B1.3.3 Groundwater Survey

(1) Geology

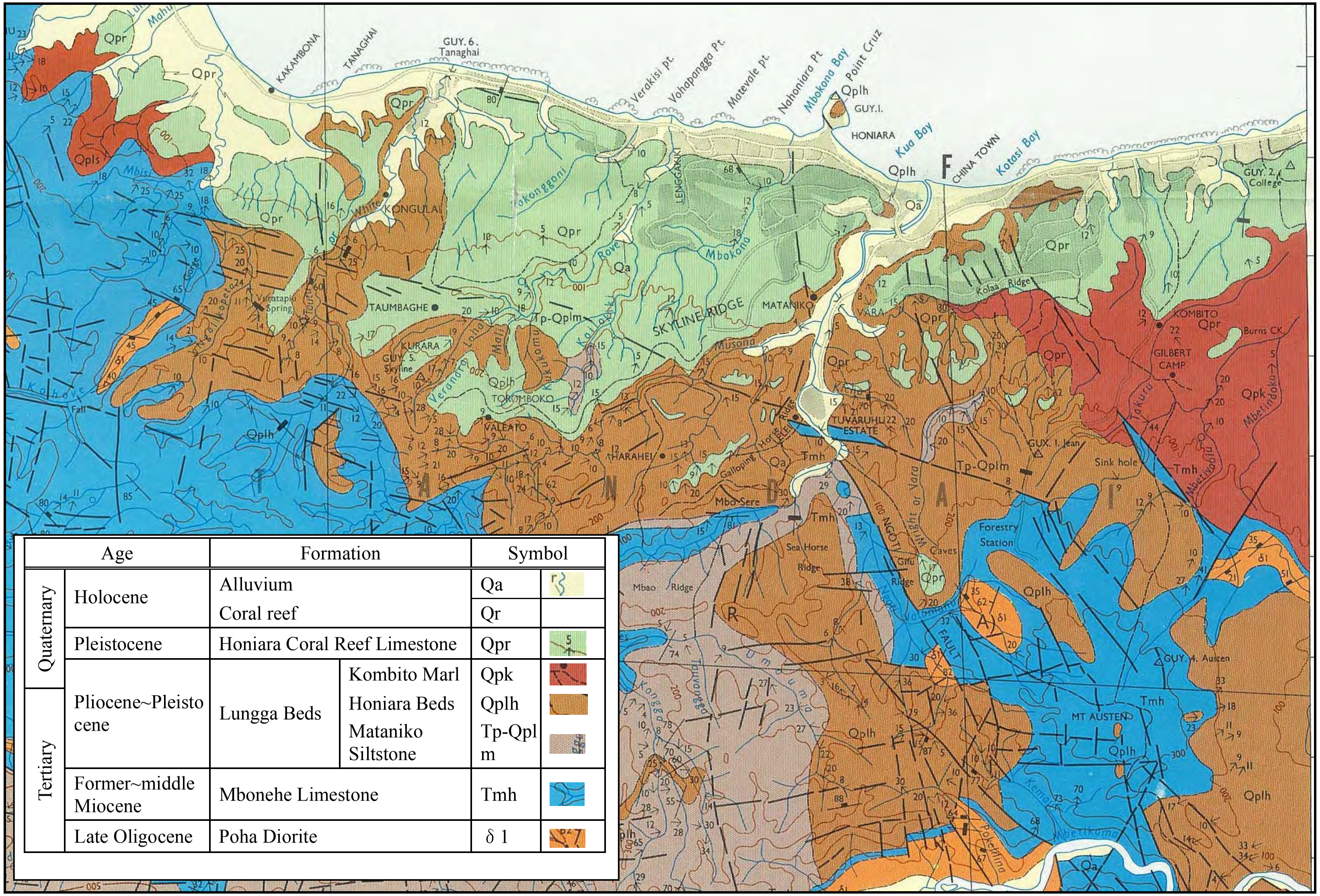
Rock formation in Honiara consists of limestone, calcareous sandstone/mudstone of Miocene to the recent, which overlies the basement rock, diorite of Oligocene. Stratigraphic classification of Honiara area is shown in Table B1.3-6.

Table B1.3-6 Stratigraphic Classification of Honiara City Area

<table>
<tr><th colspan="2">Age</th><th>Formation</th><th>Rock facies</th><th>Thickness of formation</th><th>Distribution in Honiara City</th></tr>
<tr><td rowspan="3">Quaternary</td><td>Holocene</td><td>Alluvium</td><td>Sand, clay, gravel</td><td><30m</td><td>Distributed in the coastal plain and bottom of valleys</td></tr>
<tr><td>Pleistocene</td><td>Honiara Coral Reef Limestone</td><td>Coral Limestone</td><td><60m</td><td>Distributed upper half of Marine terrace</td></tr>
<tr><td rowspan="2">Pliocene~Pleistocene</td><td rowspan="2">Honiara Beds</td><td rowspan="2">Calcareous sandstone, mudstone, conglomerate, limestone</td><td rowspan="2"><200m</td><td rowspan="2">Outcropping in the foot of marine terrace and can be encountered shallower than 200m from the ground surface.</td></tr>
<tr><td rowspan="3">Tertiary</td></tr>
<tr><td>Former~middle Miocene</td><td>Mbonehe Limestone</td><td>Limestone</td><td><100m</td><td>Not outcropping in Honiara City and encountered deeper than 100m from the ground surface.</td></tr>
<tr><td>Late Oligocene</td><td>Poha Diorite</td><td>Fine Diorite</td><td>-</td><td>Not outcropping in Honiara City and encountered deeper than 200m from the ground surface.</td></tr>
</table>

Source : Geology of the Honiara, MNR, 1979

Main faults in the study area extend the north-south direction and the west - east direction. Ngossi Fault and White River Fault with their branches represent faults of the north-south direction. There are many small faults extending from the west to the east parallel with the coastal line. In Mount Austin area, many faults were formed when the mountain was lifted up.



Age		Formation		Symbol	
Quaternary	Holocene	Alluvium		Qa	
		Coral reef		Qr	
	Pleistocene	Honiara Coral Reef Limestone		Qpr	
Tertiary	Pliocene~Pleistocene	Lungga Beds	Kombito Marl	Qpk	
			Honiara Beds	Qplh	
			Mataniko Siltstone	Tp-Qplm	
	Former~middle Miocene	Mbonehe Limestone		Tmh	
	Late Oligocene	Poha Diorite		δ 1	

Source: Geology of the Honiara, MNR, 1979

Figure B1.3-6 Geological Map of Honiara City Area

(2) Hydrogeology

(a) Aquifer classification

Aquifer of Honiara ground water basin is summarized as shown in Table B1.3-7.

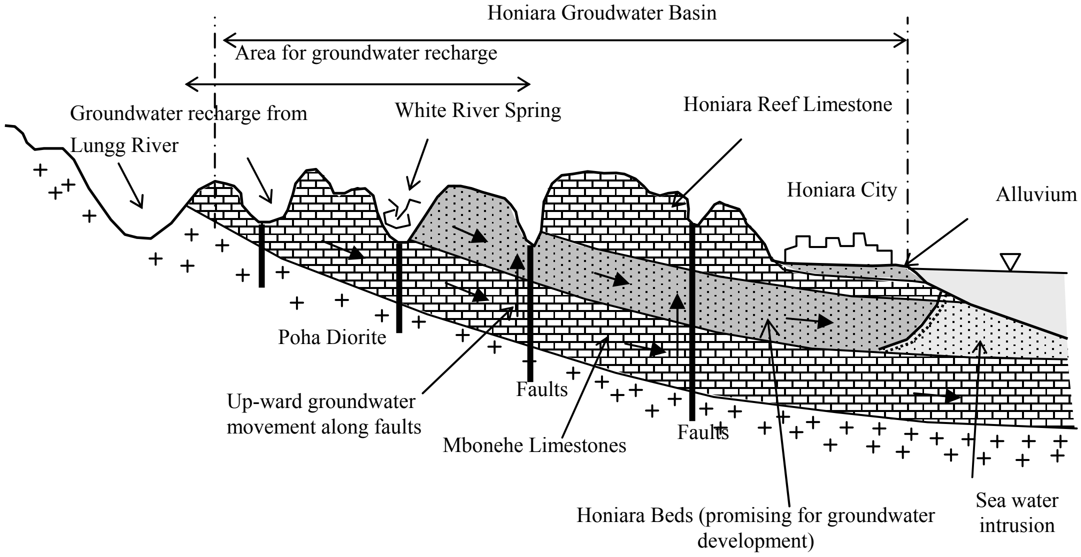
Table B1.3-7 Aquifer in Honiara Groundwater Basin

Formation	Groundwater	Merit and demerit in groundwater development
Alluvium	Sand and gravel layer store the groundwater.	Area of aquifer distribution, size of aquifer and recharge area are too small. It is subject to sea water intrusion.
Honiara Coral reef limestone	Limestone has much porosity suitable for groundwater storage. The Groundwater occurs as perched water.	Limestone is distributed only in upper half of terrace, and size of this aquifer is small. Recharge area is also small. So this aquifer is not suitable for large groundwater development. In addition, there is a risk of groundwater contamination from town area.
Honiara Beds	This formation comprises sandstone and limestone forming good aquifer. Water from Kombito Spring and Panatina Borefield comes from this formation.	Sandstone and limestone form confined aquifer in the depth of less than 100m. All the boreholes that were drilled so far are taking groundwater from Honiara Beds.
Mbonehe Limestone	This formation keeps huge amount of groundwater within in cave system, which has large recharge area. White River spring originates from this formation.	This aquifer exists deeper than GL-100m over the study area. Limestone is compact with poor porosity. Cave system with the groundwater is locally developed. It is not easy to detect the groundwater of this aquifer because of deep occurrence of groundwater. This aquifer can not be direct target of groundwater development
Poha Diorite	Groundwater occurs as fissure water.	This formation exists too deep in the ground for the study to be target for groundwater development.

Source : SIWA, MNR, JICA

(b) Hydrogeology of Honiara Groundwater Basin

Hydrogeological structure of the Honiara can be simplified as shown in Figure B1.3-7. Aquifers in Honiara can be considered independent from the other groundwater basins. Lungga River becomes physical boundary of the groundwater basin in the western and the southern side. Iron Bottom Sound is the northern boundary of the groundwater basin. There is no physical boundary in western side. This report defines the groundwater basin that covers Honiara as "Honiara Groundwater Basin". The groundwater in the basin flows from SSW to NNE direction to reach Iron Bottom Sound. This can be assumed based on the fact that both slope of hills and dipping of stratum face the same direction toward NNE. Honiara groundwater basin shows rectangle shape in plain, and aquifer is equally distributed all over the basin.



Source : JICA Study Team

Figure B1.3-7 Hydrogeological Structure of Honiara Groundwater Basin

(c) Recharge to Honiara Groundwater Basin

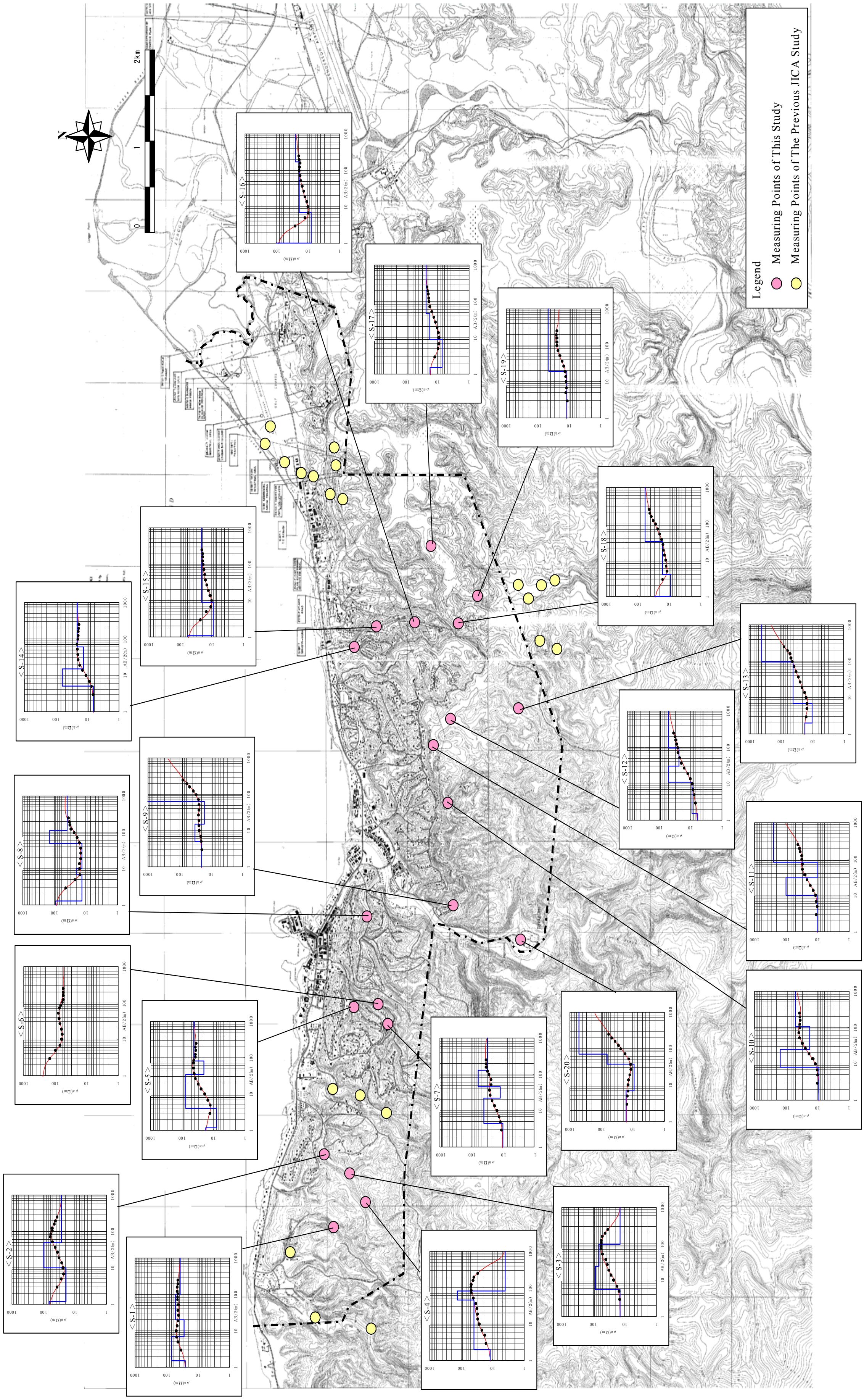
Honiara Beds is distributed in the south of Honiara, where the aquifer is recharged by rainfall and rivers. Mbonehe limestone, which underlies Honiara Beds, has huge area of distribution in the south and the west of the basin, storing confined groundwater in its body. It is assumed that this confined aquifer provides groundwater upward to overlaying Honiara beds through fracture zones. In addition to this, down-ward groundwater recharge from Honiara Reef Limestone to Honiara Beds is also expected through fracture zones. Honiara Beds has good condition to get groundwater recharge.

(3) Electric Resistivity Prospecting

(a) Outline of survey

Electric resistivity survey was carried out in Honiara. There are 20 measuring points within Honiara Town Area as shown in Figure B1.3-8. Additionally, the figure shows measuring points that were carried out in the previous JICA Basic Design for the Project for Improvement of Water Supply System in Honiara Solomon Islands, 1996".

Outline of the electric resistivity survey of the Study is shown in Table B1.3-8.



Source : JICA Study Team

Figure B1.3-8 Location of Geophysical Prospecting in Honiara

Table B1.3-8 Electric Resistivity Prospecting

Method	Configuration of electrode	Distance of current electrode (AB/2, m)	Depth for detection	No. of points	Instrument for prospecting
Electric resistivity prospecting	Schlumberger array	3, 5, 7, 10, 14, 19, 27, 37, 52, 72, 85, 105, 125, 160, 200, 250	Up-to around GL-100m	20	MiniSting R1 IP (Canada AGI company)

Source : JICA Study Team

(b) Existing Resistivity Prospecting

Before interpretation of results of resistivity prospecting of the Study, results of actual drilling and result of resistivity prospecting was compared to examine accuracy of resistivity method. Result of the comparison is shown in Table B1.3-9. From the existing prospecting results, resistivity structure of aquifer has been interpreted as two to five layer-models in the Study Area, and it is concluded that resistivity method has enough accuracy to detect distribution of aquifer. Resistivity structure of aquifer is summarized as below.

- Resistivity of the first layer, the top layer under the ground-surface, is different from place to place. Thickness of the first layer is less than 10m, and this layer will not become aquifer regardless of its resistivity.
- The intermediate layer usually shows low to medium resistivity. It means that the intermediate layer consists of clayey material with low permeability. This layer causes the underlying layer to be confined.
- The lowest layer, which shows medium to high resistivity, is expected as aquifer. Layers with resistivity of less than 100Ωm are expected good aquifer comprising sand/sandstone/limestone. On the other hand, layers with resistivity more than 200Ωm may be Mbonehe Limestone, which is not good aquifer.
- It is assumed that sea water intrusion into aquifer occur, if the lowest layer shows resistivity of less than 2Ωm, in the area within 500m from the shoreline.

Table B1.3-9 Comparison between Drilling Results and Resistivity Prospecting Results

Site	Bore No.	Depth (GL-m)	Rock Type	Aquifer or not	Electric logging (Ωm)	Analyzed structure	Type of apparent resistively curve[1)]	Measurement points[2)]
Kombito	K-1	0-24	Limestone	○	÷ 100	2-layers structure with 10 to 100Ωm	A-type curve with 10 to 100Ωm	ES-10/ES-11 of JICA BD Study
		24-80	Sandstone	○	100-250			
	K-2	15-33	Sand	○	20-200	3-layers structure with 10 to 100Ωm.	A-type curve with 10 to 40Ωm	ES-12/ES-13/ ES-14/ES-15 of JICA BD Study
		33-51	Sand/Gravel	○	140-240			
		51-80	Sand	○	40-160			
White River	W-2	16-36	Sandstone	○	100-250	3-layers structure with 12Ωm to 80Ωm.	H-type curve 10 to 40Ωm	ES-24 of JICA BD Study
		36-59	Sandstone/lime -stone/gravel	○	100-320			
		59-80	Sandstone/lime -stone/gravel	○	100-260			
	W-3	24-45	Coarse sandstone	○	40-340	÷ 15Ωm	A-type curve with 10 to 25Ωm	ES-25 of JICA BD Study
		45-69	Medium sandstone/Silt-stone	○	40-100			
		69-80	Medium to coase Sandstone	○	60-280			
Mataniko	M-2	17-25	Sand and gravel/Silt	○	÷ 180	÷ 9Ωm	H-type curve with 10 to 500Ωm	S-20 of this Study
		25-69	Sand and gravel/Silt	○	20-80	÷ 65Ωm		
		69-100	Fine limestone	×	÷ 180	÷ 500Ωm		

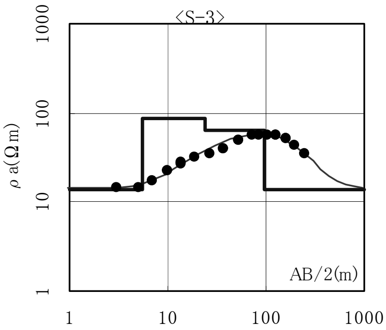
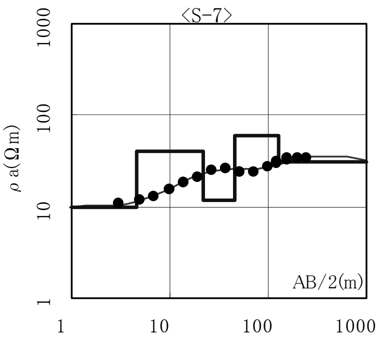
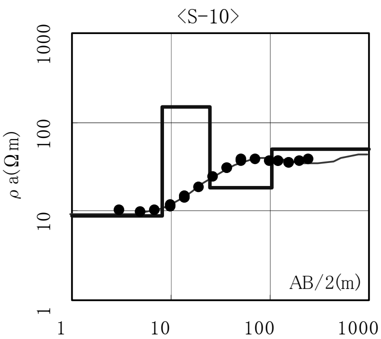
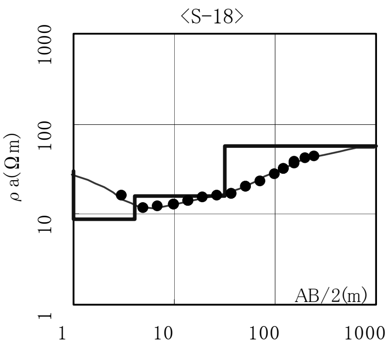
Note: 1. If layer structure is interpreted by three-layers structure with 1st-layer(ρ_1), 2nd- layer(ρ_2),3rd-layer(ρ_3), it is defined as: H-type($\rho_1>\rho_2<\rho_3$), A-type($\rho_1<\rho_2<\rho_3$), Q-type($\rho_1<\rho_2>\rho_3$), K-type($\rho_1>\rho_2>\rho_3$).
2. JICA BD Study means "Basic Design for the Project for Improvement of water Supply System in Honiara Solomon Islands, 1996".

Source : JICA Study Team

(c) Result of Resistivity Prospecting

Results of electric resistivity prospecting of the Study is shown in Figure B1.3-8 and summarized in Figure B1.3-9. Result of the survey is summarizes as below.

- Electric resistivity structure of Honiara groundwater basin has homogeneous structure covering the entire city.
- There are excellent aquifers in the entire city between 20m to 100m in depth depending on place as shown in Figure B1.3-9.
- Capacity of aquifer seems high as indicated by the existing boreholes of SIWA.
- Drilling boreholes within Honiara town area will be highly successful.

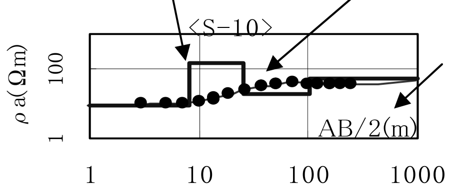
<table>
<tr><th>Site</th><th>Representative apparent resistivity curve</th><th>No.</th><th>Depth of aquifer(GL-m)</th></tr>
<tr><td rowspan="5">White River ~ Rove Creek</td><td rowspan="5">
</td><td>S-1</td><td>20-100</td></tr>
<tr><td>S-2</td><td>10-100</td></tr>
<tr><td>S-3</td><td>20-100</td></tr>
<tr><td>S-4</td><td>20-100</td></tr>
<tr><td colspan="2">Note)
Depth of borehole is recommended less than100m. So screen should be installed between 20m and 100m in depth. Aquifer shallower than GL-20 is vulnerable to groundwater contamination.</td></tr>
<tr><td rowspan="6">Rove Creek ~ Mataniko River</td><td rowspan="6">
</td><td>No.</td><td>Depth of aquifer (GL-m)</td></tr>
<tr><td>S-5</td><td>20-100</td></tr>
<tr><td>S-6</td><td>20-100</td></tr>
<tr><td>S-7</td><td>40-100</td></tr>
<tr><td>S-8</td><td>50-100</td></tr>
<tr><td colspan="2">Note)
The same as above.</td></tr>
<tr><td rowspan="7">Mataniko River ~ Vara creek</td><td rowspan="7">
</td><td>No.</td><td>Depth of aquifer(GL-m)</td></tr>
<tr><td>S-9</td><td>20-60</td></tr>
<tr><td>S-10</td><td>30-100</td></tr>
<tr><td>S-11</td><td>80-100</td></tr>
<tr><td>S-12</td><td>30-100</td></tr>
<tr><td>S-13</td><td>20-100</td></tr>
<tr><td colspan="2">Note)
The same as above.</td></tr>
<tr><td rowspan="9">Vura Creek ~ Kombito Site</td><td rowspan="9">
</td><td>No.</td><td>Depth of aquifer(GL-m)</td></tr>
<tr><td>S-14</td><td>60-100</td></tr>
<tr><td>S-15</td><td>20-100</td></tr>
<tr><td>S-16</td><td>20-100</td></tr>
<tr><td>S-17</td><td>40-100</td></tr>
<tr><td>S-18</td><td>30-100</td></tr>
<tr><td>S-19</td><td>20-100</td></tr>
<tr><td>S-20</td><td>40-70</td></tr>
<tr><td colspan="2">Note)
The same as above.</td></tr>
</table>

Legend

Layer model (blue line)

Observed apparent resistivity (black circle)

Theoretical apparent resistivity of layer model (red curve)



ρ a(Ωm) : Apparent resistivity

AB/2 : Distance of electric electrode = depth of detection

Source : JICA Study Team

Figure B1.3-9 Summary of Electric Resistivity Prospecting

(d) Sea Water Intrusion

Sea water intrusion into aquifer is likely to occur in the coastal region. Electric resistivity prospecting is useful to judge whether sea water intrusion is taking place or not. Sea water intrusion into aquifer was observed in the coastal area of Honiara city by the previous JICA Study for basic design for the Project for Improvement of water Supply System in Honiara Solomon Islands, 1996. According to this result, aquifer that is intruded by sea water can be detected as layer with resistivity of lower than 2Ωm.

Table B1.3-10 Sea Water Intrusion in the Existing Study

Area	Length of sea water intrusion from the coast line	Aquifer of intrusion
Panatina	Less than 300m	Alluvium Sand deposit
Ndondo Creek	Less than 400m	Alluvium Sandsand deposit

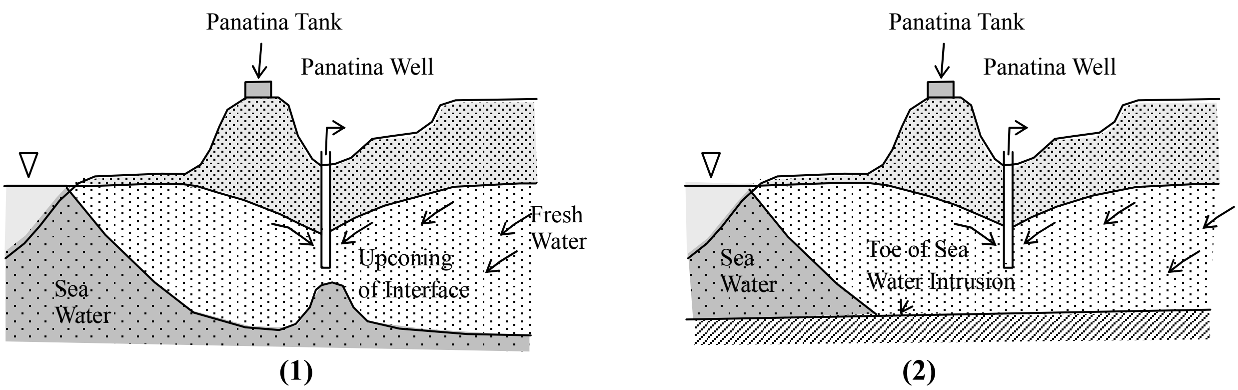
Source : JICA

Electric resistivity prospecting was carried out in the area of Honiara beds in this Study. According to its results, it becomes clear that seawater intrusion is not taking place in aquifer that is located farther than 300m to 500m from the shoreline. Seawater intrusion may be taking place only in alluvial sand-layer that is distributed in the coastal plain, and sea water does not reach underlying Honiara Beds in the shoreline.

(4) Analysis of Sea Water Intrusion

(a) Example of Panatina Bore Field

There are three boreholes in Panatina bore fields of the eastern coastal area of Honiara City. The boreholes are located in 150m distance with each other. Total yield of boreholes is 3,800m^3/day with dynamic groundwater level of 32m below surface, which is 20m below the sea level. Distance from the coastal line to bore field is 570m. According to Ghyben-Herzberg's law, seawater will easily intrude into borehole if groundwater level is lowered below the sea level. However, sea water intrusion into boreholes has not yet taken place in Panatina bore field even though groundwater level was kept lower than the sea level for more than 15 years.

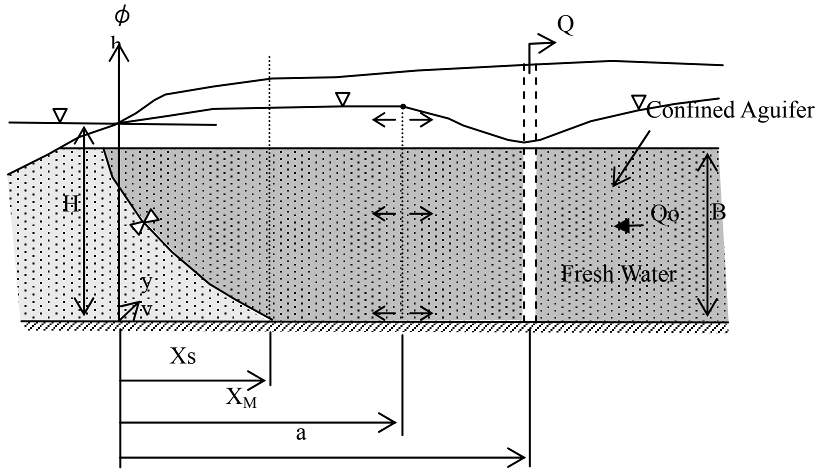


Source : JICA Study Team

Figure B1.3-10 Hydrogeological Situation of Panatina Bore Field

Situation of sea water intrusion is considered that shown in Figure B1.3-10(2) not Figure B1.3-10(1). Sea water intrusion into Honiara Beds has not yet taken place in the inland area where Panatina bore field is located. Results of electric resistivity prospecting by JICA in 1996 supported this situation.

Situation of sea water intrusion is considered as shown in Figure B1.3-11. This situation can be true not only in Panatina Area but also in many places in Honiara City. Whether sea water will intrude into borehole or not by new groundwater development depends on factors such as i) yield from borehole, ii) amount of natural groundwater flow, iii) distance between bore and the shoreline and iv) permeability of aquifer. Possibility of sea water intrusion by pumping-up from boreholes near the sea can be analyzed by formulas listed in Table B1.3-11. This table also shows result of analysis of Panatina borefields.



Source : JICA Study Team

Figure B1.3-11 Situation of Sea Water Intrusion

Table B1.3-11 Analysis of Sea Water Intrusion in Honiara Groundwater Basin

Items	Method for analysis and result
Groundwater flow in Honiara Groundwater Basin	According to water balance analysis, groundwater flow from Honiara groundwater basin into the sea is estimated 68,513m^3/day. Total length of coastal line in the basin is 10km. So unit groundwater flow of 1 m width is 68,513m^3/day/10,000m = 6.8 m^3/day/m.
Length of sea water intrusion in Honiara Groundwater Basin	Length of sea water intrusion in Honiara Groundwater basin is calculated by formula below. $Qo \times L = K\varepsilon B^2/2$ L : length of intrusion(m), Qo : Unit groundwater flow per 1m width(m^3/day/m) K : Coefficient of permeability(m/day), ε : 1/40, B : Thickness of aquifer(m) So the current length of sea water intrusion is calculated as follows. $L=K\varepsilon B^2/(2\times Qo)=0.4\times(1/40)\times200^2/(2\times6.8)=29m$
Possibility of sea water intrusion into boreholes in Panatina bore field	Condition to prevent sea water intrusion is as follows (see Figure-B1.1-8). Stagnant point (X_M) > toe of sea water intrusion (Xs) Where, • X_M=a {1-Q/(π・a・Qo)} $^{1/2}$ • Xs satisfies relationship of $K\varepsilon B^2/2=Q/(2\pi)\mathrm{In}((Xs-a)^2/(Xs+a)^2)1/2$. K : Coefficient of permeability(m/day), ε : 1/40, B : Thickness of aquifer(m) a : Distance between shoreline and bore(m), Q : Yield(m^3/day) Qo : Unit groundwater flow per 1m width(m^3/day) In case of Panatina Bore Field, Qo =6.8 m^3/day, Q =3,800 m^3/day, X_M=473m, Xs=43m. So it is concluded that X_M>Xs. Then, possibility of sea water intrusion is low as long as the current yield is kept in the future.

Source : JICA Study Team

B1.3.4 Water Quality

Water quality survey in Honiara consists of field water quality survey at site and water quality analysis in the laboratory. Field water quality survey was conducted by the Study Team with cooperation of SIWA. Water quality analysis was conducted by SIWA laboratory.

Field water quality survey was conducted in June, August, November and December 2005 and water quality analysis was conducted from June to July 2005 for an investigation of surface water and ground water quality in the dry season and rainy season.

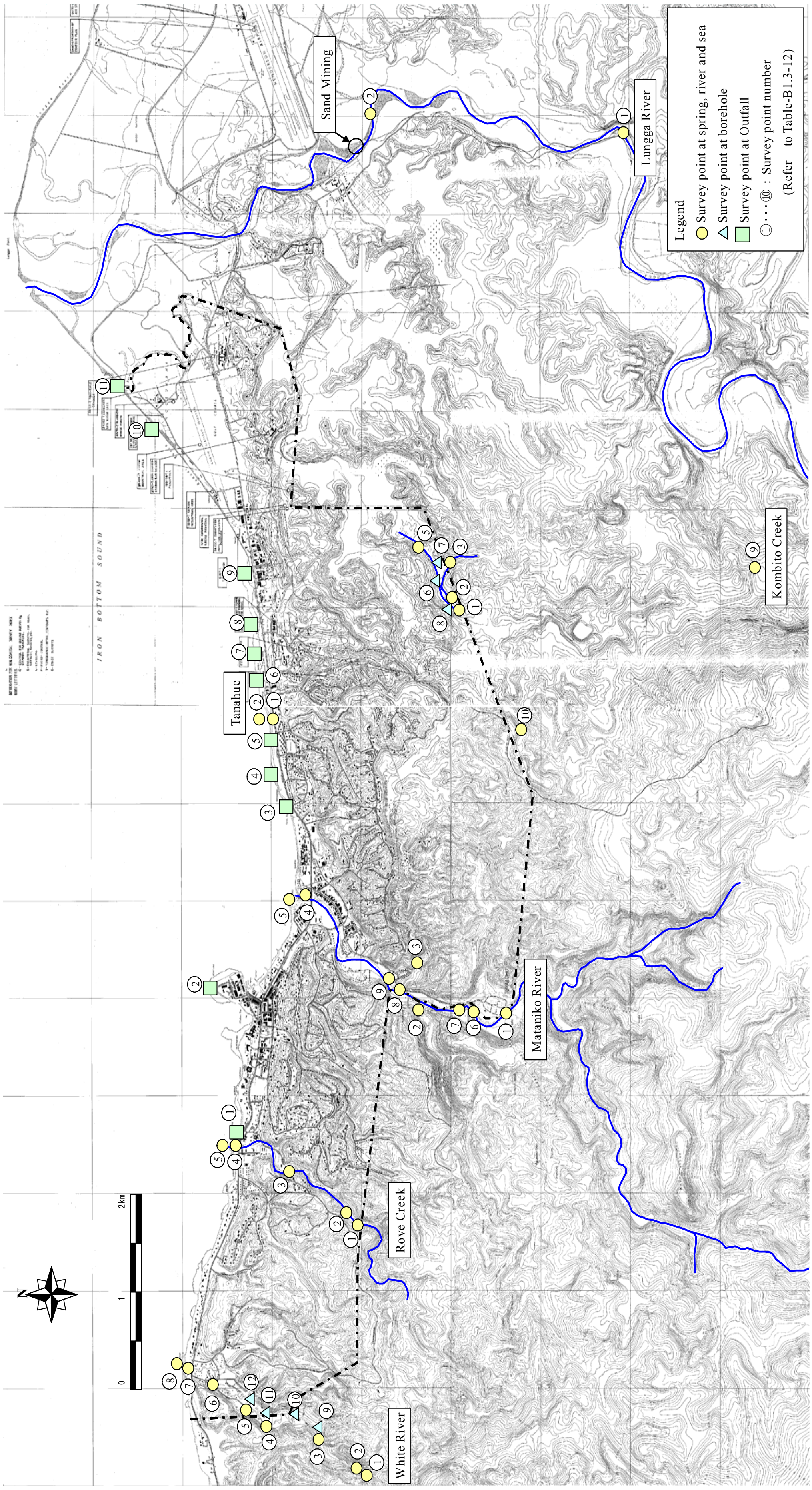
The measurement points of field water quality are shown in Figure B1.3-12 and the results are shown in Table B1.3-12. The water sampling points for water quality analysis in the laboratory is shown in Table B1.3-13 and the results are shown in Figure B 1.3-13.

DO and COD survey results are shown in the figures from B1.3-14 to B1.3-20 for the measuring points in each river. DO and COD value are important items for evaluating the contamination of river water and seawater.

Table B1.3-12 Results of Field Water Quality Survey

	2005.6						2005.8						2005.11						2005.12					
	WT	EC	Turbidity	pH	Do	COD	WT	EC	Turbidity	pH	Do	COD	WT	EC	Turbidity	pH	Do	COD	WT	EC	Turbidity	pH	Do	COD
Honiyara	℃	ms/m	mg/l		mg/l	mg/l	℃	ms/m	mg/l		mg/l	mg/l	℃	ms/m	mg/l		mg/l	mg/l	℃	ms/m	mg/l		mg/l	mg/l
white river 1 Kongulai spring	23.9	34.6	4	7.8	7.23	1	23.9	34.9	15	7.79	7.61	1	24.9	32.8	7	7.8	5.72	6	24	22.7	92	7.3	6.04	6
Kovi sinkhole	–	–	–	–	–	–	–	–	–	–	–	–	23.6	25	6	8.6	7.43	6	–	–	–	–	–	–
white river 2 down stream1	24.1	26	1	7.6	7.92	1	24	33.6	17	7.66	7.96	1	25	30.1	3	8.1	6.43	5	25.7	21.4	48	7.8	7.05	7
white river 3 down stream2	25.9	32.7	2	8.2	7.85	2	25	35.15	16	8.27	7.3	7	29.8	24.6	7	8.1	7.9	8	27.7	25.7	11	8	6.41	7
white river 4 down stream 3	26.1	36.1	2	7.9	6.59	4	25.8	37.4	18	7.96	6.35	8	30.2	34.2	5	7.6	4.54	7	28.1	33.1	0	7.3	4.52	7
white river 5 down stream 4	26.5	35.8	5	7.7	4.82	6	26.2	38.8	26	7.63	3.8	6	30.2	28.9	1	7.4	0.75	8	28.6	36	1	7.3	2.8	7
white river 6 down stream 5	27.6	38.3	5	7.6	3.54	9	26.5	38	28	7.56	3.31	9	27.7	39.1	4	7.3	1.4	8	28.6	35.7	2	7.3	2.56	7
white 7 river mouth	26.8	37.3	5	7.5	2.35	5	26.6	39	24	7.52	2.26	9	28	28.4	0	7.4	0.94	9	26.7	39.1	2	7.3	1.99	9
white 8 river sea	28	–	4	7.9	6.28	1	27.8	–	27	7.9	6.01	1	29.9	–	5	7.5	6.6	2	29.1	–	0	7.7	5	2
white river 9 well−1	26.4	46.1	14	7.6	0.81	–	–	–	–	–	–	–	26.3	41.6	5	7.3	2.4	6	26.4	26.9	7	6.7	2.54	7
white river 10 well−2	26.1	42.1	14	7.5	1.31	–	–	–	–	–	–	–	26.3	49.6	8	7.5	3.42	5	26.1	48.4	7	7.3	2.61	7
white river 11 well−3	25.4	36.1	10	8.1	1.78	–	–	–	–	–	–	–	No water flow						No overflow					
white river 12 well−4	27.1	56.1	15	7.4	1.08	–	–	–	–	–	–	–	27.2	48.6	7	7.1	2.16	6	27	52.1	8	7.2	1.81	7
Rove creek1 Spring Water	26.2	56.1	2.23	7.6	2.23	–	26.2	48.3	14	6.82	5.61	1	27	48.5	7	7.6	4.71	6	27.1	31.8	5	6.8	5.04	6
Rove creek Downstream of spring water	26.2	49	15	7	7.6	1	26.1	50.4	15	7.12	5.43	1	26.2	42.1	8	7.4	5.06	5	26.9	44.3	6	6.8	4.85	6
Rove creek 3 River Crossing Weir	26.9	51	10	7.3	5.7	1	26.2	47.8	16	7.06	5.3	1	27.6	47.1	6	7.3	4.63	7	28.8	47	35	7.2	7.02	7
Rove creek 4 SIWA water resources spillway	–	–	–	–	–	–	26.7	54.6	16	7.22	6.2	1	No water flow						26.7	49.4	7	6.9	3.24	6
Rove creek5 River (Botanical garden)	26.8	35	14	7.6	6.76	1	26.4	52.6	15	7.74	6.94	1	27.6	49	6	7.7	5.34	6	27.8	50.9	7	7.5	5.35	6
Rove creek 6 Rove creek mouth	26.8	35		7.9	5.2	2	26.3	49.6	17	7.99	6.69	6	29.2	52.5	3	7.9	5.79	9	26.2	48	4	7.6	3.05	7
Rove creek 7 Rove creek 5 sea	27.1	–	14	8.1	4	0	28.1	–	16	7.91	7.35	0	31	–	6	7.8	8.7	1	31.2	–	2	8	8.25	2
Mataniko river 1 down stream 1	25.8	29.6	3	8.2	7.98	1	25.1	39.3	8	8.25	5.32	9	27.4	20.5	4	8.1	7.75	8	26.1	23.2	5	8.2	7.9	6
Mataniko river 2 down stream 2	26.4	41	3	7.8	6.65	4	25.8	37.2	15	7.94	4.63	6	26.6	28.7	3	8	5.4	7	26	38	3	7.6	4.91	5
Mataniko river 3 down stream 3	26.4	48	26	7.8	4.95	5	26.7	44.1	20	7.79	4.23	7	32.3	34.5	4	7.8	3.15	8	26.6	40.9	10	7.4	3.89	7
Mataniko river 4 mouth	26.6	45	75	7.8	3.93	5	25.7	237.7	18	7.61	3.38	5	26.1	990	5	8.1	3.33	7	25.1	–	4	7.6	4.31	6
Mataniko river 5 sea	28		102	7.1	8.65	2	29.4	–	21	8.02	3.83	0	31.1	–	0	7.8	6.66	7	30.3	–	28	8	6.37	5
Mataniko river 6 tuvaruvu outfall upstrream	25.4	40.1	12	8.2	2.32	–	–	–	–	–	–	–	28.5	25.3	0	8	7.3	7	25.9	31.3	3	8	7.19	7
Mataniko river 7Tuvaruvu outfall downstream	25.3	40.1	9	8.3	2.25	–	–	–	–	–	–	–	28.9	50.5	1	7.6	4.34	9	26.2	32.9	7	7.7	6	50+
Mataniko river 8Vasa creek outfall upstream	26.9	68.1	44	8.1	2	–	–	–	–	–	–	–	29.1	54.5	1	7.9	5.09	8	26.1	34.9	0	7.9	4.91	7
Mataniko river 9 Vasa creek outfall downstre	25.6	58.1	7	7.8	1.83	–	–	–	–	–	–	–	29.1	49.8	10	7.6	2.95	9	26.8	44	0	7.6	4.77	50+
Kombito creek 1 spring	25.2	39.4	18	7.4	7.41	6	25.2	47.9	12	7.5	4.08	1	25.2	32.5	23	7.9	5.32	7	25.3	42	7	7.3	5.33	6
Kombito creek 2 spring2	26.3	49.6	20	7.1	5.29	6	26	48.2	17	7.06	3.09	5	26.4	36.2	2	7	5.32	8	26.3	41.6	7	6.9	5.36	6
Kombito creek 3 down stream 1	26.8	35.1	39	7.2	0.67	8	27.1	48.4	20	7.18	1.65	7	27.7	44.8	37	7.7	2.34	7	28	44.3	12	7.1	0.29	9
Kombito creek 4 down stream 2	26.1	48	44	8.1	7.09	8	27.3	36.1	34	8.12	2.99	8	27	42	8	8.3	6.35	7	28.6	43.9	16	7.9	5.73	9
Kombito creek 5 spring 3	27.5	62.8	21	7.1	5.22	4	27.3	63.8	19	7.11	2.83	5	27.3	57.4	12	7.6	3.94	7	27.5	56.3	0	6.9	3.73	6
Kombito creek 6 SIWA well−1	26.8	68.1	14	7.2	1.36	–	–	–	–	–	–	–	No overflow						No overflow					
Kombito creek 7 SIWA well−2	26.7	50.1	14	7.4	2.04	–	–	–	–	–	–	–	No overflow						No overflow					
Kombito creek 8 Euwell	26.1	46.1	0	7.6	1.95	–	–	–	–	–	–	–	26.4	45.4	7	7.5	3.75	7	26.1	44.9	7	7	3.28	4
Kombito creek 9 Mt.Austin new spring	26.7	40.1	13	7.4	1.05	–	26.1	45.1	11	7.18	7.1	–	26.1	39.2	8	7.7	5.44	7	–					
Kombito creek 10 Mamulele spring	25.9	48.1	15	7.3	1.69	–	25.9	44.6	14	7.09	7.25	–	25.9	44.2	7	6.4	4.63	6	26	44.5	7	6.9	4.2	6
Tanahue 1 mouth	26.6	66.1	8	7.7	0.64	–	27.1	72.2	20	7.69	3.74	7	26.6	53.8	43	8.1	4.09	9	30.7	68	1	7.3	1.18	9
Tanahue 2 sea	29.2		14	7.9	0.99	–	28.2	–	18	8.07	6.85	0	28.5	–	37	7.9	4.41	1	30.9	–	7	7.9	6.13	2
Lungga river 1	28.7	29.8	18	8.1	8.24	6	26.7	23.3	16	8.21	8	6	27.6	15	2	7.8	7.08	7	–	–	–	–	–	–
Lungga river 2	26.6	25.7	17	8.2	8.23	6	27	20	17	8.02	8.12	6	27.5	16.2	2	7.8	6.56	8	–	–	–	–	–	–
Outfall−1 Rove creek sewerage out flow													30.8	–	21	7.8	6.4	0	30.4	–	2	7.9	5.63	2
Outfall−2 Point Cruise Outfall													30	–	27	7.9	2.54	2	30.5	–	5	7.7	6.09	1
Outfall−3 St.Nicholas Outfall													31.1	–	1	8.1	8.27	2	31.7	–	5	7.9	7.4	5
Outfall−4 Bahai Sewarage Outfall							28	–	44	8.01	3.11	2	30.1	–	2	8	5.06	5	30.5	–	4	7.9	4.97	1
Outfall−5 Kukum Sewerage Outfall							28.6	–	23	8.03	6.65	0	30.9	–	6	8	3.63	2	31	–	6	7.8	3.62	1
Outfall−6 Kukum MbuaValley Outfall 1													30.6	–	7	8.1	7.49	2	31.4	–	7	8	6.56	1
Outfall−7 Kukum MbuaValley Outfall 2													31.8	–	13	8.2	7.75	2	31.8	–	0	7.9	6.19	1
Outfall−8 Naha Outfall													30.8	–	6	8.2	6.99	2	31.4	–	7	8	7.02	1
Outfall−9 Vura Outfall													30.4	–	4	8.1	4.73	2	30.9	–	5	7.9	4.59	1
Outfall−10 Ranadi Outfall													30.8	–	5	8.3	7.22	1	31.4	–	5	7.9	6.09	2
Outfall−11 KG VI Outfall													30.7	–	35	7.8	0.29	7	31.8	–	93	7.6	4.43	2

Source : JICA Study Team



Source : JICA Study Team

Figure B1.3-12 Measurement Points of Field Water Quality

Table B1.3-13 Results of Water Quality Analysis

	Source	Tap	Nitrate	Nitrite	Nitorogen-ammonia	Mn	Fe	K	Total hardness	SO4	Zn	Cl2	Cl	F	Ca	Mg	Cu	Pb	P	Cr (VI)	I	Al	Benzotriazole	Phenol	Total Coliform
WHO Guideline			**50**	**3**	-	**0.4**	-	-	-	-	-	-	**5**	**1.5**	-	-	**2**	**0.01**	-	**0.05**	-	-	-	-	
HONIARA WELL・SPRING																									
White river Bore-1	○		0.02	0.002	0	0	0.072	0	71	5.32	0.061	0	0.047		33	36	0.02	0	0.009	0.021	0	0.0084	0	0	>200
White river Bore-2	○		0.03	0.0021	0	0	0.071	0.13	117	7.32	0.065	0	0.011	0.014	77	43	0.03	0	0.019	0.024	0	0.0079	0	0	0
White river Bore-3	○		0.02	0.0022	0	0.001	0.07	0.12	97	6.44	0.066	0	0.035	0.003	47	39	0.02	0	0.036	0.02	0	0.008	0	0	4
White river Bore-4	○		0.094	0.0047	0	0.0031	0.028	0.0055	137	0.064	0.0038	0	0.043	0	66	32	0.028	0	0	0.038	0	0.058	0	0	0
Mataniko Bore M-2	○		0.03	0.01	0.0151	0.54	0.003	2.51	205.5	0.013	0	0	0.023	0.001	144.4	11.02	0.022	0	0.061	0.1		0.078	0	0	>200
Mataniko Borel M-4	○		0.03	0.037	0.0183	0.54	0.003	1.95	198	0.013	0.017	0	0.035	0.006	144.4	11.02	0.022	0	0.033	0.1	0	0.078	0	0	>200
Mataniko SIWA Bore-1	○		0.031	0.0102	0.152	0.51	0.003	2.52	207	0.009	0		0.012	0.005	108	96	0.02	0	0.047	0.031	0	0.0079	0	0	0
Kombito Bore K-1	○		0.0057	0	0	0	0.027	0	87	0.034	0.065	0	0.061	0	47.9	23	0.034	0	0	0.057	0	0.0033	0	0	5
Kombito Bore K-2	○		0.044	0	0	0.021	0.027	0	93	0.016	0.049	0	0.055	0	44.3	36.6	0.043	0	0	0.057	0	0.017	0	0	17
Kmbito EU Bore	○																								
Panatina Bore -1	○		0.031	0.0013	0	0.0045	0.119	0.005	173	0.2	0.0238	0	0.026	0.003	73.4	78.11	0.022	0	0.004	0.016	0	0.009	0	0	
Panatina Bore -2	○		0.04	0.0054	0	0.0032	0.265		203	0.2	0.0244	0	0.022	0.009	54.1	78.34	0.024	0	0	0.018	0	0.007	0	0	0
Panatina Bore -3	○		0.042	0.0045	0.0057	0.0033	0.0057	0.012	201	0.2	0.0243	0		0.011	76.4	97.7	0.022	0	0.012	0.018	0	0.007	0	0	0
Panatina Tank	○		0.051	0.0017	0	0.0035	0.201	0.001	163	0.04	0.0251	0	0.026		88.4	76	0.023	0		0.016	0	0.009	0	0	
White River Congulai spring	○		0.17	0.006	0.6	0.02	0.011	0.14	144	0.3	0.864	0	0.001	0.005	76.4	62	0.046	0		0.021		0.0046	0	0	>200
Rove spring	○		0.9	0.6	1.03	0	0.43	0.33	74	0.043	0.051	0	0.037	0.027	36	28	0.031	0		0.024	0	0.0088	0	0	>200
Kombito spring-1	○		1.07	0.046	0.96	0.041	0.011	0	66	0.01	0.033		0.042	0	37.7	29	0.003	0	0	0.012	0	0.062	0	0	0
Kombito spring-2	○		1.38	0.096	0.044	0.038	0.023	0.027	71	0.021	0.062	0	0.057	0	43	38.5	0.091	0	0.01	0.047	0	0.055	0	0	>200
Mt.Austen new spring source	○		0.93	0.046	0.062	0.011	0.019	0.038	64	0.005	0.012	0	0.003	0.002	41	37	0.021	0	0.003	0.033	0	0.091	0	0	>200
Mamulele new pring source	○		1.5	0.009	0.005	3.33	0.011	0.24	5	0.2	0.863	0	5	0	14.7	6.08	0.07	0	0.14	0.009	0.14	0.005	0	0	0
HONIARA TAP WATER																									
White river high level system		○	0.18	0.006	0.011	0.5	0.039	0.09	157	0.1	0.21	0.3	0.81	0.017	57.7	44.7	0.048	0	0.51	0.023	0	0.084	0	0	0
White river spring gravity system		○	0.18	0.005	0.024	0.53	0.041	0.09	155	0	0.31	0.6	0.79	0.022	56	41	0.54	0	0.59	0.023	0	0.081	0	0	0
Rove gravity system		○	0.9	0.6	1.03	0	0.43	0.33	74	0.043	0.051	0	0.037	0.039	36	28	0.031	0		0.024	0	0.0088		0	0
Mataniko Skyline System		○	0.037	0.0102	0.093	0.044	0.075	1.77	203	0.006	0.037	0.4	0.012	0.0022	97	86	0.02	0	0.038	0.031		0.076	0	0	0
Mataniko SIWA System		○	0.021	0.002	0.062	0.061	0.075	1.03	195	0.003	0.045	0.3	0.017	0.0022	98	86	0.021	0	0.038	0.022	0	0.056	0	0	
Kombito k-1.k-2 system		○	0.04	0.0093	0.008	0.017	0.011	0.007	214	5.37	0.864	0	6.3	0	107.4	6.06	0.043	0	0.001	0.1	0.03	0.0087	0	0	78
Kombito spring system		○	0.93	0.087	0.063	0.038	0.035	0.027	86	0.021	0.062	0.3	0.057	0.01	43	35		0	0.01	0.042	0	0.055	0	0	>200
Panatina system		○	0.051	0.0017	0	0.0035	0.201	0.001	163	0.004	0.251	0	0.026		88.4	76	0.023	0		0.016		0.009	0	0	0

Notes: Unit of the above is as follows;
- MPN / mL for Total Coliform Bacteria
- mg / L for other items

Source : WHO's Guideline value Source, Guidelines for drinking-water quality,3rd edition(WHO 2004)