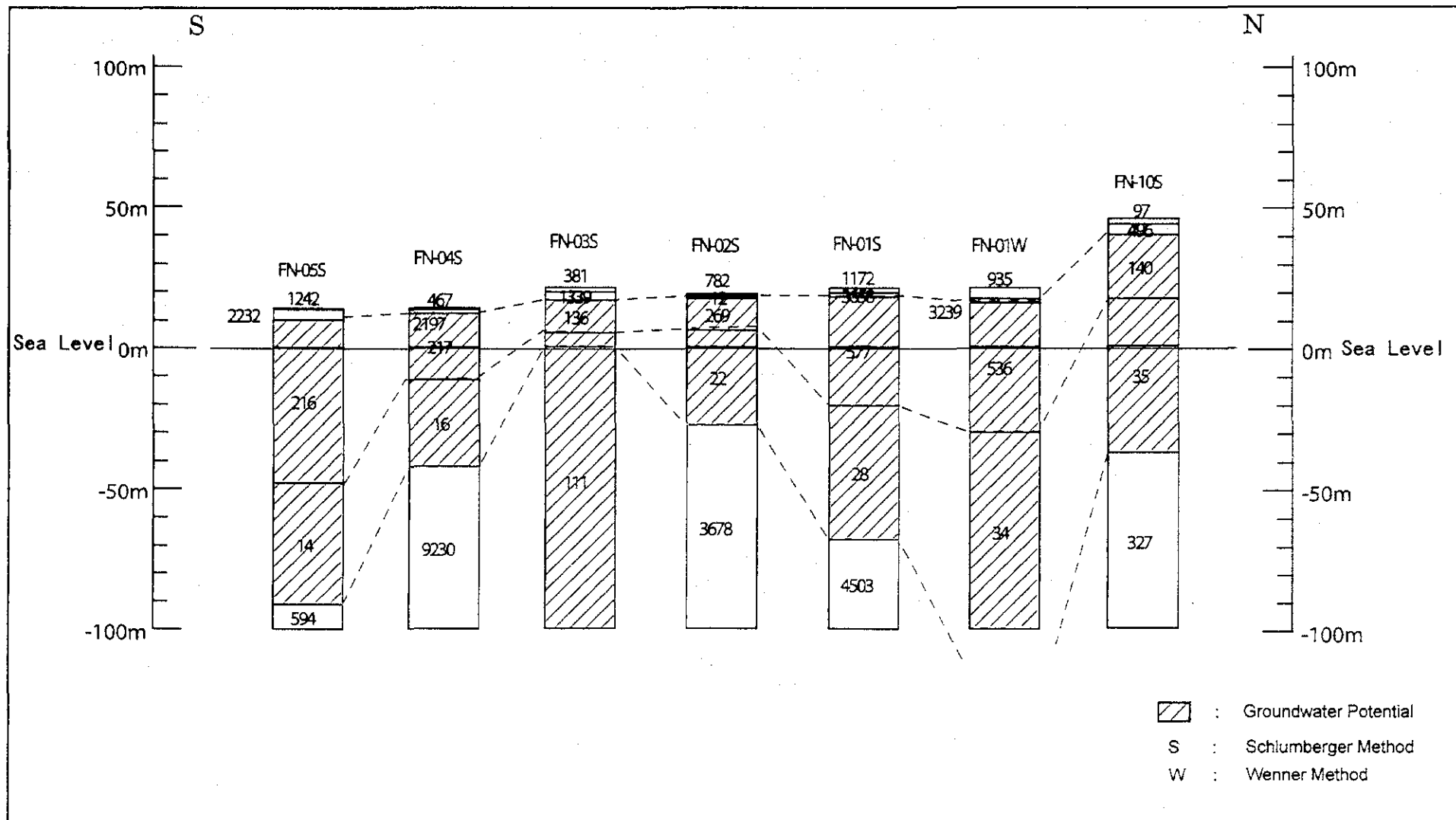


Interpreted Resistivity Sounding in Finschhafen

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Figure D9-3

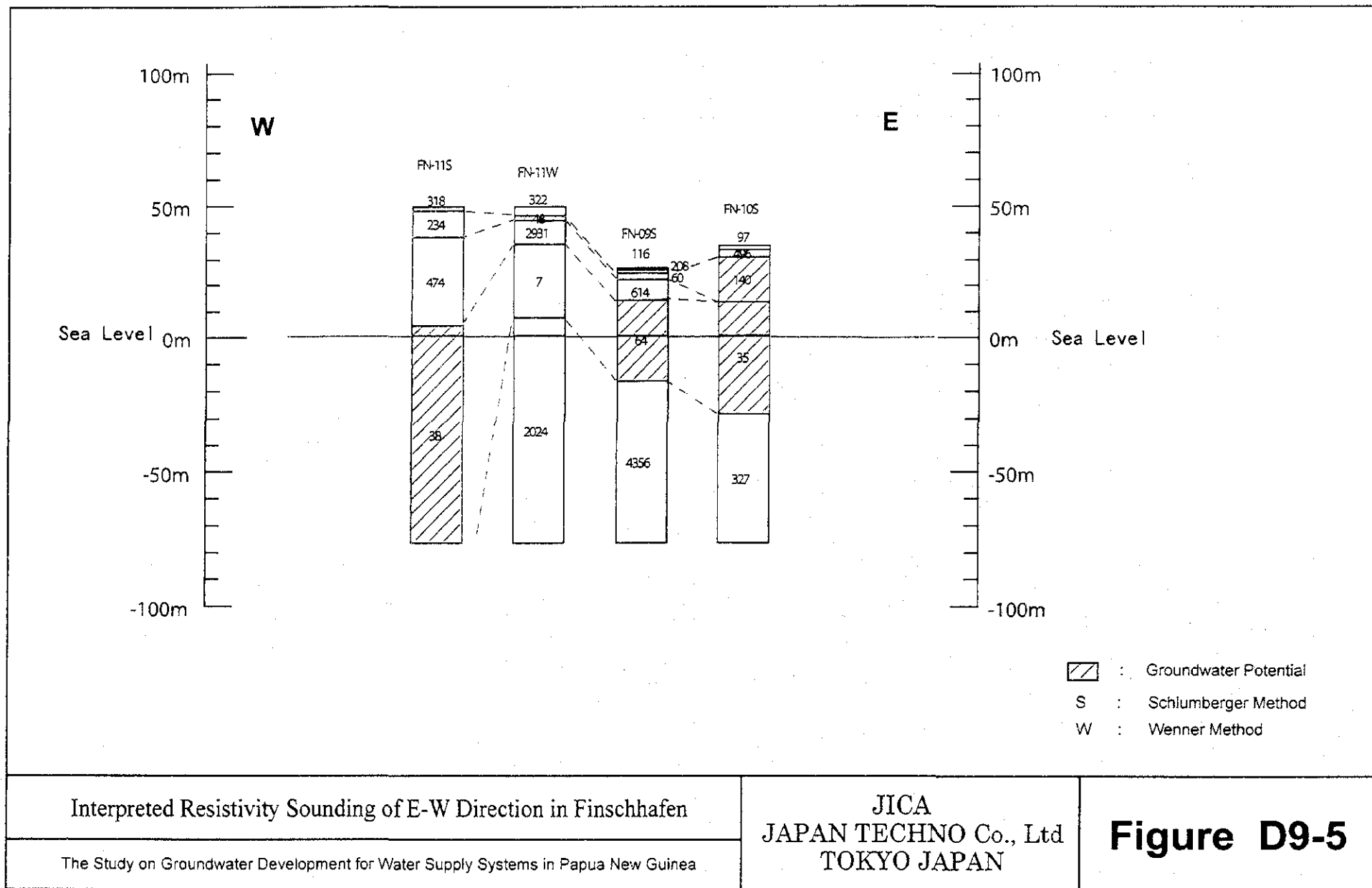


Interpreted Resistivity Sounding of N-S Direction in Finschhafen

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**Figure D9-4**



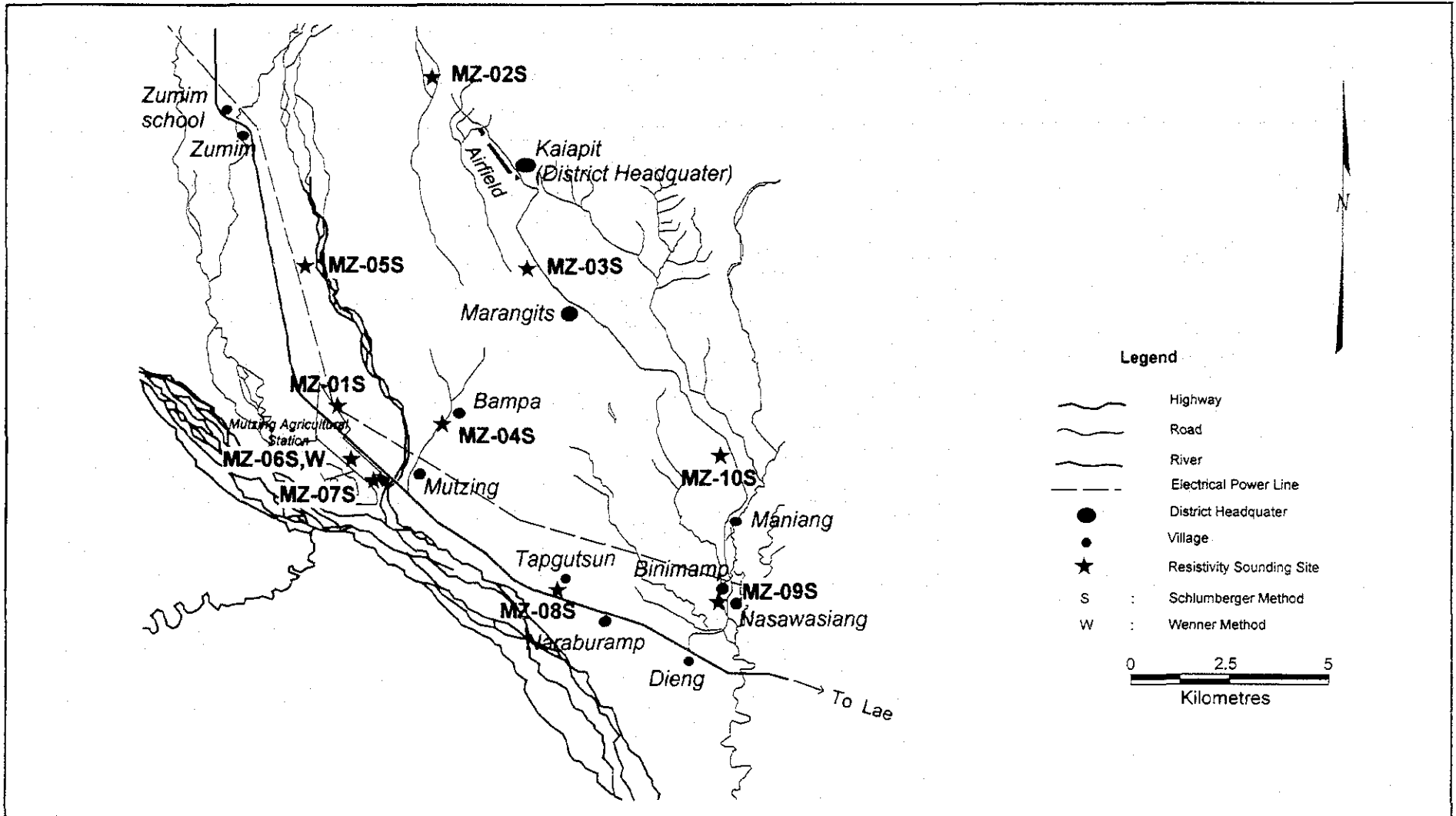
Interpreted Resistivity Sounding of E-W Direction in Finschhafen

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**Figure D9-5**



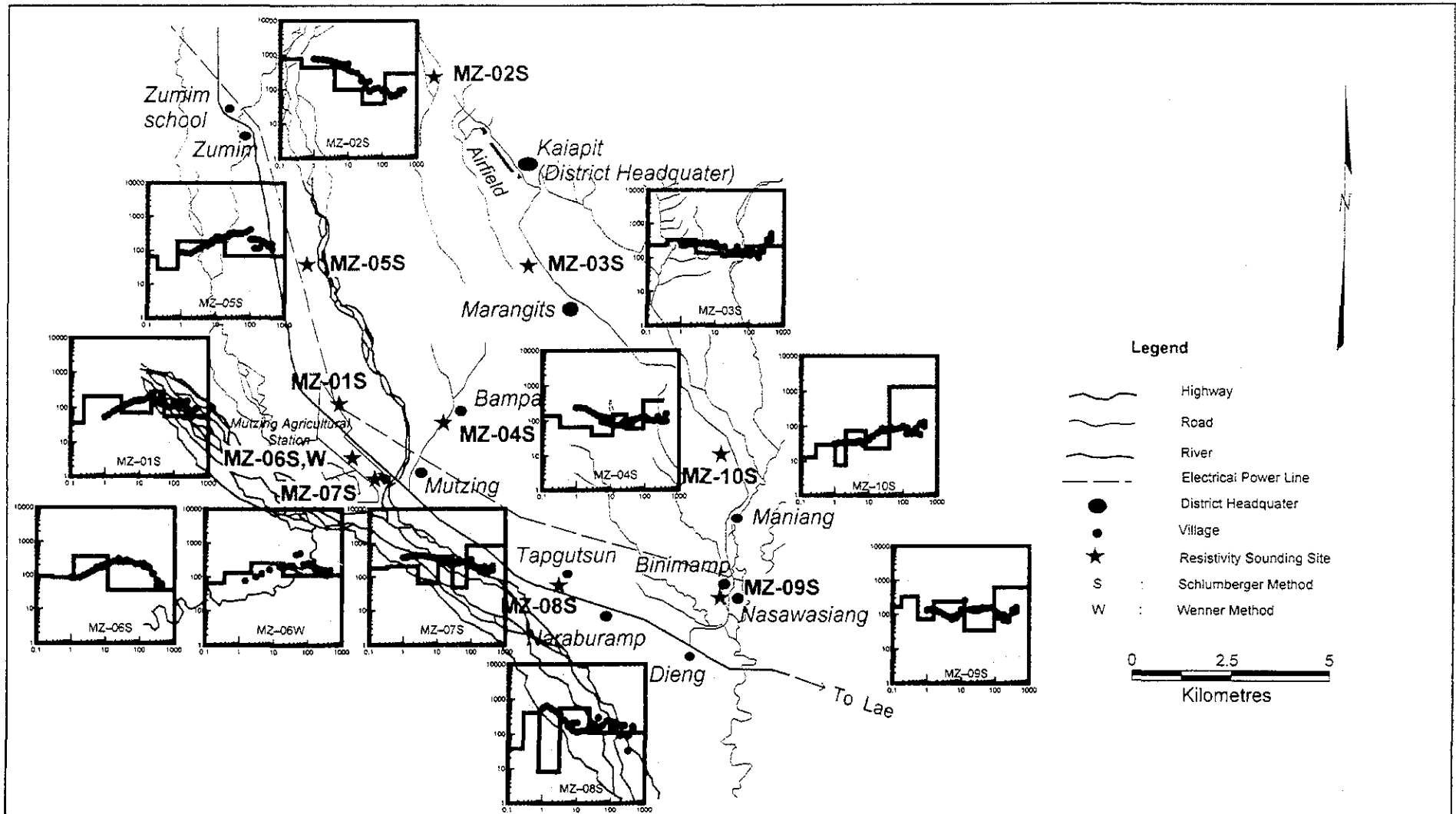


Location Map of Resistivity Sounding in Mutzing

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Figure D10-1

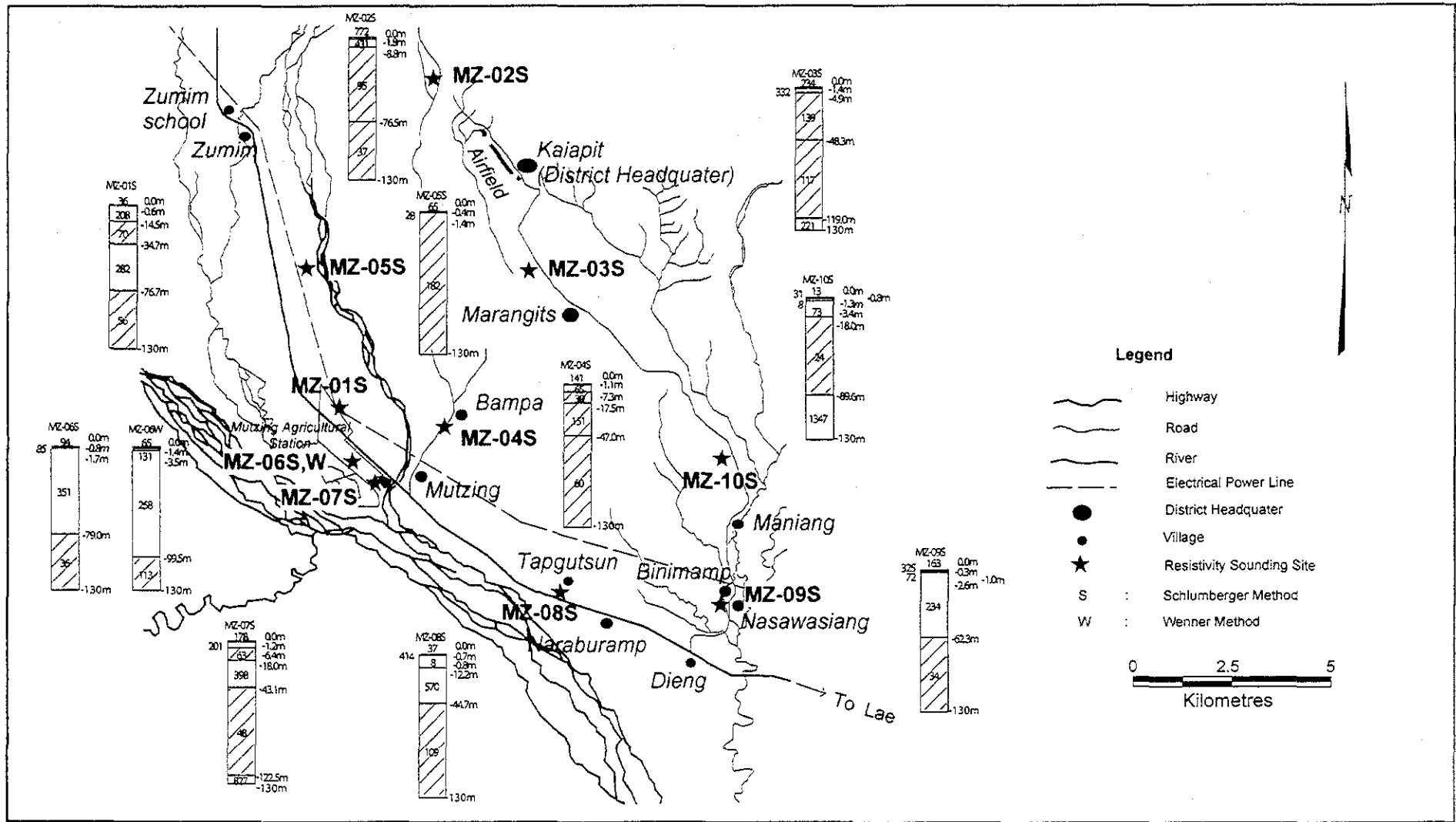


VES Curves of Resistivity Sounding in Mutzing

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

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**Figure D10-2**

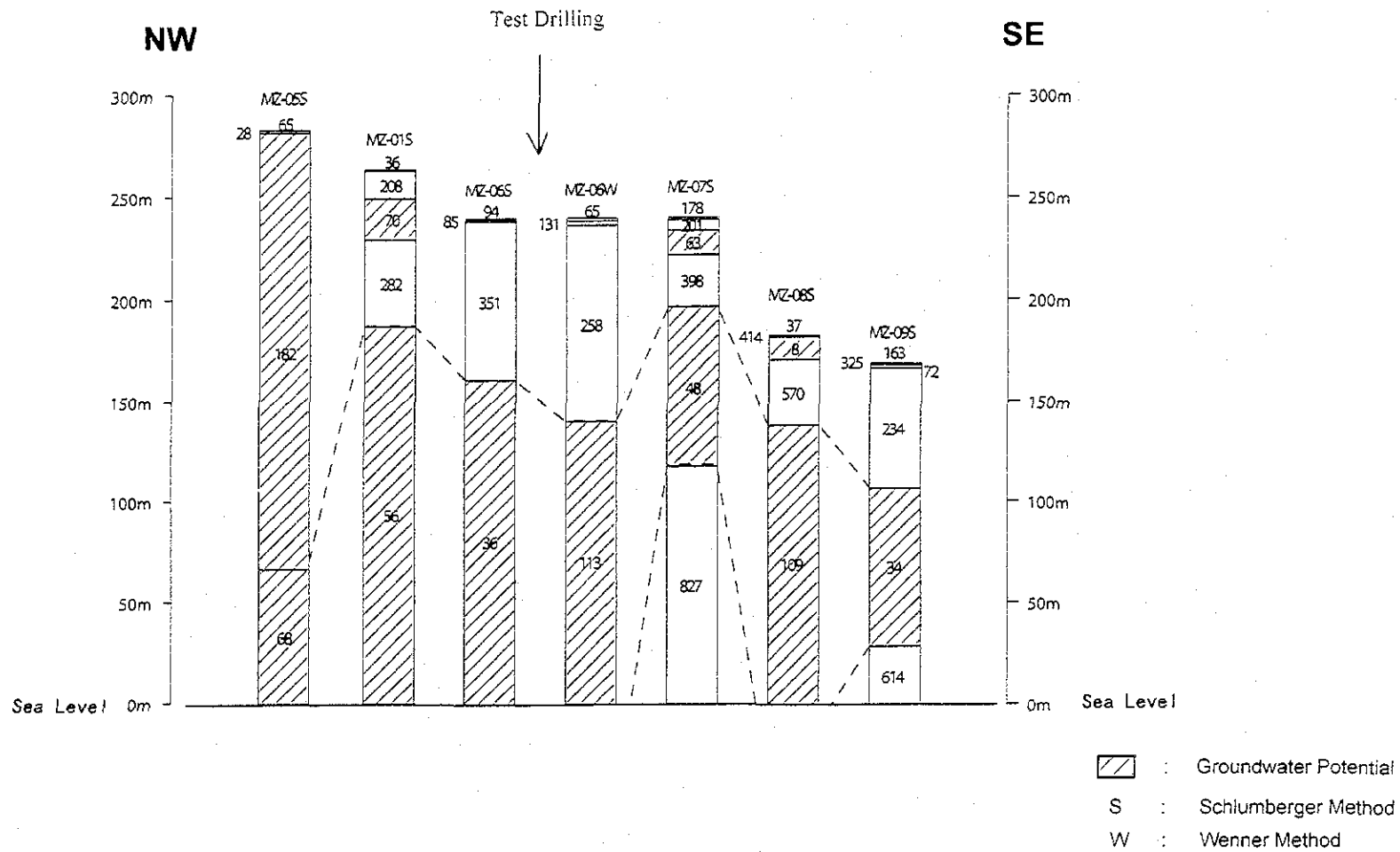


Interpreted Resistivity Sounding in Mutzing

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

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**Figure D10-3**

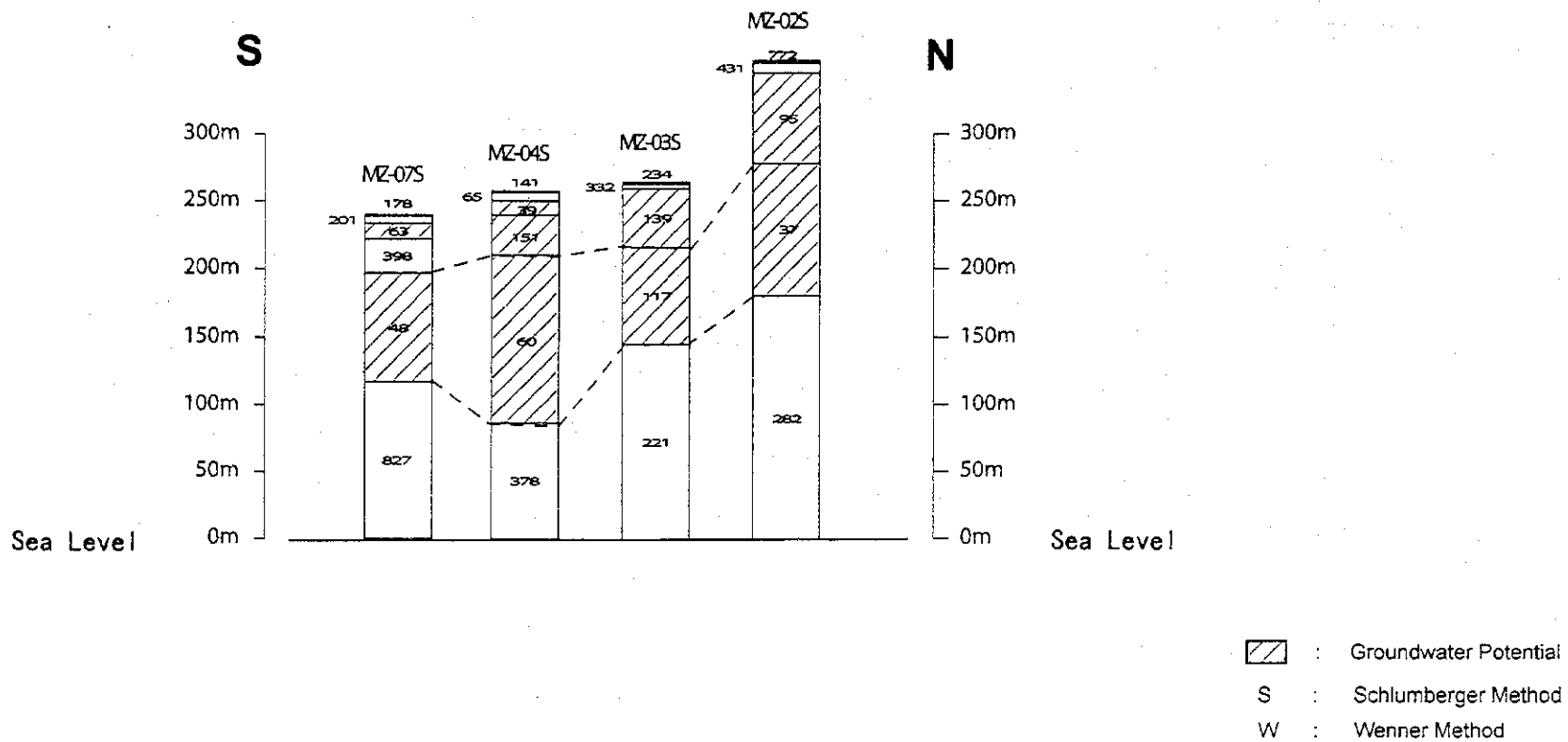


Interpreted Resistivity Sounding of NW-SE Direction in Mutzing

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**Figure D10-4**

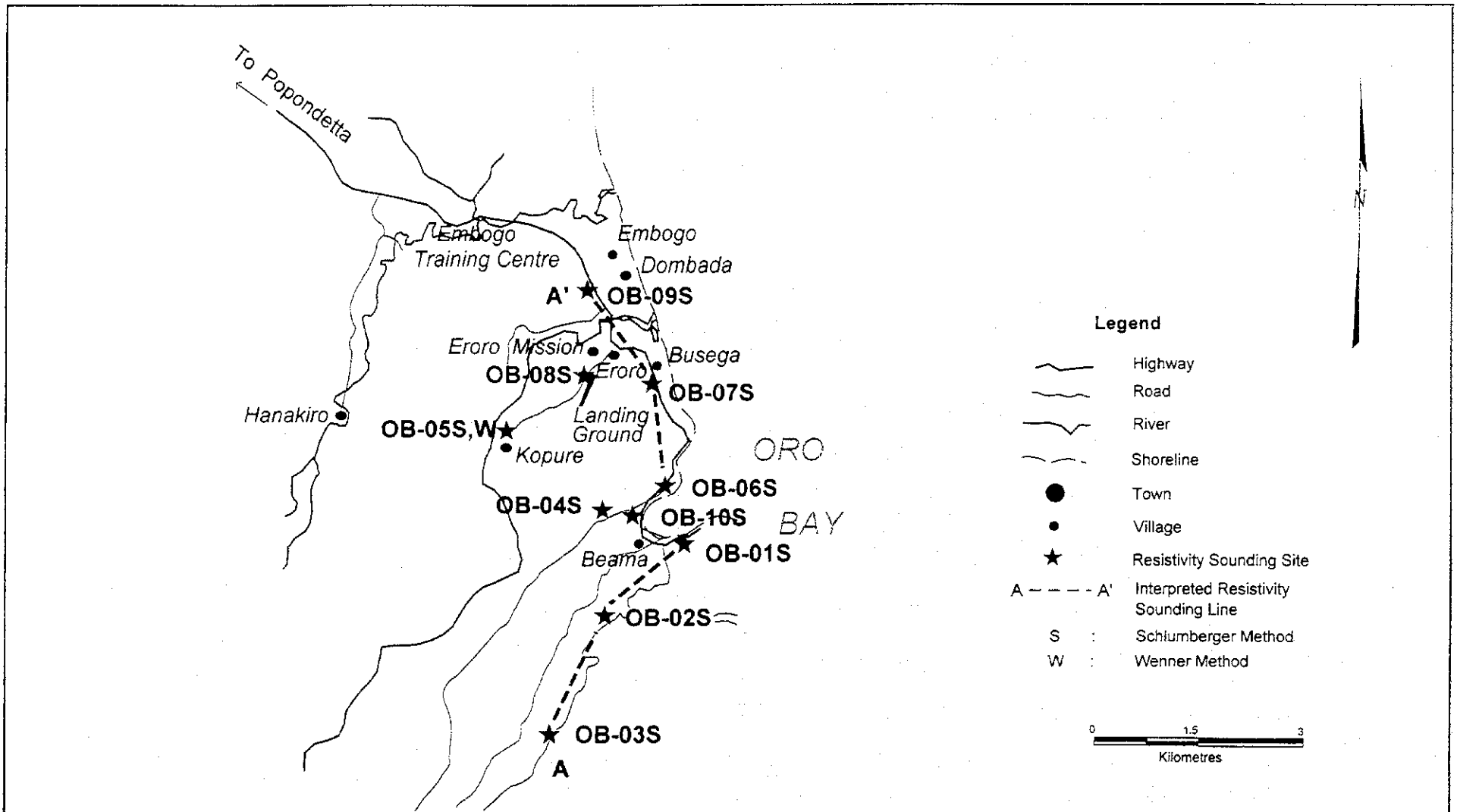


Interpreted Resistivity Sounding of N-S Direction in Mutzing

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

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**Figure D10-5**

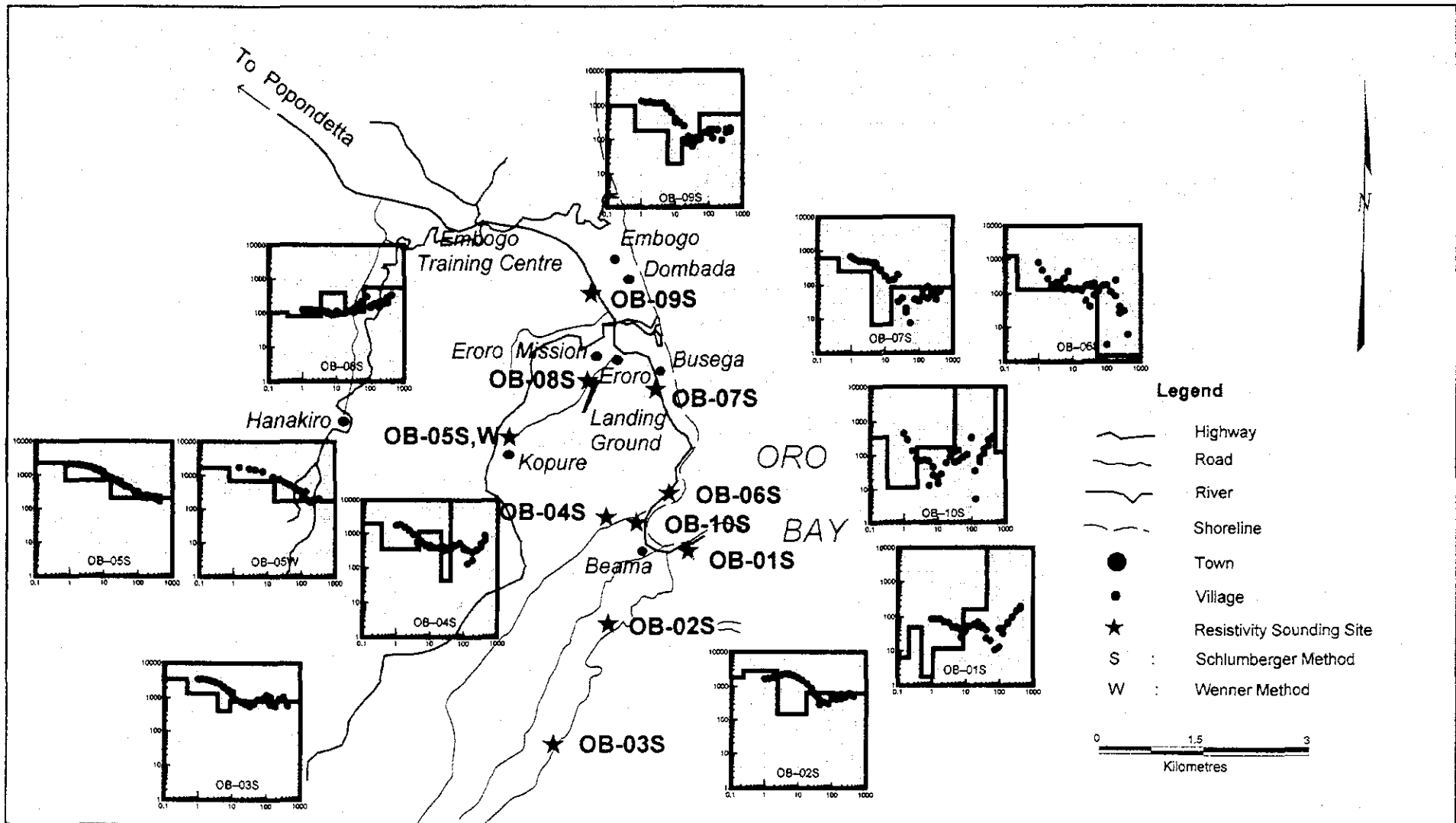


Location Map of Resistivity Sounding in Oro Bay

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Figure D11-1

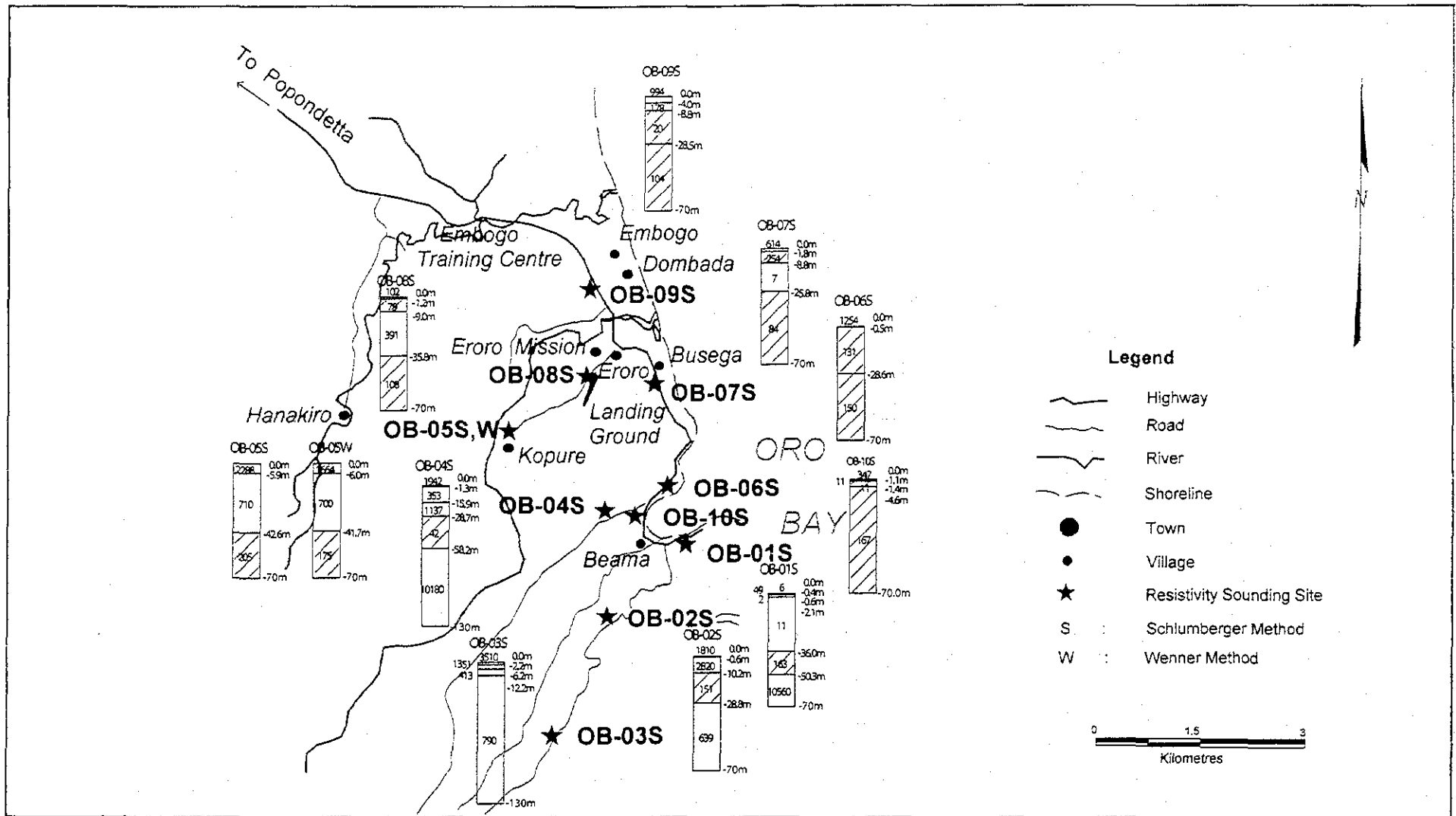


VES Curves of Resistivity Sounding in Oro Bay

The Study on Groundwater Development for Water Supply Systems in Papua New Guinea

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Figure D11-2



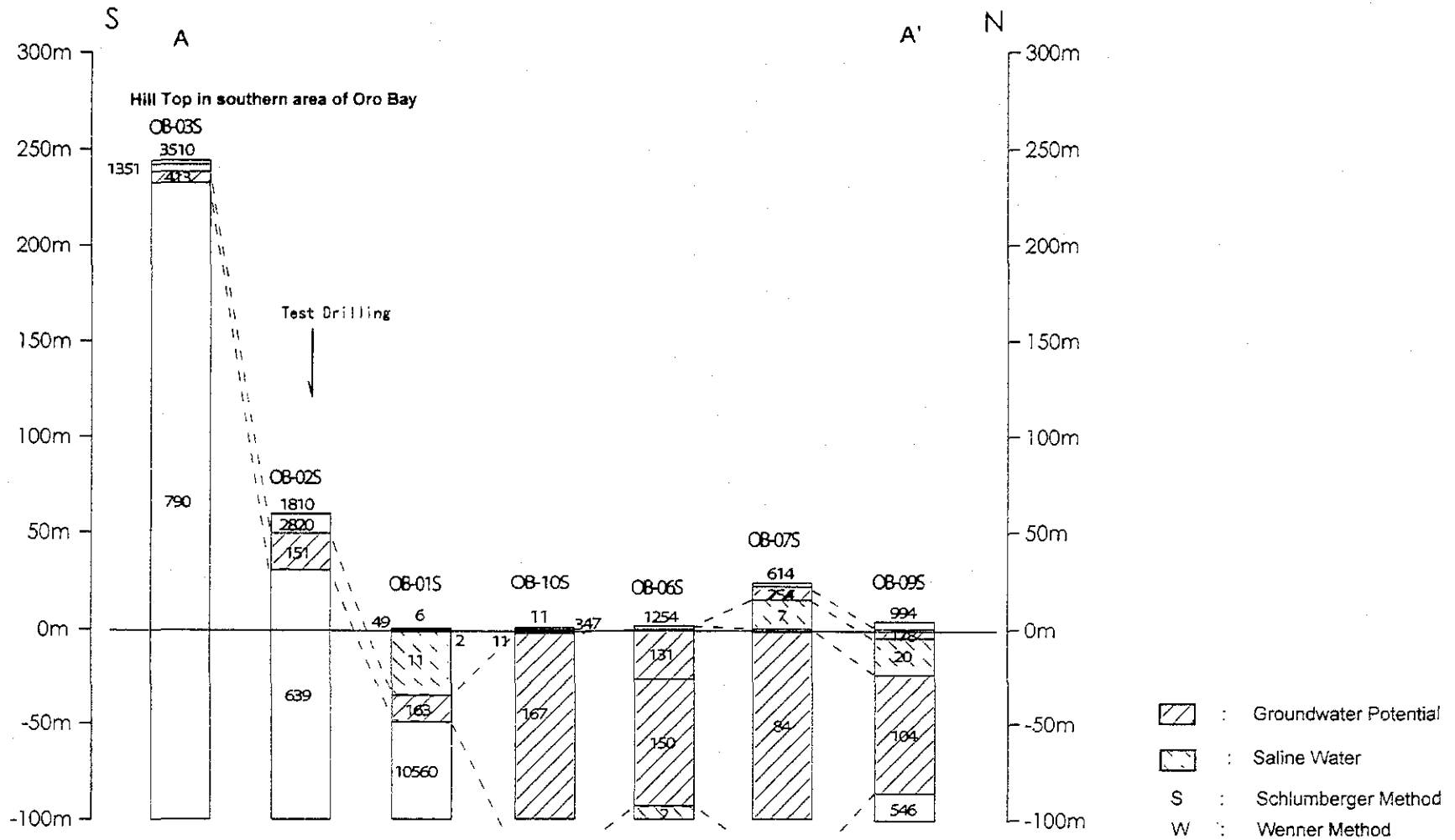
Interpreted Resistivity Sounding in Oro Bay

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**Figure D11-3**





Interpreted Resistivity Sounding of N-S Direction in Oro Bay

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**Figure D11-4**