

APPENDICES

APPENDIX 1

MEMBER LIST OF THE STUDY TEAM

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< Basic Design Study Team >

Name	Assigned Work	Current Position
Hiroyuki HAYASHI	Overall Supervisor	Transport and Electricity Team, Business Company I, Grant Aid Management Department, JICA
Kiyofusa TANAKA	Team Leader/Power Planning	Yachiyo Engineering Co., Ltd.
Noritsune CHIBA	Generating Facility Planning I (Hydraulic Turbine Generator)	“
Takumi MARUOKA	Generating Facility Planning II (Raceway) /Natural Conditions Survey I (Hydraulics and Hydrology)	“
Susumu IMAI	Natural Conditions Survey II (Topography and Geology)	“
Toru FUJII	Work and Procurement Planning / Estimation	“

< Explanation of Draft Final Report >

Name	Assigned Work	Current Position
Tetsuhiro IKE	Overall Supervisor	JICA Fiji & Regional Support Office
Kiyofusa TANAKA	Team Leader/Power Planning	Yachiyo Engineering Co., Ltd.
Noritsune CHIBA	Generating Facility Planning I (Hydraulic Turbine Generator)	“
Takumi MARUOKA	Generating Facility Planning II (Raceway) /Natural Conditions Survey I (Hydraulics and Hydrology)	“

APPENDIX 2

STUDY SCHEDULE

APPENDIX 2 STUDY SCHEDULE

< Basic Design Study >

Day No.	Date	Day of Week	Activity			Overnight Stay
			Gov. Official	Consultants (Yachiyo Engineering)		
			JICA (Hayashi)	A Team (Tanaka, Chiba & Maruoka)	B Team (Imai)	
1	Jun. 18	Sun.		• Travelling (from Tokyo 21:20 JAL771→ Sydney 07:35 + 1)		Onboard plane
2	Jun. 19	Mon.		• Travelling (from Sidney 10:50 NF011 → Port-Vila 15:30) • Courtesy visit to and meeting at the JICA Vanuatu Office		Port-Vila
3	Jun. 20	Tues.		• Courtesy visits to the MOFA, MOL, MOF and UNELCO and request for the gathering of data • Submission to, explanation of and discussions on the I/R and the study schedule with the MOL • Meeting with a local contractor on surveying, test pit and boring		Port-Vila
4	Jun. 21	Wed.		• Submission to, explanation of and discussions on the I/R and the study schedule with the MOL and gathering of data (collection rate of the electricity charge, electrification rate, spare parts procurement, finance, organization, staff assignment, power standards, future plan and power demand forecast, etc.) • Travelling (from Port-Vila 16:00 AV208 → Santo 16:55)		Luganville
5	Jun. 22	Thur.		• Courtesy visit to the power station (UNELCO), discussions with staff members and gathering of data • Field survey on the existing equipment, powerhouse, penstock and raceway of the hydroelectric power station		Luganville
6	Jun. 23	Fri.		• Field survey on the diesel power station, transmission and distribution facilities and the substation in Luganville • Study on the maintenance records		Luganville
7	Jun. 24	Sat.		• Survey on the Luganville market, port road and electricity users		Luganville
8	Jun. 25	Sun.	• Travelling (Tokyo→ Numea) Transfer	• Travelling (Santo 08:25 AV211 → Port-Vila 09:20) • Study on the Port-Vila market		Gov. official: onboard plane Consultants: Port-Vila
9	Jun. 26	Mon.	• Travelling (Numea → Port-Vila 17:50) • Team discussions	• Gathering of supplementary data • Study on the background, purpose and contents of the Project • Survey-related EIA • Team discussions (reporting on the progress: mechanical and civil engineering)		Port-Vila
10	Jun. 27	Tues.	• Courtesy visit to and discussions at the JICA Vanuatu Office • Courtesy visit to and discussions at the MOL (explanation of the policies regarding the equipment and civil engineering work)	• Study on the organization, generating, transmission and distribution facilities and the diesel oil cost, etc. • Discussions with the local contractor on the surveying, test pit and boring • Discussions at the MOL (as left)		Port-Vila
11	Jun. 28	Wed.	• Courtesy visit to and discussions at the MOL (gathering of questions) • Travelling (Port-Vila → Santo)	• Arrangement of the subcontracted work • Study on the Port-Vila market		Gov. official, A and B: Luganville C: Port-Vila

Day No.	Date	Day of Week	Activity				Overnight Stay
			Gov. Official	Consultants (Yachiyo Engineering)			
			JICA (Hayashi)	A Team (Tanaka, Chiba & Maruoka)	B Team (Imai)	C Team (Fujii)	
12	Jun. 29	Thur.	<ul style="list-style-type: none"> Discussions with the UNELCO Site visit 		<ul style="list-style-type: none"> Gathering of topographical data Study on the transmission and distribution facilities Gathering of meteorological data 	<ul style="list-style-type: none"> Arrangement of the subcontracted work Study on the Port-Vila market 	Gov. official, A and B: Luganville C: Port-Vila
13	Jun.30	Fri.	<ul style="list-style-type: none"> Discussions with the UNELCO Site visit 		<ul style="list-style-type: none"> Examination of the extension of the powerhouse; study on the raceway Study on the maintenance system, staff assignment and technical level Study on the operation and maintenance system of the UNELCO 	<ul style="list-style-type: none"> Arrangement of the subcontracted work Study on the Port-Vila market 	Gov. official, A and B: Luganville C: Port-Vila
14	Jul. 1	Sat.	<ul style="list-style-type: none"> Travelling (Santo → Port-Vila) 		<ul style="list-style-type: none"> Field survey on areas around the intake dam and head tank Study on the powerhouse and raceway Discussions with the local contractor on the surveying, test pit and boring 	<ul style="list-style-type: none"> Study on the Port-Vila market 	Gov. official, A and B: Luganville C: Port-Vila
15	Jul. 2	Sun.	<ul style="list-style-type: none"> Team discussions 		<ul style="list-style-type: none"> Field survey on the powerhouse and raceway; arrangement of data 	<ul style="list-style-type: none"> Study on the Port-Vila market Travelling (Port-Vila → Santo) 	Gov. official and A: Port-Vila B & C: Luganville
16	Jul. 3	Mon.	<ul style="list-style-type: none"> Discussions on the M/D 		<ul style="list-style-type: none"> User demand survey Field survey on the substation and transmission route, etc. 		Gov. official and A: Port-Vila B & C: Luganville
17	Jul. 4	Tues.	<ul style="list-style-type: none"> Signing of the M/D Courtesy visit to and discussions at the JICA Vanuatu Office 		<ul style="list-style-type: none"> Measuring of the flow rate of the raceway Study on the installation of the new hydraulic turbine generator 		Gov. official: Suva Consultants: Luganville
			<ul style="list-style-type: none"> Travelling (Port-Vila → Nandi → Suva) 	<ul style="list-style-type: none"> Travelling (Port-Vila → Santo) 			

Day No.	Date	Day of Week	Activity				Overnight Stay
			Gov. Official	Consultants (Yachiyo Engineering)			
			JICA (Hayashi)	A Team (Tanaka, Chiba & Maruoka)	B Team (Imai)	C Team (Fujii)	
18	Jul. 5	Wed.	<ul style="list-style-type: none"> Reporting to the EOJ and the JICA Fiji Office Travelling (Suva → Nandi) 	<ul style="list-style-type: none"> Survey on the forebay and the site for an additional penstock 	<ul style="list-style-type: none"> Progress check (1) of the surveying, test pit and boring 	Gov. official: Nandi Consultants: Luganville	
19	Jul. 6	Thur.	<ul style="list-style-type: none"> Travelling (Nandi → Tokyo) 	<ul style="list-style-type: none"> Progress check (2) of the surveying, test pit and boring Discussions with staff members of the UNELCO working on Santo Island (O&M, equipment and spare parts, etc.) 		Luganville	
20	Jul. 7	Fri.		<ul style="list-style-type: none"> Progress check (3) of the surveying, test pit and boring Discussions with staff members of the UNELCO working on Santo Island (power demand, etc.) 		Luganville	
21	Jul. 8	Sat.		<ul style="list-style-type: none"> Field survey on the Santo market, port and possible transportation route Travelling (Santo 17:25 AV209 → Port-Vila 18:20) 		Port-Vila	
22	Jul. 9	Sun.		<ul style="list-style-type: none"> Team discussions 		Port-Vila	
23	Jul. 10	Mon.		<ul style="list-style-type: none"> Preparation of the field report Arrangement of the surveying data and gathering of supplementary reference materials and data 		Port-Vila	
24	Jul. 11	Tues.		<ul style="list-style-type: none"> Preparation of the field report Gathering of supplementary reference materials and data Obtaining and analysis of surveying, test pit and boring data 		Port-Vila	
25	Jul. 12	Wed.		<ul style="list-style-type: none"> Discussions (1) with MOL officials (draft repair plan for the civil engineering structures and O&M) 		Port-Vila	
26	Jul. 13	Thur.		<ul style="list-style-type: none"> Discussions (2) with MOL officials (scope of equipment operation and O&M) 		Port-Vila	
27	Jul. 14	Fri.		<ul style="list-style-type: none"> Obtaining of the approval of the field report Courtesy visit to the MOL Reporting to the JICA Vanuatu Office 		Port-Vila	
28	Jul. 15	Sat.		<ul style="list-style-type: none"> Gathering of supplementary reference materials and data Team discussions; arrangement of the gathered reference materials and data 		Port-Vila	
29	Jul. 16	Sun.		<ul style="list-style-type: none"> Travelling (Port-Vila 16:30 QF387 → Brisbane 18:30) 		Brisbane	
30	Jul. 17	Mon.		<ul style="list-style-type: none"> Travelling (Brisbane 09:05 JL762 → Tokyo 16:55) 			

< Explanation of Draft Final Report >

Day No.	Date	Day of Week	Contents of the Study		Stay at
			Official Member	Consultant Member	
			JICA Mr. Tetsuhiro IKE	Mr. Kiyofusa Tanaka Mr. Noritsune Chiba Mr. Takumi Maruoka	
1	Oct. 29 th	Sun	• Trip{Narita NRT 21:25 Sydney 8:55+1 by JL-771}		
2	Oct. 30 th	Mon	• Trip{Sydney 11:50 Port-Vila 15:30 by DJ-181}		Port-Vila
3	Oct. 31 st	Tue	<ul style="list-style-type: none"> • Visit JICA Vanuatu Office and Meeting • Discussion with MOL, Confirmation of the Survey Schedule • Explanation and Discussion of Draft Final Report • Move to Luganville{Port-Vila 16:00 Luganville 16:55 by AV-208} 		Luganville
4	Nov. 1 st	Wed	<ul style="list-style-type: none"> • Visit Luganville Power Station and Discussion with EU MLGM and UNELCO and Data Collection • Site Survey of Power Station and Intake Water Canal • Move form Luganville (17:25) to Port-Vila (18:20) by AV-209 		Port-Vila
5	Nov. 2 nd	Thu	• Discussion with MOL		Port-Vila
6	Nov. 3 rd	Fri	• Confirmation of “Minute of Discussion (M/D)” with MOL		Port-Vila
7	Nov. 4 th	Sat	<ul style="list-style-type: none"> • Team Meeting with Team Leader • Market Survey in Port-Vila 		Port-Vila
8	Nov. 5 th	Sun	• Market Survey in Port-Vila		Port-Vila
9	Nov. 6 th	Mon	<ul style="list-style-type: none"> • Signing M/D with MOL • Report to JICA Vanuatu Office and Discussion 		Port-Vila
10	Nov. 7 th	Tue	• Move from Port-Vila (16:05) to Nadi (18:40)		SUVA
11	Nov. 8 th	Wed	<ul style="list-style-type: none"> • Move from Nadi (6:45) to SUVA (7:15) • Report to EOJ Fiji Office • Move from SUVA (12:30) to Nadi (13:00), Move from Nadi (20:40) to Brisbane (22:40) 		Brisbane
12	Nov. 9 th	Thu	• Trip{Brisbane BNE 8:05 Narita NRT 16:55}		

APPENDIX 3

LIST OF PARTIES CONCERNED IN THE RECIPIENT COUNTRY

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<u>Organization and Name</u>	<u>Job Title</u>
Ministry of Foreign Affaires	
Mr. Johnny KOANAPO	Acting Head of Asia Pacific Foreign Unit
Ministry of Finance and Economic	
Mr. H.E. Willie JIMMY	Minister
Mr. Simeon ATHY	Director General
Mr. Benjamin SHING	Director of Finance
Mr. Fredrick HOSEA	Acting Director of Dept.
Ministry of Lands, Energy, Environment, Geology, Mines and Water Resources	
Mr. Russell NARI	Director General
Mr. Chris IOAN	Director of Geology, Mines & Water Resources
Mr. Leo MOLI	Principal Energy Officer
Mr. Ernest BANI	Head of Environmental Unit
Mr. Morris STEPHEN	Water Technician of Geology Department
Mr. Esline GARAE	Geo-Hazards Manager of Geology Department
Sanma Province	
Mr. Joel PATH	Secretary General
Public Works Department	
Mr. Willie WATSON	Manager Projects
Department of Labor Office	
Mr. Kasten HERVE	Manager
Vanuatu Meteorological Services	
Mr. Robson Silas TIGONA	Climate Section
UNELCO	
Mr. John CHANIEL	Managing Director
Mr. Pascal LOUVET	Manager Electricite EFATE
Mr. Frederic FEUILIYE	Officer in Charge Electricity Controles
Mr. Francois PY	Islands Electricity Manager
Mr. Stephane GARLOPEAU	Area Manager - Santo

Embassy of Japan in the Republic of Fiji

Mr. Masashi NAMEKAWA Ambassador of Japan

Mr. Hiroshi WATANABE Second Secretary

JICA Fiji Office

Mr. Teiji TAKESHITA Resident Representative

Mr. Tetsuhiro IKE Deputy Resident Representative

JICA Vanuatu Office

Mr. Yoshinori EBATA Chief Representative

Mr. Albert KARLOSARURU Senior Program Officer

APPENDIX 4

MINUTES OF DISCUSSIONS (M/D)

**Minutes of Discussions
on the Basic Design Study on
the Project for Improvement of Power Generation
in Sarakata River Hydroelectric Power Station
in the Republic of Vanuatu**

In response to the request from the Government of the Republic of Vanuatu (hereinafter referred to as "Vanuatu"), the Government of Japan decided to conduct the Basic Design Study on the project for Improvement of Power Generation in Sarakata River Hydroelectric Power Station (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Vanuatu the Basic Design Study Team (hereinafter referred to as "the Team"), headed by Mr. Hiroyuki Hayashi, Senior Program Administration Officer of the Transportation and Electric Power Team, the Grant Aid Management Department, JICA, and is scheduled to stay in the country from June 19, 2006 to July 16, 2006.

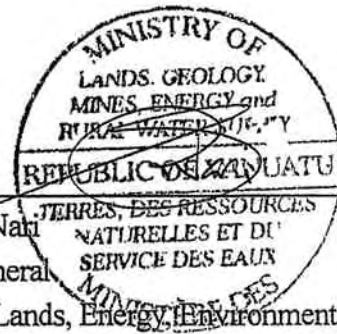
The Team held discussions with the officials concerned of the Government of Vanuatu and conducted a field survey at the study area.

As a result of discussions and field survey, both parties confirmed the main items described in the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Port Vila, July 4, 2006



Mr. Hayashi Hiroyuki
Leader
Basic Design Study Team
Japan International Cooperation Agency



Mr. Russel Natu
Director General
Ministry of Lands, Energy, Environment, Geology,
Mines & Water Resources
The Republic of Vanuatu



Mr. Benjamin Shing
Acting Director General
Ministry of Finance and Economic Management
The Republic of Vanuatu



ATTACHMENT

1. Objective

The objective of the Project is to strengthen power generation capacity of the Sarakata River Hydroelectric Power Station and to rehabilitate damages caused by rainstorms and earthquakes.

2. Project Site

The site of the Project is shown in Annex-1.

3. Organizations concerned in Vanuatu

(1) The Responsible Ministry for the Project is the Ministry of Land, Energy, Environment, Geology, Mines and Water Resources (MOL).

(2) The Implementing Agency for the Project is the Energy Unit, MOL (EU) with assistance of Public Works Department (PWD).

The organization chart of MOL and EU are shown in Annex-2.

4. Components Requested by the Government of Vanuatu

After discussions with the Team, the components described in Annex-3 were finally requested by the Vanuatu side. JICA will assess the appropriateness of the request, scrutinize each component and will recommend to the Government of Japan for approval.

5. Japan's Grant Aid Scheme

(1) The Vanuatu side understands the Japan's Grant Aid scheme and the necessary measures to be taken by the Government of Vanuatu explained by the Team as described in Annex-4.

(2) The Vanuatu side promised to take necessary measures as described in Annex-5, for smooth implementation of the Project as a condition for the Japan's Grant Aid to be implemented.

6. Schedule of the Study

(1) The Team will proceed to further studies in Vanuatu until July 16, 2006.

(2) JICA will prepare the draft report in English and dispatch a team to Vanuatu in order to explain its contents around the end of October 2006.

(3) When the contents of the draft report are accepted in principle by the Government of Vanuatu, JICA will complete the final report and send it to the Government of Vanuatu around December 2006.

7. Other Relevant Issues

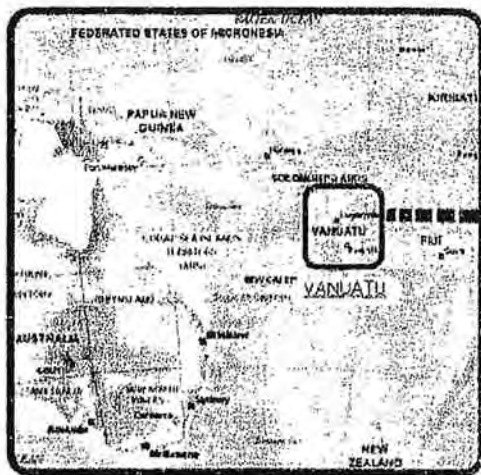
(1) The Vanuatu side should submit answers in English to the Questionnaire, which the Team handed to the Vanuatu side, by July 10, 2006.

(2) The Vanuatu side should provide necessary number(s) of counterpart personnel to the Team during the field survey.

(3) The Vanuatu side should arrange the budget allocation for undertakings shown in Annex-5 and others

described in this Minutes of Discussion.

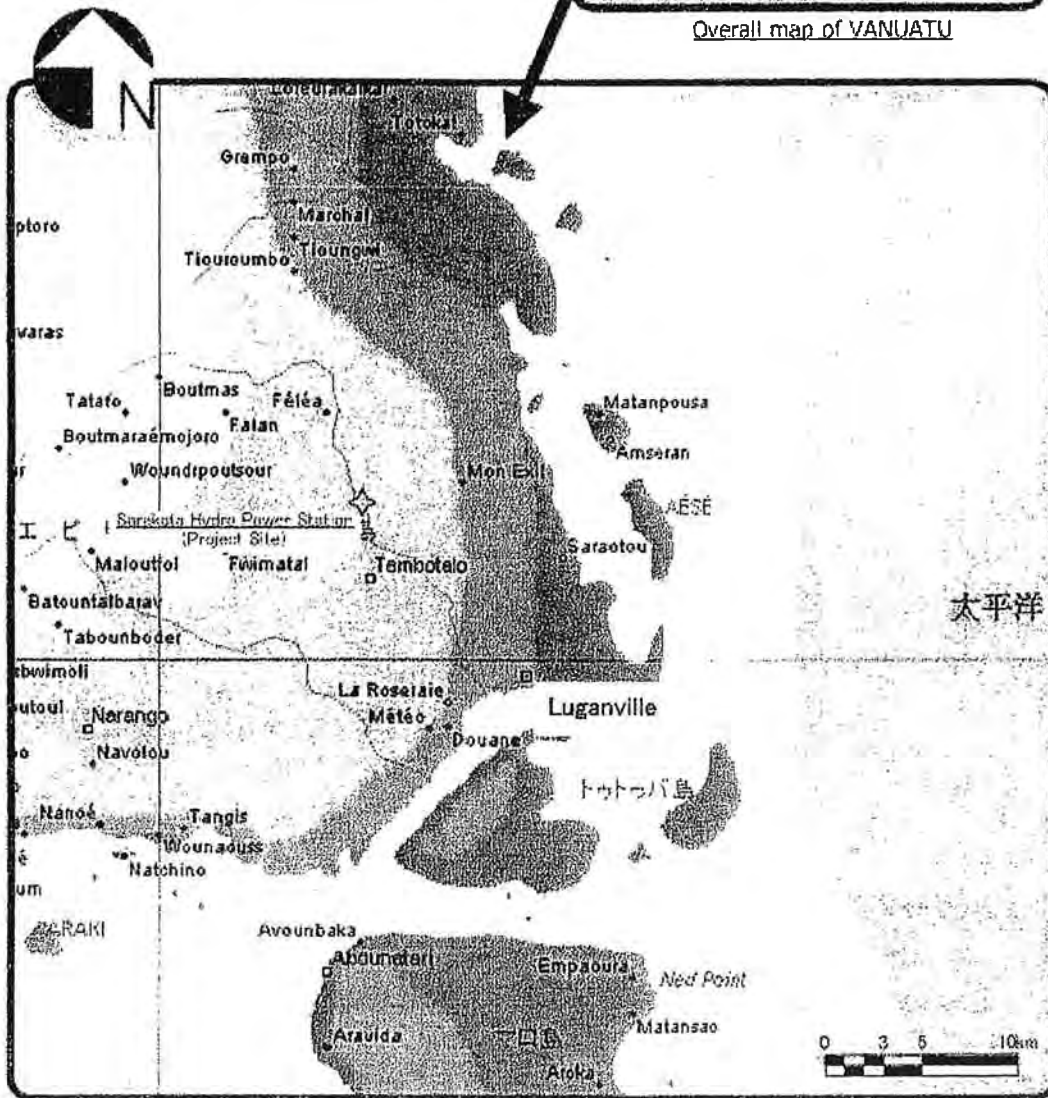
- (4) The Vanuatu side should conduct monitoring for flow volume of the Sarakata River at the intake gate in the dry season, especially in September 2006, and inform the Team through JICA Vanuatu Office of the result by the end of October 2006.
- (5) Both sides confirmed that the title of the Project should be as “the Project for Improvement of Power Generation in Sarakata River Hydroelectric Power Station”.
- (6) The Vanuatu side should repair the inside surface of the canal and remove or relocate the access bridge(s) on the canal in order to secure the quantity of water required for three units full load operation, if necessary.
- (7) The Vanuatu side should conduct the repair work on the damaged surface of the access road to the power station and temporally repair work for landsides of the access road near the power station.
- (8) The Vanuatu side should make periodical inspections on civil structures including canal, head tank etc. at least once a year.
- (9) The Vanuatu side should provide ditches and other countermeasures along the mountain side of the canal and maintain them properly in order to protect inflow of dirt and sand into the canal by the completion of the Project.
- (10) The Vanuatu side explained to the Team that unless due to adverse natural events, no more additional environmental and social considerations required other than those previously conducted for the Project.
- (11) The Vanuatu side explained the latest situation of the land lease issue to the Team as per Annex-6.



Location map of VANUATU



Overall map of VANUATU

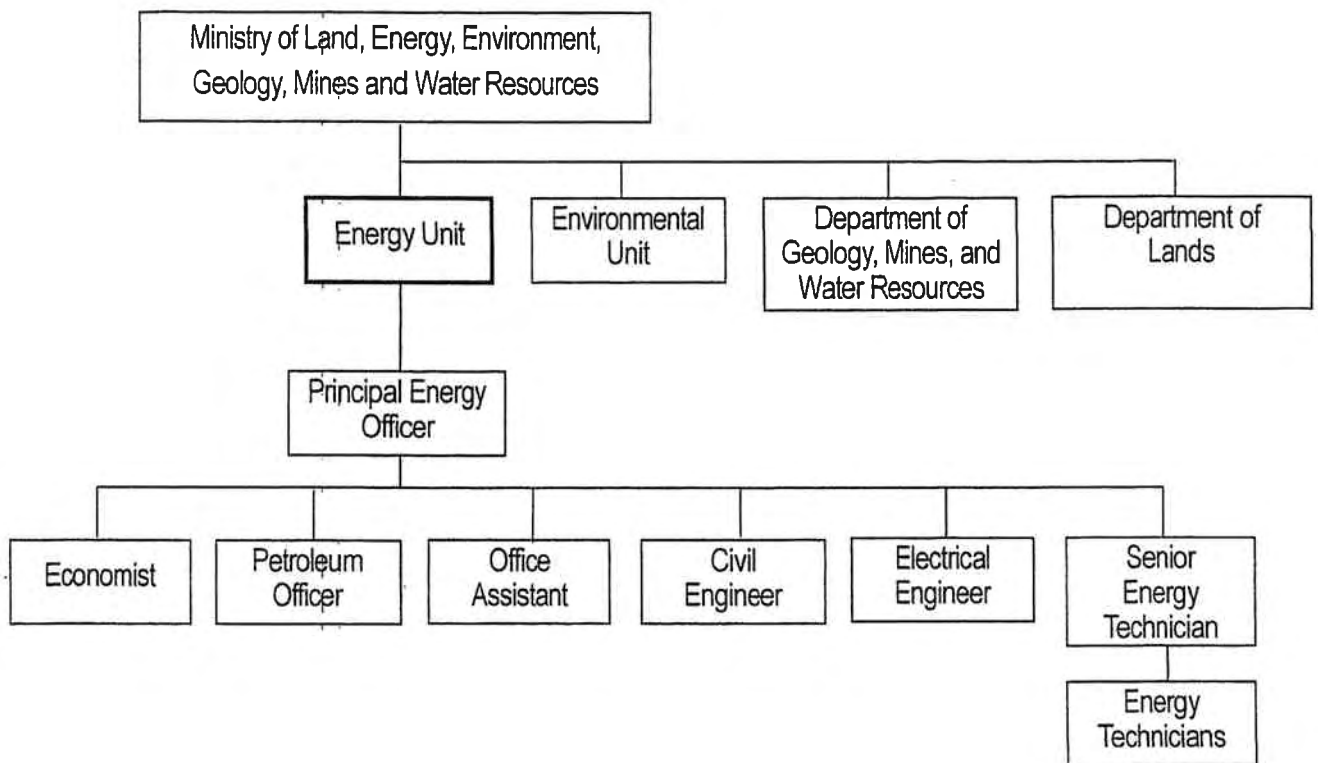


Project Site in Santo Island
The Republic of Vanuatu

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Organization

Ministry of Land, Energy, Environment, Geology, Mines and Water Resources



Components Requested by the Government of Vanuatu

A. Civil Work

- (1) **Landslide protection for canal between intake gate to head tank.** _____ one (1) lot
① Intake gate area (approx. 100 m), ② Middle area (approx. 200 m), ③ Head tank area (approx. 50 m)
- (2) **Steel penstock pipe installation.** _____ one (1) lot
Max. 1,200 mm Diameter
- (3) **Extension of power house building.** _____ one (1) lot
Approx. 10 m with Overhead Rail for Chain Block.
- (4) **Arrangement of tailrace area and rehabilitation of access road (approx. 150 m) to the hydro power station.** _____ one (1) lot

B. Generating Equipment

- (1) **Hydraulic Turbine.** _____ one (1) set
Type of Turbine: Horizontal Francis
Max. Output: Not less than 660 kW
Head: 27.3 m
Quantity of Water Flow: 2.9 m³/sec
Speed: 500 rpm
- Inlet Valve : 1,200 ϕ or less, Butterfly Type, Motor operated with connection Pipe to Turbine
 - Electric Governor with PMG
 - Motor operated Servo-motor and accessories
- (2) **Synchronous Generator.** _____ one (1) set
Horizontal air cooled type, 3.3 kV, 50 Hz, 750 kVA, 500 rpm, 12 poles, pf 0.8
- Brush less AC Exciter
 - Automatic Voltage Regulator
 - Flywheel with sufficient GD² for stabilized operation in isolated operating condition
 - 3.3 kV cables etc.
- (3) **3.3kV Switchgear and panels.** _____ one (1) lot
- Main Control Panel with meters and control switches
 - Protection Relay Panel
 - Vacuum Circuit Breaker (VCB), 3.5 kV, 600 A, Surge absorber, Cubicle
 - PCT and Disconnecting Switch Cubicle



(4) Station Service Transformer. _____ one (1) set
3.3 kV/380 V, 220 V, Approximately 50 kVA

(5) DC Battery and Battery Charger. _____ one (1) set
DC 110 V

(6) Main Step-up Transformer. _____ one (1) set
3.3/20 kV, 750 kVA, 3 phase 50 Hz, Outdoor Type

(7) 20kV Circuit Breaker Cubicle. _____ one (1) set
24 kV, 600 A
• PCT protection relays and meters
• Lightning Arrestors
• 20 kV Cables and accessories

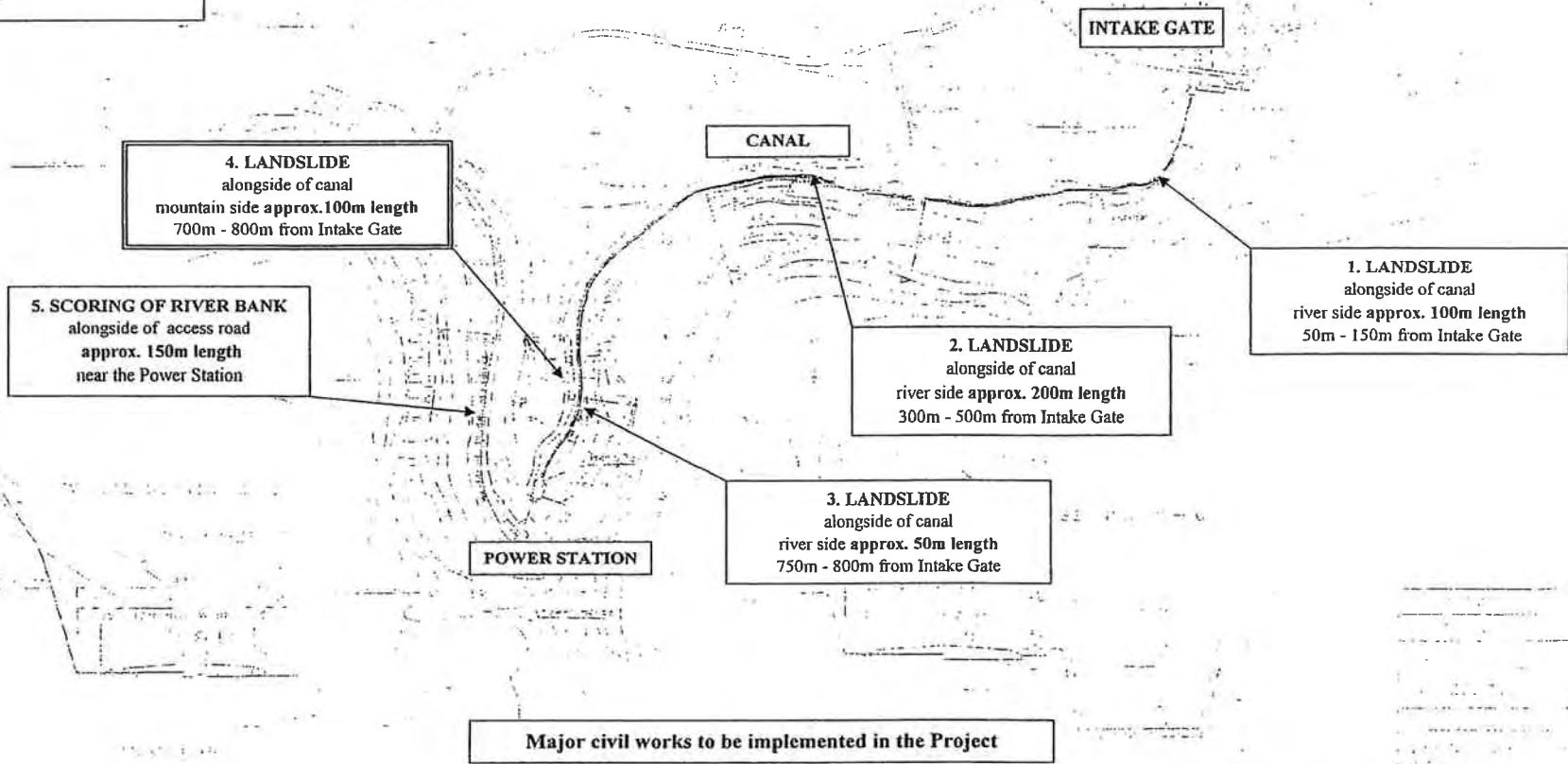
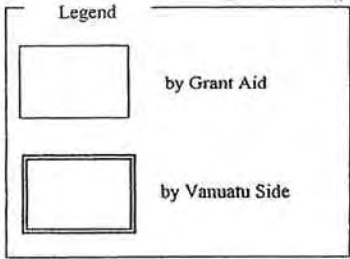
C. Substation Equipment

(1) Step-down Transformer. _____ one (1) set
20 kV/5.5 kV, 1,500 kVA, 3 phase 50 Hz, Outdoor Type
• Onload Tap Changer on low voltage side
• Arrestors and Protections devices
• 20 kV, 5.5 kV Cables and accessories

D. Tools and Spare Parts

(1) Tools for Item B and C. _____ one (1) lot
Mechanical and Electrical tools for operation and maintenance

(2) Spare Parts for Item B and C. _____ one (1) lot



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JAPAN'S GRANT AID SCHEME

The Grant Aid Scheme provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

Japan's Grant Aid Scheme is executed through the following procedures.

Application	(Request made by the recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by the Cabinet)
Determination of	(The Note exchanged between the Governments of Japan and
Implementation	recipient country)

Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study) using (a) Japanese consulting firm(s).

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Scheme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes (E/N) signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

(1) Contents of the study

The aim of the Basic Design Study (hereafter referred to as "the Study") conducted by JICA on a requested project (hereafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view.
- Confirmation of items agreed on by both parties concerning the basic concept of the Project.

- Preparation of a basic design of the Project.
- Estimation of costs of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of the Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA. The consultant firm(s) used for the Study is(are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

3. Japan's Grant Aid Scheme

(1) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

(2) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed. However, in case of delays in delivery, installation or construction due to unforeseen factors such as national disaster, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

(3) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, consulting, constructing and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(4) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(5) Undertakings required of the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as the following:



- a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction,
- b) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,
- c) To secure buildings prior to the procurement in case the installation of the equipment,
- d) To ensure all the expenses and prompt excursion for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid,
- e) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,
- f) To accord Japanese nationals, whose services may be required in connection with the supply of the products and services under the Verified contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(6) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(7) "Re-export"

The products purchased under the Grant Aid should not be re-exported from the recipient country.

(8) Banking Arrangements (B/A)

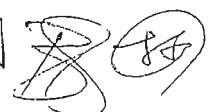
a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

(end)

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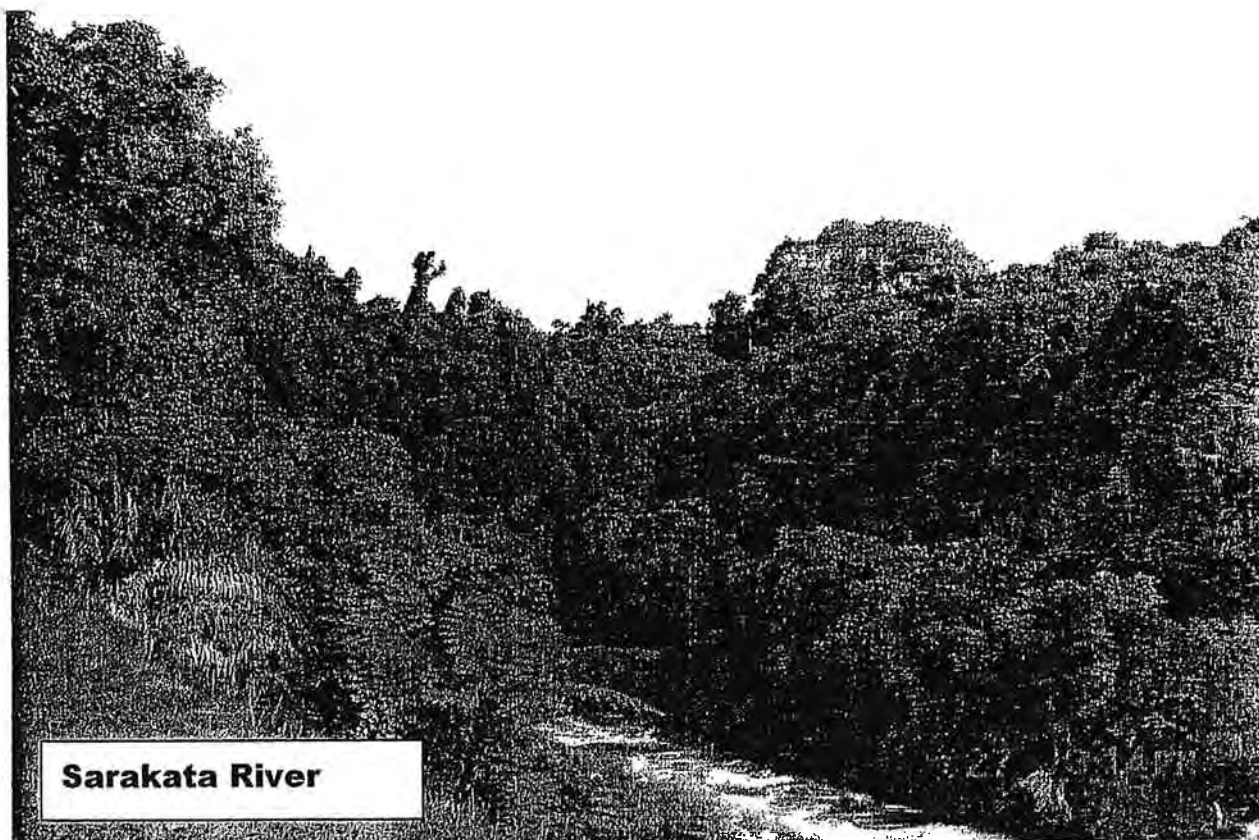
Major Undertaking to be Taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure land		●
2	To clear, level and reclaim the site when needed		●
3	To construct gates and fences in and around the site		●
4	To construct the parking lot	●	
5	To construct temporary roads		
	1) Within the site	●	
	2) Outside the site		●
6	To bear the following commissions to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
7	To ensure unloading and customs clearance at port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient country	●	
	2) Tax exemption and customs clearance of the products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	●	
8	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.		●
9	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imported in the recipient country with respect to the supply of the products and services under the verified contract.		●
10	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		●
11	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment		●

(B/A: Banking Arrangement, A/P: Authorization to Pay)

UPDATE REPORT

PROGRESS ON ACQUISITION OF THE LAND OCCUPIED BY THE SARAKATA HYDRO POWER PROJECT



Sarakata River

Ministry of Lands & Natural Resources

Port Vila

GOVERNMENT OF THE REPUBLIC OF VANUATU

Phone: (678) 25201

Fax: (678) 23586

Date:

03rd July 2006

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1.0 BACKGROUND

This updated report provides in brief the latest information regarding the Government of Vanuatu's progress in resolving the land issues on the land on which the Sarakata Hydropower Project is occupying.

Sarakata Hydropower Facility which is a nationally owned asset has been in operation for over ten years. It began commercial operation after Stage One and Stage Two were completed in 1995 and providing 55 - 70% of electricity to Luganville Concession area. The initial intention is for the third turbine to be installed after some years in operation which will increase the power output capacity of the facility. From July to August of 2004 a Preparatory Study Team from the Government of Japan upon request from the Government of Vanuatu was dispatched to Vanuatu on a mission to assess all aspects of the project in preparation for the Third Stage. The team identified certain areas which are later the responsibility of the Government of Vanuatu through the Technical Advisory Group (TAG) to attend to. One of these areas included the resolving of land issues.

The Government of Vanuatu through TAG has been in consultation with relevant authorities including the State Law Office, Valuation Unit, Land Tribunal Office, Department of Lands, Survey Department, the Manager of PRV and Custom Land Owners in preparation for legally securing the hydro occupied land.


2.0 COOPERATION WITH THE GOVERNMENT OF JAPAN

The Sarakata Hydropower Project was the outcome of the Government of Vanuatu's progress in response to its policy in achieving a self-supporting economy, through the upgrading and expansion of the energy sector. Funding for the development of the first and second stages came from the Government of Japan following request from the Government of Vanuatu.

In response to the Government of Vanuatu's request for further assistance for the development of the third stage, a study team (JICA) from the Government of Japan was sent to the site to undertake necessary studies. Upon signing of the Minutes of Discussions, it became the responsibility of the Government of Vanuatu through the TAG that all preparatory works were to proceed within a five month period. However the Government of Vanuatu had experienced a period of political instability from September of 2004 which later resulted in the formation of a new government in January of 2005. The newly appointed Minister later approved the TAG's working budget in early 2005, which means that only then allowing works to begin.

3.0 DESCRIPTION OF THE HYDRO PROJECT OCCUPIED LAND

The Sarakata Hydropower Project occupies a total of 24.60 ha of land. 5.97 ha of which is part of PRV existing leased land whilst the other 18.63 ha is still owned by Custom Land Owners. The land is located some 15 km from Luganville town. The land is described as undulation land and mostly covered with bush.

RW
SP


In preparation for the Third Stage, it is the intention of the Government of Vanuatu to legally acquire compulsory acquisition of the land. This means that Government will compensate the Custom Land Owners and declared the land to become State Land. However, after numerous negotiations with the Custom Land Owners, it is finally agreed that Government will have to pay compensation to the Custom Land Owners and to have a lease on the land for a period of 75 years.

4.0 GOVERNMENT OF VANUATU TO LEASE 24.60 HECTARES OF SAKATA HYDROPOWER OCCUPIED LAND

The delay to have a proper lease on the Sarakata Hydropower occupied land was due mainly to the ownership disputes between the Custom Land Owners. The dispute is not with the Government of Vanuatu on compensation issues but mainly between these Land Owners on customary ownership.

Government does not wish to entangle itself with the Land Owners' disputes. Therefore, the dispute was left to the Land Owners to solve by themselves through the Land Tribunal process. Government comes in only to facilitate where required but is not directly involve.

Because of the lengthy Land Tribunal process to come to a final solution of identifying the true Custom Land Owners, it is necessary that the Government sign a lease on behalf of the Custom Land Owners while the Land Tribunal continues with its processes. This lease will have the same legal effect as other leases except that Government is managing the lease on behalf of the Custom Land Owners for the period of time until the true Land owner is identified. The Custom Owners do not loose their rights when the Government signs on their behalf. Once the Land Tribunal has finally completed its process and the true Land Owners have been identified, Government will then rectify the lease with the true Custom Land Owners and detail negotiations will take place on compensation value, lease rent rate and other lease conditions.

5.0 SUMMARY OF ACTIVITIES UNDERTAKEN

Below is the summary of the activities undertaken by the Government following its decision to lease the land:

Activity	Progress Made
Official registration of boundary dispute of the 5.97 ha	On 17 th May 2005, Mr. Joseph Tangis has officially registered the land boundary dispute of the 5.97 ha. As of the date of this report, there is no date given yet for the Village Land Tribunal to hold its meeting.
Land Tribunal 21 days Notice for the 18.63 ha of the Hydro occupied land	21 days Notice has been served on 16 th June 2005. This Notice ended on 7 th July 2005
Public Notice of the names of Village Land Tribunal Judges to preside over the meeting on the 18.63 ha	This Public Notice was put out sometimes in August 2005. This was done to allow any person that does not agree with any of the Judges must register his disagreement by 1 st September 2005.

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	This Public Notice also gives the date for the Village Land Tribunal to convene its meeting. The date given by this Notice was 5 th September 2005.
Duration of the Village Land Tribunal Meeting	This meeting commenced on 5 th September 2005 and continued on until 8 th September 2005
Decision of the Village Land Tribunal Judges on the Custom Land Owner of the 18.63 ha	<p>After the four (4) days meeting to identify the Land Owner of the 18.63 ha, the Village Land Tribunal took its decision on 4th October 2005.</p> <p>The Village Land Tribunal identified that Mr. Ben Sive Tosu, Daniel Loi and Thomas Toaserekite are the Land Owners of the 18.63 ha.</p> <p>Mr. Daniel Loi does not agree with the decision therefore lodge an appeal to the Area Land Tribunal.</p> <p>As of the date of this report, there is no date given yet for the Area Land Tribunal to hold its meeting.</p>
Compensation of 2,422,500 Vatu to PRV as loss of income during the past 11 years	<p>On 21st September 2005, the Minister of Lands has given his approval for the Government to compensate PRV.</p> <p>PRV has already been informed of this decision and they have indicated that they accepted the value given as 2,422,500 Vatu.</p>
Instruction to complete lease process for both 5.97 ha and 18.63 ha by November 2005	On 18 th October 2005, the Director General of the Ministry of Lands issued an instruction to Director of Lands, Director of Lands Record, Acting Director of Lands Survey & Principal Valuation Officer to immediately collaborate and cooperate in processing a lease for the Minister to sign on behalf of the Land Owners.
Lease processing - Notice to hold first meeting in processing the necessary works for the lease	<p>On 19th October 2005, the Director of Lands sent out a letter to hold the first meeting for the following agencies:</p> <p>Lands Survey Department State Law Office Finance Department Valuation Office Department of Economic & Sector Planning Energy Unit</p>
Lease processing - First meeting on lease processing	<p>The relevant agencies held their meeting on 24th October 2005 and agreed on the following:</p> <ul style="list-style-type: none"> - Because there is dispute on both parcels of land occupied by the hydropower project, the Minister of Lands is to sign a lease on behalf of the Custom Land Owners. - The Lands Survey Section in Luganville must fix their broken down computer as soon as possible in order to complete the survey plan. - Lands Survey Section in Luganville is to send the survey plan of the occupied land to Vila by week 24 – 28th October 2005.

	<ul style="list-style-type: none"> - Valuation office is to use the survey plan to assess value of the 18.63 ha. - Heads of Lands Department, Valuation Office, Lands Tribunal Office and Energy Unit are to travel to Luganville on 28th October 2005, to hold meetings with all Custom Land Owners
Lease processing - Second meeting on lease processing	<p>The second meeting of the lease processing group was held on 26th October 2005 and informed of the following:</p> <ul style="list-style-type: none"> - Lands Survey Section in Luganville has received a new computer on Monday 24th October. - The new computer was installed on Tuesday 25th October 2005. - Trip for Heads of relevant Agencies to Luganville was postponed to afternoon of Monday 31st October due to the Port Vila Municipal election. - Lands Officer-in-Charge in Luganville is to arrange meetings with all Custom Land Owners & Claimants on Tuesday 1st November 2005 at 9:00 am for the 5.97 ha and at 2:00 pm for the 18.63 ha.
Lease processing – Meeting with Custom Land Owners of 5.97 ha	<p>On Tuesday 1st November 2005 at 9:00 am, meeting was held with all the Custom Land Owners of the 5.97 ha. All the Land Owners present have unanimously agreed that the Minister of Lands can sign a lease on their behalf while they are continuing with the Land Tribunal process to identify their individual land boundaries.</p> <p>The conditions that they want to see included in the lease document have been noted down in a document and signed. These conditions are normal land lease practices that will be included in the lease document.</p>
Lease processing – meeting with Custom Land Claimants of 18.63 ha	<p>This meeting was not being able to be held due to the fact that some of the claimants have not received the Notice to meet on 1st November 2005 at 2:00 pm. Therefore the meeting was postponed to 2nd of November 2005 at 9:00 am.</p> <p>On 2nd of November 2005 all land claimants of the 13.9 ha attended the meeting and all have unanimously agreed for the Minister of Lands to a lease on their behalf while they are continuing with the Land Tribunal process to identify the true Custom Land Owners.</p> <p>The conditions that they want to see included in the lease document have been noted down in a document and signed. These conditions are normal land lease practices that will be included in the lease document.</p>
Survey Works	<p>The Survey Department in Luganville was instructed by the Acting Director of Survey on 7th July 2005, to commence the required survey works on the land as a priority task. This survey will include:</p> <ul style="list-style-type: none"> - The parcel of land inside PRV lease which is 5.97 ha - The parcel of land in the customary side which is 18.63 ha - The PRV lease showing the easement for the access road - The bridge crossing the river

	The survey works have been fully completed on 8 th October 2005 and sent to Vila on the same date.
Lease processing – Preparation of new Land Leases for the Hydropower Project	As of the date of this report, the Department of Lands has prepared all the appropriate lease documents for the Sarakata Hydropower Project land. The land lease title now given to the project areas are: - Title No: 04/2613/002 for the 5.97 ha parcel of land - Title No: 04/2613/004 for the 18.63 ha parcel of land
Leasing processing – Signing of the lease for the Sarakata Hydropower Project occupied land	There is no set date yet for the Minister of Lands to sign the leases for the lands occupied by the Sarakata Hydropower Project. However, the main difficult parts of the lease processing have been done.
Lease processing – Preparation of new Land Lease for PRV	The new PRV lease has also been prepared and ready for signing. The Title No: given to PRV lease is 04/2613/003.
Compensation Fund	The Council of Ministers has officially approved on 22 nd of June 2006 a 20 million Vatu that will be used to pay for the hydro land compensations.
Total Value of Compensation to PRV	The updated value of compensation to be paid to PRV is as follows: - 2,610,000 Vatu being for loss of income for occupation of 5.97 ha of their land for 12 years. Please note here that it is not 2,422,500 Vatu as mentioned above. This 2,422,500 Vatu is for last year 2005. This year the compensation value has increased to 2,610,000 Vatu. - 3,582,000 Vatu being for transfer value.
Total value of Compensation to Custom Owners for 18.63 ha	The exact value of compensation has yet to be decided between the rightful land owner and the Government. The rightful land owner will be identified by the Land Courts. The present value of the land stands at 9,318,000 Vatu. Upon signing the lease document for this parcel of land (18.63 ha), 931,800 Vatu will have to be as a premium to the Custom Owners Trust Account within the Ministry of Finance.

6.0 CONCLUSION

As mentioned in the first and second progress reports, issues relating to land can take quite some time to solve. This is because in Vanuatu, land is regarded as part of life. Even if a family does not have a regular income, they can still live and enjoy life on the piece of land they own. Land holds the identity of a family and their customary inheritance is associated with their land.

The Government of Vanuatu has done its very best to solve the land occupied by the Hydropower Project in a satisfactory manner whereby all parties concern are happy. Even though it has taken quite long, fruitful achievements has been made which saw the disputing Land Owners finally gave their consent for the Minister to sign the lease on their behalf. The disputing Land Owners too gave the Government on 2nd November 2005, their assurance that they will also assist to make certain that there is security to the Hydropower Project. In fact they have requested that their assurance for security be noted down in the lease conditions.

The Government through the Technical Advisory Group is happy with the achievements made so far and is confident that the Sarakata Hydropower Project will continue to operate smoothly without any fear of land disturbance.

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Department of
 Lands,
 Survey and Records
 PMB 9090
 Port Vila



REPUBLIQUE DE VANUATU

Island Ile **SANTO**

Title Titre **04/2613/002**

Name of Property.....
 Nom de la propriété

Area Superficie **18ha 63a 72cn**

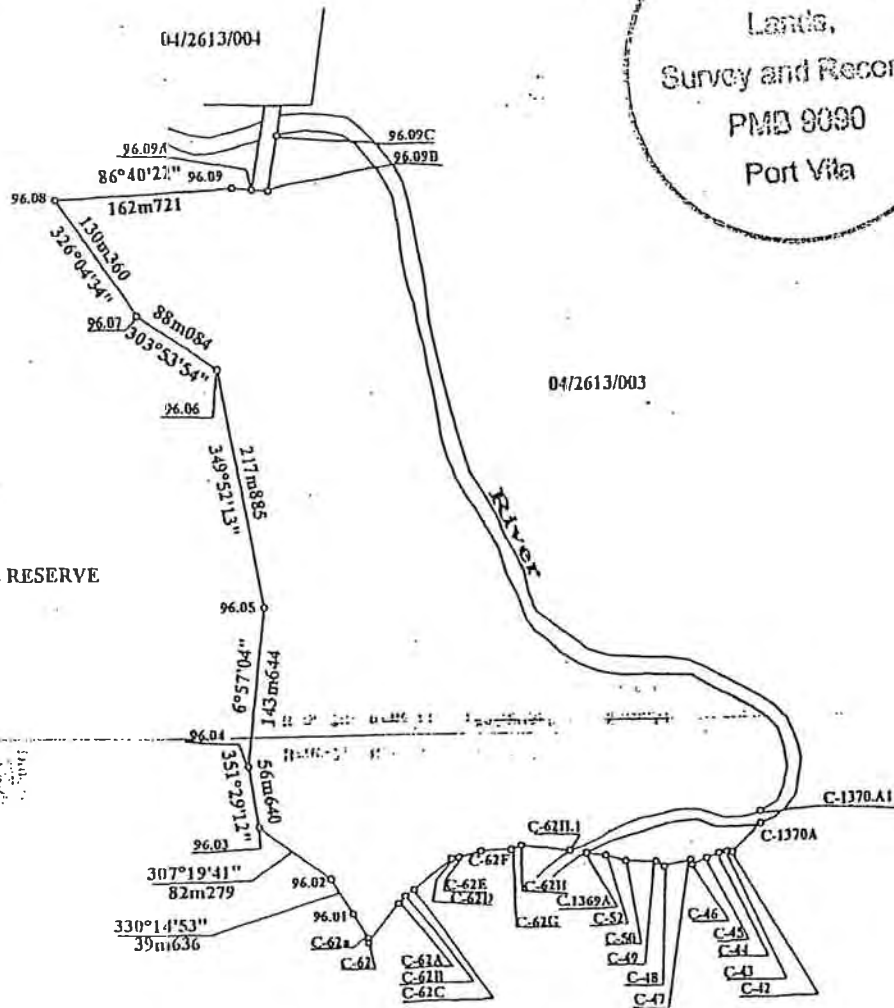
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 Department of Lands, Survey
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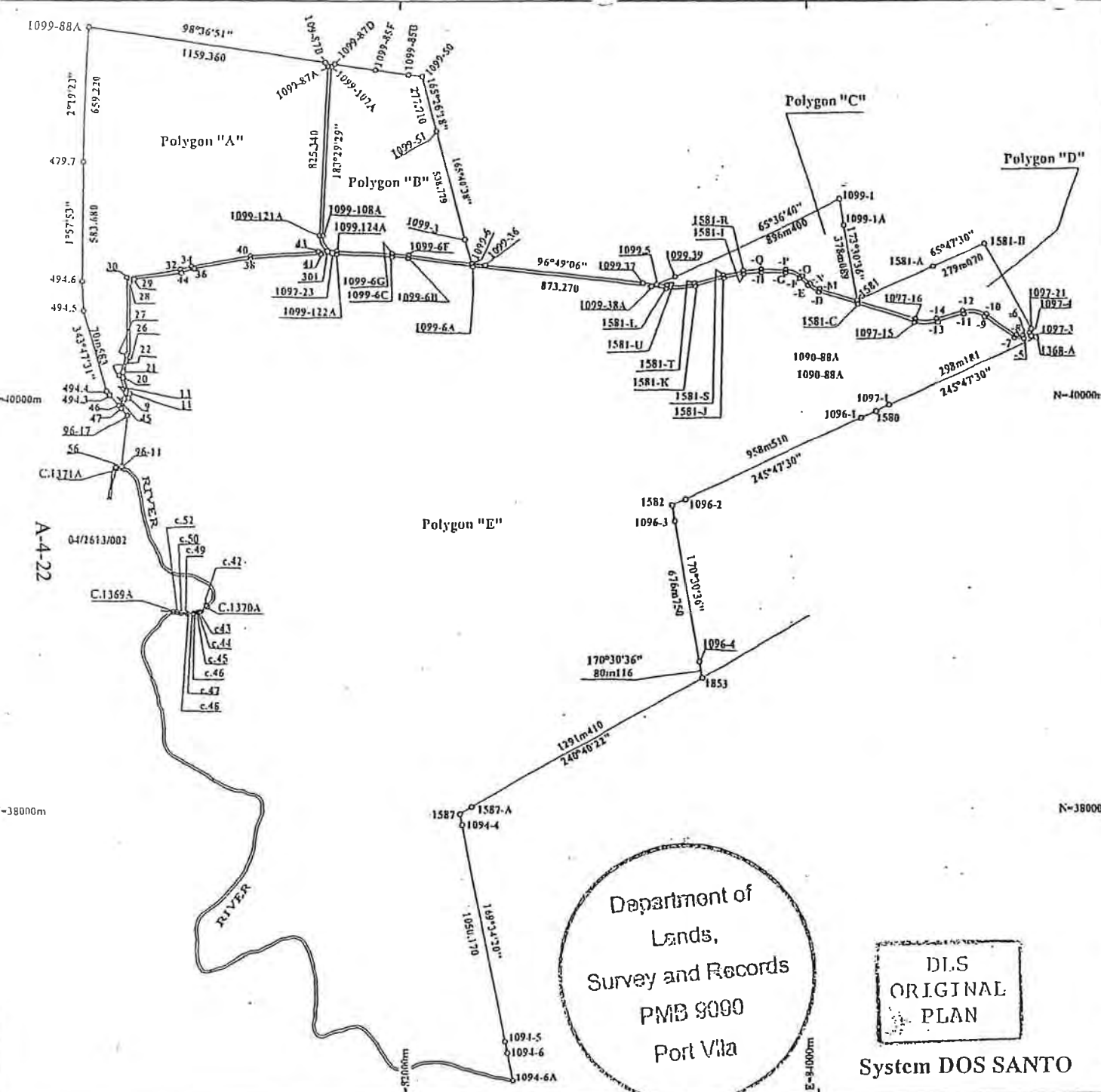
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REPUBLIC OF VANUATU



REPUBLIQUE DE VANUATU

SANTO

Island Ile

04/2613/003

Title Titre

Name of Property
Nom de la propriété

Area Superficie 1086ha 40a 59ca

REPUBLIC OF VANUATU
Department of Lands Survey
Director of Lands Survey & Records

Department of
Lands,
Survey and Records
PMB 8000
Port Vila

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REPUBLIQUE DE VANUATU

SANTO

Island De

04/2613/004

Title Titre

Name of Property

Nom de la propriété

Area Superficie 05ha 97a 32ca

REPUBLIC OF VANUATU
Department of Lands, Survey
Director of Lands, Survey & Records

Scale 1/5,000
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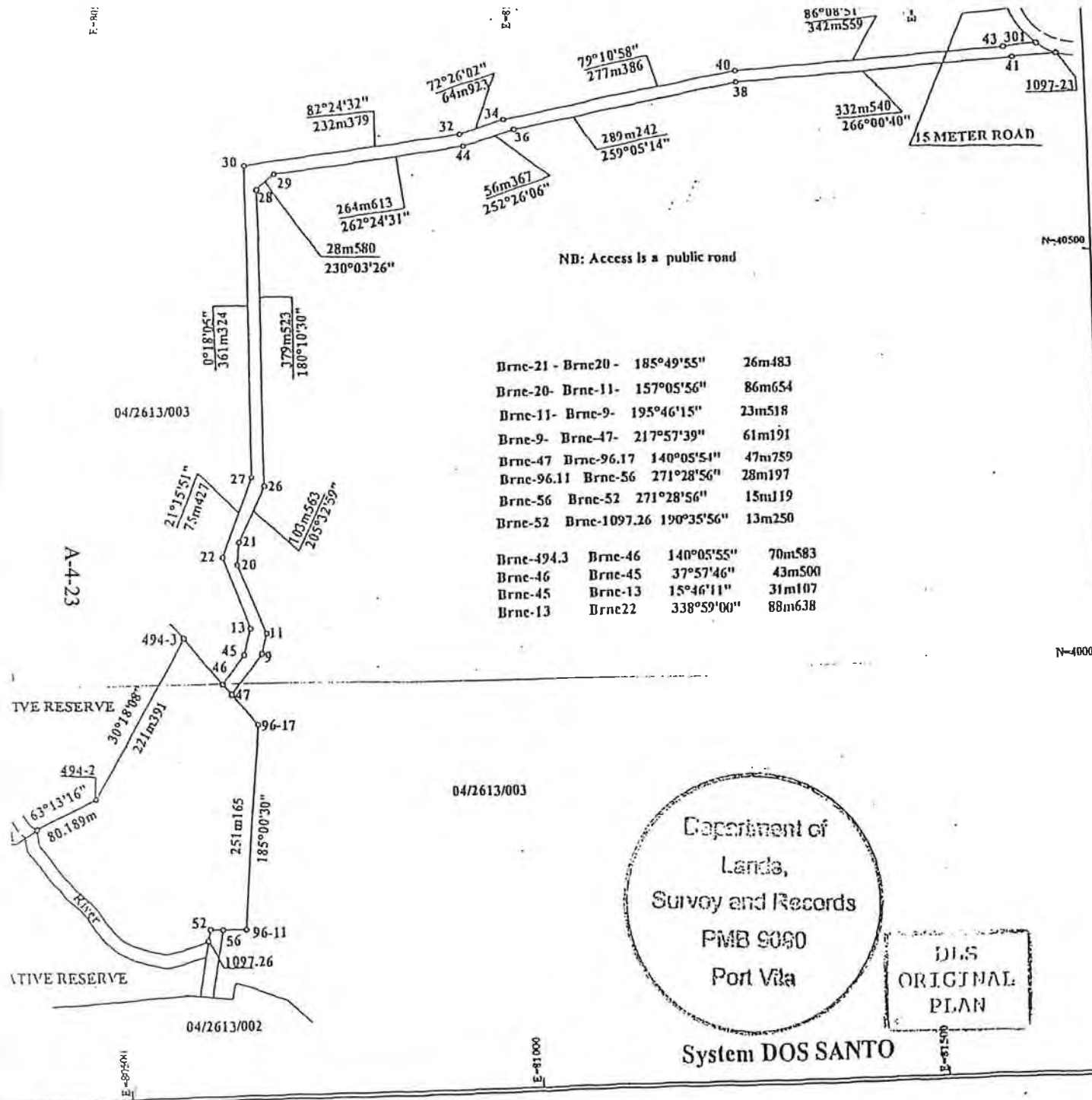
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Department of
Lands,
Survey and Records
PMB 9060
Port Vila

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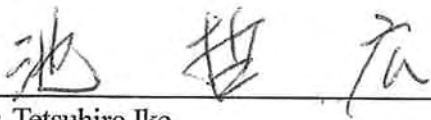
Minutes of Discussions
on the Basic Design Study on
the Project for Improvement of Power Generation
in Sarakata River Hydroelectric Power Station
in the Republic of Vanuatu
(Explanation on the Draft Report)

In June to July, 2006, the Japan International Cooperation Agency (hereinafter referred to as “JICA”) dispatched a Basic Design Study Team on the Project for Improvement of Power Generation in Sarakata River Hydroelectric Power Station (hereinafter referred to as “the Project”) to the Republic of Vanuatu (hereinafter referred to as “Vanuatu”) and through discussion, field survey, and technical examination of the results in Japan, JICA prepared a draft report of the study.

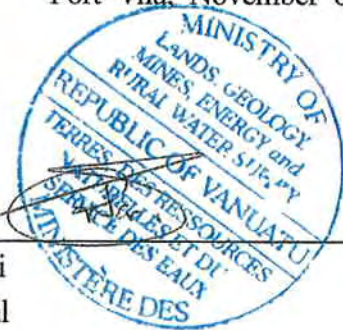
In order to explain and consult the Government of Vanuatu on the components of the draft report, JICA sent to Vanuatu the Draft Report Explanation Team (hereinafter referred to as “the Team”), which is headed by Mr. Tetsuhiro Ike, Deputy Resident Representative of the JICA Regional Support Office for Oceania and is scheduled to stay in the country from October 30 to November 7, 2006.

As a result of discussions, both sides have confirmed the main items described in the attached sheets.


Port Vila, November 6, 2006



Mr. Tetsuhiro Ike
Deputy Resident Representative
JICA Regional Support Office for Oceania



Mr. Russell Nari
Director General
Ministry of Lands, Energy, Environment,
Geology, Mines & Water Resources
The Republic of Vanuatu



Mr. Simeon Athy
Director General
Ministry of Finance and Economic Management
The Republic of Vanuatu



ATTACHMENT

1. Components of the Draft Report

The Vanuatu side agreed and accepted in principle the components of the Draft Report explained by the Team.

2. Schedule of the Study

JICA will complete the Final Report in accordance with the confirmed items and send it to the Vanuatu side around January 2007.

3. Other Relevant Issues

(1) The Vanuatu side submitted the monitoring results for flow volume of the Sarakata River during the dry season in 2006 to the Team. Both sides confirmed that the Sarakata River still has enough flow volume even in the dry season in the case of taking 6 m³/sec. of water, which is the rated water volume for 1,200 kW Hydraulic Turbine Generator (HTG).

(2) The Team explained to the Vanuatu side that the Project will be divided into two (2) phases according to the implementation stage as shown in the draft report.

- The phase I of the Project as an urgent rehabilitation will consist of countermeasures against landslides along the canal and against the scoring of riverbank alongside of access road near the entrance gate of the Sarakata River Hydroelectric Power Station.

- The phase II of the Project will consist of installation of additional 600 kW HTG and related equipment, auxiliary, tools & spare parts, and civil works relating to the expansion of generation capacity.

(3) Both sides confirmed that one (1) set of the 20 kV Circuit Breaker Cubicle is excluded from the Project as the Team evaluated existing equipment installed by the Vanuatu side in 2005 to be convertible to the expansion of generating capacity.

(4) Both sides re-confirmed that the Vanuatu side should allocate necessary budget for undertakings to be done on a timely manner, based on the provisional amount shown in the draft report from fiscal year 2007 to 2010. Both sides also confirmed major undertakings to be done by the Vanuatu side for smooth implementation of the Project as per Annex-1.

(5) The Team requested to the Vanuatu side that the Vanuatu side should properly increase and manage the amount of the Sarakata Fund (including yearly savings from the hydropower) by setting up appropriate distribution ratio between the Government of Vanuatu and subcontracting company. The Vanuatu side agreed to submit annual report on the Sarakata Fund to the Embassy of Japan in Fiji and to JICA Vanuatu Office by the end of March each year.

(6) The Vanuatu side requested the Team that JICA provides training to Vanuatu side in Japan related to the Project as technical cooperation by JICA. The Vanuatu side understands that official request regarding training will be needed to be submitted to the Japanese side. The Vanuatu side should submit

the official request with the concrete contents of trainings in line with the Japanese official procedure (following Annual Survey on technical cooperation conducted by the Government of Japan in 2007).

As a result of further discussions and survey at the site, the following items were found and agreed to make modifications and additions to the Minutes of Discussion (M/D) signed on July 4, 2006.

- (1) The Vanuatu side recently installed a new 20 kV circuit breaker house (in 2005) by their own effort because of the damage caused by humidity and lightning strike on the previous 20 kV circuit breaker cubicle supplied under the last Project (1994-95), and that circuit breaker house has already been designed to connect one other 750 kVA Main Transformer for Unit-3. Therefore, the new 20 kV circuit breaker cubicle is deleted from the scope of supply in this Project, instead, a new transformer protection and connection panel including protection devices shall be added to the scope of this Project, and shall be installed at the prepared space adjacent to the existing same panel for Unit-1 and Unit-2.
 - The Vanuatu side shall adjust the taps of CT's (Current Transformers) and/or PT's (Potential Transformers) and re-adjust the taps of existing protection relays and meters for the 20 kV line protection in the new circuit breaker house.
- (2) The main step-up transformer for Unit-3 in this project shall be installed at the place of the existing damaged 20 kV circuit breaker cubicle after removal of the existing damaged cubicle.
 - The removal of the existing damaged cubicle shall be done by the Vanuatu side before the start of the installation work of the Project.
- (3) In the Sarakata substation, the Vanuatu side recently installed a new 20 kV circuit breaker house including 20 kV line protection system, and those systems have already been designed and prepared to protect the 20 kV transmission line, taking into consideration the addition of Unit-3.
 - Therefore, the Vanuatu side shall adjust the taps of CT's, PT's and relays to suit the protection of 20 kV transmission line with double rated current (1,500 kVA).
- (4) The soil excavated will come out at the implementation of the Project.
 - Therefore, the Vanuatu side shall prepare the disposal area for the soil.
- (5) Continuous maintenance works are required to ensure that the civil structures are safe in the long term.
 - Therefore, the Vanuatu side shall maintain the civil structures as follows.
 - To dredge the soil, sand and so on when they are collected in the drainage system.
 - To maintain and rehabilitate the slope surfaces in all the landslide protection areas when the

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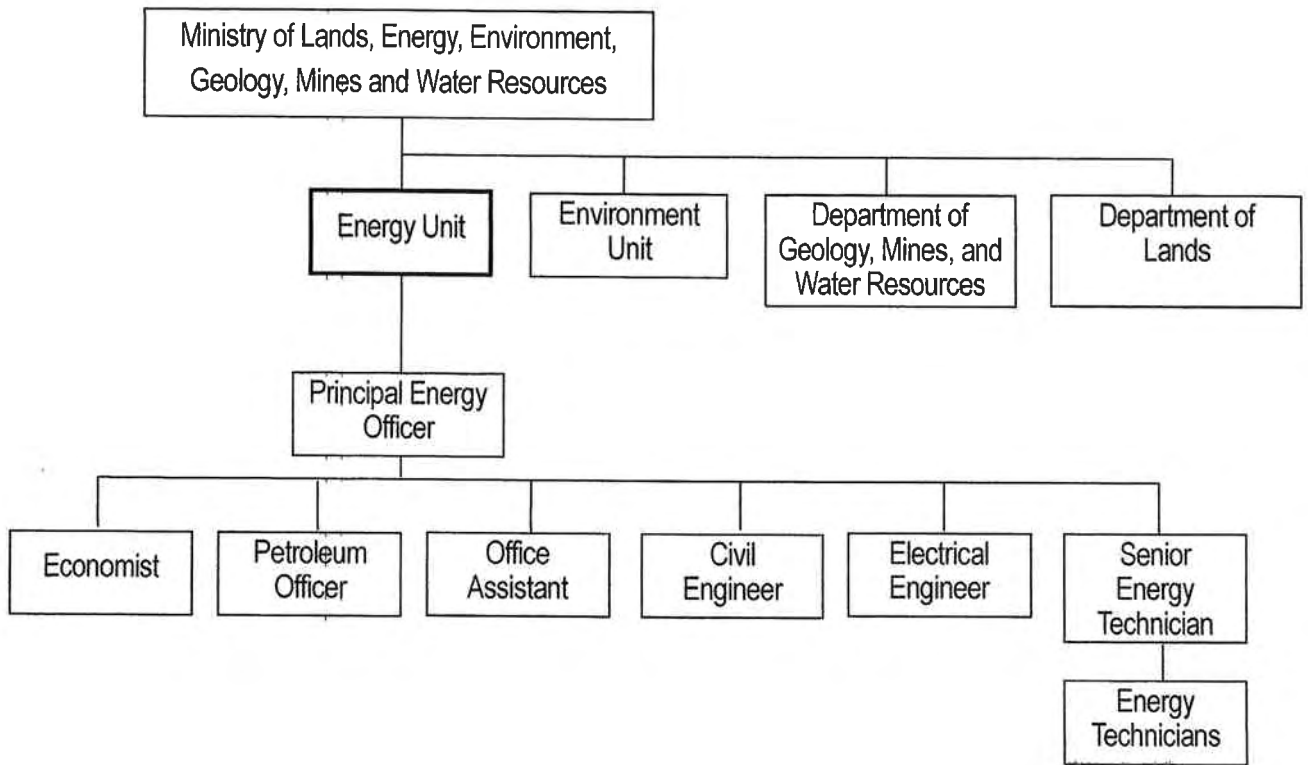
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loose sand, gravels and vegetation are found.

- (6) The maintenance works should be carried out by the Vanuatu side at least once a year on the hydro turbine and generator during the dry season as shown in the Basic Design Report.

Organization

Ministry of Lands, Energy, Environment, Geology, Mines and Water Resources



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APPENDIX 5

LIST OF ACQUIRED REFERENCE MATERIALS AND DATA

APPENDIX 5 LIST OF ACQUIRED REFERENCE MATERIALS AND DATA

Basic Design Study Report on The Project for Improvement of Power Generation in Sarakata River Hydroelectric Power Station in The Republic of Vanuatu

No.	Name	Form Book/Video/Map/ Photograph etc.	Original/Copy	Issue organization	Issue year
1	FISCAL STRATEGY REPORT BUDGET 2006	Book	Original	Government of The Republic of Vanuatu	2005
2	LAW of ENERGY SUPPLY	Book	Copy	Government of The Republic of Vanuatu	1972
3	LAW of SUUPLY of ELECTRICITY (DISTRICT)	Book	Copy	Government of The Republic of Vanuatu	1977 2000
4	ENVIRONMENTAL MANAGEMENT AND CONSERVATION ACT No.12 of 2003	Book	Original	Government of The Republic of Vanuatu	2002
5	Meteorological Records (Rainfall, Wind, Temperature, Cyclone)	Book	Copy	Vanuatu Meteorological Service	2006
6	Water Level Observation Data	Book	Copy	UNELCO	2006
7	QUATERLY ECONMIC REVIEW MARCH, JUNE, SEPTEMBER, DECEMBER, 2005	Book	Original	Reserve Bank of Vanuatu	2005
8	Annual Technical Report Electricity Year 2004	Book	Original	UNELCO	2004
9	LAW of EMPLOYMENT	Book	Copy	Government of The Republic of Vanuatu	1988
10	LAW of TRADE UNIONS	Book	Copy	Government of The Republic of Vanuatu	1988
11	LAW of TRADE DISPUTES	Book	Copy	Government of The Republic of Vanuatu	1988
12	NEW MINIMUM WAGE RATE	Book	Copy	Department of Labour, Government of The Republic of Vanuatu	2005
13	REPORT OF THE MONITORING/ MITIGATION ON SOCIAL AND ENVORONMENTAL CONSIDERATION ON THE SARAKATA HYDROPOWER PROJECT	Book	Original	Technical Advisory Group, MOL	2005
14	SLOPE STABILIZATION WORK FOR SARAKATA HYDRO LAND-CRAKS/ LANDSLIDES	Book	Original	Public Works Department	2005

APPENDIX 6

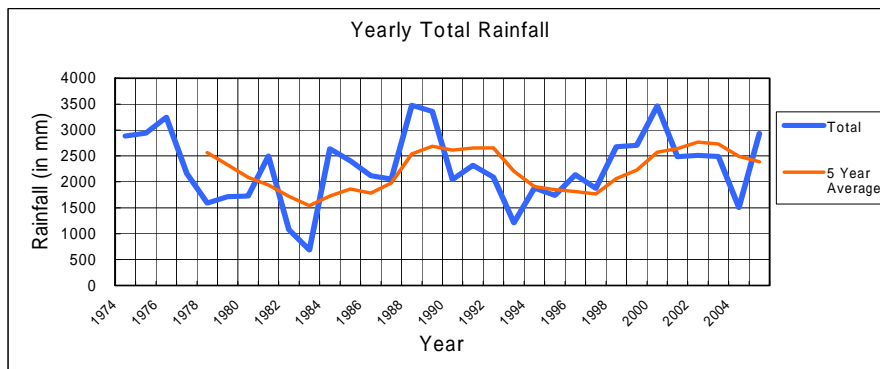
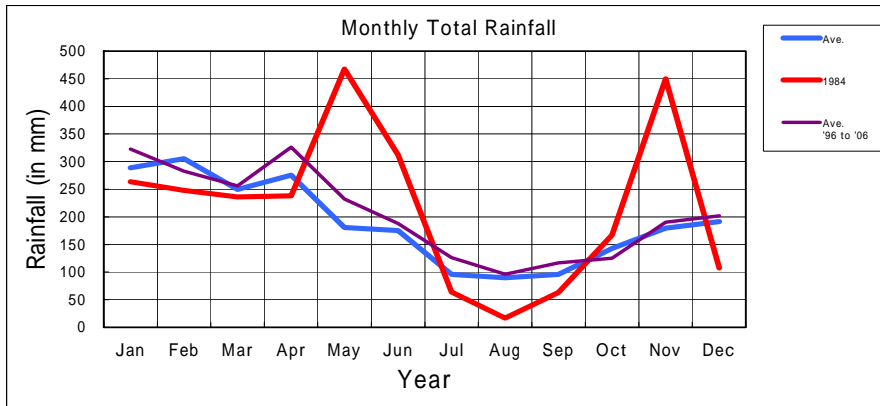
METEOROLOGICAL DATA (PEKOA AIRPORT, LUGANVILLE, SANTO ISLAND)

APPENDIX 6 METEOROLOGICAL DATA (PEKOA AIRPORT, LUGANVILLE, SANTO ISLAND)

(1) Rainfall (Pekoa Airport: January, 1974 – October, 2006)

Rainfall													in mm		
Season	Rainy Season				Dry Season					Rainy Season				Total	5 Year Ave.
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
1974	292.7	387.1	274.3	160.4	74.0	242.8	84.9	116.4	165.6	546.2	332.2	208.3	2,884.9	-	
1975	200.4	257.1	346.4	282.4	205.7	524.6	144.4	105.0	190.3	231.2	273.4	179.2	2,940.1	-	
1976	576.7	332.0	234.8	444.8	244.3	429.7	213.4	129.2	113.3	173.2	233.5	117.4	3,242.3	-	
1977	276.7	314.3	216.5	324.7	62.3	300.7	100.2	247.1	41.1	13.5	174.8	86.7	2,158.6	-	
1978	223.4	465.0	98.8	243.7	124.7	19.6	43.4	55.4	4.1	110.5	94.0	107.7	1,590.3	2,563.2	
1979	341.1	283.4	132.2	146.9	145.0	78.8	110.1	1.4	69.2	62.2	126.1	216.9	1,713.3	2,328.9	
1980	146.5	177.7	233.2	90.5	207.5	190.0	106.7	90.8	97.6	137.3	143.8	104.3	1,726.0	2,086.1	
1981	355.0	360.5	321.5	351.6	92.7	62.0	83.1	69.9	217.2	44.4	166.7	372.5	2,497.1	1,937.1	
1982	75.1	108.9	250.7	227.9	73.4	35.8	40.7	37.0	6.8	19.2	137.8	61.7	1,075.0	1,720.3	
1983	78.6	34.4	25.1	67.3	17.7	53.0	13.8	21.0	2.8	44.2	180.9	146.5	685.3	1,539.3	
1984	263.5	248.2	236.3	237.9	467.8	312.3	64.1	17.1	63.0	167.3	450.0	107.6	2,635.1	1,723.7	
1985	530.5	79.8	149.6	242.7	264.6	276.0	175.1	74.2	153.2	86.6	216.9	157.0	2,406.2	1,859.7	
1986	235.5	515.6	332.8	219.7	145.3	106.8	19.2	80.4	72.7	35.4	97.8	257.2	2,118.4	1,784.0	
1987	53.0	501.2	165.2	411.0	203.0	49.5	28.1	93.8	68.2	113.0	101.4	266.1	2,053.5	1,979.7	
1988	628.0	599.4	120.9	113.7	335.1	359.2	125.9	103.7	166.0	272.1	213.3	443.1	3,480.4	2,538.7	
1989	323.7	221.1	182.6	645.2	315.1	161.7	11.9	252.3	76.6	561.4	315.6	293.3	3,360.5	2,683.8	
1990	254.4	208.3	465.8	204.0	44.2	100.1	34.1	15.2	70.7	172.3	107.6	370.5	2,047.2	2,612.0	
1991	141.6	601.0	411.2	169.4	84.0	84.5	57.9	81.9	134.5	220.3	210.6	121.7	2,318.6	2,652.0	
1992	290.3	743.7	193.7	261.7	99.6	59.1	157.6	27.4	17.1	113.7	21.5	103.3	2,088.7	2,659.1	
1993	72.2	189.9	270.7	82.2	122.2	90.5	49.5	116.9	35.6	26.9	58.1	97.3	1,212.0	2,205.4	
1994	451.5	161.4	478.8	285.5	32.0	122.5	83.0	41.1	39.1	3.0	77.8	106.6	1,882.3	1,909.8	
1995	172.7	184.2	282.1	280.2	45.3	62.3	30.3	130.9	75.1	185.1	103.4	184.8	1,736.4	1,847.6	
1996	243.2	24.2	466.1	140.4	286.9	137.4	125.6	14.1	160.9	81.1	199.5	254.2	2,133.6	1,810.6	
1997	338.9	163.4	276.7	271.3	334.4	91.0	104.3	44.0	9.4	18.6	59.8	158.9	1,870.7	1,767.0	
1998	287.9	272.6	384.3	346.6	207.6	256.5	59.5	61.1	177.5	133.3	146.3	343.6	2,676.8	2,060.0	
1999	489.8	397.4	167.1	185.9	271.4	15.3	166.1	178.1	182.6	91.9	195.5	364.3	2,705.4	2,224.6	
2000	417.7	155.6	397.8	525.4	113.1	187.6	165.6	184.2	203.6	398.3	353.2	365.7	3,467.8	2,570.9	
2001	295.2	472.3	179.5	309.7	132.3	246.5	200.6	52.1	172.3	96.0	253.8	75.3	2,485.6	2,641.3	
2002	188.3	378.9	193.2	376.8	262.4	330.5	187.1	62.9	151.7	139.7	198.9	38.3	2,508.7	2,768.9	
2003	368.3	225.8	104.0	161.1	292.3	523.9	115.1	6.1	7.8	185.9	336.9	163.5	2,490.7	2,731.6	
2004	113.1	306.8	168.6	112.8	48.7	100.9	149.6	159.6	88.1	131.7	20.3	103.8	1,504.0	2,491.4	
2005	509.3	374.8	198.9	949.9	225.3	112.7	99.7	58.7	72.4	41.1	139.2	149.9	2,931.9	2,384.2	
2006	298.1	337.8	283.2	211.0	380.3	65.0	17.3	237.5	57.8	59.6			-	-	
Ave.	288.9	305.6	249.8	275.3	180.6	175.4	96.0	89.9	95.9	142.9	179.4	191.5	2,269.6	-	
Max.	628.0	743.7	478.8	949.9	467.8	524.6	213.4	252.3	217.2	561.4	450.0	443.1	3,480.4	-	
Min.	53.0	24.2	25.1	67.3	17.7	15.3	11.9	1.4	2.8	3.0	20.3	38.3	685.3	-	
Ave. '96 to '06	322.7	282.7	256.3	326.4	232.2	187.9	126.4	96.2	116.7	125.2	190.3	201.8	2,477.5	-	

Over 500mm

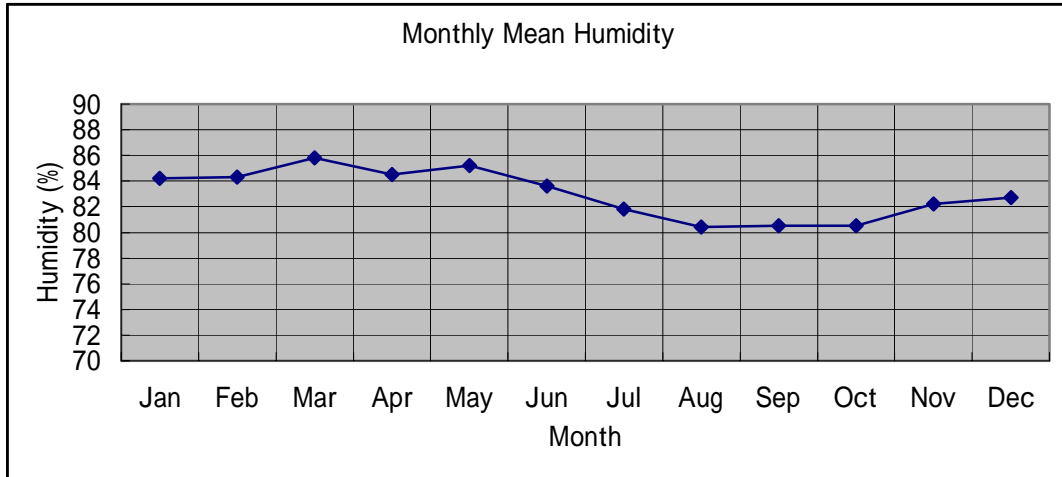


Source: Vanuatu Meteorological Service

(2) Mean Monthly Humidity (Pekoa Airport: January, 1995 – March, 2006)

(in %)

Season	Rainy Season				Dry Season						Rainy Season		
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
Ave.	84.2	84.3	85.8	84.5	85.2	83.6	81.8	80.4	80.5	80.5	82.2	82.7	83.0

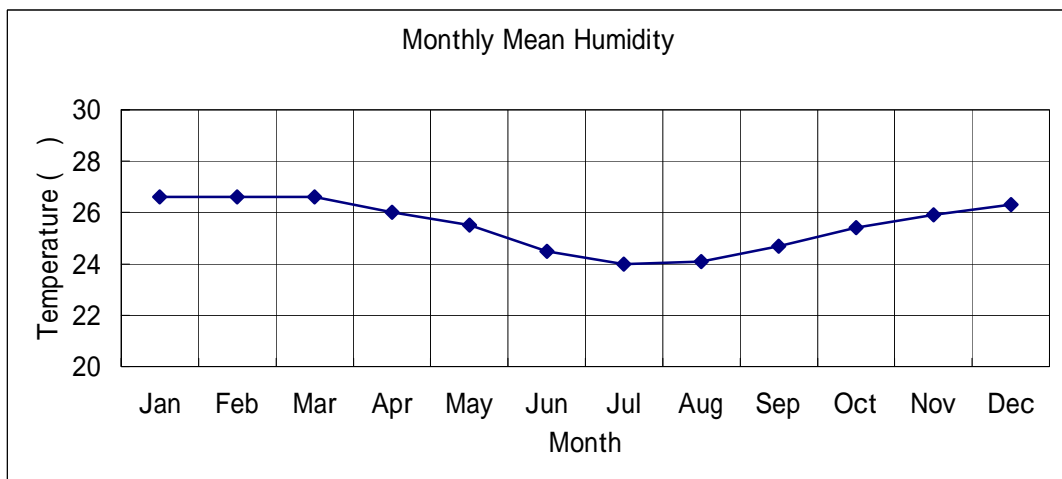


Source: Vanuatu Meteorological Service

(3) Mean Monthly Temperature (Pekoa Airport: January, 1995 – March, 2006)

(in °C)

Season	Rainy Season				Dry Season						Rainy Season		
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
Ave.	26.6	26.6	26.6	26.0	25.5	24.5	24.0	24.1	24.7	25.4	25.9	26.3	25.5

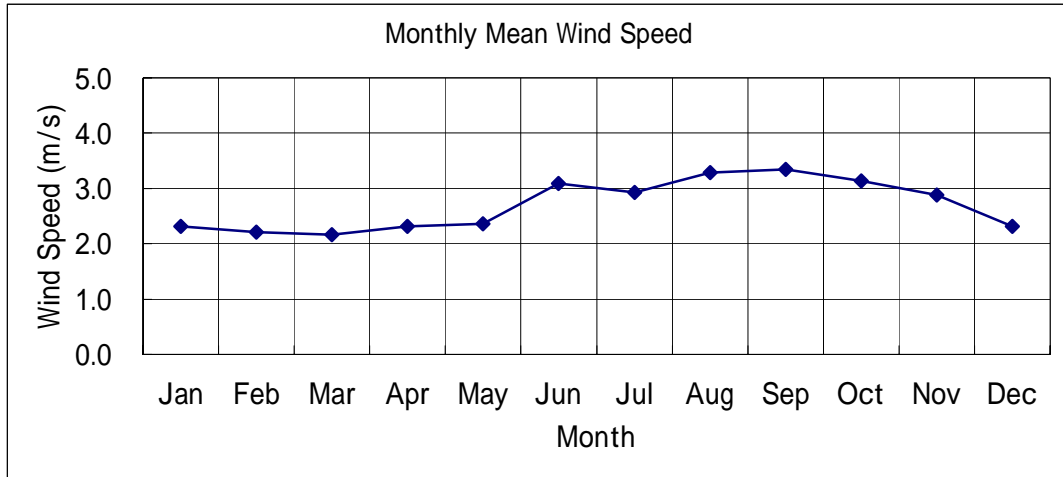


Source: Vanuatu Meteorological Service

(4) Mean Monthly Wind Velocity (Pekoa Airport: January, 1995 – March, 2006)

(in m/s)

Season	Rainy Season				Dry Season						Rainy Season		
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
Ave.	2.3	2.2	2.2	2.3	2.4	3.1	2.9	3.3	3.3	3.1	2.9	2.3	2.7



Source: Vanuatu Meteorological Service

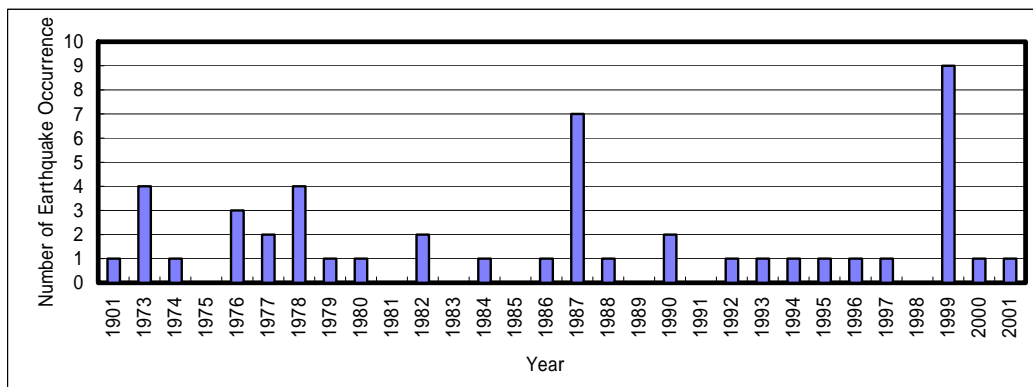
APPENDIX 7

EARTHQUAKE RECORDS AROUND SANTO ISLAND

APPENDIX 7 EARTHQUAKE RECORDS AROUND SANTO ISLAND

Date			Num.	Latitude	Longitude	Depth (km)	Magnitude	Max. Magunitude in a Year	Remarks
Y	M	D							
1901	8	9	1	-16.00	167.00	-	8.4	8.4	-
1973	4	8	4	-15.78	167.22	35	6.4	6.4	-
	4	21		-15.88	167.28	33	5.3		
	8	27		-15.99	168.10	11	5.7		
	12	4		-16.50	167.10	9	5.3		
1974	11	19	1	-16.07	167.46	42	5.2	5.2	-
1976	6	6	3	-16.29	167.33	18	5.1	5.6	-
	6	8		-16.30	167.26	13	5.6		
	7	5		-16.39	167.19	22	5.4		
1977	9	22	2	-15.94	167.30	25	5.1	5.2	-
	11	9		-16.24	166.86	27	5.2		
1978	2	14	4	-15.58	168.09	33	5.4	5.5	-
	5	23		-16.14	167.58	47	5.2		
	9	8		-15.96	167.63	39	5.3		
	11	29		-15.51	168.08	33	5.5		
1979	6	21	1	-15.61	168.00	33	5.1	5.1	-
1980	12	5	1	-16.50	167.08	35	5.0	5.0	-
1982	5	1	2	-15.85	167.42	33	5.3	5.8	-
	10	5		-15.59	168.00	17	5.8		
1984	5	28	1	-15.84	167.05	33	5.2	5.2	-
1986	11	20	1	-16.26	167.55	60	5.7	5.7	-
1987	2	11	7	-15.83	167.35	23	6.6	6.6	inc. Aftershock
	3	7		-16.02	167.40	35	5.6		
	11	26		-16.35	168.12	18	6.3		
	11	27		-16.26	168.13	32	5.5		
	11	27		-16.31	168.14	28	5.3		
	11	27		-16.37	168.12	28	6.4		
	11	27		-16.22	168.17	30	5.0		
1988	8	20	1	-16.48	167.17	21	6.1	6.1	-
1990	7	7	2	-15.52	168.09	33	5.2	5.2	-
	12	14		-15.90	167.39	55	5.0		
1992	9	19	1	-15.73	168.15	20	5.1	5.1	-
1993	4	22	1	-16.32	167.44	33	5.0	5.0	-
1994	4	17	1	-15.90	167.51	39	5.7	5.7	-
1995	6	22	1	-16.41	168.11	33	5.8	5.8	-
1996	2	11	1	-16.39	168.18	18	5.4	5.4	-
1997	4	3	1	-16.05	168.14	50	5.0	5.0	-
1999	2	14	9	-15.51	168.00	10	6.0	6.5	inc. Aftershock
	2	15		-15.54	168.00	33	5.4		
	8	22		-16.12	168.04	33	6.5		
	11	26		-15.98	167.93	33	5.7		
	11	26		-15.88	167.89	33	5.3		
	11	26		-15.77	167.80	33	5.5		
	11	26		-15.91	167.89	33	5.0		
	11	26		-16.48	168.07	33	5.5		
	11	26		-15.57	167.92	33	5.9		
2000	10	4	1	-15.42	166.91	23	6.7	6.7	-
2001	1	9	1	-14.93	167.17	103	7.1	7.1	-

- Note: 1) Date : Rainy Season from May to October
 : Dry Season from November to April
- 2) Latitude from -14 to -16 degree
Longitude from -166.2 to -168.2 degree
- 3) Depth < 70 km excluding an earthquake on Jan 9, 2001
Magnitude > 5.0



Source: Assessment of the Port Vila Earthquake Vanuatu 2nd January 2002, Department of Geology, Mines and Water Resources

APPENDIX 8

DISCHARGE STATISTICS FOR SARAKATA RIVER

APPENDIX 8 DISCHARGE STATISTICS FOR SARAKATA RIVER

Discharge Statistics for Sarakata River (Mean Discharge in April and October, 2006)

Conditions		Breadth		38.1 m	Overflow Coefficient		1.8 (Assumption)		
Dam		Breadth		10 m	Overflow Coefficient		1.8 (Assumption)		
Oevrflow Weir		Breadth		10 m	Overflow Coefficient		1.8 (Assumption)		
Month		April							
Observed at 6:00 AM									
Date	Dam (D)		Head Tank (E)		Power Station (F)		Discharge		
	Water Level (m)	Discharge (m ³ /s)	Water Level (m)	Discharge (m ³ /s)	Output (KW)	Discharge (m ³ /s)	Inflow (m ³ /s)	Dam Overflow (m ³ /s)	Water Way (m ³ /s)
1	0.165	4.60	0.17	1.26	350	1.69	7.55	4.60	2.95
2	0.165	4.60	0.20	1.61	300	1.45	7.66	4.60	3.06
3	0.220	7.08	0.16	1.15	400	1.93	10.16	7.08	3.08
4	0.205	6.37	0.27	2.53	400	1.93	10.83	6.37	4.46
5	0.220	7.08	0.18	1.37	300	1.45	9.90	7.08	2.82
6	0.200	6.13	0.17	1.26	350	1.69	9.08	6.13	2.95
7	0.175	5.02	0.13	0.84	450	2.18	8.04	5.02	3.02
8	0.165	4.60	0.12	0.75	300	1.45	6.80	4.60	2.20
9	0.155	4.18	0.18	1.37	300	1.45	7.00	4.18	2.82
10	0.150	3.98	0.17	1.26	350	1.69	6.93	3.98	2.95
11	0.160	4.39	0.20	1.61	300	1.45	7.45	4.39	3.06
12	0.155	4.18	0.18	1.37	350	1.69	7.24	4.18	3.06
13	0.193	5.81	0.20	1.61	300	1.45	8.87	5.81	3.06
14	0.158	4.31	0.18	1.37	300	1.45	7.13	4.31	2.82
15	0.150	3.98	0.23	1.99	200	0.97	6.94	3.98	2.96
16	0.155	4.18	0.20	1.61	350	1.69	7.48	4.18	3.30
17	0.150	3.98	0.20	1.61	250	1.21	6.80	3.98	2.82
18	0.152	4.06	0.18	1.37	300	1.45	6.88	4.06	2.82
19	0.152	4.06	0.18	1.37	400	1.93	7.36	4.06	3.30
20	0.152	4.06	0.18	1.37	300	1.45	6.88	4.06	2.82
21	0.154	4.14	0.17	1.26	350	1.69	7.09	4.14	2.95
22	0.200	6.13	0.18	1.37	350	1.69	9.19	6.13	3.06
23	0.220	7.08	0.18	1.37	300	1.45	9.90	7.08	2.82
24	0.160	4.39	0.18	1.37	300	1.45	7.21	4.39	2.82
25	0.170	4.81	0.20	1.61	300	1.45	7.87	4.81	3.06
26	0.150	3.98	0.18	1.37	350	1.69	7.04	3.98	3.06
27	0.160	4.39	0.18	1.37	350	1.69	7.45	4.39	3.06
28	0.150	3.98	0.18	1.37	400	1.93	7.28	3.98	3.30
29	0.160	4.39	0.18	1.37	300	1.45	7.21	4.39	2.82
30	0.160	4.39	0.16	1.15	300	1.45	6.99	4.39	2.60
31	-	-	-	-	-	-	-	-	-
Ave.	0.169	4.81	0.182	1.41	328	1.59	7.8	4.8	3.0

Conditions		Breadth		38.1 m	Overflow Coefficient		1.8 (Assumption)		
Dam		Breadth		10 m	Overflow Coefficient		1.8 (Assumption)		
Oevrflow Weir		Breadth		10 m	Overflow Coefficient		1.8 (Assumption)		
Month		MAY							
Observed at 6:00 AM									
Date	Dam (D)		Head Tank (E)		Power Station (F)		Discharge		
	Water Level (m)	Discharge (m ³ /s)	Water Level (m)	Discharge (m ³ /s)	Output (KW)	Discharge (m ³ /s)	Inflow (m ³ /s)	Dam Overflow (m ³ /s)	Water Way (m ³ /s)
1	0.160	4.39	0.16	1.15	300	1.45	6.99	4.39	2.60
2	0.165	4.60	0.18	1.37	300	1.45	7.42	4.60	2.82
3	0.230	7.56	0.18	1.37	300	1.45	10.38	7.56	2.82
4	0.155	4.18	0.18	1.37	250	1.21	6.76	4.18	2.58
5	0.150	3.98	0.20	1.61	350	1.69	7.28	3.98	3.30
6	0.250	8.57	0.18	1.37	250	1.21	11.15	8.57	2.58
7	0.230	7.56	0.20	1.61	350	1.69	10.86	7.56	3.30
8	0.240	8.06	0.18	1.37	300	1.45	10.88	8.06	2.82
9	0.200	6.13	0.17	1.26	300	1.45	8.84	6.13	2.71
10	0.220	7.08	0.19	1.49	300	1.45	10.02	7.08	2.94
11	0.215	6.84	0.19	1.49	300	1.45	9.78	6.84	2.94
12	0.200	6.13	0.19	1.49	200	0.97	8.59	6.13	2.46
13	0.135	3.40	0.22	1.79	300	1.45	6.64	3.40	3.24
14	0.165	4.60	0.19	1.49	350	1.69	7.78	4.60	3.18
15	0.160	4.39	0.20	1.61	300	1.45	7.45	4.39	3.06
16	0.150	3.98	0.19	1.49	300	1.45	6.92	3.98	2.94
17	0.160	4.39	0.18	1.37	300	1.45	7.21	4.39	2.82
18	0.140	3.59	0.19	1.49	450	2.18	7.26	3.59	3.67
19	0.170	4.81	0.17	1.26	250	1.21	7.28	4.81	2.47
20	0.440	20.02	0.21	1.73	450	2.18	23.93	20.02	3.91
21	0.270	9.62	0.17	1.26	480	2.32	13.20	9.62	3.58
22	0.210	6.60	0.18	1.37	400	1.93	9.90	6.60	3.30
23	0.185	5.46	0.16	1.15	300	1.45	8.06	5.46	2.60
24	0.350	14.20	0.20	1.61	400	1.93	17.74	14.20	3.54
25	0.210	6.60	0.20	1.61	350	1.69	9.90	6.60	3.30
26	0.260	9.09	0.18	1.37	400	1.93	12.39	9.09	3.30
27	0.250	8.57	0.17	1.26	350	1.69	11.52	8.57	2.95
28	0.210	6.60	0.18	1.32	400	1.93	9.85	6.60	3.25
29	0.180	5.24	0.17	1.26	400	1.93	8.43	5.24	3.19
30	0.180	5.24	0.17	1.26	350	1.69	8.19	5.24	2.95
31	0.170	4.81	0.25	2.25	100	0.48	7.54	4.81	2.73
Ave.	0.207	6.65	0.186	1.45	327	1.58	9.7	6.7	3.0

Conditions
 Dam Breadth 38.1 m Overflow Coefficient 1.8 (Assumption)
 Oevrflow Weir Breadth 10 m Overflow Coefficient 1.8 (Assumption)

Month **JUNE**

Observed at 6:00 AM

Date	Dam (D)		Head Tank (E)		Power Station (F)		Discharge		
	Water Level (m)	Discharge (m ³ /s)	Water Level (m)	Discharge (m ³ /s)	Output (KW)	Discharge (m ³ /s)	Inflow (m ³ /s)	Dam Overflow (m ³ /s)	Water Way (m ³ /s)
1	0.170	4.81	0.25	2.25	100	0.48	7.54	4.81	2.73
2	0.180	5.24	0.22	1.86	250	1.21	8.31	5.24	3.07
3	0.180	5.24	0.22	1.86	250	1.21	8.31	5.24	3.07
4	0.175	5.02	0.22	1.86	250	1.21	8.09	5.02	3.07
5	0.150	3.98	0.22	1.86	250	1.21	7.05	3.98	3.07
6	0.150	3.98	0.22	1.86	250	1.21	7.05	3.98	3.07
7	0.150	3.98	0.26	2.39	0	0.00	6.37	3.98	2.39
8	0.155	4.18	0.00	0.00	0	0.00	4.18	4.18	0.00
9	0.155	4.18	0.00	0.00	0	0.00	4.18	4.18	0.00
10	0.150	3.98	0.00	0.00	0	0.00	3.98	3.98	0.00
11	0.150	3.98	0.00	0.00	0	0.00	3.98	3.98	0.00
12	0.150	3.98	0.00	0.00	0	0.00	3.98	3.98	0.00
13	0.155	4.18	0.00	0.00	0	0.00	4.18	4.18	0.00
14	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
15	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
16	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
17	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
18	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
19	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
20	0.155	4.18	0.00	0.00	0	0.00	4.18	4.18	0.00
21	0.155	4.18	0.00	0.00	0	0.00	4.18	4.18	0.00
22	0.150	3.98	0.00	0.00	0	0.00	3.98	3.98	0.00
23	0.150	3.98	0.00	0.00	0	0.00	3.98	3.98	0.00
24	0.155	4.18	0.00	0.00	0	0.00	4.18	4.18	0.00
25	0.155	4.18	0.00	0.00	0	0.00	4.18	4.18	0.00
26	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
27	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
28	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
29	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
30	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
31									
Ave.	0.158	4.32	0.054	0.46	45	0.22	5.0	4.3	0.7

Conditions
 Dam Breadth 38.1 m Overflow Coefficient 1.8 (Assumption)
 Oevrflow Weir Breadth 10 m Overflow Coefficient 1.8 (Assumption)

Month **JULY**

Observed at 6:00 AM

Date	Dam (D)		Head Tank (E)		Power Station (F)		Discharge		
	Water Level (m)	Discharge (m ³ /s)	Water Level (m)	Discharge (m ³ /s)	Output (KW)	Discharge (m ³ /s)	Inflow (m ³ /s)	Dam Overflow (m ³ /s)	Water Way (m ³ /s)
1	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
2	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
3	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
4	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
5	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
6	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
7	0.160	4.39	0.00	0.00	0	0.00	4.39	4.39	0.00
8	0.150	3.98	0.00	0.00	0	0.00	3.98	3.98	0.00
9	0.150	3.98	0.00	0.00	0	0.00	3.98	3.98	0.00
10	0.140	3.59	0.00	0.00	0	0.00	3.59	3.59	0.00
11	0.140	3.59	0.00	0.00	0	0.00	3.59	3.59	0.00
12	0.150	3.98	0.00	0.00	0	0.00	3.98	3.98	0.00
13	0.140	3.59	0.00	0.00	0	0.00	3.59	3.59	0.00
14	0.140	3.59	0.00	0.00	0	0.00	3.59	3.59	0.00
15	0.140	3.59	0.00	0.00	0	0.00	3.59	3.59	0.00
16	0.140	3.59	0.00	0.00	0	0.00	3.59	3.59	0.00
17	0.140	3.59	0.00	0.00	0	0.00	3.59	3.59	0.00
18	0.135	3.40	0.00	0.00	0	0.00	3.40	3.40	0.00
19	0.135	3.40	0.00	0.00	0	0.00	3.40	3.40	0.00
20	0.130	3.21	0.00	0.00	0	0.00	3.21	3.21	0.00
21	0.050	0.77	0.17	1.26	300	1.45	3.48	0.77	2.71
22	0.050	0.77	0.17	1.26	300	1.45	3.48	0.77	2.71
23	0.050	0.77	0.17	1.26	300	1.45	3.48	0.77	2.71
24	0.050	0.77	0.17	1.26	300	1.45	3.48	0.77	2.71
25	0.040	0.55	0.17	1.26	300	1.45	3.26	0.55	2.71
26	0.060	1.01	0.17	1.26	300	1.45	3.72	1.01	2.71
27	0.060	1.01	0.17	1.26	300	1.45	3.72	1.01	2.71
28	0.060	1.01	0.17	1.26	300	1.45	3.72	1.01	2.71
29	0.060	1.01	0.17	1.26	300	1.45	3.72	1.01	2.71
30	0.050	0.77	0.17	1.26	300	1.45	3.48	0.77	2.71
31	0.170	4.81	0.25	2.25	300	1.45	8.51	4.81	3.70
Ave.	0.118	2.94	0.063	0.48	106	0.51	3.9	2.9	1.0

Conditions
 Dam Breadth 38.1 m Overflow Coefficient 1.8 (Assumption)
 Oevrflow Weir Breadth 10 m Overflow Coefficient 1.8 (Assumption)

Month **AUGUST**

Observed at 6:00 AM

Date	Dam (D)		Head Tank (E)		Power Station (F)		Discharge		
	Water Level (m)	Discharge (m ³ /s)	Water Level (m)	Discharge (m ³ /s)	Output (KW)	Discharge (m ³ /s)	Inflow (m ³ /s)	Dam Overflow (m ³ /s)	Water Way (m ³ /s)
1	0.050	0.77	0.17	1.26	300	1.45	3.48	0.77	2.71
2	0.050	0.77	0.15	1.05	300	1.45	3.27	0.77	2.50
3	0.070	1.27	0.17	1.26	300	1.45	3.98	1.27	2.71
4	0.510	24.98	0.15	1.05	300	1.45	27.48	24.98	2.50
5	0.930	61.51	0.20	1.61	0	0.00	63.12	61.51	1.61
6	0.530	26.46	0.20	1.61	0	0.00	28.07	26.46	1.61
7	0.330	13.00	0.14	0.94	250	1.21	15.15	13.00	2.15
8	0.250	8.57	0.14	0.94	250	1.21	10.72	8.57	2.15
9	0.230	7.56	0.14	0.94	250	1.21	9.71	7.56	2.15
10	0.190	5.68	0.14	0.94	350	1.69	8.31	5.68	2.63
11	0.170	4.81	0.15	1.05	250	1.21	7.07	4.81	2.26
12	0.160	4.39	0.17	1.26	250	1.21	6.86	4.39	2.47
13	0.140	3.59	0.16	1.15	200	0.97	5.71	3.59	2.12
14	0.135	3.40	0.16	1.15	350	1.69	6.24	3.40	2.84
15	0.130	3.21	0.19	1.49	350	1.69	6.39	3.21	3.18
16	0.130	3.21	0.18	1.37	300	1.45	6.03	3.21	2.82
17	0.140	3.59	0.18	1.37	400	1.93	6.89	3.59	3.30
18	0.140	3.59	0.20	1.61	400	1.93	7.13	3.59	3.54
19	0.130	3.21	0.19	1.49	350	1.69	6.39	3.21	3.18
20	0.110	2.50	0.19	1.49	350	1.69	5.68	2.50	3.18
21	0.100	2.17	0.17	1.26	200	0.97	4.40	2.17	2.23
22	0.090	1.85	0.19	1.49	400	1.93	5.27	1.85	3.42
23	0.100	2.17	0.19	1.49	500	2.42	6.08	2.17	3.91
24	0.100	2.17	0.15	1.05	500	2.42	5.64	2.17	3.47
25	0.090	1.85	0.15	1.05	520	2.51	5.41	1.85	3.56
26	0.090	1.85	0.16	1.15	400	1.93	4.93	1.85	3.08
27	0.085	1.70	0.16	1.15	450	2.18	5.03	1.70	3.33
28	0.085	1.70	0.16	1.15	430	2.08	4.93	1.70	3.23
29	0.085	1.70	0.16	1.15	470	2.27	5.12	1.70	3.42
30	0.085	1.70	0.16	1.15	470	2.27	5.12	1.70	3.42
31	0.085	1.7	0.16	1.15	400	1.93	4.78	1.70	3.08
Ave.	0.178	6.67	0.167	1.23	330	1.60	9.5	6.7	2.8

Conditions
 Dam Breadth 38.1 m Overflow Coefficient 1.8 (Assumption)
 Oevrflow Weir Breadth 10 m Overflow Coefficient 1.8 (Assumption)

Month **SEPTEMBER**

Observed at 6:00 AM

Date	Dam (D)		Head Tank (E)		Power Station (F)		Discharge		
	Water Level (m)	Discharge (m ³ /s)	Water Level (m)	Discharge (m ³ /s)	Output (KW)	Discharge (m ³ /s)	Inflow (m ³ /s)	Dam Overflow (m ³ /s)	Water Way (m ³ /s)
1	0.090	1.85	0.19	1.49	400	1.93	5.27	1.85	3.42
2	0.090	1.85	0.19	1.49	350	1.69	5.03	1.85	3.18
3	0.090	1.85	0.19	1.49	350	1.69	5.03	1.85	3.18
4	0.090	1.85	0.19	1.43	350	1.69	4.97	1.85	3.12
5	0.075	1.41	0.17	1.26	400	1.93	4.60	1.41	3.19
6	0.080	1.55	0.20	1.61	300	1.45	4.61	1.55	3.06
7	0.080	1.55	0.18	1.37	400	1.93	4.85	1.55	3.30
8	0.080	1.55	0.17	1.26	400	1.93	4.74	1.55	3.19
9	0.070	1.27	0.15	1.05	450	2.18	4.50	1.27	3.23
10	0.070	1.27	0.22	1.86	250	1.21	4.34	1.27	3.07
11	0.070	1.27	0.20	1.61	280	1.35	4.23	1.27	2.96
12	0.070	1.27	0.17	1.26	430	2.08	4.61	1.27	3.34
13	0.080	1.55	0.17	1.26	470	2.27	5.08	1.55	3.53
14	0.070	1.27	0.17	1.26	450	2.18	4.71	1.27	3.44
15	0.070	1.27	0.17	1.26	500	2.42	4.95	1.27	3.68
16	0.070	1.27	0.17	1.26	430	2.08	4.61	1.27	3.34
17	0.080	1.55	0.17	1.26	400	1.93	4.74	1.55	3.19
18	0.080	1.55	0.17	1.26	450	2.18	4.99	1.55	3.44
19	0.070	1.27	0.17	1.26	400	1.93	4.46	1.27	3.19
20	0.070	1.27	0.15	1.05	450	2.18	4.50	1.27	3.23
21	0.080	1.55	0.16	1.15	400	1.93	4.63	1.55	3.08
22	0.070	1.27	0.19	1.49	300	1.45	4.21	1.27	2.94
23	0.070	1.27	0.18	1.37	300	1.45	4.09	1.27	2.82
24	0.100	2.17	0.15	1.05	400	1.93	5.15	2.17	2.98
25	0.100	2.17	0.17	1.26	450	2.18	5.61	2.17	3.44
26	0.100	2.17	0.15	1.05	450	2.18	5.40	2.17	3.23
27	0.080	1.55	0.15	0.99	450	2.18	4.72	1.55	3.17
28	0.090	1.85	0.14	0.94	500	2.42	5.21	1.85	3.36
29	0.190	5.68	0.14	0.94	450	2.18	8.80	5.68	3.12
30	0.160	4.39	0.15	1.05	450	2.18	7.62	4.39	3.23
31									
Ave.	0.086	1.79	0.171	1.28	402	1.94	5.0	1.8	3.2

Conditions					
Dam	Breadth	38.1 m	Overflow Coefficient	1.8 (Assumption)	
Oevrflow Weir	Breadth	10 m	Overflow Coefficient	1.8 (Assumption)	

Month **OCTOBER**

Observed at 6:00 AM

Date	Dam (D)		Head Tank (E)		Power Station (F)		Discharge		
	Water Level (m)	Discharge (m ³ /s)	Water Level (m)	Discharge (m ³ /s)	Output (KW)	Discharge (m ³ /s)	Inflow (m ³ /s)	Dam Overflow (m ³ /s)	Water Way (m ³ /s)
1	0.200	6.13	0.21	1.73	350	1.69	9.55	6.13	3.42
2	0.190	5.68	0.21	1.73	350	1.69	9.10	5.68	3.42
3	0.280	10.16	0.28	2.67	400	1.93	14.76	10.16	4.60
4	0.240	8.06	0.15	1.05	500	2.42	11.53	8.06	3.47
5	0.180	5.24	0.20	1.61	500	2.42	9.27	5.24	4.03
6	0.150	3.98	0.14	0.94	500	2.42	7.34	3.98	3.36
7	0.130	3.21	0.15	1.05	330	1.60	5.86	3.21	2.65
8	0.120	2.85	0.14	0.94	350	1.69	5.48	2.85	2.63
9	0.115	2.67	0.17	1.26	400	1.93	5.86	2.67	3.19
10	0.110	2.50	0.14	0.94	500	2.42	5.86	2.50	3.36
11	0.100	2.17	0.14	0.94	500	2.42	5.53	2.17	3.36
12	0.095	2.01	0.14	0.94	450	2.18	5.13	2.01	3.12
13	0.090	1.85	0.14	0.94	470	2.27	5.06	1.85	3.21
14	0.085	1.70	0.15	0.99	450	2.18	4.87	1.70	3.17
15	0.110	2.50	0.13	0.84	450	2.18	5.52	2.50	3.02
16	0.145	3.79	0.14	0.94	440	2.13	6.86	3.79	3.07
17	0.150	3.98	0.14	0.94	480	2.32	7.24	3.98	3.26
18	0.165	4.60	0.15	0.99	520	2.51	8.10	4.60	3.50
19	0.140	3.59	0.14	0.94	530	2.56	7.09	3.59	3.50
20	0.150	3.98	0.14	0.94	500	2.42	7.34	3.98	3.36
21	0.140	3.59	0.15	0.99	500	2.42	7.00	3.59	3.41
22	0.150	3.98	0.15	0.99	420	2.03	7.00	3.98	3.02
23	0.150	3.98	0.16	1.15	420	2.03	7.16	3.98	3.18
24	0.190	5.68	0.16	1.15	450	2.18	9.01	5.68	3.33
25	0.200	6.13	0.16	1.15	450	2.18	9.46	6.13	3.33
26	0.170	4.81	0.16	1.15	450	2.18	8.14	4.81	3.33
27	0.150	3.98	0.16	1.15	450	2.18	7.31	3.98	3.33
28	0.180	5.24	0.16	1.15	400	1.93	8.32	5.24	3.08
29	0.170	4.81	0.16	1.15	500	2.42	8.38	4.81	3.57
30	0.190	5.68	0.21	1.73	300	1.45	8.86	5.68	3.18
31	0.160	4.39	0.16	1.1	450	2.18	7.67	4.39	3.28
Ave.	0.155	4.29	0.160	1.17	444	2.15	7.6	4.3	3.3

Source: MOL

APPENDIX 9

DISCHARGE MEASUREMENT RESULTS FOR SARAKATA RIVER

APPENDIX 9 DISCHARGE MEASUREMENT RESULTS FOR SARAKATA RIVER

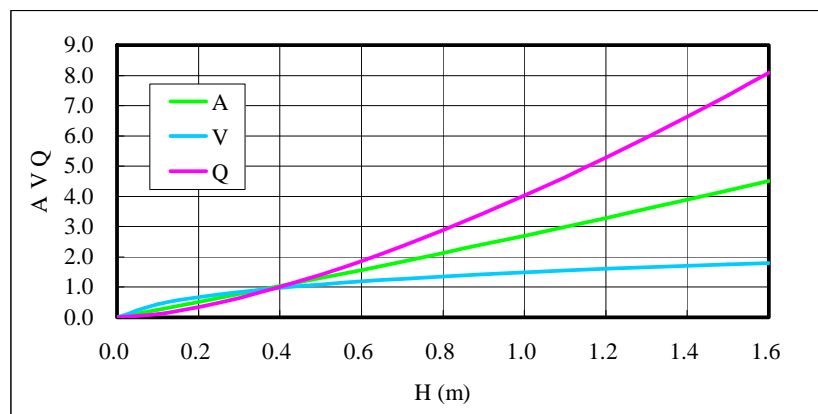
Sarakata River Discharge Measurement Results (by the Study Team)

The field survey discovered secular deterioration of the inner concrete faces of the raceway. The original design of the raceway adopted a roughness coefficient of 0.015 and a water depth of 1.3 m for the discharge of some 6.0 m³/sec from three generating units. The roughness coefficient literally means the roughness of the surface. The lower the value is, the smoother the surface is from the hydraulic viewpoint. 0.015 is the standard value for sound concrete but severe deterioration of the concrete as in the case of the raceway for the Sarakata Hydroelectric Power Plant suggests that the actual value has increased.

When the roughness coefficient of the raceway increases, the raceway may only be able to carry a level of discharge below the design discharge even if the water is carried at the design water depth of 1.3%. Table 1 shows the relation between the design water depth and the discharge.

Table 1 Relation Between Water Depth of the Raceway and the Discharge

nc= 0.015 I= 0.001		nc= 0.015			B= 2.5 m S= 1: 0.2			
Water Depth (m)	Wetted Perimeter (m)	Wetted Perimeter of Gunite (m)	Wetted Perimeter of Concrete (m)	Combined Roughness Coefficient	Area (m ²)	Hydraulic Mean Depth (m)	Velocity (m/s)	Discharge (m ³ /s)
H	B	Bg	Bc	na	A	R	V	Q
0.0	2.500	0.000	2.5	0.015	0.000	0.000	0.000	0.000
0.1	2.704	0.204	2.5	0.015	0.252	0.093	0.433	0.109
0.2	2.908	0.408	2.5	0.015	0.508	0.175	0.659	0.335
0.3	3.112	0.612	2.5	0.015	0.768	0.247	0.829	0.637
0.4	3.316	0.816	2.5	0.015	1.032	0.311	0.968	0.999
0.5	3.520	1.020	2.5	0.015	1.300	0.369	1.085	1.411
0.6	3.724	1.224	2.5	0.015	1.572	0.422	1.186	1.865
0.7	3.928	1.428	2.5	0.015	1.848	0.471	1.275	2.357
0.8	4.132	1.632	2.5	0.015	2.128	0.515	1.355	2.883
0.9	4.336	1.836	2.5	0.015	2.412	0.556	1.426	3.440
1.0	4.540	2.040	2.5	0.015	2.700	0.595	1.491	4.026
1.1	4.744	2.244	2.5	0.015	2.992	0.631	1.551	4.639
1.2	4.948	2.448	2.5	0.015	3.288	0.665	1.605	5.279
1.3	5.151	2.651	2.5	0.015	3.588	0.696	1.656	5.943
1.4	5.355	2.855	2.5	0.015	3.892	0.727	1.704	6.632
1.5	5.559	3.059	2.5	0.015	4.200	0.755	1.749	7.345
1.6	5.763	3.263	2.5	0.015	4.512	0.783	1.791	8.080



On 6th July, 2006 during the field survey period, the flow velocity in the raceway was measured using a float to estimate the level of feasible discharge under the condition of a deteriorated concrete surface.

Measurement was taken four times by placing a float at the centre of the raceway twice and near each side. In general, the flow velocity observed using a float is the surface flow velocity. In this test, the mean velocity in the raceway was calculated by multiplying each measurement result by 0.8. The resulting mean velocity, discharge and roughness coefficient were 1.412 m/sec, 4.22 m³/sec and 0.016 respectively.

During the test, the reading of the water gauge installed by UNELCO to measure the overflow discharge from the head tank was 0.39 m. Assuming an overflow coefficient of 1.8, the resulting discharge and roughness coefficient of the raceway would be 4.38 m/sec and 0.016 respectively, indicating similar results to those of the discharge measuring using a float. As generating operation was suspended at the time of measuring, the overflow discharge from the head tank was equal to the discharge of the raceway. Table 2 shows the discharge measurement results.

Table 2 Discharge Measurement Results

Date	July 6, 2007																																								
Water Depth	Canal	1.1 m																																							
Water Level (UNELCO)	Head Tank	0.39 m																																							
Coefficient	0.8																																								
<table border="1"> <thead> <tr> <th>No.</th> <th>Distance (m)</th> <th>Time (Sec)</th> <th>Floating Position in Canal</th> <th>Surface Velocity (m/sec)</th> <th>Mean Velocity (m/sec)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>20</td> <td>10.46</td> <td>Center</td> <td>1.912</td> <td>1.530</td> </tr> <tr> <td>2</td> <td>20</td> <td>10.69</td> <td>Center</td> <td>1.871</td> <td>1.497</td> </tr> <tr> <td>3</td> <td>20</td> <td>12.70</td> <td>Side</td> <td>1.575</td> <td>1.260</td> </tr> <tr> <td>4</td> <td>20</td> <td>11.75</td> <td>Side</td> <td>1.702</td> <td>1.362</td> </tr> <tr> <td>Ave.</td> <td colspan="3"></td> <td>1.765</td> <td>1.412</td> </tr> </tbody> </table>						No.	Distance (m)	Time (Sec)	Floating Position in Canal	Surface Velocity (m/sec)	Mean Velocity (m/sec)	1	20	10.46	Center	1.912	1.530	2	20	10.69	Center	1.871	1.497	3	20	12.70	Side	1.575	1.260	4	20	11.75	Side	1.702	1.362	Ave.				1.765	1.412
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APPENDIX 10

GEOLOGICAL SURVEY RESULTS

APPENDIX 11

WATER QUALITY ANALYSIS RESULTS FOR SARAKATA RIVER

APPENDIX 11 WATER QUALITY ANALYSIS RESULTS FOR SARAKATA RIVER

Water Analysis Report

Project Title : Basic Design Study on the Project for Improvement of Power Generation at the Sarakata River Hydroelectric Power Station in the Republic of Vanuatu

- Deposits and Water Quality Analysis –

August, 2006

This report explains the results of the deposits and water quality analysis.

Details

- 1) Requested by : Yachiyo Engineering Co., Ltd.
- 2) Project Title : Basic Design Study on the Project for Improvement of Power Generation at the Sarakata River Hydroelectric Power Station in the Republic of Vanuatu
- 3) Samples : Deposits and River Water
- 4) Date of Sampling : 29th June, 2006
- 5) Location of Sampling : Sarakata Hydroelectric Power Station

Kowa Kaihatsu Co., Ltd.

1. Project Title

Basic Design Study on the Project for Improvement of Power Generation at the Sarakata River Hydroelectric Power Station in the Republic of Vanuatu

2. Purposes of the Analysis

- (1) Analysis of deposits at the intake and raceway of the Sarakata Hydroelectric Power Station
- (2) Analysis of the water quality of Sarakata River

3. Analysis Methods

(1) Analysis of Deposits

- Qualitative analysis by the X-ray diffraction method
- Qualitative analysis and semi-quantitative analysis by fluorescent X-ray spectroscopy

(2) Water Quality Analysis

- Semi-quantitative analysis by ICP emission spectral analysis
- Water quality analysis (pH, HCO_3^- , H_2CO_3 , SO_4^{2-} , Ca and Na)

4. Analysis Results

(1) Analysis Results of Deposits

The X-ray diffraction analysis results indicate the strong presence of calcite (CaCO_3) at both the intake and the raceway.

As the results of the semi-quantitative analysis using fluorescent X-ray showed a very strong presence of CaO at both the intake and the raceway, the main constituent of the deposits at the intake and the raceway was inferred to be calcite (CaCO_3).

At the intake, a minor quantity of aragonite (CaCO_3) was detected.

There is a possibility that the deposits contain organic substances (those containing such elements as C, H and H, etc.) which were not analysed this time.

Table 1 Qualitative Analysis Results by the X-Ray Refraction Method

Identified Substances	Sampling Site	Intake	Raceway
	Sampling Date	29/06/2006	29/06/2006
CaCO ₃ (Calcite)		++++	++++
CaCO ₃ (Aragonite)		+	-

Relative Strength: +++++ Very Strong +++ Strong ++ Medium + Weak (+) Extremely Weak

Table 2 Qualitative Analysis Results by Fluorescent X-Ray Spectroscopy

Identified Substances	Sampling Site	Intake	Raceway
	Sampling Date	29/06/2006	29/06/2006
++++ Very High		Ca	Ca
+++ High		-	-
++ Medium		-	-
+ Low		-	-
- Very Low (Trace)		Sr, Fe, Mn, Ti, K, S, P, Si, Al, Mg	Sr, Br, Cu, Fe, Mn, Ti, K, S, P, Si, Al, Mg

* Subjects of analysis: atomic weight 23 (Na) – atomic weight 238 (U)

Table 3 Semi-Quantitative Analysis Results of Fluorescent X-Ray Spectroscopy (Outline)

Identified Substances	Sampling Site	Intake	Raceway
	Sampling Date	29/06/2006	29/06/2006
CaO	%	88.89	96.05
SiO ₂	%	5.54	1.29
Fe ₂ O ₃	%	2.05	1.05
Al ₂ O ₃	%	1.65	0.79

* Subjects of analysis: atomic weight 23 (Na) – atomic weight 238 (U)

* The semi-quantitative analysis results only show the rough concentration levels and are not the exact measurement results.

(2) Water Quality Analysis Results

The semi-quantitative analysis by ICP emission spectral analysis detected medium levels of Na, Mg, Si and Ca.

The water quality analysis detected a relatively high concentration level of HCO₃⁻ of 154 mg/L and Ca of 36.8 mg/L.

Table 4 Semi-Quantitative Analysis Results of ICP Emission Spectral Analysis (Outline)

Identified Substances	Sampling Site	Sarakata River	
	Sampling Date	29/06/2006	
	Judgement Result	Lower Limit Concentration (mg/L)	Upper Limit Concentration (mg/L)
Na	*	0.708	2.834
Mg	*	0.596	2.383
Si	*	0.361	1.444
Ca	*	0.311	1.245

Judgement Results: *** High ** Medium * Low

* Subjects of Analysis: atomic weight 7 (Li) – atomic weight 238 (U)

* The semi-quantitative analysis results only show the rough concentration levels and are not the exact measurement results.

Table 5 Water Quality Analysis Results

Identified Substances	Sampling Site	Sarakata River
	Sampling Date	29/06/2006
pH	-	7.9
HCO ₃	mg/L	154
H ₂ CO ₃	mg/L	4.6
SO ₄ ²⁻	mg/L	4
Ca	mg/L	36.8
Na	mg/L	2.8

5. Conclusions

The main constituent of the deposits at the intake and the raceway is inferred to be calcite (CaCO₃). The water quality analysis results for Sarakata River show a HCO₃⁻ level of 154 mg/L and a CA level of 36.8 mg/L which is some 4 – 5 times higher than the corresponding mean concentration level for Japanese rivers (HCO₃⁻: 31.0 mg/L; Ca: 8.8 mg/L).

Although the exact cause of the deposition of calcite (CaCO₃) is unknown at present, it can be inferred that the deposition of calcite occurs at the boundary where the water level fluctuates due to the reaction between the Ca in the water, which is attached to the walls, and the CO₂ in the air. In the case of the walls which are constantly below the water level, the HCO₃⁻ in the water is inferred to be involved in the deposition process.

(Reference) Mean Chemical Composition of River Water in Japan

Region	Number of Sampled Dry Riverbed	Ca ²⁺	Mg ²⁺	Na ⁺	K ⁺	HCO ₃ ⁻	SO ₄ ²⁻	Cl ⁻	SiO ₂	Fe	PO ₄ ³⁻	NO ₃ ⁻ -N	NH ₄ ⁺ -N	Evaporation Residual	Suspended Matter
Hokkaido	(22)	8.3	2.3	9.2	1.45	33.9	10.7	9.0	23.6	0.50	0.01	0.54	0.06	87.9	76.9
Tohoku	(35)	7.7	1.9	7.3	1.06	19.9	17.6	7.9	21.5	0.49	0.01	0.26	0.06	79.1	18.6
Kanto	(11)	12.7	2.9	7.3	1.43	42.4	15.9	6.1	23.1	0.23	0.03	0.29	0.08	93.5	22.1
Chubu	(42)	8.9	1.7	4.8	1.05	30.1	7.7	3.9	13.7	0.14	0.02	0.18	0.05	62.0	26.9
Kinki	(28)	7.6	1.3	5.5	1.04	27.4	7.4	5.3	12.1	0.11	0.01	0.21	0.04	56.8	20.0
Chugoku	(25)	6.7	1.1	6.5	0.94	27.2	4.4	6.6	14.1	0.05	0.00	0.20	0.03	56.7	7.4
Shikoku	(19)	10.6	1.5	3.8	0.66	37.2	5.7	2.4	9.8	0.01	0.00	0.12	0.02	57.0	6.1
Kyushu	(43)	10.0	2.7	8.6	1.84	40.9	13.1	4.6	32.2	0.13	0.04	0.20	0.04	106.0	29.8
Nationwide	(225)	8.8	1.9	6.7	1.19	31.0	10.6	5.8	19.0	0.24	0.02	0.26	0.05	74.8	29.2

Source: Groundwater Handbook Editing Committee, *Groundwater Handbook*, 1998, Kensetsu Sangyo Chosakai

6. Company Conducting the Analysis

Kowa Kaihatsu Co., Ltd.

Shasoku Building, 3 – 13 Koto-bashi 5-chome, Sumida-ku, Tokyo

Tel: 03-3633-7351

Fax: 03-3633-7356

(Person in Charge of Analysis) Hideyuki Kon, Environmental Analysis Office

*The X-ray diffraction analysis, fluorescent X-ray spectroscopy and water quality analysis were entrusted to the following specialist company

Environmental Control Centre Co., Ltd. (East Kanto Branch)

4-17 Inari-machi 3-chome, Chuo-ku, Chiba, Chiba Prefecture

Tel: 043-261-1100

Fax: 043-265-2412

7. Attachments

(1) X-Ray Diffraction Analysis and Fluorescent X-Ray Spectroscopy Results (RC06-05802)

(2) ICP Emission Spectral Analysis Results (No. 21-0608-013)

(3) Water Quality Analysis Results (RC06-05801)