

**FIJI
MWTPU
FMS**

**PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR
IMPROVEMENT OF EQUIPMENT
FOR DISASTER RISK MANAGEMENT
IN
THE REPUBLIC OF FIJI**

APRIL 2013

**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
YACHIYO ENGINEERING CO., LTD.
JAPAN METEOROLOGICAL BUSINESS SUPPORT CENTER**

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Summary

1. Overview of Fiji

Fiji, located in the south central Pacific Ocean, is an island nation covering a wide expanse of roughly 130,000 square kilometers including ocean area, and composed of more than 330 islands. It has a total land area of 18,333 square kilometers (2012, Pacific Islands Centre), which is approximately the same area as Shikoku in Japan. There are two main islands in Fiji as the next, the largest island in which there's the capital city Suva is Viti Levu, and the second largest city is Vanua Levu. These two islands have mountains that reach altitudes over 900 meters and have an impact on weather conditions.

Fiji is a country with a population of about 840,000 and Viti Levu is the most populous island (2007, Fiji Bureau of Statistics). To a lesser degree of population, there are various regional cultures in Fiji, especially Melanesian and Polynesian. Major industries in Fiji are food export such as sugar and seafood, and tourism based on ocean resort areas with marine sources. GNI per capita in Fiji has smoothly increased since about 2002 and reached 4,030US\$ in 2008. In 2011, GNI per capita became 3,680US\$. (World Bank)

2. Background and Outline of the Project

Having very limited land area and low altitude, the Pacific island nations are extremely prone to natural disasters and urgently need to implement strategic countermeasures. In these circumstances, initiatives on protection from disasters are conducted within numerous frameworks such as the Pacific Islands Forum (hereinafter referred to as PIF), the Council of Regional Organizations of the Pacific (hereinafter referred to as CROP) the Pacific Disaster Risk Partnership Network and so on. Meanwhile, because each country's disaster prevention implementation setup (funding and human resources) is extremely fragile, it is necessary to conduct effective support based on inter-regional cooperation and networking in addition to the independent efforts of each country. Moreover, it is also necessary to conduct effective support via collaboration and cooperation as required in tandem with donors and other concerned partners. However, following the Sumatra Offshore Earthquake and Indian Ocean Tsunami disaster of 2004, the countries that were badly affected have strived to improve their disaster prevention capability. Even so, the observation network is still not adequate and there is room for improvement regarding the system for analyzing and transmitting accurate tsunami forecasting information. For this reason, the preparatory survey of the Project for Improvement of Equipment for Disaster Risk Management was recently implemented by JICA based on the instruction from the Ministry of Foreign Affairs of Japan, which aims at making a Grant Aid Project under the "Basic Concept of Rehabilitation from Great East Japan Earthquake".

3. Outline of the Study Findings and Contents of the Project

As a part of the Project, JICA dispatched the Study Team to Fiji to implement field survey including confirmation of the requested component of the Project, survey at the Project sites and so on from 27th June to 14th July, 2012. After the field survey, the Study Team analyzed and discussed the survey data. Moreover, outline design and cost estimation of the Project were implemented. As the results, the Study Team had implemented exploration of Outline Design from 16th to 25th Jan 2013.

The responsible agency is the Ministry of Works, Transport and Public Utilities (MWTPU) and the implementation agency is Fiji Meteorological Service (FMS). Based on the field survey, concept of the Project is to improve and reinforce the system to observe factor of natural disasters. The concept above becomes possible by introduction of the procured equipment related to meteorological and oceanographic observation and telecommunication, and by not only observing anomalous tide level caused by cyclones, weather conditions like heavy rain and lightning and so on but also observing and collecting the observed data in real-time. And the components were selected considering the objectives of the Project, technical appropriateness, priority for the Fijian side and benefiting effect. (Benefiting effect includes the contribution for reconstruction of industry in “Specified Disaster Affected Area” in Japan). The final components are as shown in the following table.

Items	Q'ty	Location			
1 Tide Observation System	1				
		T1	Vatia	Viti Levu	1
2 VSAT Communication System	5				
		V1	Naibalebale	Viwa	1
		V2	Udu Point	Vanua Levu	1
		V3	Tubou	Lakeba	1
		V4	Yaroi	Matuku	1
		V5	Nadi (FMS Headquarters)	Viti Levu	1
3 Wind Profiler System	1				
		N1	Nadi (FMS Headquarters)	Viti Levu	1
4 Automatic Weather Station (AWS)	1				
		A1	Suva	Viti Levu	1
5 Calibration Equipment	1				
			Nadi (FMS Headquarters)	Viti Levu	1
6 Lightning Detection System	6				
		L1	Rakiraki	Viti Levu	1
		L2	Suva	Viti Levu	1
		L3	Vatudamu	Vanua Levu	1
		L4	Matei	Taveuni	1
		L5	Nabouwalu	Vanua Levu	1
		L6	Nadi (FMS Headquarters)	Viti Levu	1

FMS aims to implement reliable online meteorological observation in real-time which covers the whole country as described in the “FMS Business Plan 2012”. The components of the Project were selected to contribute to the aim above. By the Project, it becomes possible for FMS to observe tide level and changes in weather conditions such as direction and velocity of the wind, temperature, humidity, rain and lightning in real-time. As a result, because observed data will be transferred smoothly to National Disaster Management Office (NDMO) and Mineral Resource Department (MRD), people will be able to obtain information of natural disasters. In addition, the above information can be transmitted not only to Fiji but also to surrounding Pacific island nations by being shared among international.

4. Project schedule and cost estimation

The Project implementation period under the Government of Japan’s grant aid scheme including detailed design, tender, installation and so on will be around 14.5 months. The total Project cost on the Fijian side will be approximately 37 million yen including mainly exemption of value-added tax (VAT) and bearing charges for telecommunication. Furthermore, in the Project, the equipment manufactured in Japan will be procured as high priority, especially in the disaster stricken area of the Great East Japan Earthquake.

5. Evaluation of the Project

(1) Quantitative effects

Installation of the meteorological and oceanographic observation and telecommunication equipment is expected to raise quantitative effects such as spreading observation coverage and increasing observation points, observation frequency and transmission speed of observed data. Quantitative effects of each item of equipment are described in 1) to 5).

1) Detailed tide observation - Tide Observation System-

In case that earthquake originates at the ocean trench near Samoa or Tonga, it would take approximately 1.5 hour for the first tsunami to arrive at Fiji. And in the same case near Vanuatu, it would take approximately 1.3 hour for the first tsunami to arrive at Fiji. Since such a tsunami would reach successive coastlines at intervals of 30 minutes, observed information would be important for predicting damage along coastal areas that have already been hit and estimating the height of tsunami waves that have not yet arrived.

Indicator	Reference value (2012)	Target value (2015)
Tide observation and interval time	60 minutes	30 minutes

Observed data by stations adjoining populous areas and areas of trade and industrial activity can make a major contribution to the provision of information and telecommunication of evacuation orders to citizens at times of disaster. Meanwhile, since Fiji is a Pacific island nation, it is difficult for it to issue tide information, warnings and evacuation orders in units of administrative districts (prefectures) like in Japan. Since one additional tidal gauge to be installed by the Project makes it possible to establish the basis of the observation network, it is possible for Fiji by self-help to spread the observation network in future.

Indicator	Reference value (2012)	Target value (2015)
Number of tide observation stations	2 sites	3 sites

2) Reinforcement of Communication Network -VSAT Communication System-

Currently, telecommunication between FMS Headquarters and local Met Offices are conducted by phone, radio, mobile phone and e-mail. But the existing way is considered fragile as urgent telecommunication especially for Met Offices in remote islands because cable break and jamming are caused by the natural disaster. In the Project, installation of VSAT Communication System to five locations including FMS Headquarters and four Met Offices enables mutual satellite telecommunication only of disaster information (including alert and warning) from FMS Headquarters to each Met Office but information of disaster situation from remote islands.

Indicator	Reference value (2012)	Target value (2015)
Locations within satellite telecommunication network	0 sites (Only by Telephone and radio)	5 sites

3) Wind Observation at high altitude -Wind Profiler System-

Fiji is damaged in every rainy season by heavy rains and storms caused by cyclones. The movement of cyclone itself and the flow of a rain cloud can be observed by existing Doppler radar. In addition, it will be possible to observe detailed aerodynamic flows of wind in the upper air with the Wind Profiler System, and it this will make it possible to forecast meteorological information accurately. Accordingly, by using existing Rasiosonde (which can observe weather conditions such as temperature, humidity, wind and so on at high altitude only two times per a day.) together, it will be possible to observe more quickly and accurately. In the Project, installation of Wind Profiler System to FMS Headquarters next to Nadi International Airport will contribute to forecasting natural disasters and enabling safe flying of airplanes in Fiji as the tourist country.

Indicator	Reference value (2012)	Target value (2015)
Wind Profiler System	Rasiosonde : 1 sites	Rasiosonde : 1 sites Wind Profiler : 1 sites
Frequency in observation	2 times per a d ay	1 times per 10 m inutes

4) Improvement of meteorological observation around the capital area –AWS-

AWS is essential especially for observing heavy rain for observing meteorological information approximately in real-time. FMS has 16 Met Offices and there are 12 offices in which AWS has been installed, but five (including the capital city Suva) out of the 12 AWS are broken down. By the Project, renewal of AWS in Suva Met Office will improve existing capability of meteorological observation around the capital area, and it will help observation be automated and go online as is promoted by FMS.

Indicator	Reference value (2012)	Target value (2015)
AWS in capital area	0 sites	1 sites

5) Lightning prevention in nationwide area-Lightning Detection System-

About 10 lives are lost by lightning every year in Fiji. Though one lightning sensor has been installed at FMS Headquarters, detection coverage is not enough to cover all areas of Fiji but only around Nadi centered upon FMS Headquarters. In the Project, six new Lightning Detection System will be installed at the project sites in Viti Levu and Vanua Levu island to extend detection coverage to the most populous islands as described above. Accordingly, installation of Lightning Detection System will contribute to reducing lightning victims.

Indicator	Reference value (2012)	Target value (2015)
Lightning Detection System	Just only within 56 km radius from Nadi international airport	Approximately whole areas of Viti Levu and Vanua Levu islands (almost largest populous islands in Fiji)

(2) Qualitative effects (Project overall)

As a result of the Project, it's anticipated that disaster prevention system such as the nationwide transmission of disaster information in Fiji will be improved. By the Project, meteorological observation data will go online, and introduction of the Wind Profiler System will enable some observation items such as wind conditions at high altitude to be observed more frequency (It's conventionally taken by radiosonde only two times per a day.). Accordingly, it will be possible to immediately report on sudden weather changes to citizens and officials, and the Project will contribute to greater safety in industries such as agriculture, fisheries and aircraft operations that tends to be affected by weather change. Also, through automating meteorological observation instruments such as Wind Profiler System, AWS and Lightning Detection System, and providing Calibration Equipment, meteorological observation will be conducted with more accuracy and frequency. As a result, this will contribute to the general economic development of Fiji through the promotion of industries, improvement of safety on transportation, and promotion of air travel due to better safety.

PREPARATORY SURVEY REPORT

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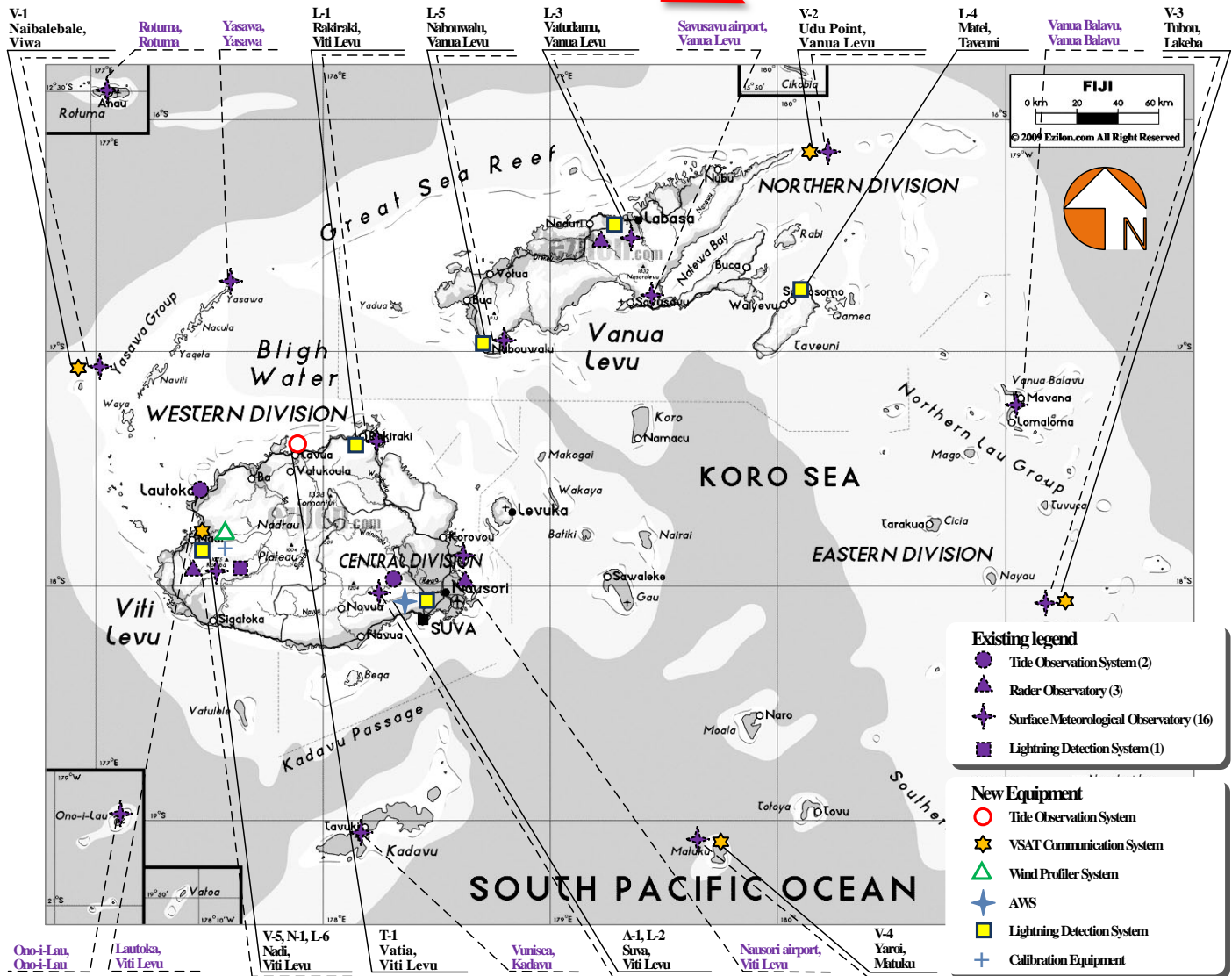
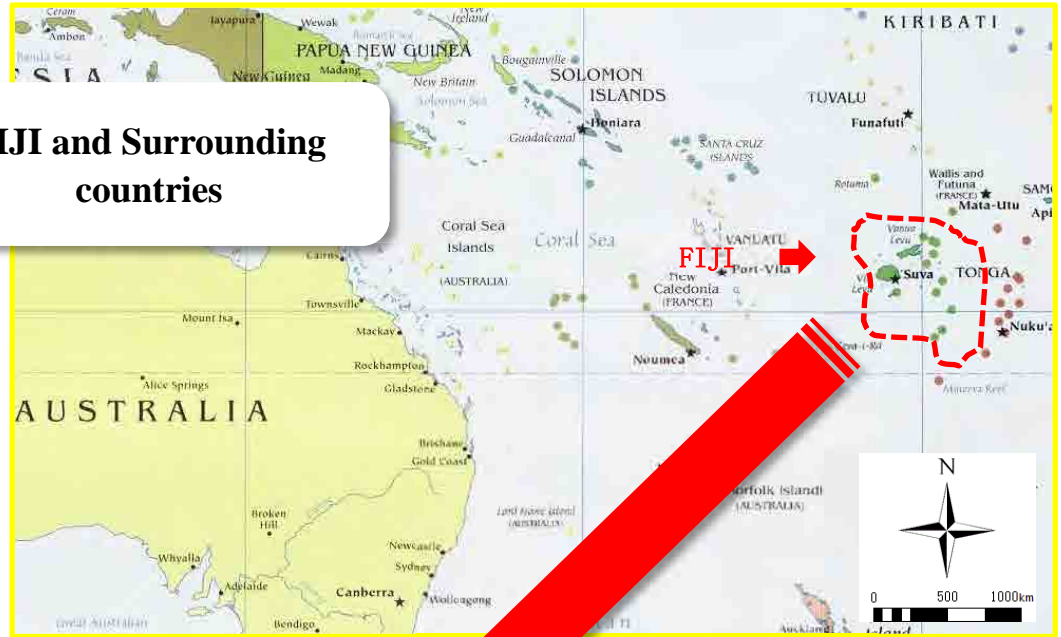
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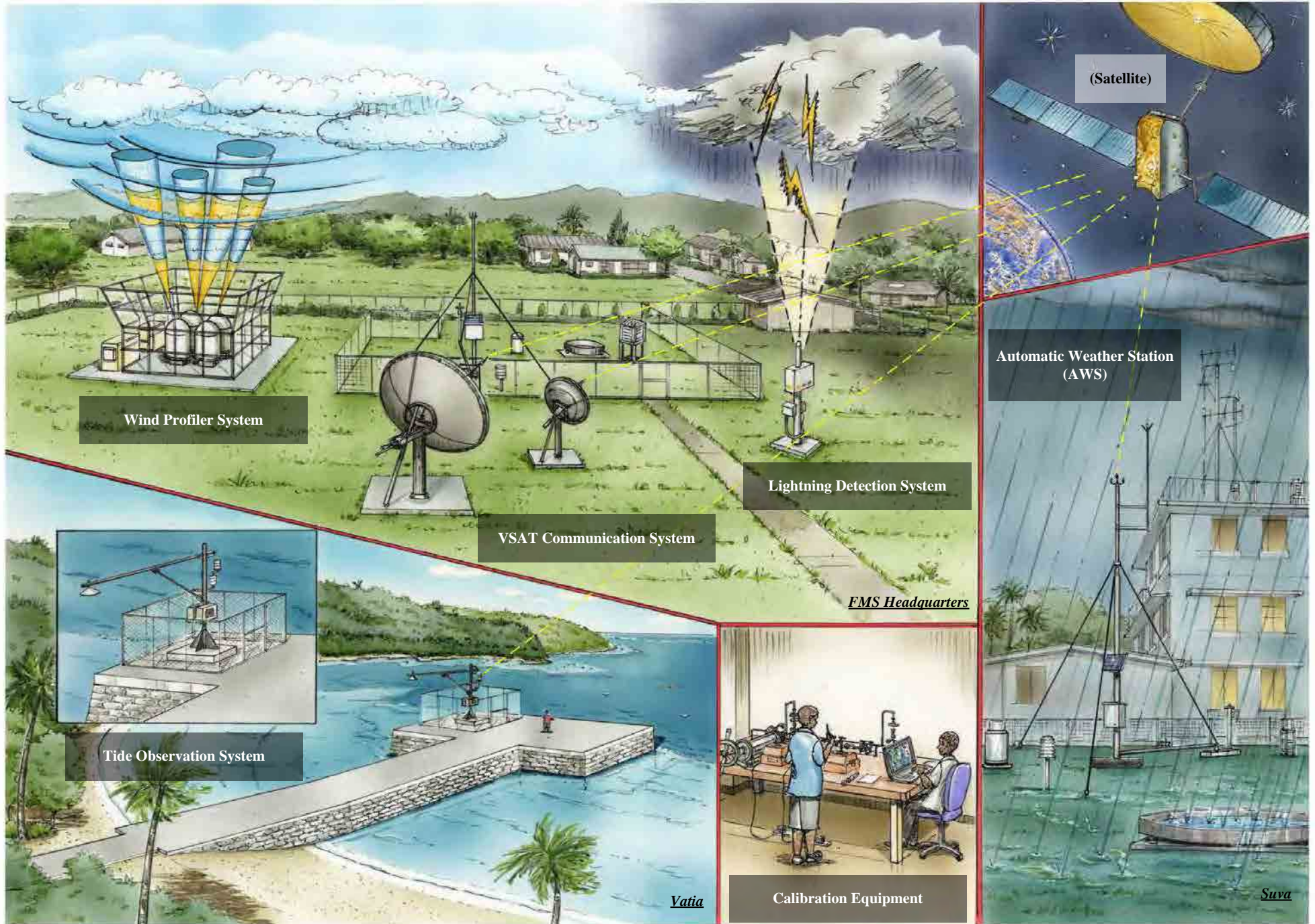
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FIJI and Surrounding countries



Location of the Project sites in FIJI



The Project for Improvement for Disaster Risk Management (Perspective)

Photos (Existing Equipment)



FMS Headquarters built in 1995 by Grant Aid

Fiji Meteorological Service (FMS) is collecting and analyzing meteorological and oceanographic observation data.



Input/output terminal and display for GTS

A lot of the observation equipment owned by FMS are automated but some analog equipment need to be renewed.



Equipment for satellite transmission

Meteorological and ocean observed data is shared via internet and satellite communications with overseas.



Existing meter for anemometer and barometer

Existing analog equipment procured by Grant Aid. These are used with good maintenance but need to be renewed to realize accurate observation.



Tidal gauge owned by BOM in Suva- Laucala bay

Observed data is directly transmitted to Australia, and FMS does not observe the tidal data in real-time.



Jetty in Vatia in which new tidal gauge will be installed by the Project

Formerly, oil tanker was landing on this jetty.

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List of Abbreviations

AC	Alternating Current
AMeDAS	Automated Meteorological Data Acquisition System
ATWS	Australian Tsunami Warning System
AusAID	Australian Agency for International Development
AWS	Automatic Weather Station
BGAN	Broadband Global Area Network
BOM	Bureau of Meteorology (Australia)
CAAF	Civil Aviation Authority of Fiji
COMS	Communication, Ocean and Meteorological Satellite (Korea)
COS	Central Operation System
CPU	Central Processing Unit
CROP	Council of Regional Organization in the Pacific
DC	Direct Current
DCP	Data Collection Platform
E/N	Exchange of Notes
FEA	Fiji Electricity Authority
FMS	Fiji Meteorological Service
G/A	Grant Agreement
GDP	Gross Domestic Product
GNI	Gross National Income
GOES	Geostationary Operational Environmental Satellite (USA)
GPS	Global Positioning System
GPRS	General Packet Radio Service
GTS	Global Telecommunication System
HDD	Hard Disc Drive
IEC	International Electrotechnical Commission
IMF	International Monetary Fund
IOC	Intergovernmental Oceanographic Committee
IPP	Independent Power Producer
ISO	International Organization for Standardization
ITU	International Telecommunication Union
JEC	Japanese Electrotechnical Committee
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standards
JMA	Japan Meteorological Agency
KOICA	Korea International Cooperation Agency

LAN	Local Area Network
LIDEN	Lightning Detection Network system
M	(notation of local magnitude of JMA “Mj”)
Mb	Body - wave Magnitude
M/D	Minutes of Discussion
Mj	Local Magnitude of JMA
MWTPU	Ministry of Works, Transport and Public Utilities
MRD	Mineral Resources Department
Ms	Surface wave Magnitude
MSS	Message Switching System
MTSAT	Multi-functional Transport Satellite
Mw	Moment Magnitude Scale
NDMO	National Disaster Management Office
NOAA	National Oceanic and Atmospheric Administration
OJT	On the Job Training
PTWC	Pacific Tsunami Warning Center
PIF	Pacific Islands Forum
RSMC	Regional Specialized Meteorological Center
SOPAC	South Pacific Applied Geoscience Commission
SPREP	South Pacific Regional Environment Programme
TAF	Terminal Aerodrome Forecast
TCWC	Tropical Cyclone Warning Center
TFL	Telecom Fiji Limited
UHF	Ultra High Frequency
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNOCHA	United Nation Office for Coordination of Humanitarian Affairs
VAT	Value Added Tax
VHF	Very High Frequency
VSAT	Very Small Aperture Terminal
WAF	Water Authority of Fiji
WINDAS	Wind profiler Network and Data Acquisition System
WMO	World Meteorological Organization

CHAPTER 1 BACKGROUND OF THE PROJECT

CHAPTER 1 BACKGROUND OF THE PROJECT

1-1 Background and Outline of the Grant Aid

Having very limited land area and low altitude, the Pacific island nations are extremely prone to natural disasters and urgently need to implement strategic countermeasures. In these circumstances, initiatives on protection from disasters are conducted within numerous frameworks such as the Pacific Islands Forum (hereinafter referred to as PIF), the Council of Regional Organizations of the Pacific (hereinafter referred to as CROP), the Pacific Disaster Risk Partnership Network and so on. As the main donors, Japan, Australia, New Zealand and so on support the above initiatives, while the regional frameworks of the Pacific Tsunami Warning Center (hereinafter referred to as PTWC) in Hawaii and the Regional Special Meteorological Center (hereinafter referred to as RSMC) based in Fiji and so forth are also utilized. The Government of Japan provides support via the “Disaster Prevention Program”, which is geared to mitigating the risk of natural disasters arising from climate change in this region.

The Great East Japan Earthquake that occurred on March 11, 2011 caused massive damage to Japan and once again reminded the international community of the importance of disaster prevention. However, because each country’s disaster prevention implementation setup (funding and human resources) is extremely fragile, it is necessary to conduct effective support based on inter-regional cooperation and networking in addition to the independent efforts of each country. Moreover, it is also necessary to conduct effective support via collaboration and cooperation as required in tandem with donors and other concerned partners. Similarly, following the Sumatra Offshore Earthquake and Indian Ocean Tsunami disaster of 2004, the countries that were badly affected have strived to improve their disaster prevention capability. Even so, the observation network is still not adequate and there is room for improvement regarding the system for analyzing and transmitting accurate tsunami forecasting information. For this reason, the preparatory survey of the Project for Improvement of Equipment for Disaster Risk Management was recently implemented by JICA based on the instruction from the Ministry of Foreign Affairs of Japan, which aims at making a Grant Aid Project under the “Basic Concept of Rehabilitation from Great East Japan Earthquake”.

Fiji is an area of low seismicity and it’s possible to observe seismic activities by using existing seismographs in Fiji. For the reasons stated above, Strong- motion Seismograph is set as low priority within the whole components. On the other hand, a characteristic of Fiji having a tropical climate is that there are a lot of disasters caused by tropical climate such as rain and low pressure. In the rainy season every year (between November and April), the cyclone comes and causes damage to many people who live near the rivers due to high tide and flood. Against this background, quickly informing not only meteorological information but also tide information to citizens in Fiji contributes to holding the disaster damage to minimum. So, regarding prevention of natural disasters, it’s very important to observe precise meteorological and tide information. From the above, Tide Observation System and

meteorological observation equipment are set with high priority within the requested components and they will contribute to comprehensive disaster prevention including natural disasters. It has been confirmed and stated in the M/D (refer to “Appendices-4 Minutes of Discussion” A-4-10) that the contents of the request on the Fijian side are as follows.

Table 1-1-1 Outline of the Contents of the Request

Priority	No.	Item	Quantity
S	1	Tide Observation System	5 sites
	2	VSAT Communication System	6 sites
A	3	Wind Profiler System	1 site
	4	Automatic Weather Station (AWS)	2 sites
	5	Calibration Equipment	1 set
	6	Lightning Detection System	7 sites
B	7	Vehicle for Disaster Prevention Education (VSAT VAN)	1 set
	8	Digital Barometer	10 sites
	9	Anemoscope and Anemometer	5 sites
	10	Replacement of Network Cable at FMS Headquarters	1 set
	11	Data Backup Service for FMS Server	1 set
C	12	Doppler Radar	1 set
	13	Meteorological Data Visualization Software Package Manufactured by TRIVS	1 set
	14	Ocean Tethered Buoy for Marine Meteorological Observation	1 set
D	15	Radioactivity Sensor	1 set
	16	Strong- motion Seismograph	1 set

<Definitions of Priority>

S: Highest priority for the Fijian side and directly related to disaster risk management.

A: High priority for the Fijian side.

B: Medium priority for the Fijian side.

C/D: Low priority for the Fijian side.

1-2 Natural Conditions

(1) Topographical features

Fiji, located in the south central Pacific Ocean, is an island nation covering a wide expanse of roughly 130,000 hectares centered on the area of Long. 180° west and Lat. 18° south, although most of this area is ocean. Fiji is composed of more than 330 islands, of which one-third are inhabited. It has a total land area of 18,333 square kilometers (2012, Pacific Islands Centre), which is approximately the same area as Shikoku in Japan. The capital city Suva is located on the largest island of Viti Levu, which has an area of 10,429 square kilometers, and the next largest island is Vanua Levu with an area of 5,556 square kilometers. These two islands have mountains that reach altitudes over 900 meters and have an impact on weather conditions.

(2) Climate

Fiji has a maritime tropical climate that is comfortable throughout the year. The coastal parts of Viti Levu and Vanua Levu islands are constantly exposed to trade winds blowing from the southeast, however, the winds are not very strong except for during the cyclone season from November to April. Temperatures are almost constantly uniform and the difference in mean temperatures between the lowest season (July and August) and the highest season (January and February) is only 2~4°C. Temperature is roughly 2°C higher on the downwind side (northwest) of islands compared to the upwind side (southeast), although humidity is lower. The lowest recorded temperature in Fiji so far has been 8°C and the highest recorded temperature has been 39.4°C.

Fiji has a rainy season from November to April and a dry season during the other months of the year, and rainfall is sometimes torrential and localized during the rainy season. The northwestern side suffers from a lack of rain during the dry season. In areas of low rainfall, annual precipitation is around 2,000 millimeters, while it is 3,000 millimeters in coastal areas and reaches up to 6,000 millimeters in mountain areas. On the other islands apart from Viti Levu and Vanua Levu, rainfall varies from 1,500 millimeters to 3,500 millimeters depending on the location and size of the island. In an average year, on the southeast side of Viti Levu Island, rainfall is around 150 millimeters per month during the dry season and around 400 millimeters per month during the rainy season. Whereas rain falls for six out of 10 days during the dry season, it falls for eight out of 10 days during the rainy season. The rain clouds that cause rain in mountain parts sometimes flow down into the northwest parts of islands and bring rain there. March is the month with the most rainfall, and July is the month with the least. The northwest area experiences afternoon squalls and thunderstorms during the rainy season.

Monthly Mean Maximum Temperatures [°C]

Location	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Suva	30.6	31.0	30.6	29.7	28.3	27.6	26.5	26.6	27.0	27.8	28.8	29.8
Nadi	31.6	31.5	31.1	30.6	29.8	29.2	28.5	28.7	29.4	30.2	30.9	31.4

Monthly Mean Minimum Temperatures [°C]

Location	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Suva	23.6	23.8	23.5	23.1	21.9	21.4	20.4	20.5	20.9	21.7	22.5	23.2
Nadi	22.7	23.0	22.6	21.7	20.1	19.3	18.3	18.4	19.3	20.4	21.5	22.1

Monthly Mean Sunlight Hours [hours]

Location	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Suva	6.3	6.0	5.5	5.1	4.9	4.6	4.3	4.9	4.5	5.0	5.6	6.2
Nadi	6.9	6.5	6.2	6.6	6.9	6.9	7.0	7.5	7.2	7.3	7.4	7.3

Monthly Mean Rainfall [mm]

Location	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Suva	315	288	371	690	267	164	142	159	184	234	264	263
Nadi	299	302	324	163	78	62	46	58	77	103	138	159

Rainy Days per Month (0.1 mm or more) (days)

Location	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Suva	23	22	23	22	20	18	18	17	17	19	19	21
Nadi	18	18	19	12	7	6	5	5	6	9	11	13

Source: FMS materials

(3) Earthquake, Tsunami and natural disasters in Pacific Ocean countries including Fiji

Fiji is infrequently damaged by earthquake and tsunami. Although five magnitude seven (7) earthquakes with epicenter close to Fiji have been recorded since 1900, there are no memorable records of damage. FMS has recorded no tsunami disaster in Fiji over the past 20 years, although the country did suffer tsunami damage on September 14, 1953 and December 17, 1975.

Since Fiji is situated on a course taken by cyclones, it frequently experiences cyclones between November and April, especially from January to April. Fiji is hit by one or two cyclones on average every year, and it suffers serious damage around once every two years.

Table 1-2-1 List of Earthquakes and Tsunami Damage in the Pacific Region

Year	Month	Day	Epicenter and Area of Damage	Size	Damage, etc.
1855	1	23	New Zealand (Wellington Earthquake)	M 8.0	Coastal uplift, faults
1875	3	28	New Caledonia: Royalty Island	M 8.0	Fatalities
1900	7	29	Solomon: Santa Cruz Island	M 8.1 (Ms7.6)	
1909	2	22	Fiji	M 7.9 (Mb7.6)	
1910	6	16	Vanuatu: New Hebrides	M 8.6 (Mb7.9)	
1910	11	9	Vanuatu: New Hebrides	M 7.9 (Mb7.5)	
1913	10	14	Vanuatu: New Hebrides	M 8.1 (Mb7.6)	
1917	5	1	New Zealand: Kermadec Islands	M 8.6 (Ms7.9)	
1917	6	26	Tonga~Samoa	M 8.7 (Ms8.4)	
1920	9	20	Vanuatu: New Hebrides	M 8.3 (Ms7.9)	
1931	2	2	New Zealand (Hawks Bay Earthquake)	M 7.9 (Ms7.8)	256 fatalities
1931	10	3	Solomon Islands	M 7.9 (Ms7.9)	50 fatalities

Year	Month	Day	Epicenter and Area of Damage	Size	Damage, etc.
1932	5	26	Fiji Basin	M 7.9 (Mb7.5)	
1937	4	16	Tonga	M 8.1 (Mb7.5)	
1939	4	30	Solomon Islands	M 8.1 (Ms8.0)	12 fatalities
1948	9	8	Tonga	M 7.9 (Ms7.8)	
1950	12	2	Vanuatu: New Hebrides	M 8.1 (Ms7.2, Mb7.6)	
1950	12	14	Fiji	M 7.9 (Mb7.5)	
1955	2	27	New Zealand: Kermadec Islands	M 7.8 (Ms7.7)	
1966	6	15	Solomon Islands	M 7.8 (Ms7.7)	0 fatalities
1973	12	28	Vanuatu: Santo Island	M 7.8 (Ms7.3)	
1975	10	11	Tonga	M 7.8 (Ms7.7)	
1975	12	26	Tonga	M 7.8 (Ms7.5)	
1976	1	14	New Zealand: Kermadec Islands	M 7.8 (Ms7.7)	
1976	1	14	New Zealand: Kermadec Islands	M 8.2 (Ms7.9)	
1980	7	17	Solomon Islands: Santa Cruz Island	M 7.9 (Ms7.7, Mw7.7)	0 fatalities
1986	10	20	New Zealand: Kermadec Islands	M 8.2 (Ms8.1, Mw7.7)	
1995	4	7	Tonga	M 8.0 (Mw7.4)	
1995	8	16	Solomon Islands	M 7.8 (Mw7.7)	0 fatalities
2003	1	20	Solomon Islands	M 7.8 (Mw7.3)	
2006	5	3	Tonga	M 7.8 (Mw8.0)	
2007	4	1	Solomon Islands	M 7.9 (Mw8.1)	52 fatalities, tsunami
2007	12	29	Fiji	Mw 7.8	
2009	9	29	Solomon Islands	M 8.1 (Mw8.1)	192 fatalities, tsunami

Source: Chronological Scientific Tables

The magnitudes that express the size of earthquakes are as follows.

- Meteorological Agency magnitude (M_j):
Used for earthquake information in Japan, this closely approximates to the moment magnitude. In Japan, the Meteorological Agency magnitude (M_j) is frequently expressed as just 'M'.
- Surface-wave magnitude (M_s):
Here, the magnitude is defined from the horizontal components of surface waves, i.e. the maximum amplitude and epicentral distance (angle).
- Body wave magnitude (M_b):
Here, the magnitude is defined from the maximum amplitude, cycle and epicentral depth of body waves (P waves and S waves).
- Moment magnitude (M_w):
This is defined from the moment (M₀) of fault movement caused by an earthquake.

(4) Topography and ground conditions

Regarding large equipment such as Wind Profiler System and Automatic Weather Station (hereinafter referred to as the AWS) that are included in the requested components, topographic survey and soil investigation have been implemented to grasp topography and ground condition of the Project sites and to plan suitable location and structure.

Soil investigation survey has been implemented in FMS Headquarters, Suva Met. Office in Viti Levu Island and Vatudamu radar site in Vanua Levu Island. It is planned to install the Wind Profiler System at FMS Headquarters and the AWS at the others two sites. The survey includes dynamic cone penetration test and soil sampling for the three sites above, analyzing geological features based on soil test. Moreover topographic survey has been implemented in FMS Headquarters because some observation equipment beginning with Wind Profiler System will be installed at the site. As a result, there's no problem in installing each piece of equipment. (Refer to “Appendices-7 Report of Topographical Survey and Soil Investigation” for the results of the survey above.)

CHAPTER 2 CONTENTS OF THE PROJECT

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

(1) Superior Goals and Project Objectives

Fiji is an island country having a tropical climate and it is prone to the effects of wind such as flooding and high tide damage caused by cyclones as well as natural disasters such as earthquakes and tsunamis. Of these disasters, cyclones which occur from November to April in the average rainy season are the most frequent and cause major damage in most years. Moreover, Fiji is situated on the Fiji Plate and destructive earthquakes occur on average once every three years. In order to respond to such natural disasters, based on the government's national disaster management plan, FMS aims to construct a more objective and faster observation system through upgrading meteorological and oceanographic observation equipment and make observation data available online and automatized, etc.

As the background above, through providing equipment for observation, prediction and warning related to meteorological and oceanographic observation, information contributed to disaster prevention will be quickly transmitted to citizens, thereby enabling human damage to be mitigated.

(2) Outline of the Project

In order to achieve the above goals in the Project, Tide Observation System will be installed on Viti Levu island, and VSAT Communication System, AWS and Lightning Detection System will be mainly allocated to FMS Meteorological Offices (hereinafter referred to as the Met Office), and Wind Profiler System and Calibration Equipment will be installed at FMS Headquarters. Therefore the Project aims to procure the equipment for promptly observing and giving notification of natural disaster conditions all over the country, and to install additional online network systems for promptly transmitting and collecting data from each observation point to the FMS Headquarters via satellite telecommunication. By doing so, it will become possible to promptly transmit information contributing to disaster prevention such as rise in tide level, weather changes and so on to citizens and minimize the damage caused by natural disasters.

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

Based on the field survey, concept of the Project is to improve and reinforce the system to observe factors of natural disasters. The concept above becomes possible by introduction of the procured equipment under the Project related to meteorological and oceanographic observation and telecommunication, and by not only observing anomalous tide levels caused by cyclone, weather conditions like heavy rain and lightning and so on but also observing and collecting the observed data in real-time.

Preparing for natural disasters usually by having disaster prevention information transmitted promptly and accurately enables disaster damage to be mitigated with small investment. Therefore, it's possible to mitigate a large amount of cost compared with that one estimated to be incurred in case there's no countermeasure to the disaster. Moreover, it is essential not only for direct effects above but also for indirect effects such as mitigating hindrance to the social and economic development of a country to protecting the lives and property of citizens from natural disasters. An important role for FMS as the meteorological agency in Fiji is to promptly and accurately notify citizens of natural disaster and evacuation information by providing telecommunication systems such as VSAT Communication System that enables real-time telecommunication, especially in the region where the populated islands vulnerable to natural disasters are scattered widely. Therefore, the Project components have been selected upon the considering following points indicated in Table 2-2-1 considered based on field survey.

Table 2-2-1 Criteria of Components Selection

<p>(1) Objectives of the Project</p>	<ul style="list-style-type: none"> -To introduce Tide Observation System for observing tide levels such as high tide in real-time -To expand and reinforce the existing meteorological observation system - To introduce VSAT Communication System that enables prompt telecommunication between FMS Headquarters and Met Offices. -To make observation equipment be linked online and automatized.
<p>(2) Technical appropriateness</p>	<ul style="list-style-type: none"> - The meteorological and oceanographic observation equipment to be procured in the Project will be linked online to the FMS Headquarters by means of satellite telecommunications, wireless and internet. -It's possible to observe tide level and meteorological conditions in real-time. -Since natural disaster information and so on will be promptly transmitted to citizens through agencies involved with disaster prevention, transmission time between outbreak of the disaster and start of evacuation will be shortened. -Observed data of meteorological and oceanographic observation will be shared among the international community and transmitted not only to Fiji but also Japan and Pacific Ocean Countries
<p>(3) Order of priority on the Fijian side</p>	<ul style="list-style-type: none"> -To promote observation equipment to be linked online and automatized in accordance with "FMS Business Plan 2012" -Based on the business plan above, to examine whether the procured equipment and the locations are appropriate or not.
<p>(4) Benefiting effects</p>	<p><u>For Fiji</u> Through implementing the Project, it is anticipated that anomalous tide level and meteorological information will be conveyed to approximately 840,000 citizens, and disaster damage will be mitigated.</p>

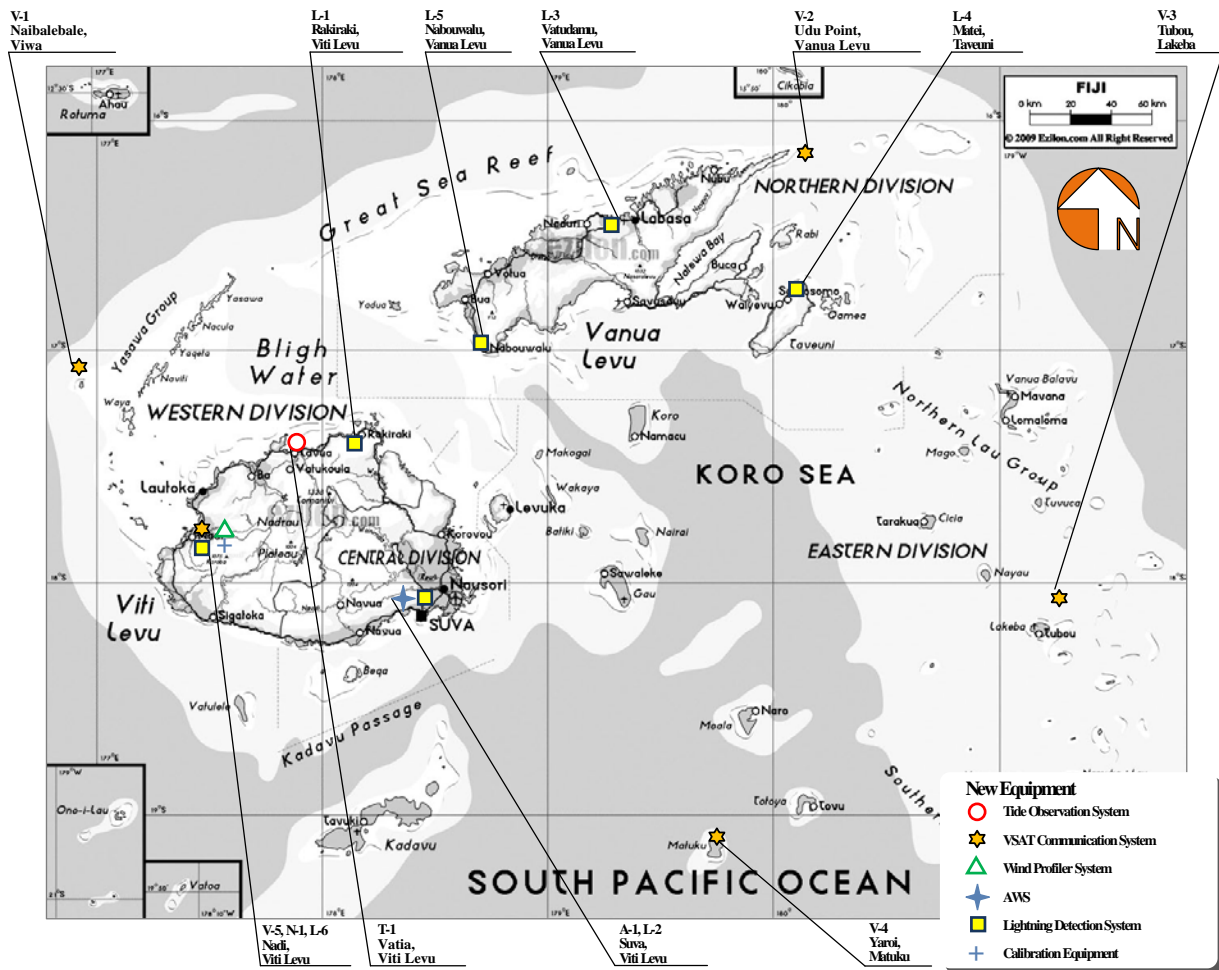
	<p><u>For Japan or Pacific Ocean Countries</u></p> <p>-Anomalous tide levels and meteorological information will be shared among the international community transmitted not only to Fiji but also Japan and Pacific Ocean Countries</p> <p><u>For Stricken Areas of Great East Japan Earthquake</u></p> <p>Assuming that the Project is implemented under “Basic Concept of Rehabilitation from the Great East Japan Earthquake”, since some components shall be composed of the products manufactured in the “Specified Disaster Affected Area” of the Great East Japan Earthquake, the Project will contribute to the said areas.</p>
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As a results of cost estimation based on the criteria above, a comparison table between the requested components by Fijian side and the procured components of the Project is indicated in Table 2-2-2, and locations of the Project sites are shown in Figure 2-2-1. Moreover, for each component, detailed description is in “(3) Policy regarding Equipment Arrangement”.

Table 2-2-2 Comparison between requested components and procured components

Priority	No.	Items	Request	Plan	Reason for change
S	1	Tide Observation System	5 sites	1 sites	Equipment Arrangement
	2	VSAT Communication System	6 sites	5 sites	Equipment Arrangement
A	3	Wind Profiler System	1 sites	1 sites	-
	4	Automatic Weather Station (AWS)	2 sites	1 sites	Equipment Arrangement
	5	Calibration Equipment	1 set	1 set	-
	6	Lightning Detection System	7 sites	6 sites	Equipment Arrangement
B	7	Vehicle for Disaster Prevention Education (VSAT VAN)	1 set	0 set	Low Priority
	8	Digital Barometer	10 sites	0 sites	Low Priority
	9	Anemoscope and Anemometer	5 sites	0 sites	Low Priority
	10	Replacement of Network Cable at FMS Headquarters	1 set	0 set	Low Priority
	11	Data Backup Service for FMS Server	1 set	0 set	Low Priority
C	12	Doppler Radar	1 set	0 set	Low Priority
	13	Meteorological Data Visualization Software Package Manufactured by TRIVS	1 set	0 set	Low Priority
	14	Ocean Tethered Buoy for Marine Meteorological Observation	1 set	0 set	Low Priority
D	15	Radioactivity Sensor	1 set	0 set	Low Priority
	16	Strong- motion Seismograph	1 set	0 set	Low Priority

(note) the equipment which is not adopted is in gray.



(Source : FMS)

Figure 2-2-1 Locations of each component

(2) Policy regarding Implementation Setup

1) Disaster Prevention Communication Setup in Fiji

Natural Disaster Management Office (NDMO) receives meteorological observation information and warnings in terms of meteorological observation from FMS, and tsunami and earthquake information and warnings from the Mineral Resource Department (MRD) respectively. Conventionally, tsunami information has been transmitted from PTWC to MRD and FMS, and MRD issues a warning if necessary by analyzing information. Introduction of Tide Observation System in the Project enables that FMS transmits to MRD and NDMO the independent data of tide level added to tsunami information above. Moreover, introduction of VSAT Communication System in the Project will enable not only mutual telecommunication between each Met Office and FMS Headquarters, but also both prompt transmission to NDMO and accurate information sharing among surrounding countries through GTS.

2) Maintenance Setup in FMS

FMS currently operates and staffs a 24hour setup for meteorological observation, forecasting and observing the other information on disasters. Accordingly, it will need to conduct examination as followings.

- it will be necessary to ensure that the impact on FMS activities is kept to a minimum and observation instruments are designed as far as possible to minimize the need for maintenance.
- Since the new observation equipment for FMS will be introduced, it will be necessary to conduct OJT related to maintenance and operation.

Moreover, in order for comparison observation and detailed inspection to be conducted once a month and once a year to keep conducting accurate observation, it will be necessary to establish periodic operation and maintenance setup.

(3) Policy regarding Equipment Arrangement

1) Tide Observation System

<Observation outline in Japan>

Tidal gauges have conventionally been installed in order to conduct observations for deciding elevation and reference levels in port works, observing high tides caused by typhoons and observing tidal variations and anomalous tide levels. Accordingly, they have frequently been installed at large ports, major fishing ports and at the mouths of large rivers. In recent years, advances in seismic observation equipment and analytic technology have made it possible to clarify the mechanism of submarine earthquake and tsunami occurrence, and tidal gauges have come to also play an important part in observing tsunami. In tidal observation geared to observing tsunami, there are no standards for locating tidal gauges, however, on the international stage, the IOC (Intergovernmental Oceanographic Commission) is advancing the construction of a global tsunami observation network.

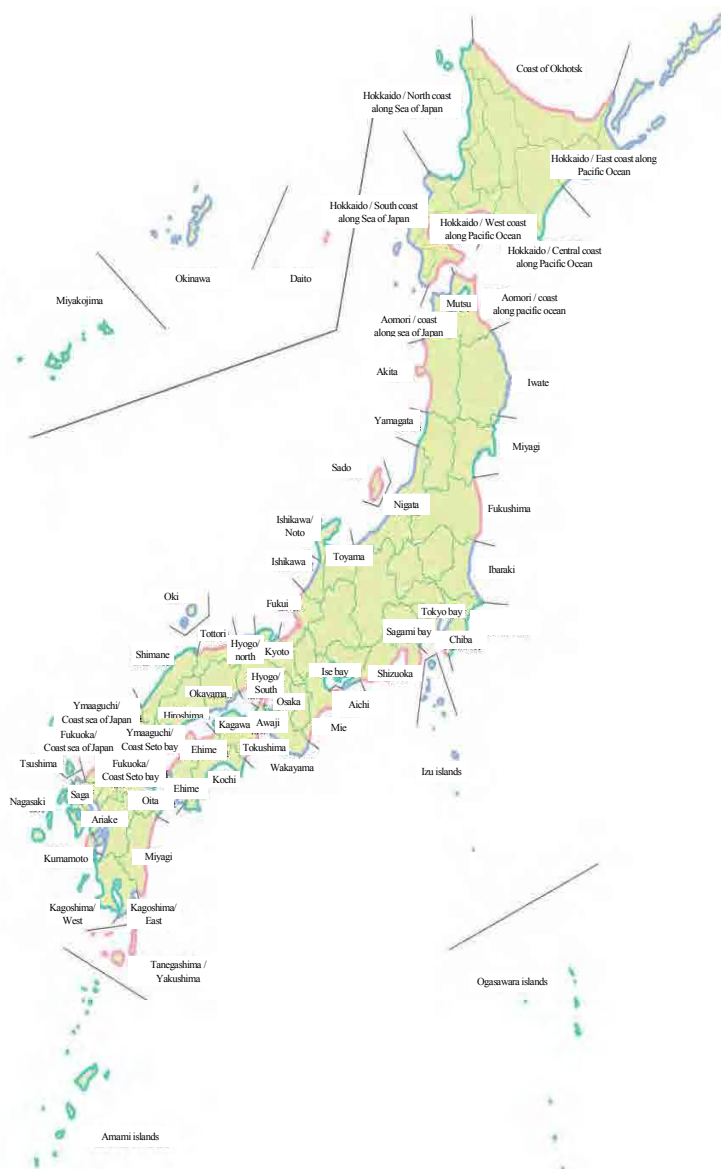
In Japan, Japan Meteorological Agency (JMA) is deploying tidal gauges all over the country with the objectives of announcing and cancelling tsunami forecasts and warnings and observing tsunami. As criteria for installing tidal gauges, JMA aims to install at least one gauge in each tsunami forecasting district. A tsunami forecasting district is the minimum unit for issuing tsunami forecasts and warnings and is basically set according to prefectures; however, in the case of Hokkaido which has long coastlines or the cases of Tokyo Bay and Ise Bay which have differing types of coast in the same prefecture, the forecasting districts are subdivided into smaller sections. Figure 2-2-2 shows the tsunami forecasting districts of Japan. Taking the case of the Pacific coastline of Japan, there are 24 forecasting districts that cover approximately 2,500 kilometers of coastline from Hokkaido to Kyushu. This means that one station is installed for approximately every 100 kilometers of coast on average. Furthermore, since other government

agencies (apart from JMA), research agencies and local governments, etc. also install tidal gauges, observations are actually conducted with even higher density. In the United States, the National Oceanic and Atmospheric Administration (NOAA) conducts tidal observations at 250 locations including Hawaii, Alaska and remote islands and has roughly one tidal weather station (mainly for observing high tides) for every 25 kilometers in the hurricane hotspot of the Gulf of Mexico. Weather stations on the Pacific and Atlantic coastlines are installed at intervals of one every 50 kilometers or so.

<Selection criteria of observation points>

Tidal gauges are desirable to be allocated separately for each and widely in order to observe change of tide level depending on high tide and so on. Moreover, it's necessary for tide gauges to be allocated facing the direction from which high tide will come.

Currently in Fiji, tidal gauges are installed at two locations in Suva and Lautoka, and conducted observing by BOM, but observed data is not observed by FMS in real-time. Accordingly, observation points need to be selected considering both contributions to disaster prevention described above and to obtaining tide observation data in real-time.



(Source : JMA)

Figure 2-2-2 Tsunami Forecasting Districts of Japan

<Installation locations and reasons for selection>

In the preparatory survey of the Project, FMS requested installation of five tidal gauges at five locations in Fiji, and the field survey was conducted in five jetties along the coast. Currently in Viti Levu, since existing tidal gauges owned by BOM are installed at trading ports in the east and west, it's possible to observe both ends of coastline extending for approximately 350 kilometers in a straight-line. By combining existing tidal gauges with the new tidal gauges installed at the

center between those two, it will be possible to have one gauge at roughly every 120 kilometers in Viti Levu Island, that means intervals almost the same as those in Japan.

Based on the examination above, Vatia indicated in Figure 2-2-3 is feasible for installing new tidal gauge because the jetty in Vatia has enough space and structure to support the massive equipment, and the installation area is sufficiently higher than sea level and at low risk of being broken by tsunami.

Parts of area not to be observed will exist in the eastern and southern parts of the Fiji Islands by installing tide gauge only in Vatia. However, it's difficult to increase installation locations in the Project because it is necessary to secure solid land facilities such as jetties and means of telecommunication. Since the observation network will act as a base that will enable nationwide expand tide observation and information provision in Fiji, it will improve ability of disaster prevention by which the Fijian side will conduct self-help in future.

<Prospective Project Effectiveness>

- Real-time observation and observation of anomalous tide levels will become possible.
- Observed tide data will be promptly transmitted to agencies involved with disaster prevention such as NDMO, MRD and so on that need to share tide observation data with FMS.
- By sharing information among the international community through GTS and DCP, tidal change will be shared among Pacific Ocean Countries and Japan, and that will contribute to disaster prevention.



Figure 2-2-3 Arrangement of Tidal Gauges in Fiji

2) VSAT Communication System

<Outline of telecommunication system in Japan>

JMA operates the system to collect, process and distribute enormous real-time observed data, and exchanges meteorological and oceanographic observation data observed not only in Japan but also foreign countries through GTS.

<Selection criteria of installation locations>

Mutual telecommunications between FMS Headquarters and Met Office in terms of meteorological and disaster information observed in Met Office are conducted depending mainly on voice call using short-wave radio. Since it's not available for FMS Headquarters to contact each of the fifteen Met Office at the same time because of just one radio channel, exchange of messages have to be conducted one by one, and short-wave radio can easy easily be jammed.

Meanwhile, Very Small Aperture Terminal (VSAT) is inexpensive and stable telecommunication infrastructure especially for less volume data, and telecommunication locations can be linked for each other using only by satellite telecommunication lines as a leased line. Accordingly, since it will be possible for VSAT Communication System to secure telecommunication lines via satellite in case unstable line connections occur at times of disasters, it is desirable to install mainly in Met Office in remote islands where telecommunication conditions are not stable.

<Installation locations and reasons for selection>

For the criteria above, five installation locations were selected as indicated in Figure 2-2-1, i.e. FMS Headquarters as the location of data collection and four Met Offices in Viwa, Lakeba, Matuku and Udu point. The former Met Offices are located at the four cardinal points in Fiji and on the cyclone route together with the other Met Offices. Accordingly, it's possible to promptly and accurately transmit data on meteorological changes and disaster information caused by cyclones observed widely in Fiji.

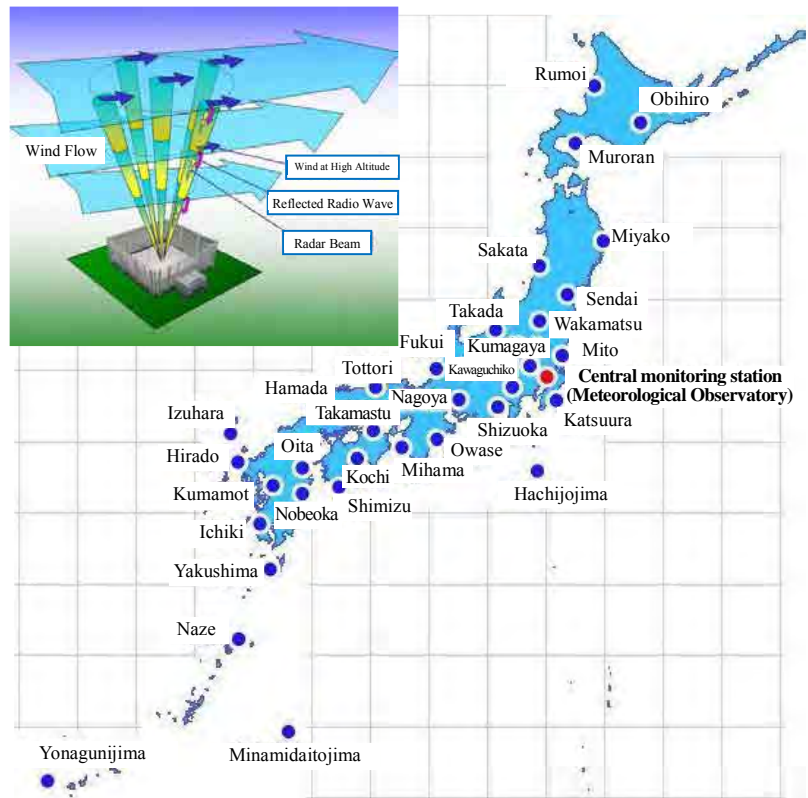
<Prospective Project Effectiveness>

- It will become possible both to promptly transmit data observed in Met Offices to FMS Headquarters by using telephone, FAX and internet and to transmit information to Met Offices depending on 24-hours setup in FMS Headquarters.
- It will become possible both to observe and transmit data on cyclones and so on causing natural disaster in real-time and to secure stable telecommunication lines via satellite in case unstable line connections occur at a time of disasters.

3) Wind Profiler System

<Observation outline in Japan>

JMA in April 2001 commenced nationwide observation based on a network of 33 wind profilers. The observation data obtained via the wind profilers is consolidated in a central monitoring station in JMA Headquarters, and it is then utilized to make numerical forecasts that provide the basis for detailed meteorological forecasts. This observation and processing system is collectively referred to as WINDAS (Wind profiler Network and Data Acquisition System) (see Figure 2-2-4).



(Source : JMA)

Figure 2-2-4 Wind Profiler Network in Japan

Wind profilers observe wind conditions at altitude intervals of 300 meters every 10 minutes. Observation outline of Wind Profiler System is indicated in Figure 2-2-4, which radio waves are shot from antenna to the sky and are scattered by wind flow and reflected waves are received by the antenna. The possible height for observation differs according to the state of the atmosphere, weather conditions and season, however, generally observation can be conducted at altitudes of 3~6 kilometers when there is no precipitation and 7~9 kilometers when there is precipitation.

<Selection criteria of installation locations>

Introduction of Wind Profiler System will make it possible to grasp atmospheric vertical conditions affected by the movement of cyclone, cumulonimbus cloud and so on by observing wind direction, velocity and wind flow just above the observation point. That information above will contribute to numerical forecasting, prompt meteorological forecasting of atmospheric vertical conditions and provision of information from aerodrome meteorological observation. Accordingly, it's effective for Wind Profiler System to be installed to the wide space surrounded by as few high buildings as possible and where aerodrome meteorological observation can be easily conducted.

<Installation locations and reasons for selection>

Based on the request by FMS, Wind Profiler System will be installed to the site of FMS Headquarters next to the Nadi International Airport because accurate forecasting based on the observation of wind flow at high altitude just near by the airport contributes to safety flight.

<Prospective Project Effectiveness>

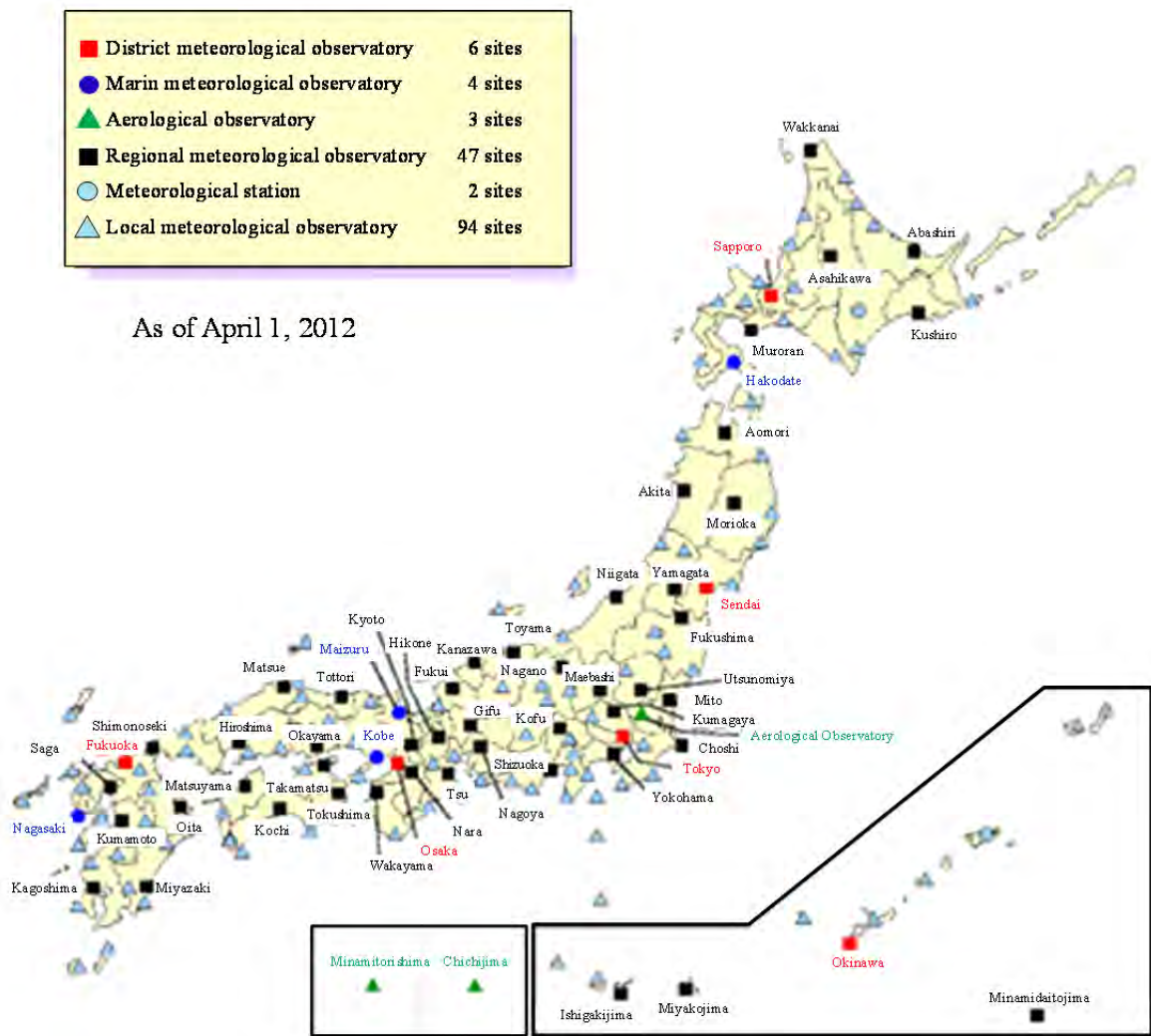
- It will become possible to ordinarily observe vertical conditions of upper wind in FMS Headquarters next to Nadi in real-time.

- It will become possible to promptly provide information contributing to safe flights by sharing information among related agencies such as the Civil Aviation Authority of Fiji (CAAF).

4) Automatic Weather Station (AWS)

<Observation outline in Japan>

JMA conducts two types of meteorological observation, i.e. 1) surface meteorological observation conducted by meteorological observatories (some of which were formerly meteorological stations), and 2) the local meteorological observation system known as AMeDAS (Automated Meteorological Data Acquisition System). Concerning surface meteorological observation, approximately 60 meteorological observatories and meteorological stations throughout the country conduct meteorological observation of air pressure, temperature, humidity, wind direction, wind velocity, precipitation, fallen snow (depth), falling snow depth, sunlight hours, solar irradiation, cloud, visibility and atmospheric phenomena, etc. Observation personnel can visually observe cloud, visibility and atmospheric phenomena and so on, however, other items are automatically observed by equipment at surface weather stations. Moreover, approximately 90 local meteorological observatories conduct only automatic observations using the same equipment used for surface meteorological observation. These observation data are utilized for announcing advisories, warnings and weather forecasts as well as for grasping meteorological fluctuations and surveying and researching industrial activities, etc. Some of the observation findings above are transmitted as Japan's meteorological observation data to the world's meteorological agencies via GTS, thereby making an international contribution to meteorological observation and analysis on the global scale, setting of initial values for the numerical forecasting model and observation of meteorological fluctuations. Figure 2-2-5 shows the location of surface meteorological observatories in Japan.



(Source : JMA)

Figure 2-2-5 Surface Weather Stations in Japan

Meanwhile, AMeDAS automatically observes limited items such as precipitation, wind direction and velocity, temperature and sunlight hours in order to observe meteorological conditions in detail on an hourly and local basis. This system thus plays an important role in preventing and mitigating natural disasters. AMeDAS commenced operation on November 1, 1974 and currently comprises approximately 1,300 observatories observing precipitation throughout the country. Out of these, approximately 840 observatories (at intervals of roughly 21 kilometers) also observe wind direction and velocity, temperature and sunlight hours in addition to precipitation, while 310 observatories in snowy locations also observe the depth of fallen snow during the cold season. Moreover, not only do surface weather stations observe meteorological conditions at each location, but their observations provide important data for early detection of natural disasters and observing of climate change over the long term. Since each country's observation findings not only provide meteorological data for domestic use but also prove useful in analyzing meteorological phenomena and climate changes on the global scale, they are important for all

countries including Japan. Accordingly, the WMO has established regulations concerning the standards of equipment, observation methods and maintenance in order to realize observations based on internationally common methods and with similar accuracy. JMA has refined these WMO regulations to establish a certification test system for meteorological instruments and it conducts ongoing guidance on guaranteeing accuracy and conducting continuous maintenance in meteorological observation.

<Selection criteria of installation locations>

At first, it's necessary for AWS to be located in the sites where it's possible to observe meteorological phenomena widely. Secondly, it's effective from perspective of disaster prevention to select the sites that are prone to natural disasters and where many people can benefit from observation findings. Moreover, since there are not so many AWS in Fiji and manual observation activities such as personnel watching, voice call transmission to FMS Headquarters and so on in many Met Offices, it's necessary to improve present conditions as soon as possible in order to have an early grasp of disasters. Accordingly, the installation locations have been decided based on three criteria as follows, 1) Observing as widely as possible, 2) Even arrangement within the locations of existing observatories, 3) Maintenances is certainly conducted.

<Installation locations and reasons for selection>

Existing Met Offices are widely located nationwide as indicated in "Location of the Project Sites in Fiji" (at the begging of the Report). Meanwhile it's desirable for some Met Offices where observation hasn't been automatized yet to be renewed. Currently, FMS is conducting extension and structural alteration of the building of Suva Met Office to be completed in 2014 as the backup for FMS Headquarters in the case it suffers from disasters. Accordingly, one new AWS will be introduced to the most populous city Suva in the Project as part of improvement of FMS observation setup. Therefore, meteorological information on the principal area Suva and so on will be transmitted to FMS Headquarters in real-time, and it will be possible to examine meteorological data compared to that of the other cities.

<Prospective Project Effectiveness>

-By real-time observing of meteorological data observed in capital city Suva in FMS Headquarters, it will be possible to accurately observe heavy rain, strong winds and so on, and the Project will benefit the populated area.

-Observed data in Fiji shared among the meteorological agencies in the world will be utilized to grasp meteorological conditions internationally.

5) Calibration Equipment

<Outline of examination for meteorological observation instruments in Japan>

Meteorological Instruments Center, which is designated as an examining body using meteorological instruments in Asian region by WMO, examines instruments used for meteorological observation and maintains accuracy. Moreover, regarding observation method, maintenance and inspection, conditions necessary for observation and observation accuracy are kept according to standards based on the regulations provided by JMA, and observation accuracy of instruments in observation points related to AMeDAS is kept by periodic value inspection by standard calibration equipment.

<Necessity for appropriate maintenance and operation>

It's important for continuous accurate meteorological observation to inspect instruments periodically, to keep accuracy of each instrument, to process observed values correctly and so on. The calibration equipment currently used in Fiji was introduced more than 15 years ago and some equipment and parts have been damaged and have impaired quality. Many observation instruments such as thermometer, hygrometer and barometer and so on have been upgraded from conventional analog type to digital (electric) type gradually and it's necessary to introduce new calibration equipment that is available for widespread observation instruments.

<Installation locations and reasons for selected>

FMS in 2012 hosted third-country training on meteorological instrument calibration by JICA, and it plays a central role within the Pacific region in meteorological observation. However, during this third-country training, the JMA pointed out the current problems with existing calibration equipment in Fiji and FMS was requested to introduce some new calibration equipment in the Project. For this reason in addition to that new observation equipment that will be introduced in the Project, some calibration equipment needs to be renewed with a view to utilizing existing equipment as much as possible. By conducting such renewal, it become possible for FMS to improve meteorological observation accuracy and provide accurate observation data internationally by calibrating both new instruments and existing ones.

<Prospective Project Effectiveness>

-Periodic calibration on observation instruments owned by FMS will make it possible to obtain correct values and improve disaster prevention setup.

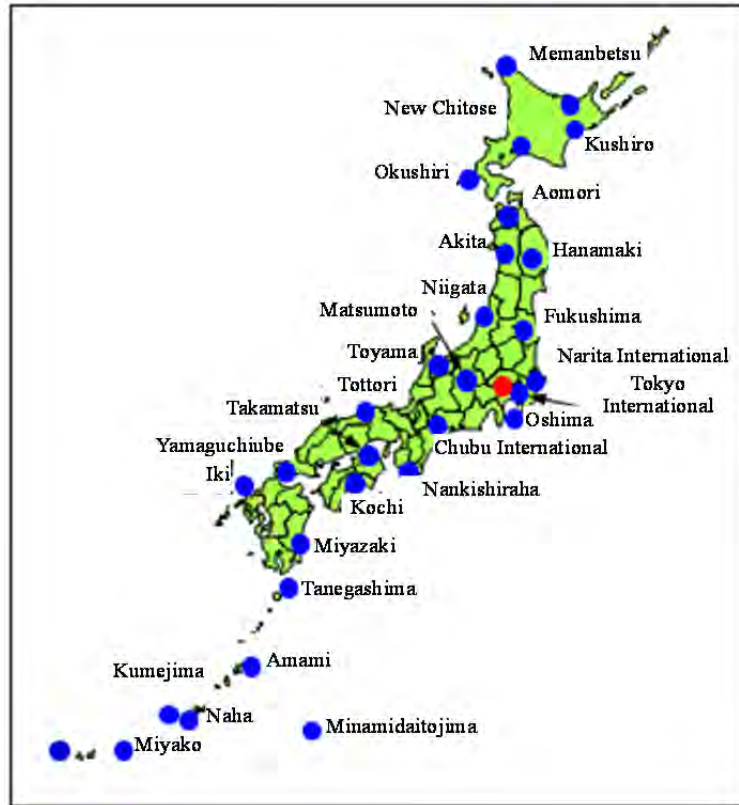
-Periodic inspection enables instruments to extend life expectancy and to avoid impairment of quality.

-Since it becomes possible to calibrate observation instruments in other Pacific Ocean countries, meteorological observation data from the whole Pacific Ocean area will be more reliable.

6) Lightning Detection System

<Observation Outline in Japan>

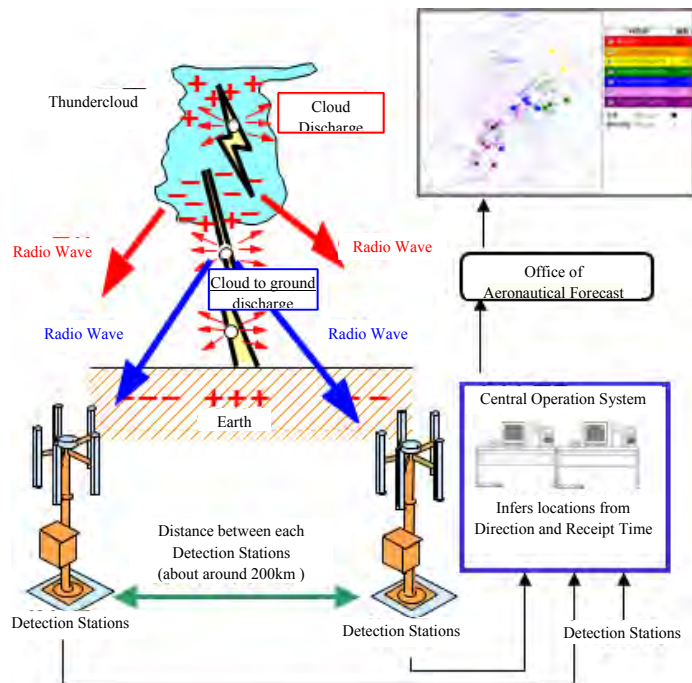
Lightning Detection System receives radio waves generated by lightning and compiles data on the location and time, etc. of occurrence. Through immediately presenting this information to airline companies and so on, it can be effectively utilized for securing safety in ground work at airports and the safe operation of aircraft. JMA calls this lightning detection system LIDEN (Lightning Detection Network system). Figure 2-2-6 shows the network of JMA



(Source : JMA)

Figure 2-2-6 Location of LIDEN

In LIDEN, lightning electromagnetic waves are received by 30 detection stations throughout the country, and information on the lightning reception time, orientation of cloud discharge, scale of ground discharge and so on is instantaneously transmitted to the central operation system. The central operation system automatically calculates the type and location of the lightning based on the received information. Figure 2-2-7 shows the composition of LIDEN.



(Source : JMA)

Figure 2-2-7 Composition of LIDEN

<Selection criteria of installation locations>

The system analyzing resolution of distance between observation point and origin and orientation will be introduced in the Project. Moreover, since radio waves accompanying by lightning are attenuated depending on the distance from origin, it's desirable to install in the areas that benefit by obtaining lightning detection information near there, such as populated areas, areas where there are some facilities prone to lightning damage and so on. Accordingly, the two main islands Viti Levu and Vanua Levu characterized above have been selected as installation areas in the Project. Detection coverage that will be realized in the Project is indicated in "Appendices-5 Outline Design Drawings".

<Installation locations and reasons for selection>

About 10 lives are lost by lightning every year in Fiji. Though one lightning sensor has been installed at FMS Headquarters, detection coverage is not enough to cover all areas of Fiji but only around Nadi centered upon FMS Headquarters. In the Project, six new Lightning Detection Systems will be installed in order to cover the most populous island Viti Levu and second most populous island Vanua Levu. Hereby, it's expected that lightning accidents will decrease by promptly collecting accurate information on lightning occurrence conditions widely over the main area of Fiji.

< Prospective Project Effectiveness >

- Lightning detection in main areas of Fiji contributes to safe operation of aircraft.
- Observed lightning detection data will be provided to the concerned government agencies, and to citizens if possible.

(4) Policy regarding Measurement System of Tidal Gauges

There are various types of tidal gauge depending on objectives, and for example, not only the ultrasonic type that emits ultrasonic wave signals from above the ocean to the ocean surface and measures the position of the sea surface based on the time taken by reflected signals, but also the float type, the buoy type and the hydraulic type are generally used. In the Project, since emphasis will be placed on realizing a tide level automatic observation and automatic transmission system for as low a cost as possible, ultrasound gauges fitted to existing jetties have been adopted and will also facilitate maintenance by the Fijian side.

(5) Policy regarding Power Sources

Since the measuring instruments related to meteorological and oceanographic observation to be procured in the Project are generally prone to the effects of vibration and noise, they are installed in areas away from roads and houses. Therefore, power supply is not secured in almost all the Project site except for the area of FMS Headquarters. The ways to secure power supply are leading from the

commercial grid and installing independent sources. In the former case, it's necessary to install equipment, which considers voltage drop depending on distance between existing distribution lines and installed locations. In the latter case, though generator and solar power system are relevant to independent source, generator which vibrates, gives a noise and generates heat is not adoptable for observation points of meteorological and oceanographic observation, and it incurs costs for fuel and expendables and so on. Since the procured equipment and other measuring instruments in the Project will have relatively low power consumption, solar power systems that entail low initial investment and maintenance costs will be principally adopted as the power source.

(6) Policy regarding Transmission of Measurement Data

Regarding to meteorological and oceanographic observation equipment, thanks to recent advances in computer technology, it has become possible to digitize observed values and topographical data from tidal gauges and other instruments and to transmit data as encoded signals. As methods for transmitting data, the systems with the greatest transmitting capacity are, in order, satellite lines, wireless transmission networks and internet, etc. It's necessary for Lightning Detection System, Tide Observation System and AWS of the procured equipment in the Project to transmit observed data to FMS Headquarters. And those shall be designed to transmit data per between 5 to 10 seconds (Lightning Detection System), per 1 minute (Tide Observation System), and per 10 minutes (AWS) respectively. Moreover, if the interval is shortened in the interests of disaster prevention, the volume of transmitted data becomes bigger. Therefore, it has been decided to primarily utilize satellite line for transmitting data from meteorological and oceanographic observation equipment procured in the Project in order for large volumes of data to be promptly transmitted. Satellite lines in Fiji are mainly operated by Telecom Fiji Limited (TFL), and it has been agreed in the M/D that charges for using telecommunication equipment will be borne by the Fijian side.

Since a lot of the Project sites are not suitable for providing telecommunication system such as wireless network, internet, and telephone and so on, satellite telecommunication system will be principally adopted for transmitting the observed data. The satellite telecommunication systems used in the Project are indicated in Table 2-2-3. Moreover, since Tide Observation System, Wind Profiler System, AWS and Lightning Detection System will be connected online to Data Collection System in FMS Headquarters, observed data can be monitored there in real-time. Though the equipment is procured mainly in Japan including "Specified Disaster Affected Area", of which data transmission system is different from the existing system in Fiji, the new independent data collection system will be installed for the system above in order to reduce risk such as malfunction of mixture of the system. Data transmission system for each equipment and sites are indicated in Table 2-2-4.

Table 2-2-3 Characteristic of Satellite Transmission

Satellite telecommunication	Characteristic
BGAN	A satellite telecommunication system that is charged depending on data volume and telecommunication duration, and is relatively expensive. In case it's operated to constantly transmit data such as meteorological and oceanographic observation data, it will be possible to keep running costs low since charge will be set only depending on telecommunication duration.
VSAT	A leased line operated by contracting a fixed amount every month. It's suitable for the telecommunication systems that need to be always on such as internet, data telecommunication on lightning and so on.
DCP	A leased line for meteorological data operated by using meteorological satellite telecommunication in Japan. Though it's used for telecommunication restricted to data telecommunication regulated internationally such as tide observation data, there are no charges.

Table 2-2-4 Methods of Data Transmission for each Equipment and Sites

Components	Locations	Data transmission
No.1 Tide Observation System (1 site)	T-1 Vatia	BAGN and DCP
No.2 VSAT Communication System (5 sites)	V-1 Naibalebale	VSAT
	V-2 Udu Point	VSAT
	V-3 Tubou	VSAT
	V-4 Yaroi	VSAT
	V-5 Nadi (FMS Headquarters)	VSAT
No.2 Wind Profiler System (1 site)	N-1 Nadi (FMS Headquarters)	--
No.4 AWS (1 site)	A-1 Suva	BGAN
No.6 Lightning Detection System (6 sites)	L-1 Rakiraki	VSAT
	L-2 Suva	VSAT
	L-3 Vatudamu	VSAT
	L-4 Matei	VSAT
	L-5 Nabouwalu	VSAT
	L-6 Nadi (FMS Headquarters)	VSAT

(7) Policy regarding Online Uploading and Sharing of Data

The data concerning meteorological and oceanographic observation is generally recorded in data loggers installed in each pieces of equipment. If equipment is not online, it is necessary to dispatch employees into the field to recover the data from the loggers. Therefore, since observed data cannot be promptly transmitted and analyzed, it's considered that information related to disasters is not promptly transmitted to citizens. In the Project, satellite transmission system will be introduced in order to put meteorological and oceanographic observation equipment online. Doing so will make it possible to immediately transmit meteorological and oceanographic observation information to disaster prevention agencies such as NDMO, and the smooth provision of information for citizens to evacuate to safe places can be expected. Moreover, in the Project, principally satellite transmission for on

business will be used to transmit data from each observation device to monitoring systems installed in FMS Headquarters. However, in terms of Tide Observation System, DCP provided on the MTSAT weather satellite is used and the sent data can be incorporated into GTS and shared among international meteorological observation agencies. Concerning data that doesn't pass through weather satellites, it has been decided to distribute information onto the internet via the monitoring system network so that it too can be shared internationally.

(8) Policy regarding Natural Conditions

1) Concerning temperature and humidity conditions

According to meteorological observation data published by FMS, the maximum recorded temperature in the Project target area is around 38.0°C and the lowest recorded temperature is around 6.5°C. Accordingly, the procured equipment in the Project will be given a maximum permissible temperature of 45°C to ensure that functions can be secured.

2) Concerning rainfall and lightning

Precipitation in Fiji varies according to area, and there are some observation stations where maximum precipitation exceeds 865 millimeters. Moreover, since squalls sometimes occur during the rainy season (January to March), consideration will be given to adopting waterproof observation instruments and ancillary equipment (tidal gauges, transmitter antennas, GPS sensors, solar power systems, etc.) for outdoor installation. In particular, since river flooding causes a lot of damage every year between November and March, it will be necessary for measuring instruments installed on the ground to be moved to install on high locations not at risk of flooding. Also, flood trends will need to be taken into account when installing the foundations for outdoor instruments.

(9) Policy regarding Social Conditions

Since almost all people in Fiji are Christians and Hindu, there are no social customs such as the Moslem custom of Ramadan that have a relatively long-term impact on the construction schedule.

(10) Policy regarding the Construction Situation

The procured equipment in the Project is composed of relatively small-size precision instruments. When installing, adjusting and testing such instruments, it is normal for engineers dispatched from the maker or operators specified by the maker to conduct work to ensure the performance and quality of equipment. Moreover, whenever necessary, an efficient and economical works implementation setup will be adopted through employing electricians, qualified laborer and common laborer, etc. from local firms to assist in the carrying-in, unpacking and installation of equipment. As for tidal gauges and other instruments to be installed on the coast, it will be necessary to take steps against salt damage

such as using stainless steel members and so on. Moreover, in consideration of the moisture caused by flooding, steps will be taken to ensure that electronic parts are waterproofed.

(11) Policy regarding Procurement Conditions in Third Countries

Since the Project is implemented under “Basic Concept of Rehabilitation from Great East Japan Earthquake”, policy regarding procurement is to select Japanese products comprising mainly products made in stricken areas of The Great East Japan Earthquake. However, since some products are not made in Japan, it is planned to procure equipment from other countries apart from Japan. Out of the equipment requested by the Fijian side, the VSAT Communication System has previously been operated by Telecom Fiji Limited, and it is considered appropriate in terms of post-sales service, maintenance and cost to procure from the same company. As for the Lightning Detection System, in terms of having wide coverage in two main island Viti Levu and Vanua Levu, the same products need to be installed at all six locations.

(12) Policy regarding Grade Setting

In designing the observation equipment to be procured in the Project, considering the existing equipment composition and implementation setup, care will be taken not to deviate from the technical level of FMS, which will implement operation and maintenance following supply.

(13) Policy regarding Transportation and Works Schedule

Equipment procured from Japan or third countries will primarily be transported overseas to the main port of Suva in Fiji. From there, the equipment will be transported by sea route or overland to each Project site, and there shouldn't be any particular problems in terms of inland transportation. The required lead time for transportation from Japan to each Project site in Fiji, including customs clearance procedure at Suva Port, will be around 50 days maximum. Moreover, before the Japanese side implements installation of the procured equipment, it will be necessary for the Fijian side to secure authorization to use tidal gauge installation sites and complete the application procedure concerning use of DCP lines and so on. Accordingly, the Consultant will give appropriate advice and guidance to the counterparts to ensure that these obligations on the Fijian side can be implemented without delay. Moreover, works schedule of the Project is planned under examining periods about transportation above, equipment manufacture, installation works, OJT and so on. However, since cyclones comes between November to April in the average year, period of a contract both for the Consultant and the Contractor includes an extension of two or three months, considering cases where cyclone season falls on the works schedule.

2-2-2 Basic Plan (Equipment Plan)

(1) General Plan

1) Weather and Site Conditions

① Temperature

Minimum : -5 °C

Maximum : 40 °C

② Humidity : Maximum 100%

③ Wind velocity : Maximum 60 m/s

④ Rainfall : Daily maximum rainfall 865 mm

⑤ Altitude : 10 m or less (tidal gauge installation sites)

⑥ AC power supply : 415 V (3 phase), 240 V (single phase), 50 Hz

2) Applicable Standards

	Name of Standards	Application
(a)	International Electrotechnical Commission (IEC)	Electrical goods in general
(b)	International Standardization Organization (ISO)	Industrial products in general
(c)	Japanese Industrial Standards (JIS)	Industrial products in general
(d)	Japanese Electrotechnical Commission (JEC)	Electrical goods in general
(e)	The Standard of Japan Electrical Manufacturer's Association (JEM)	Electrical goods in general
(f)	Japan Electric Association Code (JEAC)	Electrical goods in general
(g)	Japan Cable Maker's Association Standard (JCS)	Electrical cable
(h)	Electrical Industrial Association of Japan (EIAJ)	Electrical goods in general
(i)	International Telecommunication Union (ITU)	Electrical goods in general

(2) Equipment Plan

1) Tide Observation System

Tidal gauges will be installed on jetties and coasts under the control of FMS. The tidal gauges will adopt the ultrasonic method of measurement, and tidal data will be transmitted to FMS Headquarters via satellite links. Basically, BGAN (Broadband Global Area Network) or other private satellite lines will be used to send data to FMS, however, weather satellite DCP (Data Collection Platform) functions will be used for transmission. Since DCP has a longer data sampling cycle than BGAN, it is not suitable for disaster prevention use, however, since observation data can be directly incorporated into GTS via the weather satellite MTSAT that is managed by JMA, the observation data shared on GTS can also be viewed by FMS. Power to the tidal gauges will be supplied from solar power systems. Since tidal gauges will be installed at the ends of jetties, salt damage prevention specifications will be adopted and exposed metal parts will

comprise anti-corrosive aluminum or stainless steel, etc. Also, since it will be necessary to protect tidal gauge sensors, data loggers and batteries, etc. from humidity and dust, these instruments will be housed in waterproof and dustproof cabinets. To ensure that sensors can be easily cleaned, structures that permit easy maintenance will be adopted and fences will be constructed to prevent theft and ensure safety. Ultrasonic tidal gauges emit ultrasonic waves

from above the ocean to the sea surface and calculate the tide level by measuring the time it takes for the waves to rebound and return from the sea. Since the measured outward and inward time differs according to temperature in the propagation route, it is necessary to simultaneously measure temperature and correct the tide level.

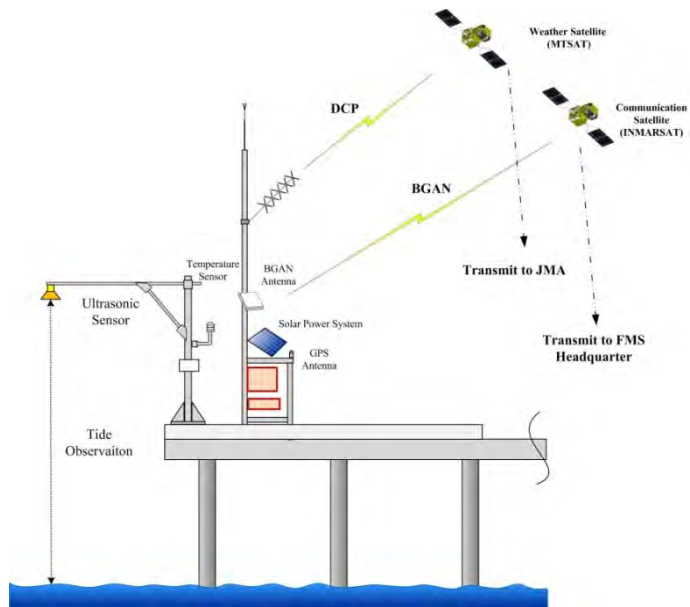


Figure 2-2-8 Outline of Tide Observation System

2) VSAT Communication System

Introduction of this system makes it possible to transmit and receive via a leased line of satellite by using small caliber parabolic antenna for satellite telecommunication and to link public network lines and telephone and internet. Characteristic of the system is that it's possible to use satellite telecommunication lines inexpensively by transmitting small volume data. Moreover, this system enables the Met Offices in remote islands with unstable condition of telecommunication conditions to use telephone, FAX and internet stably via VSAT communication line. Since power source in remote islands is not securely provided, solar power system will be installed.

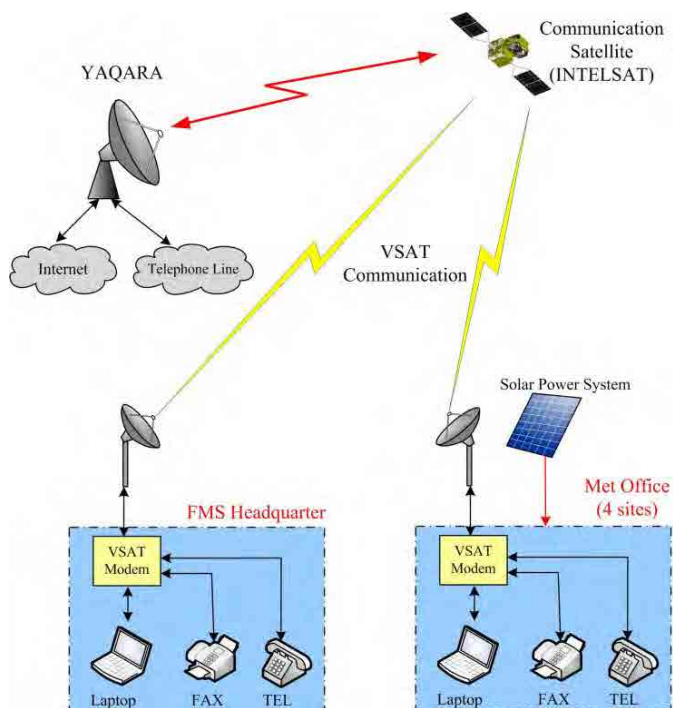


Figure 2-2-9 Outline of VSAT Communication System

3) Wind Profiler System

Introduction of this system makes it possible to observe wind direction and velocity in real-time and to grasp actual condition of wind in the upper air for every ten minutes. Since this system will be installed to FMS Headquarters, wind above the landing strip of Nadi International Airport will be accurately observed. Though possible altitude to be observed fluctuates depending on weather condition as indicated in clause 2-2-1 of the report, this system is designed to target to observe at an altitude of about 1,500 meters every 100 meters vertically from the ground level by radar beam shot from antenna unit.

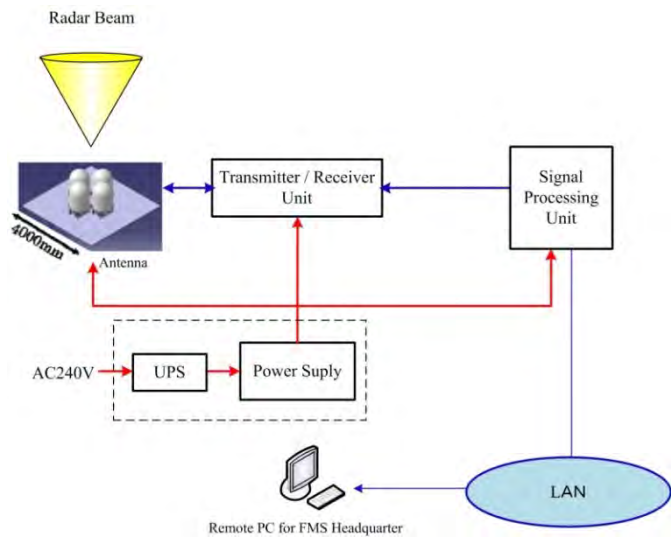


Figure 2-2-10 Outline of Wind Profiler System

4) Automatic weather station (AWS)

Introduction of this system enables meteorological observation to be automatized and observed data to be transmitted to FMS Headquarters in real-time via satellite telecommunication line, and the data will be monitored in FMS Headquarters by data collection system included in this system. This system is composed of instruments for observing wind direction, velocity, rainfall, temperature, humidity, air pressure and isolation, which are part of the items of meteorological observation. Each instrument composing this system will have passed the examination test of JMA, and will be designed to be weatherproof in Fiji. Moreover, Suva Met Office will carry out power supply to this system.

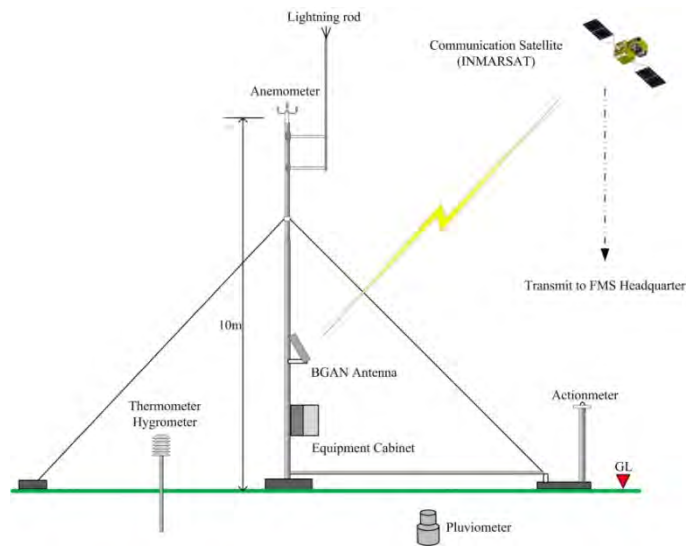


Figure 2-2-11 Outline of AWS

5) Calibration equipment

In order to maintain the accuracy and performance of major meteorological instruments, the calibration equipment necessary for conducting appropriate maintenance inspections and to be renewed depending on being superannuated will be procured. Moreover, since FMS is required to operate observation instruments with accuracy and quality above standard level in order to share meteorological and oceanographic observation data internationally through GTS, it's necessary for FMS to accurately calibrate observation instruments. Accordingly, Calibration Equipment will comply with specification of JMA Meteorological Instruments Center as indicated in Table2-2-5.

Table 2-2-5 Each Calibration Equipment and Function

Items	Function
Calibration equipment for barometer	Composed of pressure controller and standard barometer as electronic type.
Calibration equipment thermometer	Composed of liquid chamber, water purifier, icebreaker, standard thermometer as electronic type, carrying asmann type standard of psychrometer and carrying electronic type standard of psychrometer.
Calibration equipment for hygrometer	Composed of chilled mirror dew-point hygrometer, temperature sensor, indicator and air pump.
Laptop	Shall display, convert and store calibration data of meteorological instruments

6) Lightning Detection System

Introduction of this system enables information on lightning detection near each observation point to be transmitted to FMS Headquarters in real-time via satellite telecommunication line, and the information above will be displayed on the map of Fiji in FMS Headquarters within data collection system included in this system. Lightning sensor will be designed so that detection coverage of it is between 50km to 100km radius from each installation location. Moreover, solar power system will be adopted as power source of this system and VSAT

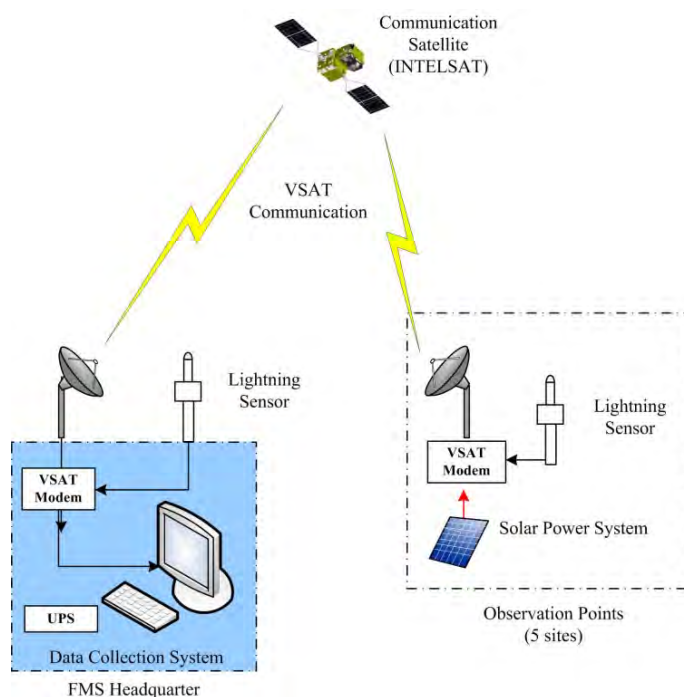


Figure 2-2-12 Outline of Lightning Detection System

communication line will be adopted for data telecommunication considering promptness and data volume. The realized detection coverage is indicated in “Appendices-5 Outline Design Drawings”.

(3) Equipment List

1) Outline specifications of major equipment

Table 2-2-6 Outline specifications of major equipment

No.		Item	Requirement
1		Tide Observation System	
	1.1	Tidal Gauge	
	(1)	General condition	
		- Operating time	24 hours/ 365(366) days
		- Operating temperature	-20°C to 50°C
		- Weatherproof	All weatherproof and Salinity tolerance
		- Power supply	DC12V +/-2V
	(2)	Ultrasonic Sensor	
		- Measuring range (MR)	0 to 10 m
		- Resolution	Less than +/-1.0cm (In calm condition)
		- Dead zone	Less than 1m
		- Mounting	Shall be mounted on the supporting pole
		- Frequency band	Shall not be much affected by weather conditions such as rainfall and so on.
		Width of ultrasonic beam	Shall be narrow as possible not to be affected by the landing pier, facilities and so on.
	(3)	Temperature Sensor	
		- Measuring range	-30 to 50°C
		-Resolution	Less than 0.1°C
		-Ventilation	Natural vent sleeve
		-Mounting	Shall be mounted on the supporting pole
	(4)	Converter	
		-Output data	Shall convert the traveling time to tide level with temperature correcting
		-Output signal	Digital RS232C Analogue +/- 1.0V/ 5.0V (FS)
		-Standard level	Shall set up a standard observation level.
	(5)	Supporting Pole	
		-Composition	It consists of a vertical pole and a horizontal pole.
		-Material	Aluminium or stainless steel.
		-Installation	Shall be installed on the landing pier/ landing facility by anchor bolts strongly enough.

No.		Item	Requirement
		-Sensor installation	Ultrasonic sensor shall be installed on the end of a horizontal pole and Temperature sensor shall be installed on an adequate position.
	(6)	Lightning Arrester	
		-Function	Shall protect the Ultrasonic sensor and converter from induced lightning.
1.6		Solar Power System	
	(1)	PV Module	
		- Voltage	DC12V
		- Capacity	Shall cover 100% of the total power consumption of whole system.
	(2)	Battery	
		- Type	Sealed Lead Acid Battery
		- Voltage	DC12V
		- Capacity	72 hours or more after the charge stop.
	(3)	Charge controller	
		- Function	Shall protect from overload and low voltage
1.7		Frame and Container	
		- Weatherproof	All weatherproof and Salinity tolerance such as stainless
		- Degree of Protection	IP56 or equivalent
		- Container-1	Shall contain all equipment except power supply unit.
		- Container-2	Shall contain power supply unit.
		- Frame	Shall contain the Container-1, -2 and PV module
1.8		Data Collection System for FMS Headquarters	
		-CPU	Intel Xeon ES-1660 or equivalent
		-Memory	16GB or more
		-Hard Disk	2.0TB or more
		-Display	42inch or more
		-OS	Linux or equivalent (latest English version)
		-Software	For processing the tidal information from the sites through BGAN transmission system, monitoring and storing those information in HDD
		-Information to be monitored	Tide level (Bar graph / Time progress of the level) Anomaly between measured tide and estimated tide (Estimated tide data file shall be recorded.)
		-Expandability	Shall support to add locations (stations) in future.
		-Browsing	Shall enable the observed data to be viewable through internet

No.	Item	Requirement
2		VSAT Communication System
2.3		Solar Power System
	(1)	PV Module
		- Voltage
		DC12V
		- Capacity
		Shall cover 100% of the total power consumption of whole system
	(2)	Battery
		- Type
		Sealed Lead Acid Battery
		- Voltage
		DC12V
		- Capacity
		72 hours or more after the charge stop.
	(3)	Charge controller
		- Function
		Shall protect from over load and low voltage
	(4)	Inverter
		Shall be provided.
	(5)	MCBs
		Shall be provided.
3		Wind Profiler System
3.1		Antenna Unit
		-Frequency
		1.3GHz band (0.1MHz resolution)
		-Peak Power
		1000W or more
		-Average Power
		300W or more
3.2		Transmitter / Receiver Unit
		-Frequency
		1.3GHz band (0.1MHz resolution)
		-Peak Power
		1000W or more
		-Average Power
		300W or more
3.3		Signal Processing Unit with Shed
		-Sampling Frequency
		60MHz or less
		-Measuring Elements
		Horizontal Velocities; east-west, north-south Vertical Velocity, Temperature
		-Resolution
		Velocity; 0.1m/s or less Direction; 1degree or less Temperature; 1°C or less Height ; 100m or more
		-Minimum Measurable Height
		100m in case height resolution is 100m.
		-Maximum Measurable Height
		1,500m or more
		(Shed)
		-Shed
		Prefabricated, all weatherproof, heat insulating,

No.		Item	Requirement
			salinity tolerance
		-Equipment	Indoor light, air conditioner, air inlet, power supply (distribution panel), wiring duct, lightning arrester
		-Foundations and frame	Concrete foundations and salinity tolerance frame
		-Stairs and hand rails	Salinity tolerance
		-Door	Sealed door with lock
	3.4	Data Processing PC for Site	
		-CPU	Intel Core i7 or equivalent
		-OS	Microsoft Windows (latest English version)
		-Display	17inch or more with LED backlight
		-Memory	8GB or more
		-Hard Disk Drive	500GB or more
		-DVD Drive	Shall be included.
		-Wireless LAN	Shall be included.
		-Application Software	Microsoft® Office Professional (Latest English version)
	3.5	Power Supply Unit with UPS	
		-Power Supply	Single phase, AC240V, 50Hz
		-Power Consumption	Shall cover 100% of the total power consumption of whole system
		-UPS backup	30minutes or more
4		Automatic Weather Station (AWS)	
	4.3	Anemometer	
		-Type	Ultrasonic type
	(1)	Wind direction	
		-Measuring Range	0 to 360°
		-Resolution	1° or less
		-Accuracy	+/-5° or less
		-Operating temperature	5 to 40°C
		-Setting height	10m (above GL)
	(2)	Wind speed	
		-Measuring Range	0.3 to 60m/s or more
		-Resolution	0.1m/s or less
		-Accuracy	+/-0.3m/s or less
		-Starting threshold	0.5m/s or less

No.		Item	Requirement
		-Operating temperature	5 to 40°C
		-Setting height	10m (above GL)
4.10		Supporting Pole	
		-Type	Tiltable type
		-Height	10m
		-Material	Aluminium or stainless steel
		-Lightning arrester	Lightning rod and earthing
		-Function	Meteorological instruments shall be mounted on the Pole.
4.11		Data Collection System for FMS Headquarters	
		-Function	AWS observed data shall be collected and processed.
		-Display	42 inch or more
		-Software	Observed data shall be received via BGAN and displayed on the System. And statistic value (1 min, 10 min and hourly value) shall be recorded in HDD.
		-Information to be monitored	Daily list and daily chart of 1 minute data and 10 minute data. Daily list and daily chart of 1 hour data and daily statistics. Monthly list and monthly chart of daily statistics and monthly statistics. Observation data distribution map and emphasizing extreme value which is beyond the threshold.
		-CPU	Intel Xeon ES-1660 or equivalent
		-Memory	16GB or more
		-HDD	2.0TB or more
		-OS	Linux or equivalent (latest English version)
		-Expandability	Shall support to add locations (stations) in future.
		-Data Share	Shall enable the observed data to be viewable through internet.
6		Lightning Detection System	
	6.1	Lightning Sensor	
		-Power Supply	DC12V
		-Detection Range	30km radius or more from sensor location
		-Range Resolution	0 to 8km, 8 to 16km, 16 to 32km
		-Data Output	RS232C
	6.4	Solar Power System	
	(1)	PV Module	

No.		Item	Requirement
		- Voltage	DC12V
		- Capacity	Shall cover 100% of the total power consumption of whole system
	(2)	Battery	
		- Type	Sealed Lead Acid Battery
		- Voltage	DC12V
		- Capacity	72 hours or more after the charge stop.
	(3)	Charge controller	
		- Function	Shall protect from over load and low voltage
	(4)	Inverter	Shall be provided.
	(5)	MCBs	Shall be provided
6.6		Data Collection System for FMS Headquarters	
		-CPU	Intel Xeon ES-1660 or equivalent
		- Memory	16GB or more
		- HDD	2.0 TB or more
		- Display	42inch or more
		- OS	Linux or equivalent (Latest English version)
		- Software	Observed data shall be received via VSAT, displayed in the system and recorded in HDD.
		-Information to be monitored	Locations where lightning is detected shall be displayed on the map of Fiji on one screen.
		- Detection Notice	When detected within 5km radius from the location of the site, it shall be notified by buzzer.

2) Measuring instruments and tools for maintenance

Measuring instruments and tools for maintenance are not included within the Project components.

3) Replacement parts and expendables

Replacement parts and expendables are not included within the Project components.

2-2-3 Outline Design Drawings

The draft basic design drawings of the equipment targeted in the Project are indicated below. [Drawings are attached in the “Appendices-5 Outline Design Drawings”].

Dwg no	Title
G-01	Location Map of the Project Sites
ST-01	System Diagram of Tide Observation System
ST-02	Composition Diagram of Tide Observation System
SV-01	System Diagram of VSAT Communication System
SN-01	System Diagram of Wind Profiler System
SA-01	System Diagram of Automatic Weather Station (AWS)
SA-02	System Diagram of AWS Network System
SL-01	System Diagram of Lightning Detection System
SL-02	Location Map of Lightning Detection Coverage
LT-01	Location of the Site and Survey Photos of Vatia, Viti Levu
LV-03	Location of the Site and Survey Photos of Tubou, Lakeba
LA-01	Location of the Site and Survey Photos of Suva, Viti Levu
LL-01	Location of the Site and Survey Photos of Rakiraki, Viti Levu
LL-02	Location of the Site and Survey Photos of Suva, Viti Levu
LL-03	Location of the Site and Survey Photos of Vatudamu, Vanua Levu
LL-04	Location of the Site and Survey Photos of Matei, Taveuni
LL-05	Location of the Site and Survey Photos of Nabouwalu, Vanua Levu
LND-01	Layout Plan at FMS Headquarter Nadi, Viti Levu
LND-02	Location of the Site and Survey Photos of Nadi, Viti Levu

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The Project will be implemented based on Japan's Grant Aid scheme. Therefore, after the Government of Japan has given approval for Project implementation and the Exchange of Notes (E/N) has been conducted between the Government of Japan and Government of Fiji, the Grant Agreement (G/A) will be concluded between the Japan International Cooperation Agency (JICA) and the responsible agency, Ministry of Works, Transport and Public Utilities (MWTPU), and the Project will be implemented. (However, based on necessity to implement the Project soon as possible, both E/N and G/A had been concluded for the duration of the outline design.) The Procurement Agent will be recommended by the Government of Japan to the Fijian side, and will conclude the Agent Agreement (A/A) with the responsible agency under which it will act as the agent for MWTPU in implementing the Project work to ensure that the Project (tender and equipment procurement) is appropriately and smoothly executed. Therefore, since the Project will be implemented under the "Basic Concept of Rehabilitation from Great East Japan Earthquake", not only procuring the equipment that is manufactured in the stricken area of the Great East Japan Earthquake as priority but also aiming at cooperating with ASEAN and Pacific Ocean countries in order to establish international disaster prevention network. The following paragraphs describe the basic items and points requiring particular consideration in the event where the Project is implemented.

(1) Responsible and Implementing Agency

The implementing agency on the Fijian side is FMS, while the MWTPU will organize the Consultative Committee as the responsible agency. Therefore, in order to smoothly advance the Project, it will be necessary for FMS as the implementing agency to conduct close communications and discussions with the Japanese Consultant and contractor, and appoint a person who is responsible for the Project.

(2) Procurement Agent

In implementing the procurement work for the Project, the Procurement Agent will conclude A/A with MWTPU, which is the responsible agency. The Procurement Agent will implement the tender and procurement management work in general including fund management such as transfer of funds, binding of contracts and making of payments to the Consultant and Contractor on behalf of the implementing agency.

(3) Consultant

In order to smoothly implement the procurement and installation of equipment, the Japanese Consultant will conclude a consultant contract with the procurement agency and implement the Project tender work and consultant supervision.

(4) Contractor

In accordance with Japan's Grant Aid scheme, the Japanese contractor that has been selected in open tender will implement the Project equipment and materials procurement, installation works and initial operation guidance. Also, following completion of the Project, since it will be necessary to continue supplying spare parts and conducting post-installation service to resolve breakdowns and so on, it will be necessary to establish a liaison setup with MWTPU and FMS after the handover of equipment and materials.

(5) Necessity for Dispatch of Engineers

FMS employees have learned the operation and maintenance techniques for existing equipment and have no particular difficulties in maintaining it. However, since high-level techniques will be required for installing the Project equipment and conducting adjustment and testing after installation, it will be necessary to dispatch engineers from Japan to conduct quality control, technical guidance and schedule control. Moreover, because FMS employees are inexperienced in operating and maintaining Japanese manufacture equipment, it will be necessary for Japanese engineers dispatched from manufacturer of the equipment to conduct technical guidance (OJT) on the operation and maintenance.

2-2-4-2 Implementation Conditions

In Fiji it is possible to secure workers (laborers) to take part in the installation works, however, there are few skilled operators or engineers who possess expert technology in process, quality and safety control, etc. Therefore, it will be necessary for the Japanese contractor to dispatch engineers and skilled operators to Fiji as necessary.

2-2-4-3 Scope of Works

Table 2-2-7 shows the scope of works on the Japanese and Fijian sides.

Table 2-2-7 The Work Demarcation of the Project

No.	Item	Scope		Remarks
		Japanese Side	Fijian Side	
A	Common to All Components			
1*	Securing of lands for installation of equipment (hereinafter referred to as "the Project sites").		○	To be completed by February 2013
2*	Leveling and removal of obstacles in the Project sites.		○	To be completed by March 2014
3*	Obtaining of agreement letter from owner of the land for installation of the equipment to FMS about approval of use of the land, fee, security and method of maintenance of the land		○	To be completed by February 2013
4	Preparation of access roads to the Project sites, if necessary		○	
5*	Extension of power supply lines to the Project sites		○	

No.	Item	Scope		Remarks
		Japanese Side	Fijian Side	
6*	Securing of budget for and implementation of environmental and social consideration necessary for Project implementation		○	To be completed before implementation of the Project
7	Obtaining of the following permits for the Japanese Consultant and Supplier: - Permits required for installation works - Permits to access restricted areas		○	
8	Procurement of the equipment	○		
9*	Transportation of the equipment, customs procedures and tax procedures			
	Transportation to the port of disembarkation in Fiji	○		
	Procedures for tax exemption and customs clearance at the port of disembarkation		○	
	Internal transportation from the port of disembarkation to the Project sites	○		
	Exemption of value-added tax (VAT) on locally procured items		○	
10	Securing of land for temporary material storage yard		○	
11	Installation of the equipment, adjustment and testing	○		
12	Installation of security fences and gates in and around the Project sites and guardhouse, if necessary		○	
13	Provision of training for initial operation and maintenance of the equipment	○		
14	Assuring security for personnel in the Project sites, when necessary		○	
15*	Allocation of necessary staff and budget for operation and maintenance of the equipment to be procured under the Project		○	
16	Providing of security to equipment and Project sites.		○	
17	Proper disposing of spent batteries		○	
18*	Payment of bank commissions for banking services based upon the Banking Arrangement		○	
19*	Bearing of all the expenses, other than those covered by the Grant		○	
20*	Uploading observed data and information to GTS operated by the WMO for sharing those data and information with international organizations, Japan Meteorological Agency and neighboring countries		○	
21	Periodical cleaning of the equipment and the Project sites		○	PV module should be cleaned every month at least.
22*	Publishing positive results through the observed data and information provided by the equipment procured under the Japan's Grant Aid Project		○	
B	Tide Observation System			
1	Application to use DCP (Data Collection Platform) to Japan Meteorological Agency (JMA)		○	To be completed by June 2013
2	Application to use BGAN to INMARSAT in USA and bearing charges of BGAN		○	To be completed by March 2014 (Japanese Supplier will support the application process for FMS.)
3	Removal of wooden floor and beam (Approx. 3m x 3m) on the existing pier in Vatia, Viti Levu (T-1 site)		○	To be completed by March 2014

No.	Item	Scope		Remarks
		Japanese Side	Fijian Side	
4	Registering of new locations of the Project equipment into the Data Collection System at FMS Headquarters	○		
5	Sharing observed data with relevant authorities through internet where necessary		○	
C	VSAT Communication System			
	Application to use VSAT to Telecom Fiji Limited and bearing charges of VSAT		○	To be completed by March 2014 (Japanese Supplier will support the application process for FMS.)
D	Wind Profiler System			
	Internet connection with switching hub for Data Processing PC and Remote PC at FMS Headquarters		○	To be completed by March 2014. LAN cables will be provided by the Japanese side.
E	Automatic Weather Station (AWS)			
1	Application to use BGAN to INMARSAT in USA and bearing charges of BGAN		○	To be completed by March 2014 (Japanese Supplier will support the application process for FMS.)
2	Registering of new locations of the Project equipment into the Data Collection System at FMS Headquarters	○		
F	Lightning Detection System			
1	Application to use VSAT to Telecom Fiji Limited and bearing charges of VSAT		○	To be completed by March 2014 (Japanese Supplier will support the application process for FMS.)
2	Removal of the existing 3 poles (2 for anemometers and 1 for radio communication) on the roof top of the existing building in Suva Met. Office, in case to install the new equipment on the same location		○	To be completed by March 2014
3	Registering of new locations of the Project equipment into the Data Collection System at FMS Headquarters	○		

Note: ○ indicates the scope of works. Items marked with * are described in the “Minutes of Discussion.”

2-2-4-4 Consultant Supervision

(1) Basic Policy of Consultant Supervision

The Procurement Agent will organize a project team to smoothly implement the tender work and consultant supervision according to the Japan’s Grant Aid guidelines and contents of the outline design. Moreover, the Consultant will dispatch expert engineers in line with the progress of equipment installation, testing and adjustment works, and it will instruct and supervise the contractor and strive to ensure that schedule control, quality control, progress management and safety management are implemented based on the plan. It will also have the duty of implementing pre-shipping inspections and preventing troubles from occurring following delivery of the equipment.

The following paragraphs describe the important points to consider in the consultant supervision.

1) Schedule control

The Consultant will compare progress with the implementation schedule decided in the contract every month or every week in order to ensure that the contractor adheres to the delivery deadline given in the contract. In cases where delays are predicted, the Consultant will report to the Procurement Agent and caution the contractor, demanding the submission and implementation of a plan of countermeasures. The comparison of the planned schedule and actual progress will be carried out according to the following items:

- ① Confirmation of works performance (manufacture of equipment in plant and shipping)
- ② Confirmation of equipment delivery
- ③ Confirmation of yield and actual numbers of engineers, skilled workers and laborers, etc.

2) Quality and performance control

The Consultant will carry out supervision of quality and performance based on the following items to ensure the procured equipment satisfies the required quality and performance stated in the contract documents. In cases where doubts arise over quality and performance, the Consultant will immediately demand that the contractor make amendments, revisions or corrections.

- ① Checking of equipment specifications
- ② Checking of shop drawings and specifications of equipment
- ③ Attendance of plant inspections of equipment and checking of plant inspection results
- ④ Checking of installation guidelines
- ⑤ Checking of trial operation, adjustment, test and inspection guidelines of equipment
- ⑥ Supervision of equipment site installation works and attendance of trial operations, adjustments, tests and inspection

3) Labor supervision

The Consultant will hold ample discussions with the safety officers of the contractor with a view to preventing industrial accidents and accidents affecting third parties on the works sites during the construction period. Important points to consider in safety control on the ground are as follows:

- ① Establishment of safety control regulations and appointment of manager
- ② Planning of the works vehicles and construction machinery operating routes and thorough enforcement of safe driving
- ③ Encouragement of laborers to utilize welfare measures and vacations

(2) Contractor

The contractor will procure and deliver the equipment and implement the installation works. In order to implement these works, since the contractor will need to thoroughly ensure that subcontractors comply with the works schedule, quality, performance and safety measures prescribed in the contract, it will dispatch engineers who have experience of similar projects in overseas countries to provide guidance and education on the ground. Figure 2-2-13 shows the mutual relationships between Project parties.

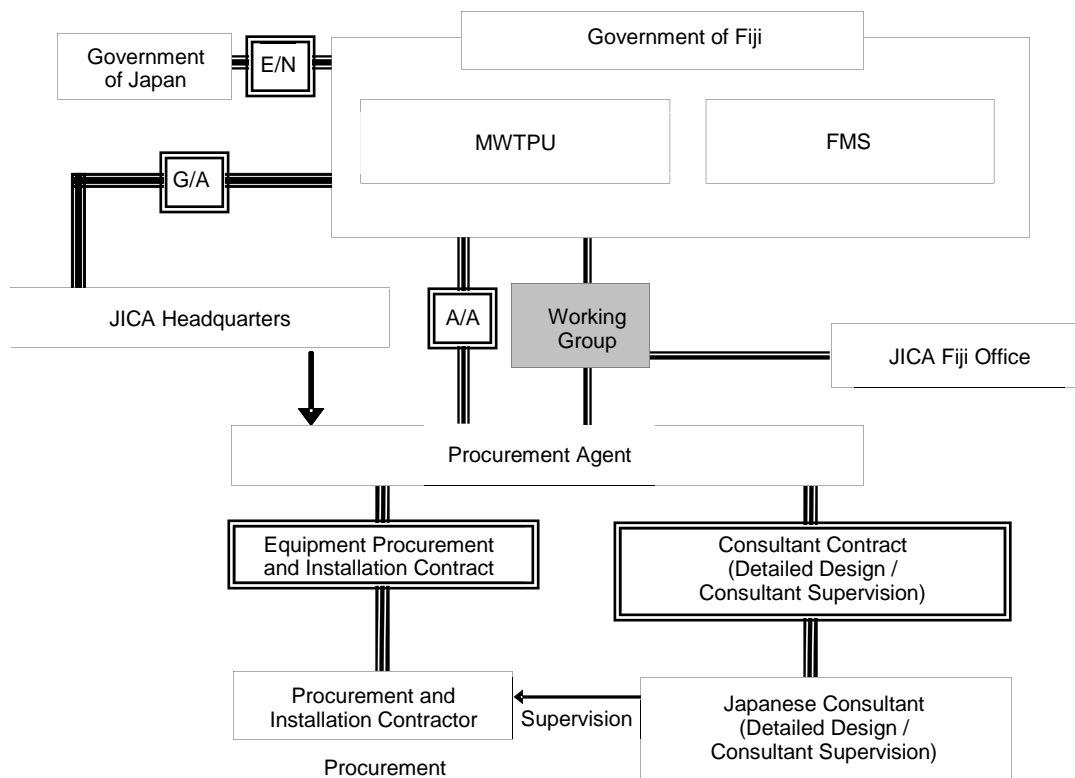


Figure 2-2-13 Project Implementation Relationships

The Consultative Committee will be organized to adjust and coordinate problematic issues occurring during the implementation of the Project. It will consist of the MWTPU as the responsible agent of the Project, FMS as the implementing agency of the Project, the Embassy of Japan in Fiji, JICA and the procurement agent. MWTPU will be in charge of and coordinate the Consultative Committee.

2-2-4-5 Quality Control Plan

The Consultant will conduct plant pre-shipping inspections to make sure that the procured equipment complies with the technical specifications, dimensions, functions, electrical and mechanical characteristics, etc. that are specified in the tender documents. Also, on completion of the installation works, it will conduct handover inspections to confirm that the installed equipment operates and functions normally.

2-2-4-6 Procurement Plan

The equipment in the Project shall be basically procured in Japan and some of the equipment or parts shall be manufactured in the stricken area of the Great East Japan Earthquake based on the “Basic Concept of Rehabilitation from Great East Japan Earthquake”. However, some equipment that cannot be procured in Japan shall be procured in Fiji or surrounding countries.

2-2-4-7 Operational Guidance Plan

FMS has so far experienced no particular technical difficulties in operating and maintaining existing equipment including telecommunications and measuring equipment. However, the equipment of the Project is procured mainly in Japan, and the local side has inadequate experience regarding operation and maintenance of such products. Therefore, it will be necessary to dispatch engineers from Japan in order to conduct initial operational guidance on how to operate the equipment, conduct troubleshooting and implement routine inspections following the site installation, testing and adjustment of the equipment.

2-2-4-8 Implementation Schedule

Based on the Government of Japan’s Grant Aid scheme, the following implementation schedule has been adopted. The time required for the Project including the detailed design will be 14.5 months.

Table 2-2-8 Project Implementation Schedule

	1	2	3	4	5	6	7	8	9	10	11	12		
Detailed Design	■ (Preparation of tender document)		■ (Approval of tender document)		■ (Preparation for tender)		■ (Tender)							
												(Total: 5 months)		
	■ (Creation and approval of shop drawings and working drawings)			■ (Equipment manufacture)						■ (Transportation)				
	■ (Installation works, adjustment, testing)							■ (OJT)					(Total: 9.5 months)	

2-3 Obligations of Recipient Country

Whereas the Japanese side will conduct the procurement and installation of equipment, the Fijian side will carry out the removal of existing equipment and so on that is required to implement the said works. The items to be borne by the Fijian side are indicated in Table 2-3-1.

Table 2-3-1 Obligations of Recipient Country

No.	Item	Remarks
A	Common to All Components	
1*	Securing of lands for installation of equipment (hereinafter referred to as “the Project sites”).	To be completed by February 2013
2*	Leveling and removal of obstacles in the Project sites.	To be completed by March 2014
3*	Obtaining of agreement letter from owner of the land for installation of the equipment to FMS about approval of use of the land, fee, security and method of maintenance of the land	To be completed by February 2013
4	Preparation of access roads to the Project sites, if necessary	
5*	Extension of power supply lines to the Project sites	
6*	Securing of budget for and implementation of environmental and social consideration necessary for Project implementation	To be completed before implementation of the Project
7	Obtaining of the following permits for the Japanese Consultant and Supplier: - Permits required for installation works - Permits to access restricted areas	
8*	Transportation of the equipment, customs procedures and tax procedures	
	Procedures for tax exemption and customs clearance at the port of disembarkation	
	Exemption of value-added tax (VAT) on locally procured items	
9	Securing of land for temporary material storage yard	
10	Installation of security fences and gates in and around the Project sites and guardhouse, if necessary	
11	Assuring security for personnel in the Project sites, when necessary	
12*	Allocation of necessary staff and budget for operation and maintenance of the equipment to be procured under the Project	
13	Providing of security to equipment and Project sites.	
14	Proper disposing of spent batteries	
15*	Payment of bank commissions for banking services based upon the Banking Arrangement	
16*	Bearing of all the expenses, other than those covered by the Grant	
17*	Uploading observed data and information to GTS operated by the WMO for sharing those data and information with international organizations, Japan Meteorological Agency and neighboring countries	
18	Periodical cleaning of the equipment and the Project sites	PV module should be cleaned every month at least.
19*	Publishing positive results through the observed data and information provided by the equipment procured under the Japan’s Grant Aid Project	
B	Tide Observation System	
1	Application to use DCP (Data Collection Platform) to Japan Meteorological Agency (JMA)	To be completed by June 2013

No.	Item	Remarks
2	Application to use BGAN to INMARSAT in USA and bearing charges of BGAN	To be completed by March 2014 (Japanese Supplier will support the application process for FMS.)
3	Removal of wooden floor and beam (Approx. 3m x 3m) on the existing pier in Vatia, Viti Levu (T-1 site)	To be completed by March 2014
4	Sharing observed data with relevant authorities through internet where necessary	
C	VSAT Communication System	
	Application to use VSAT to Telecom Fiji Limited and bearing charges of VSAT	To be completed by March 2014 (Japanese Supplier will support the application process for FMS.)
D	Wind Profiler System	
	Internet connection with switching hub for Data Processing PC and Remote PC at FMS Headquarters	To be completed by March 2014. LAN cables will be provided by the Japanese side.
E	Automatic Weather Station (AWS)	
	Application to use BGAN to INMARSAT in USA and bearing charges of BGAN	To be completed by March 2014 (Japanese Supplier will support the application process for FMS.)
F	Lightning Detection System	
1	Application to use VSAT to Telecom Fiji Limited and bearing charges of VSAT	To be completed by March 2014 (Japanese Supplier will support the application process for FMS.)
2	Removal of the existing 3 poles (2 for anemometers and 1 for radio communication) on the roof top of the existing building in Suva Met. Office, in case to install the new equipment on the same location	To be completed by March 2014

2-4 Project Operation Plan

2-4-1 Operation Setup

The procured equipment in the Project has no moving parts or expendable parts that need to be replaced within one year from beginning of operation. Since Tide Observation System, Wind Profiler System and AWS include a lightning arrester, the surge absorber will need to be replaced, and so will the batteries used in the solar power systems used as the power sources for each system.

In the Project, it will be necessary for FMS, which will manage the meteorological observation instruments, to procure replacement parts based on a maintenance plan in order to fulfill its role as a meteorological agency. Moreover, since the equipment will be installed in harsh outdoor natural environments, in consideration of deterioration over time and the need for model changes of core units and peripheral equipment including telecommunication equipment, solar power systems and so on, it will be necessary to upgrade the equipment around once every 10 years or so. Therefore, the maintenance plan for the procured equipment in the Project will incorporate periodic upgrades. The maintenance plan is indicated in Table 2-4-1. Moreover, as is indicated in Table 2-5-2, the budget for the maintenance plan will be allocated from the government.

Table 2-4-1 Equipment Maintenance Plan

Replacement interval	Target parts
3 years	Solar panel batteries (approximately 22,000 USD)
When worn or damaged	Lightning arrester surge absorbers, fuses (approximately 13USD)
After 10 years	Meteorological and oceanographic observation equipment, etc. (approximately 1,678,000 USD)

2-4-2 Routine Inspections

Thanks to recent technical innovations, electronic instruments have become more reliable and durable, and reduction in the number of component parts has contributed to lower frequency of equipment malfunction. In these circumstances, maintenance inspection intervals are not so frequent in Japan too. However, for agencies that do not have the financial freedom to conduct frequent equipment upgrades, it is important to implement routine and periodic inspections without fail to ensure that equipment can be effectively utilized over the long term. Therefore, it will be necessary to compile the minimum required maintenance criteria for routine inspections and periodic inspections and develop a setup for preventing failures in equipment. FMS currently encounters no difficulties in operating its existing meteorological observation instruments and telecommunication instruments and it possesses the minimum required equipment to conduct inspections. Table 2-4-2 indicates the routine inspection and periodic inspection items for the procured equipment in the Project and the inspection instruments.

Table 2-4-2 Equipment Inspection Items and Necessary Instruments

Inspection Contents	Inspection Item	Necessary Inspection Instruments
Routine inspection and pre-work inspection	Visual inspection of meters and failure displays, etc.	—
	Visual inspection of connections	Tool set
	Voltage measurement of power source, etc.	Tester
1 year inspection (characteristics inspection)	Tide level	Scales

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

This section is closed due to confidentiality.

2-5-1-1 Cost on the Fijian Side US\$ 456,650 (approximately 37 million yen)

The contents and costs to be borne by the Fijian side are as follows.

<Cost for the first year of the Project>

No.	Undertakings	Estimated Cost (US\$)	Notes
1	Exemption or payment of value-added tax (VAT) on equipment procured from Japan or third countries and local equipment	330,000	VAT: 15% of the total equipment cost (Approx. US\$2.2 million)
2	Exemption or payment of fiscal duty on equipment procured from Japan or third countries	110,000	Fiscal duty: 5% of the total equipment cost (Approx. US\$2.2 million)
3	Payment of bank commissions based upon the Banking Arrangement	3,750	Estimated amount
4	Application to use BGAN to INMARSAT in USA and bearing charges of BGAN		
	(1) Tide Observation System	506	FJ\$74/month x 12 months x 1 site = FJ\$888 = US\$506
	(2) Automatic Weather Station (AWS)	506	FJ\$74/month x 12 months x 1 site = FJ\$888 = US\$506
5	Application to use VSAT to Telecom Fiji Limited and bearing charges of VSAT		
	(1) VSAT Communication System	5,404	FJ\$158/month x 12 months x 5 sites = FJ\$9,480 = US\$5,404
	(2) Lightning Detection System	6,484	FJ\$158/month x 12 months x 6 sites = FJ\$11,376 = US\$6,484
	Total	456,650	US\$0.57/FJ\$ (As of January 2013)

<Annual Operation & Maintenance Cost from the 2nd year of the Project>

No.	Undertakings	Estimated Cost (US\$)	Notes
1	Bearing charges of BGAN to INMARSAT in USA		
	(1) Tide Observation System	506	FJ\$74/month x 12 months x 1 site = FJ\$888 = US\$506
	(2) Automatic Weather Station (AWS)	506	FJ\$74/month x 12 months x 1 site = FJ\$888 = US\$506
2	Bearing charges of VSAT to Telecom Fiji Limited		
	(1) VSAT Communication System	5,404	FJ\$158/month x 12 months x 5 sites = FJ\$9,480 = US\$5,404
	(2) Lightning Detection System	6,484	FJ\$158/month x 12 months x 6 sites = FJ\$11,376 = US\$6,484
	Total	12,900	US\$0.57/FJ\$(As of January 2013)

2-5-1-2 Estimation Conditions

- 1) Estimation point August 2012
- 2) Exchange rate 1 US\$=81.06 JPY
 1 FJ\$=44.64 JPY

2-5-2 Operation and Maintenance Cost

In order for FMS to be soundly operated into the future, it will need to upgrade the procured equipment in the Project at appropriate intervals. Therefore, it will need to formulate a maintenance plan that incorporates not only the maintenance cost for new and existing equipment but also the cost of periodic equipment upgrading.

2-5-2-1 Setting Conditions

Conditions for estimating operating expenditure and revenue have been set as follows.

(1) Expenditure

The procured equipment in the Project will go into operation from 2015, and annual expenditure will be estimated assuming that funds are set aside in readiness for the target year of 2025 (10 years). The original capital for the reserve fund will come from government subsidies, Table 2-5-1 shows the other expenditure items and method for setting the budget.

Table 2-5-1 Budget Setting

		(Unit: FJS)
Operating Expenditure Item	Budget Setting Method	Necessary Budget
Salaries of full-time employees	Adopt the mean amount of expenditure over the past 5 years (2007~2011). (Concerning the forecast indicator, considering the Fijian GDP projected growth rate of 1.5%, it is aimed to limit the annual rate of increase to around 0.9%).	1,891,574
Salaries of part-time employees	Adopt the mean amount of expenditure over the past 5 years (2007~2011). (Concerning the forecast indicator, considering the Fijian GDP projected growth rate of 1.5%, it is aimed to limit the annual rate of increase to around 0.9%).	75,406
Travel and communications expenses	Adopt the mean amount of expenditure over the past 5 years (2007~2011). (Concerning the forecast indicator, considering the Fijian GDP projected growth rate of 1.5%, it is aimed to limit the annual rate of increase to around 0.9%).	190,207
Operational expenses	Adopt the mean amount of expenditure over the past 5 years (2007~2011). Also, reflect the contents of the Fijian scope of works (communications cost).	394,116
Parts purchase cost	Adopt the mean amount of expenditure over the past 5 years (2007~2011). This also covers equipment to be upgraded in line with service life.	191,575
External assistance cost	Adopt the mean amount of expenditure over the past 5 years (2007~2011).	15,211
Building capital	Adopt the mean amount of expenditure over the past 5 years (2007~2011).	339,450
Purchase capital	Adopt the mean amount of expenditure over the past 5 years (2007~2011).	894,989

(2) Revenue

All revenue will be obtained from government subsidies.

Table 2-5-2 Annual Revenue

		(Unit: FJS)
Revenue Item	Setting Method	Revenue (Annual)
Central government	Calculated from mean expenditure between 2007~2011	About 4,000,000

2-5-2-2 Results of Estimation

Table 2-5-3 shows the revenue and expenditure balance for 10 years up to the upgrading of equipment based on the aforementioned setting conditions. It is assumed that the reserve fund for upgrading equipment can be secured.

Table 2-5-3 Projected Revenue and Expenditure Balance

FMS

(Unit: FJ\$)

	Project completion	1	2	3	4	5	6	7	8	9	10	
No.	Item	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
A	Operating revenue	4,018,952	4,344,332	4,363,921	4,383,687	4,403,630	4,423,753	4,444,058	4,464,545	4,485,216	4,506,073	4,527,118
	1. Government subsidy (*1)	4,018,952	4,344,332	4,363,921	4,383,687	4,403,630	4,423,753	4,444,058	4,464,545	4,485,216	4,506,073	4,527,118
B	Operating expenditure items	4,018,952	4,038,367	4,057,956	4,116,318	4,097,665	4,117,789	4,176,689	4,158,580	4,179,251	4,238,705	7,165,013
	1. Salaries of full-time employees	1,891,574	1,908,598	1,925,776	1,943,108	1,960,595	1,978,241	1,996,045	2,014,009	2,032,136	2,050,425	2,068,879
	2. Salaries of part-time employees	75,406	76,085	76,769	77,460	78,157	78,861	79,571	80,287	81,009	81,738	82,474
	3. Travel and communications expenses	190,207	191,919	193,646	195,389	197,147	198,922	200,712	202,518	204,341	206,180	208,036
	4. Operational expenses	420,540	420,540	420,540	420,540	420,540	420,540	420,540	420,540	420,540	420,540	420,540
	Operational expenses	394,116	394,116	394,116	394,116	394,116	394,116	394,116	394,116	394,116	394,116	394,116
	Increase in communications cost	26,424	26,424	26,424	26,424	26,424	26,424	26,424	26,424	26,424	26,424	26,424
	5. Parts purchase cost	191,575	191,575	191,575	230,171	191,575	191,575	230,171	191,575	191,575	230,171	3,135,435
	Parts purchase cost	191,575	191,575	191,575	191,575	191,575	191,575	191,575	191,575	191,575	191,575	191,575
	Recommended replacement parts (3 years)				38,596			38,596			38,596	
	Recommended replacement parts (10 years)											2,943,860
	6. External assistance cost	15,211	15,211	15,211	15,211	15,211	15,211	15,211	15,211	15,211	15,211	15,211
	7. Building capital	339,450	339,450	339,450	339,450	339,450	339,450	339,450	339,450	339,450	339,450	339,450
	8. Purchase capital	894,989	894,989	894,989	894,989	894,989	894,989	894,989	894,989	894,989	894,989	894,989
C	Balance after subsidy revenue	0	305,965	305,965	267,368	305,965	305,965	267,368	305,965	305,965	267,368	-2,637,895
D	Accumulated reserve fund (*2)		305,965	611,930	879,298	1,185,263	1,491,228	1,758,596	2,064,561	2,370,526	2,637,895	0

*1: Government subsidy is equivalent to expenditure. It's approximately equal to the annual revenue described on table 2-5-2.

*2: Accumulated reserve fund is for replacement of the equipment which will be replaced in the 10th year after installation.

CHAPTER 3 PROJECT EVALUATION

CHAPTER 3 PROJECT EVALUATION

3-1 Preconditions

- The scope of works on the Fijian side as indicated in Table 2-3-1 will be smoothly implemented.

3-2 Necessary Inputs by Recipient Country

- The budget needed to recruit the personnel for routine inspections and other maintenance work will be secured.
- The budget needed to purchase the repair parts will be secured.

3-3 Important Assumptions

- Fijian government policies concerning the meteorological observation sector and disaster prevention sector will remain unchanged.
- Major natural disasters such as earthquake and so on will not occur.
- Sudden incidents such as acts of terrorism and coup d'état and so on will not occur.

3-4 Project Evaluation

3-4-1 Relevance

Since the Project will contribute to the disaster prevention of Fiji and benefit of Japan as indicated below, it is deemed to be highly relevant.

(1) Benefiting population

In the Project, Tide Observation System, Wind Profiler System, AWS, Calibration Equipment and Lightning Detection System will be procured, and the installation of the VSAT Communication System will enable smooth telecommunications between FMS Headquarters and Met Offices on remote islands. Accordingly, since it will become possible for FMS to smoothly obtain information concerning natural disasters such as cyclones and heavy rain and tide level etc., project implementation will make it possible to provide information to prevent disaster to approximately 868,000 citizens of Fiji (according to the World Bank, 2011).

(2) Contribution to development plans in Fiji

National plans in the disaster prevention field in Fiji were established under the National Disaster Management Law that was enacted in 1998. A revised national disaster management plan was compiled in 2006. Accordingly, since the Project is consistent with the promotion of “development plans and projects in consideration of disaster prevention,” it will make a contribution to development plans in Fiji.

(3) Necessity and superiority of using Japanese technology

The equipment for tide and meteorological observation and telecommunication that will be procured in the Project is manufactured in Japan, U.S. and Europe. In particular, Japanese products offer good post-sales services such as troubleshooting, repairs and spare parts supply, and they offer good durability and reliability. Therefore, it is necessary that technically superior equipment manufactured in Japan is renewed in order to contribute to the socially important field of disaster prevention and meteorological observation.

(4) Sharing of information for disaster prevention with neighbouring countries

Currently in Fiji, tidal gauges are installed at two locations and observation is conducted by BOM, but observed data is not monitored by FMS in real-time. One tidal gauge will be procured in the Project, and FMS directly receives data via satellite telecommunications such as BGAN. In addition, one gauge is installed with DCP, and the transmitted data can be shared among meteorological agencies of countries all over the world including JMA.

3-4-2 Effectiveness

(1) Quantitative effects

Installation of the meteorological and oceanographic observation and telecommunication equipment will raise quantitative effects such as the following. Detailed quantitative effects are described in 1) to 5).

- Spreading observation coverage and increasing observation points
- Observation conducted more frequently
- Increasing transmission speed of observed data

1) Detailed tide observation - Tide Observation System-

Currently in Fiji, tidal gauges are installed at two locations in Suva and Lautoka, and conducted observing by BOM, but observed data is not monitored by FMS in real-time. Regarding the two locations above, FMS will be able to monitor observed data in real-time just by adding transmitting equipment and data collection system, because the data collection system (included within Tide Observation System procured in the Project,) is adopted to increase observation points in future. Moreover, since these tidal gauges are only installed at trading ports in the east and west, these two locations aren't enough to cover major sections of coastline extending for approximately 350 kilometers in a straight-line. Installing one additional tidal gauge at regular intervals in this middle area will make it possible to observe at intervals of approximately 120 kilometers.

In case an earthquake originates at the ocean trench near Samoa or Tonga, it would take approximately 1.5 hours for the first tsunami to arrive at Fiji. And in the same case near Vanuatu, it would take approximately 1.3 hours for the first tsunami to arrive at Fiji. Since such a tsunami would reach successive coastlines at intervals of 30 minutes, observed information would be important for predicting damage along coastal areas that have already been hit and estimating the height of tsunami waves that have not yet arrived.

Indicator	Reference value (2012)	Target value (2015)
Tide observation and interval time	60 minutes	30 minutes

Observed data is important information for estimating whether or not damage caused by high tide and tsunami will occur and what the extent of damage will be. Accordingly, observed data by stations adjoining populous areas and areas of trade and industrial activity can make a major contribution to the accurate provision of information and telecommunication of evacuation orders to citizens at times of disaster. Meanwhile, since Fiji is a Pacific island nation, it is difficult for it to issue tide information, warnings and evacuation orders in units of administrative districts (prefectures) like in Japan. Since one additional tidal gauge to be installed by the Project make it possible to establish the basis of the observation network, it is possible for Fiji by self-help to spread the observation network in future.

Indicator	Reference value (2012)	Target value (2015)
Number of tide observation stations	2 sites	3 sites

2) Reinforcement of Communication Network -VSAT Communication System-

Currently, telecommunications between FMS Headquarters and local Met Offices are conducted by phone, radio, mobile phone and e-mail. But the existing way is considered fragile as urgent telecommunication especially for Met Office in remote islands because cable breaks and jamming are caused by natural disaster. In the Project, installation of VSAT Communication System to five locations including FMS Headquarters and four Met Offices enables mutual satellite telecommunication certainly via satellite that not only of disaster information (including alert and warning) from FMS Headquarters to each Met Office but also information on disaster situations from remote islands.

Indicator	Reference value (2012)	Target value (2015)
Locations within satellite telecommunication network	0 sites (Only by telephone and radio)	5 sites

3) Wind observation at high altitude -Wind Profiler System-

Fiji is damaged in every rainy season by heavy rains and storms caused by cyclones. The movement of cyclone itself and the flow of a rain cloud can be observed by existing Doppler

radar. In addition, it will be possible to observe detailed aerodynamic flows of wind in the upper air with the Wind Profiler System, and it this will make it possible to forecast meteorological information accurately. Accordingly, by using existing Rasiosonde (which can observe weather conditions such as temperature, humidity, wind and so on at high altitude only two times per a day) together, it will be possible to observe more quickly and accurately. In the Project, installation of Wind Profiler System to FMS Headquarters next to Nadi International Airport will contribute to forecasting natural disasters and enabling safe flying of airplanes in Fiji as the tourist country.

Indicator	Reference value (2012)	Target value (2015)
Wind Profiler System	Rasiosonde : 1 sites	Rasiosonde : 1 sites Wind Profiler : 1 sites
Frequency in observation	2 times per a d ay	1 time per 10 m inutes

4) Improvement of meteorological observation around the capital area –AWS-

AWS is essential especially for observing heavy rain for observing meteorological information approximately in real-time. FMS has 16Met Offices and there are 12Met Offices in which AWS has been installed, but five (including the capital city Suva) out of the 12 AWS are broken down. By the Project, renewal of AWS in Suva Met Office will improve existing capability of meteorological observation around the capital area, and it will help observation be automated and go online as is promoted by FMS.

Indicator	Reference value (2012)	Target value (2015)
AWS in capital area	0 sites	1 sites

5) Lightning prevention in nationwide area-Lightning Detection System-

About 10 lives are lost by lightning every year in Fiji. Though one lightning sensor has been installed at FMS Headquarters, detection coverage is not enough to cover all areas of Fiji but only around Nadi centered upon F MS Headquarters. In the Project, six new Lightning Detection System will be installed at the project sites in Viti Levu and Vanua Levu island to extend detection coverage to the most populous islands as described above. Accordingly, installation of Lightning Detection System will contribute to reducing lightning victims.

Indicator	Reference value (2012)	Target value (2015)
Lightning Detection System	Just only within 56 km radius from Nadi international airport	Approximately whole areas of Viti Levu and Vanua Levu islands (almost largest populous islands in Fiji)

(2) Qualitative effects (Project overall)

As a result of the Project, it's anticipated that disaster prevention system such as the nationwide transmission of disaster information in Fiji will be improved. By the Project, meteorological observation data will go online, and introduction of the Wind Profiler System will enable some observation items such as wind conditions at high altitude to be observed more frequently (It's conventionally taken by radiosonde only two times per day). Accordingly, it's possible to immediately report on sudden weather changes to citizens and officials, and the Project will contribute to greater safety in industries such as agriculture, fisheries and aircraft operations that tend to be affected by weather changes. Also, through automating meteorological observation instruments such as Wind Profiler System, AWS and Lightning Detection System, and providing Calibration Equipment, meteorological observation will be conducted with more accuracy and frequency. As a result, this will contribute to the general economic development of Fiji through the promotion of industries, improvement of safety on transportation and promotion of air travel due to better safety.

Appendices

Appendices -1. Member List of the Study Team

1. Member List of the Study Team

Name	Work Assignment	Position
Mr. Shumon YOSHIARA	Leader/ Project Coordinator (First Field Survey)	Resident Representative, JICA Fiji Office, JICA
Mr. Noriaki NAGATOMO	Leader/ Project Coordinator (Draft Outline Design)	Senior Advisor to the Director General, Global Environment Department, JICA
Mr. Chigiru YAMASHITA	Cooperation Planning 1	Assistant Director Grant Aid Project Management Division 2 Financing Facilitation and Procurement Supervision Department, JICA
Mr. Yohei Hashimoto	Cooperation Planning 2	Assistant Resident Representative, JICA Fiji Office, JICA
Mr. Ryoji YAGINUMA	Grant Aid Program/ Procurement Agent	Japan International Cooperation System
Mr. Kiyofusa TANAKA	Chief Consultant/ Operation & Maintenance Planning	Yachiyo Engineering Co., Ltd.
Mr. Tatsuya KOBAYASHI	Sub Chief Consultant/ Procurement Planning/ Cost Estimation 1	Yachiyo Engineering Co., Ltd.
Mr. Hironori KOMATSU	Construction/ Installation Planning 2/ Cost Estimation 2	Yachiyo Engineering Co., Ltd.
Mr. Masuo WADA	Earthquake and Tsunami Warning System / Information Network Planning	Yachiyo Engineering Co., Ltd.
Mr. Daichi KANAZASHI	Construction/ Installation Planning 3/ Cost Estimation 3	Yachiyo Engineering Co., Ltd.
Mr. Koji MITSUHASHI	Earthquake & Tsunami Equipment / Installation Planning 1	Japan Meteorological Business Support Center
Mr. Chuji YAMAMOTO	Weather and Oceanic Phenomenon Equipment	Japan Meteorological Business Support Center

Appendices -2. Study Schedule

Schedule for Preparatory Survey on Fiji and Vanuatu

(1) First Field Survey

No.	Date		Content Survey							Stay at
			Mr. Yamasita (Fiji) Ms. Tanaka (Vanuatu)	JICS Mr. Yaginuma	YEC Mr. Tanaka	JMBSC Mr. Mitsuhashi	YEC Mr. Wada	YEC Mr. Komatsu	JMBSC Mr. Yamamoto	
Person in Charge			JICA	Grant Aid Program /Procurement Agent	Chief Consultant /Operating& Maintenance Planning	Earthquake Tsunami Equipment /Installation Planning1	Earthquake and Tsunami Warning System /Information Network Planning	Construction/Installation Planning2 /Cost Estimation2	Weather and Oceanic phenomenon Equipment	Sub Chief Consultant /Procurement Planning /Cost Estimation1
1	26 June 2012	Tue			Trip [Narita 19:50 → Sydney 06:35, JL771]					On Flight
2	27 June 2012	Wed			Trip [Sydney 17:10 → Fiji 22:55, FJ910]					Nadi
3	28 June 2012	Thu			Trip [Nadi → Suva] •Meeting with JICA, •Courtesy call to Embassy of Japan •Meeting with WAF (confirming of role and merger process with Met. Service) Trip [Suva 16:00 → Nadi 16:30, FJ016] •Meeting with FMS (confirming of project site)					Nadi
4	29 June 2012	Fri			•Meeting with FMS (confirming of project site)					Nadi
5	30 June 2012	Sat	Trip [Narita 19:50 → Sydney 06:35, JL771]		•Site survey (Project sites at island VITI LEVU)					Nadi
6	01 July 2012	Sun	Trip [Sydney 13:10 → Nadi 18:55, QF391] •Team meeting		•Team meeting					Nadi
7	2 July 2012	Mon	•Meeting with FMS (Minutes of Discussion) •Discussion on MD-1 with FMS, Explanation on Procurement Procedure to FMS (Mr. Tuidraki Aminiasi, Acting Director) Trip [Nadi → Suva, JL771]			•Meeting with FMS				Suva (Tanaka/Mitsuhashi) Nadi (Other Member)
8	3 July 2012	Tue	•Meeting with EOJ •Meeting with NDMO •Meeting with MRD •Discussion on MD-2 with FMS			Trip [Nadi → Labasa] •Site survey (Project sites at island VANUA LEVU)				Suva (Tanaka/Mitsuhashi) Labasa (Other Member)
9	4 July 2012	Wed	•Meeting with AusAID •Meeting with Ministry of Finance & Reserve Bank •Discussion on MD-3 with FMS •Signing M/D			•same as Chief Consultant Trip [Suva → Nadi]	Trip [Labasa → Nadi] •Meeting with FMS •Meeting with TFL			Suva (Tanaka) Nadi (Other Member)
10	5 July 2012	Thu	•Report to JICA •Report to EOJ •Meeting with SOPAC •Meeting with KOICA			•Meeting with FMS •Planning of Antenna and survey for transmission line				Suva (Tanaka) Nadi (Other Member)
11	6 July 2012	Fri	Trip [Suva → Nadi (by car)] Trip [Nadi 13:30 → Sydney 16:25, QF346]		Trip [Suva → Nadi] •Meeting with FMS •Confirming of Radio permit	•same as Chief Consultant	•Site survey (Project sites at FMS Headquarters)			Nadi
12	7 July 2012	Sat	Trip [Sydney 8:15 → Narita 17:05, JL772]		•Meeting with FMS •Team meeting					Nadi
13	8 July 2012	Sun						Trip [Narita 19:50 → Sydney 06:35, JL771]		On Flight (Yamamoto/Kobayashi) Nadi (Other Member)
14	9 July 2012	Mon			•Meeting with FMS		•Procurement information •Survey for layout of FMS Headquarters	Trip [Sydney 13:10 → Fiji 18:55, FJ910]		Nadi
15	10 July 2012	Tue			•Meeting with FMS		•Procurement information •Survey for layout of FMS Headquarters	• same as Chief Consultant		Nadi

Schedule for Preparatory Survey on Fiji and Vanuatu

(1) First Field Survey

No.	Date		Content Survey							Stay at
			Mr. Yamasita (Fiji) Ms. Tanaka (Vanuatu)	JICS Mr. Yaginuma	YEC Mr. Tanaka	JMBSC Mr. Mitsuhashi	YEC Mr. Wada	YEC Mr. Komatsu	JMBSC Mr. Yamamoto	
Person in Charge			JICA	Grant Aid Program /Procurement Agent	Chief Consultant /Operating& Maintenance Planning	Earthquake Tsunami Equipment /Installation Planning1	Earthquake and Tsunami Warning System /Information Network Planning	Construction/Installation Planning2 /Cost Estimation2	Weather and Oceanic phenomenon Equipment	Sub Chief Consultant /Procurement Planning /Cost Estimation1
16	11 July 2012	Wed			<ul style="list-style-type: none"> •Meeting with FMS •Preparing of Field Report •Communication procedure, Operating& Maintenance strategy, Finance investigation •Site survey (Project sites at Vatia) 			<ul style="list-style-type: none"> •Procurement information •Confirmation of Land Permit •Preparing of Field Report 	* same as Chief Consultant	Nadi
17	12 July 2012	Thu			<ul style="list-style-type: none"> •Communication procedure, Operating& Maintenance strategy, Finance investigation •Preparing of Field Report •Site survey (Project sites at FMS Headquarters) 					Nadi
18	13 July 2012	Fri			<ul style="list-style-type: none"> •Meeting with FMS •Preparing of Field Report 					Nadi
19	14 July 2012	Sat			Trip [Fiji 11:30→Vanuatu 12:10, FJ261=NF041]					Vanuatu
~										
20	31 July 2012	Tue			Trip [Port Vila 14:55→Nadi 17:20, FJ260]			*same as Chief Consultant		Nadi
21	01 August 2012	Wed			(Tanaka, Komatsu) Trip [Nadi (09:00) → Lakeba (10:00), Charter Flight] •Site Survey at Lakeba Trip [Lakeba (13:00) → Nadi (14:00), Charter Flight]			*same as Chief Consultant		Nadi
22	2 August 2012	Thu			Trip [Nadi 08:00 → Suva 08:30, FJ007] •Site Survey and Meeting at Suva with FMS •Reporting to JICA Fiji Trip [Suva 16:00 → Nadi 16:30, FJ016]			*same as Chief Consultant		Nadi
23	3 August 2012	Fri			[Nadi 09:00→Sydney 11:40, QF392]			<ul style="list-style-type: none"> •Procurement information •Acquiring quotation 		Sydney(Tanaka) Nadi(Komatsu)
24	4 August 2012	Sat			Trip [Sydney 08:15→Narita 17:05, JL772]			Trip [Nadi 11:30 → Port Vila 12:10, FJ261]		Port Vila

Schedule for Preparatory Survey on Fiji and Vanuatu

(2) Explanation of Draft Outline Design and Soil Investigation & Topographical Survey

No.	Date		Content Survey					Stay at	
			JICA	Mr. Tanaka	Mr. Yamamoto	Mr. Kobayashi	Mr. Kanazashi		Mr. Komatsu
Person in Charge			Mr. Nagatomo Mr. Hashimoto Mr. Yaginuma	Chief Consultant /Operating& Maintenance Planning	Earthquake and Tsunami Warning System	Sub Chief Consultant /Procurement Planning /Cost Estimation1	Construction/Installation Planning3 /Cost Estimation3	Construction/Installation Planning2 /Cost Estimation2/Soil Investigation & Topographical Survey	
1	5 Jan. 2013	Sat						Trip [Narita 19:50 → Sydney 7:35, JL771]	On Flight
2	6 Jan. 2013	Sun						Trip [Sydney 13:45 → Nadi 19:35, FJ910]	Nadi
3	7 Jan. 2013	Mon						•Meeting with FMS (Expropriation of Land) •Soil Investigation Nadi (FMS Headquarters)	Nadi
4	8 Jan. 2013	Tue						Trip [Nadi 8:00 → Suva 8:30, FJ7] •Soil Investigation Suva (Laucala-Bay Office)	Suva
5	9 Jan. 2013	Wed						Trip [Suva 7:30 → Labasa 8:10, FJ32] •Soil Investigation Vatudamu (FMS Rader Site)	Labasa
6	10 Jan. 2013	Thu						Trip [Labasa 12:45 → Nadi 13:25, FJ80]	Nadi
7	11 Jan. 2013	Fri						•Topographical Survey Nadi (FMS Headquarters)	Nadi
8	12 Jan. 2013	Sat						•Site Survey Vatia	Nadi
9	13 Jan. 2013	Sun						•Verification of the results from the Contractor	Nadi
	14 Jan. 2013	Mon						•Meeting with FMS (Expropriation of Land)	Nadi
1	15 Jan. 2013	Tue						Trip [Narita 19:50 → Sydney 7:35+, JL771] •Meeting with FMS (Expropriation of Land) •Site Survey (Land Inspection with Land Department)	Nadi(Komatsu) On Flight (Other Member)
2	16 Jan. 2013	Wed						Trip [Sydney 12:35 → Nadi 18:30, FJ910] •Team Meeting •Meeting with FMS (Expropriation of Land) •Team Meeting	Nadi
3	17 Jan. 2013	Thu						•Meeting with FMS (Description of the Project Components)	Nadi
4	18 Jan. 2013	Fri						•Meeting with FMS (Description of Specifications, Demarcation and Execution Schedule)	Nadi
5	19 Jan. 2013	Sat	Trip [Narita → Sydney]					•Site Survey Rakiraki Trip [Nadi 9:00 → Sydney 11:35, FJ911]	Sydney(Komatsu) Rakiraki(Other Member)
6	20 Jan. 2013	Sun	Trip [Sydney → Nadi]					•Team Meeting Trip [Sydney 9:15 → Narita 17:05, JL772]	
7	21 Jan. 2013	Mon						•Discussion on MD with FMS	Nadi
8	22 Jan. 2013	Tue						•Discussion on MD with FMS	Nadi
9	23 Jan. 2013	Wed	Trip [Nadi → Suva]					Trip [Nadi 7:30 → Suva 8:00, FJ3] •Site Survey Suva (Laucala-Bay Office) •Reporting to JICA Fiji •Call to NDMO	Suva
10	24 Jan. 2013	Thu	•Signing M/D Trip [Suva → Nadi]					•Signing M/D Trip [Suva 16:15 → Nadi 16:45, FJ16]	Nadi
11	25 Jan. 2013	Fri	Trip [Nadi → Sydney]					•Meeting with FMS (Layout Plan of the Project Components) Trip [Nadi 13:40 → Sydney 17:15, FJ915]	Sydney
12	26 Jan. 2013	Sat	Trip [Sydney → Narita]					Trip [Sydney 9:15 → Narita 17:05, JL772]	

Appendices -3. List of Parties Concerned in the
Recipient Country

3. List of Parties Concerned in the Recipient Country

<u>Name and Organization</u>	<u>Position</u>
Ministry of Works, Transport and Public Utilities (MWTPU)	
Francis. B. Kean	Permanent Secretary
Malakai Tadulala	Deputy Secretary
Ministry of Finance, Strategic Planning, National Development & Statistics	
Marica Turaganivalu	Senior Economic Planning Officer
Mereseni Waibuta	Chief Economic Planning Office
Sherylin Hassan	Economic Planning Officer
Ministry of Provincial Development and National Disaster Management	
Pajirai Dobui	Director (former)
Joji Satakala Ibeco	Principal Administrative Officer
Manasa Tagicakibau	Director (existing)
Akawisi Korodrau	Principal Administrative Officer
Reserve Bank of Fiji	
Janice Korovulavula	Manager External Markets Reserve Bank of Fiji
Fiji Meteorological Service (FMS)	
Alipate Waqaicelua	Director of Meteorology
Ameniasi Tuidraki	Principal Technical Officer
Tan Singh	Senior Technical Officer
Harish Pratap	Senior Technical Officer
Anal Chandra	Senior Technical Assistant
Uraia Tuilovoni	Senior Technical Assistant
Losana Vesikula	Acting Account Officer
Misaeli Funaki	Principal Scientific Officer
Makereta Cinavilakeba	Principal System Analyst
Leonard Bale	Senior System Analyst

Marica Ratuki	Senior Technical Assistant
Lasama Vesikula	Account
Jale Uluilakeba	Officer in Charge (Suva Met. Office)

Mineral Resources Department (MRD)

Sakarai Vunisa	Senior Technical Officer Seismology Section
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Water Authority of Fiji (WAF)

Timoci Turaga	General Manager Project Management
Taito Delana	General Manager Production

South Pacific Applied Geoscience Commission (SOPAC)

Wolf Forstreuter	GIS & RS Team Leader
Robert Smith	Senior Adviser
Noa Tokavou	Disaster management Adviser
Peni Musunamasi	Team Leader

United Nations Educational, Scientific and Cultural Organization (UNESCO)

Rajendra Prasad	Programme Officer
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Australia Agency for International Development (AusAID)

Rebecca McClean	Programme Manager
Tukatara Tangi	Programme Manager

Korea International Cooperation Agency/Embassy of the Republic of Korea (KOICA)

Jin Byeong-Cheul	First Secretary & Consul
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Fiji Sugar Corporation (FSC)

Sanmogam Gounder	Technical Engineer
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Embassy of Japan in Fiji

Eiichi Oshima
Hideaki Kuroki

Ambassador of Japan
Second Secretary

JICA Fiji Office

Shumon Yoshiara
Yutaka Fukase
Yohei Hashimoto
Nila Prasad

Resident Representative
Deputy Director
Assistant Resident Representative
Program Officer

Appendices -4. Minutes of Discussions (M/D)

4. Minutes of Discussions (M/D)

(1) First Field Survey

MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY
ON THE PROJECT FOR IMPROVEMENT OF EQUIPMENT
FOR DISASTER RISK MANAGEMENT

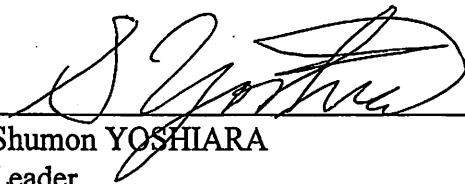
In response to the request from the Government of the Republic of Fiji (hereinafter referred to as "Fiji"), the Japan International Cooperation Agency (hereinafter referred to as "JICA"), in consultation with the Government of Japan (hereinafter referred to as "the GOJ") decided to conduct a Preparatory Survey on the Project for Improvement of Equipment for Disaster Risk Management (hereinafter referred to as "the Project").

JICA sent to Fiji the Preparatory Survey Team (hereinafter referred to as "the Team"), which is headed by Mr. Shumon YOSHIARA, Chief Representative of JICA Fiji Office, and is scheduled to stay in the country from 27th June to 14th July, 2012.

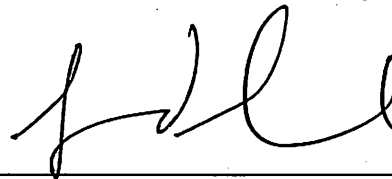
The Team held discussions with the officials concerned of the Government of Fiji (hereinafter referred to as "the GOF") and conducted a field survey at the survey area.

In the course of discussions and field survey, both sides confirmed the main items described in the attached sheets. The Team will proceed to further works and prepare the Preparatory Survey Report.

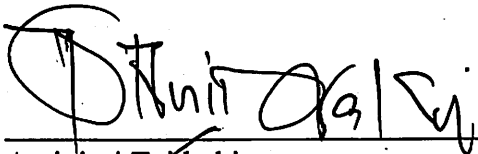
Suva, 4th July, 2012



Shumon YOSHIARA
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan



Malakai Tadulala
Deputy Secretary for Transport
Ministry of Works, Transport and Public Utilities
Republic of Fiji



Aminiasi Taddraki
Acting Director
Fiji Meteorological Service
Republic of Fiji

ATTACHMENT

1. Current Situation

The Great East Japan Earthquake, occurred on 11th March, 2011, resulted in tremendous damages to Japan, and it reminded the international community of importance of disaster prevention.

The Pacific Islands are extremely vulnerable to natural disasters. It is predicted that climate change due to global warming will increase wind speed and rainfall of tropical cyclones, which may increase the damages by floods and landslides. The areas around Solomon Sea and Tonga Trench where the plate boundaries exist have high risks for earthquake and tsunami. Thus, strategic countermeasures against natural disasters are strongly required in the area to improve their disaster risk management systems. However, monitoring networks, data analysis systems and warning systems for natural disasters are not yet well-developed in most of the countries in the Pacific Islands including Fiji.

2. Objective of the Project

The objective of the Project is to contribute toward improving disaster risk management in Fiji through the provision and installation of equipment in the facilities of the Fiji Meteorological Service (FMS).

3. Project site

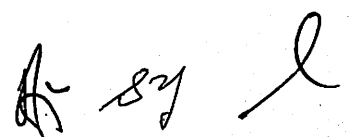
The candidate sites of the Project proposed by the Fijian side are confirmed as shown in Annex-1.

4. Responsible and Implementing Agency

- (1) The Responsible Agency is the Ministry of Works, Transport and Public Utilities (MWTPU). MWTPU shall be the focal point for the Project and be responsible for the coordination with related organizations.
- (2) The Implementing Agency is FMS. The organization charts of MWTPU and FMS is shown in Annex-2. The Fijian side explained that the Implementing Agency would be fully responsible for the installation, operation, maintenance, repair and proper management of the requested equipment shown in Annex 3.

5. Items requested by the Government of Fiji

- (1) After discussions between the Fijian side and the Team (hereinafter referred to as "both sides"), the items described in Annex-3 were finally requested by the Fijian side.
- (2) Both sides confirmed that further studies and analysis would be done to examine the appropriateness of the requested items. JICA will assess the appropriateness of the requested items based on the prioritization criteria shown in Annex-4, and will recommend to the GOJ for approval.



- (3) The Team explained that the equipment to be procured by the Grant Aid under the Project should be directly related to earthquake and tsunami disaster risk management. However, the Fijian side strongly requested weather monitoring equipment as a part of the Project which can contribute to the risk management of natural disasters such as cyclones, floods and lightening since these disasters often cause serious damages in Fiji. Both sides confirmed that the items not directly related to earthquake and tsunami disaster risk management must be appraised and approved by the GOJ to be included in the Project component.
- (4) The Team explained that the Project components together with the priority list of the items would be explained to the Fijian side by the Team around December before finalization. The priority list would include reserve items, and in case there would be remaining amount after the tendering, the reserve items may be additionally procured according to the priority.

6. Japan's Grant Aid for Disaster Prevention and Reconstruction

(1) Outline of Japan's Grant Aid for Disaster Prevention and Reconstruction

The Grant Aid is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

The Grant Aid for Disaster Prevention and Reconstruction (GADPR) was introduced in 2006, in the context of worldwide greater interest in disaster management after the Sumatra Earthquake and the Asian Tsunami in December 2004. GADPR is designed to assist disaster affected countries in disaster prevention and/or disaster reconstruction.

- (2) This Project will be implemented under GADPR. The Fijian side understood the Japan's Grant Aid scheme explained by the Team, as described in Annex-5.
- (3) The Fijian side would take the necessary measures as described in Annex-6 for the smooth implementation of the Project, as a condition for the Grant Aid to be extended to the Project.

7. Special Consideration

Both sides confirmed that when the Grant Aid for this Project is extended to Fiji, it would be required;

- (a) to procure products which can contribute to the reconstruction of the industries in "the Specified Disaster Affected Area" stipulated in "the Act on Special Fiscal Aid and Subsidy for Recovery from the Great East Japan Earthquake", and
- (b) to procure equipment for disaster risk management based on the lessons learnt in Japan and the advanced technologies of Japan which Japan intends to share with the international community as common properties.

Ar sy l

Therefore, equipment covered by the Grant Aid shall be made in and procured from Japan principally, while it may not apply for installation works which can be locally procured, manufactured and/or built.

Since the Project components may include equipment with Japan's advanced technologies, soft components will be appropriately considered to encourage sustainable operation and maintenance of the equipment based on the present situation and needs in Fiji.

8. Schedule of the Survey

- (1) The consultant members of the Team will proceed to further studies in Fiji until 14th July, 2012.
- (2) GOF will complete the procedures for opening of the Yen ordinary deposit account at a bank in Japan and request JICA to make payments of the grant by the end of July, 2012.
- (3) JICA will prepare the Draft Final Report of the Preparatory Survey in English and dispatch a mission in order to explain its contents to the GOF around December 2012.
- (4) In case that the contents of the Draft Final Report are accepted in principle by the GOF, JICA will finalize the report and send the Final Report to the GOF around February 2013.
- (5) Both sides confirmed that the Project would be carried out in accordance with the tentative schedule as shown in Annex-7.
- (6) Both sides confirmed that the Agent Agreement would be concluded after the acceptance of the Draft Final Report by the GOF around February 2013, as shown in Annex-7.

9. Consultative Committee

The Fijian side agreed to establish a consultative committee in order to coordinate with the Japanese side which consists of JICA Fiji Office as a member, the Embassy of Japan as an observer, and the procurement agent as an advisor. The terms of reference and the members of the Consultative Committee are shown in Annex-8.

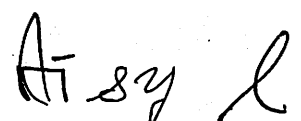
10. Other relevant issues

The following issues were discussed and confirmed by both sides.

10-1. Undertakings of the Fijian Side

The Fijian side agreed to take necessary measures as shown in Annex-6 including the following points in accordance with the Exchange of Notes and Grant Agreement signed on 20th April, 2012;

- (a) to obtain necessary permission for the use of land and installation of the equipment before the completion of the Final Report around February 2013,
- (b) to take necessary measures and obtain required permissions from the competent authorities



regarding social and environmental considerations if necessary before the commencement of the procurement of the equipment around April 2013,

- (c) to allocate necessary staff and budget for the operation, maintenance, repair and proper management of the equipment to be procured by the Project, and
- (d) to improve disaster risk management utilizing the equipment procured by the Project.

10-2. Arrangement for the Survey

As a response to the request by the Team, the Fijian side agreed to arrange the followings:

- (a) to provide the Team with available relevant data, information and materials necessary for the survey and implementation of the Project,
- (b) to submit the answers of the Questionnaires presented by the Team by 9th July,
- (c) to assign full-time counterparts to the Team during their stay in Fiji who can support the Team as coordinators and advise the Team on any technical and/or administrative matters related to the survey and the implementation of the Project,
- (d) to obtain permissions for the Team to enter into and/or photograph private properties and/or restricted areas if necessary for the survey,
- (e) to take any necessary measures to secure safety of the Team Members, and
- (f) to obtain permissions if necessary for the Team to bring back to Japan data, maps and/or materials related to the survey, subject to approval of the GOF, in order to prepare the preparatory survey report.

10-3. Tax Exemption

The Fijian side explained that the tax exemption would be applied to the Project as stipulated in the Exchange of Notes signed between the GOF and the GOJ on April 20, 2012. Ministry of Works, Transport and Public Utilities will coordinate with the Ministry of Finance, Strategic Planning, National Development and Statistics and take any necessary procedures for the tax exemption.

10-4. Overlapping with Other Projects

The Fijian side explained that the Project would not be overlapped with any other project supported by other donor agencies, NGOs and/or Fijian official organization(s).

10-5. Effective Utilization of the Equipment

The Fijian side explained that the data collected by the equipment to be procured by the Project will be shared with neighboring countries, international organizations and Japan as much as possible through existing communication systems such as the Global Telecommunication System (GTS).

10-6. Visibility of the Project

The Team explained that the visibility of the Project should be ensured as a token of the cooperation from the Japanese people. The following ideas could be considered to enhance publicity of the Project:

- (a) to display commemoration panels or stickers on the equipment, and
- (b) to publicize the Project in the mass media.

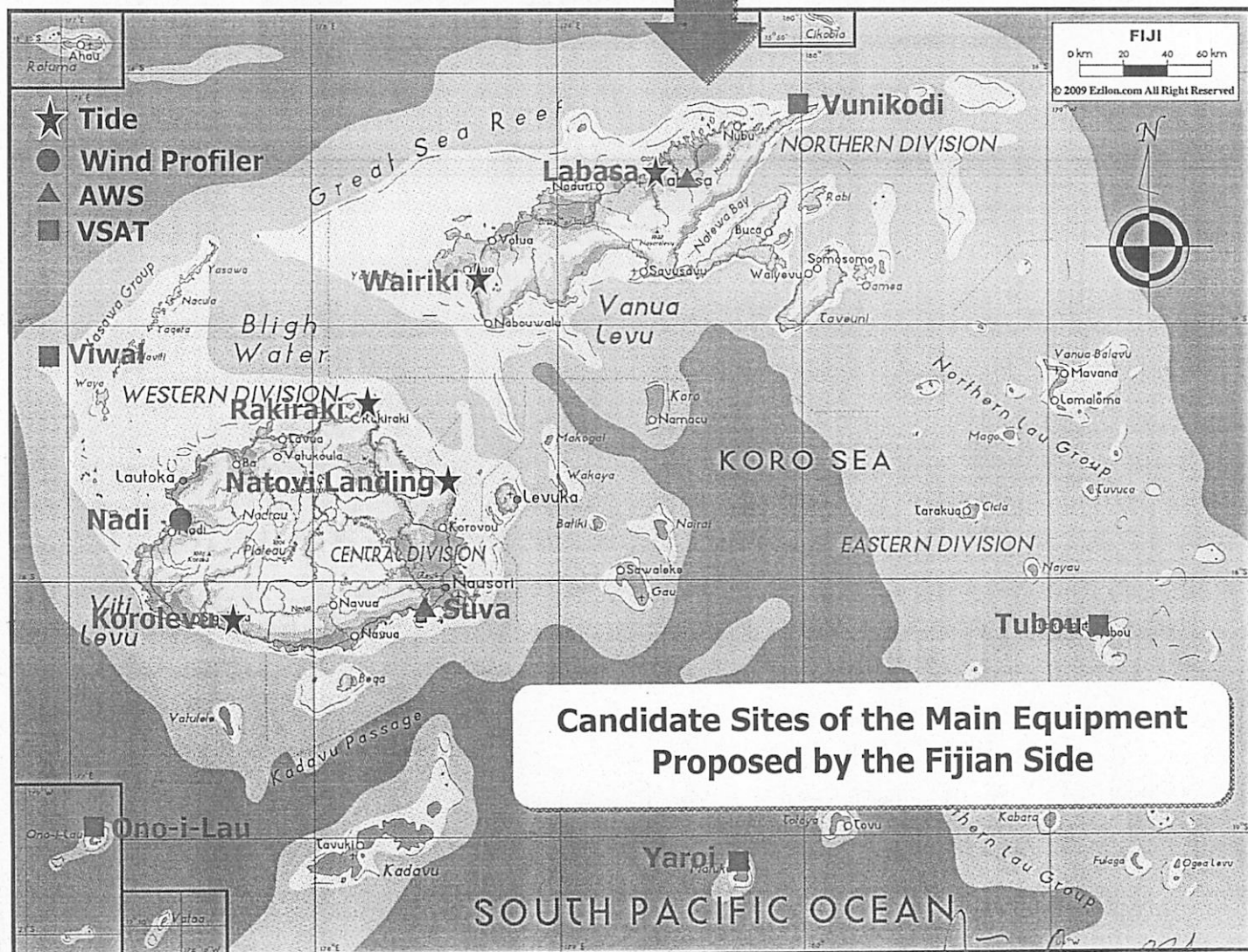
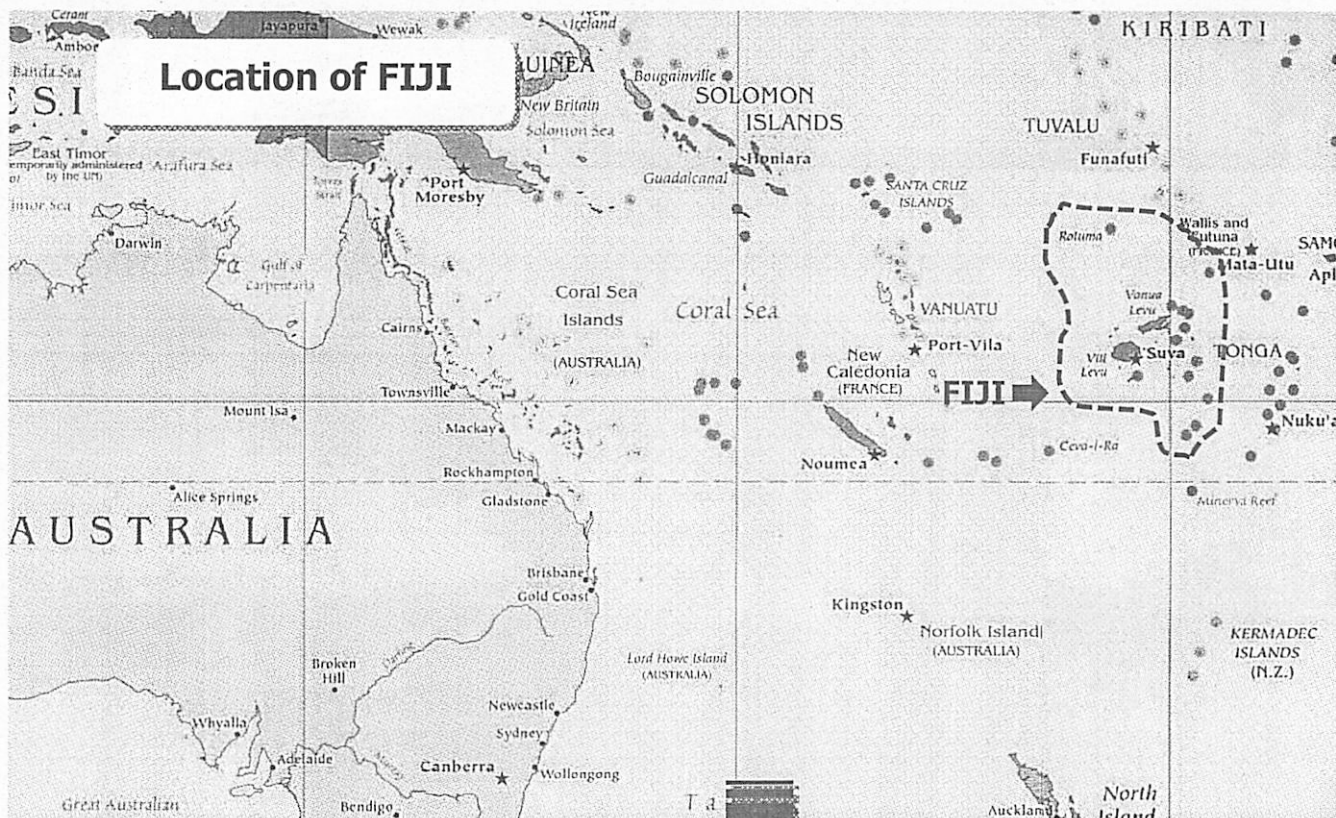
10-6. Confidentiality of the Survey Report

The Team explained that the preparatory survey report to be prepared at the end of the Survey would be disclosed to the public in principle in Japan. However, the Team also explained that the confidential parts which might affect the tendering process such as cost estimation should be kept undisclosed until the completion of the tendering.

Annex-1	Project Sites Map
Annex-2	Organization Charts
Annex-3	Items Requested by the Fijian Side
Annex-4	Criteria for Prioritization
Annex-5	Japan's Grant Aid Scheme for Disaster Prevention and Reconstruction
Annex-6	Major Undertakings to be taken by Each Government
Annex-7	Tentative Implementation Schedule
Annex-8	Terms of Reference and Members of the Consultative Committee

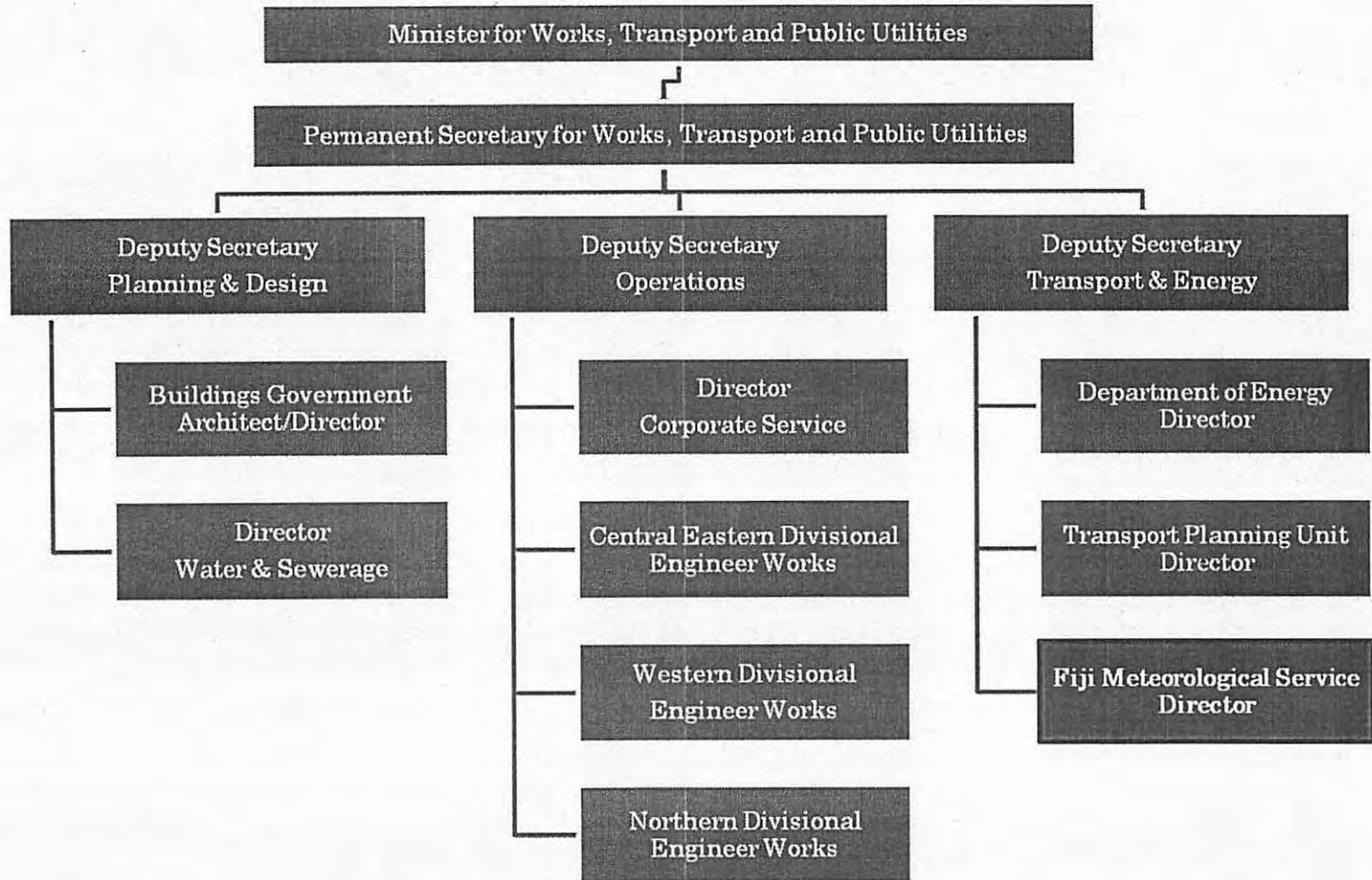
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Project Sites Map



Organization Charts

1. Ministry of Works, Transport and Public Utilities (Responsible Agency)

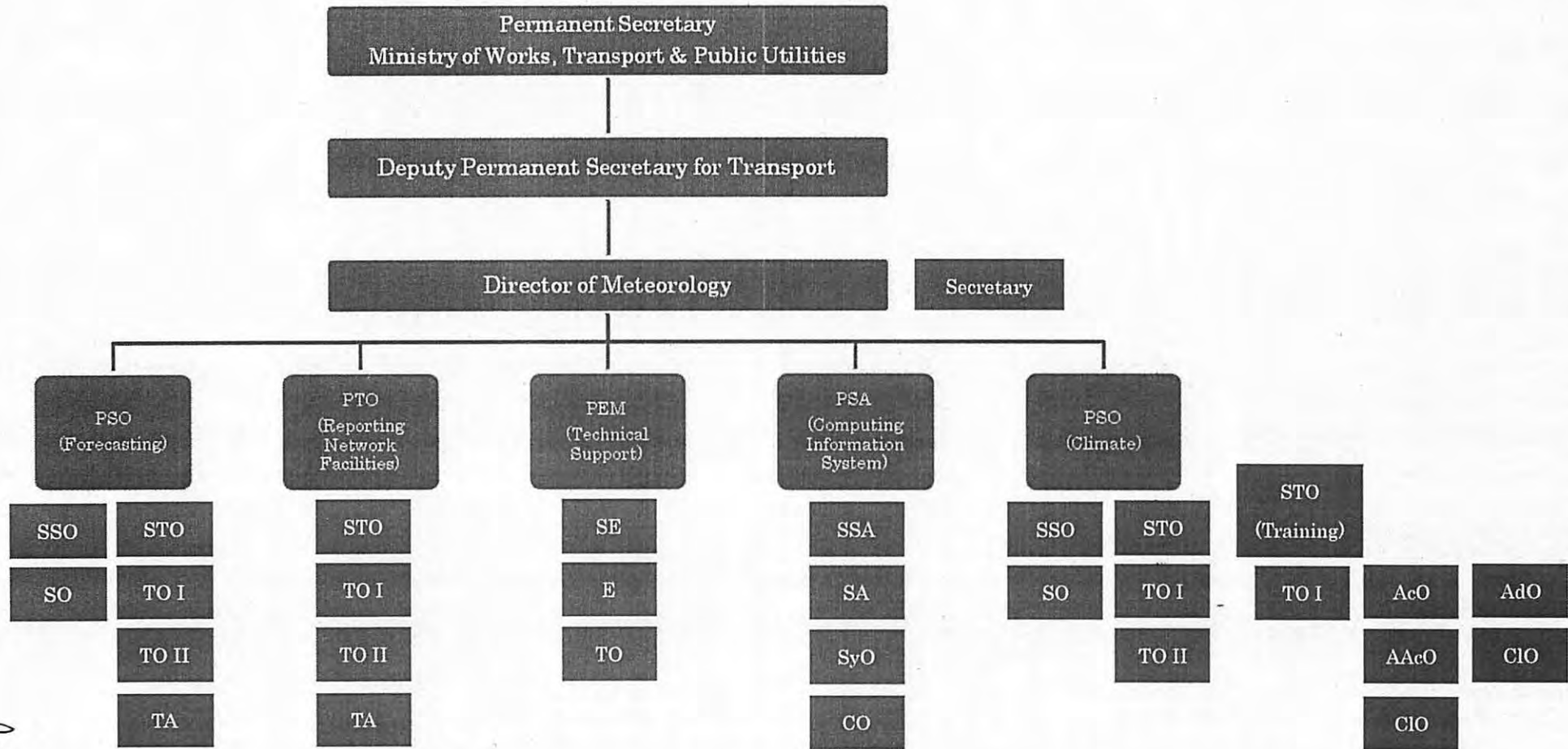


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2. Fiji Meteorological Service (Implementing Agency)

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PSO:PrincipalScientific Officer, PTO:Principal Technical Officer, PEM:Principal Engineer Manager, PSA:Principal System Analyst

SSO:SeniorScientific Officer, STO:SeniorTechnical Officer, SE:Senior Engineer, SSA:Senior System Analyst

SO:Scientific Officer, TO:Technical Officer, E:Engineer, SA:System Analyst, AcO:Accounts Officer, AdO:Administrative Officer

TA: Technical Assistant, SyO:System Operator, CO: Computer Operator, AAcO:Assistant Accounts Officer, CIO:Clerical Officer

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Items Requested by the Fijian Side

1	Tide Gauge for Sea Level	5 set	S
2	VSAT Communication Infrastructure for Outstations (connection to 5 branch stations)	1 lot	S
3	Wind Profiler	1 set	A
4	Automatic Weather Station (AWS)	2 set	A
5	Calibration Chamber / Equipment —pressure, temperature, humidity	1 set	A
6	Lightning Detection and Warning System	6 set	A
7	Vehicle for Disaster Prevention Education	1 set	B
8	Digital Barometer	10 set	B
9	Wind speed and direction mete	5 set	B
10	Re-new of Network cable at FMS office	1 lot	B
11	Network system at Disaster management center(Data back-up System)	1 lot	B
12	Doppler Radar	1 set	C
13	Meteorological Data Visualization Software Package Manufactured by TRIVIS	1 set	C
14	Ocean Tethered Buoy (for Marine Meteorological Observation)	1 set	C
15	Radioactivity Sensor	1 set	D
16	Strong-motion Seismograph		D

S: Highest priority for the Fijian side and directly related to earthquake and tsunami disaster risk management

A: High priority for the Fijian side

B: Medium priority for the Fijian side

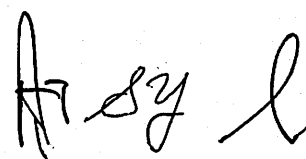
C: Relatively low priority for the Fijian side

D: Low priority for Fijian side

Criteria for Prioritization

1. Equipment which does not fulfill the following criteria will be deleted automatically:
 - (1) the Implementing Agency has enough technical, financial and institutional capacity to install, operate, maintain, repair and properly manage the equipment (technical capacity may be strengthened by the implementation of the soft component), and
 - (2) the space to install the equipment is available (land owner, permission for use).

2. The appropriateness of the equipment will be appraised from the following viewpoints:
 - (1) contribution to the improvement of natural disaster risk management especially of earthquake and tsunami disaster risk management,
 - (2) possibility of the equipment or a part of the equipment to be made in and procured from "the Specified Disaster Affected Area" stipulated in "the Act on Special Fiscal Aid and Subsidy for Recovery from the Great East Japan Earthquake", and
 - (3) benefit to Japan and the South Pacific Region including neighboring countries.

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**JAPAN'S GRANT AID SCHEME
FOR DISASTER PREVENTION AND RECONSTRUCTION**

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

The Grant Aid is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such. Grant Aid for Disaster Prevention and Reconstruction (GADPR) is one of the several types of the Japan's Grant Aid scheme designed to assist disaster affected countries in disaster prevention and/or disaster reconstruction.

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures:

- Preparatory Survey
 - The Survey conducted by JICA
- Appraisal & Approval
 - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
 - The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
 - Agreement concluded between JICA and a recipient country
- Implementation
 - Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project:
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid scheme from a technical, financial, social and economic point of view.

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- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline Design of the Project is confirmed based on the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve 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 of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

3. Japan's Grant Aid for Disaster Prevention and Reconstruction Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be signed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

In order to maintain technical consistency, the consultant firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue work on the Project's implementation after the E/N and the G/A.

(3) Banking Arrangements (B/A)

The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"), and shall notify JICA in the written form prescribed in the G/A attached herewith of the completion of the procedures for opening the account. JICA will execute the Grant Aid by making payments in Japanese yen to the account during the period

referred to in the G/A and on or after the date of receipt of the written notification above.

(4) Contract with Procurement Agent

The recipient country will conclude an Agent Agreement with the designated Procurement Agent stipulated in the E/N in order to secure smooth implementation of the Project.

(5) Details of Procedures

Details of procedures on procurement and services under GADPR will be agreed between the authorities of the two governments concerned at the time of the signing of the G/A.

Essential points to be agreed are outlined as follows:

- a) JICA will supervise the implementation of the Project.
- b) Products and services will be procured and provided in accordance with JICA's "Procurement Guidelines of Japan's Grant Aid for Disaster Prevention and Reconstruction (Type I-D)."
- c) The Recipient will conclude a contract with the Agent.
- d) The Agent is the representative acting in the name of the Recipient concerning all transfers of funds for the Project.

(6) Focal points of "Procurement Guidelines of Japan's Grant Aid for Disaster Prevention and Reconstruction (Type I-D)"

a) The Agent

The Agent is the organization, which provides procurement of products and services on behalf of the Recipient according to the Agent Agreement with the Recipient. The Agent is recommended to the Recipient by the Government of Japan and agreed between the two Governments in the A/M.

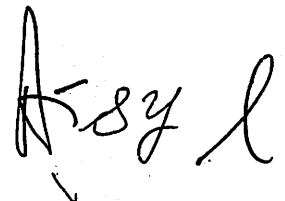
b) Agent Agreement

The Recipient will conclude the Agent Agreement, in principle, within two months after the signing of the G/A, in accordance with the A/M. The scope of the Agent's services will be clearly specified in the Agent Agreement.

c) Approval of the Agent Agreement

The Agent Agreement is prepared as two identical documents and the copy of the Agent Agreement will be submitted to JICA by the Recipient through the Agent. JICA confirms whether the Agent Agreement is concluded in conformity with the E/N, A/M, and G/A and the Procurement Guidelines of Japan's Grant Aid for Disaster Prevention and Reconstruction (Type I-D) then approves the Agent Agreement.

The Agent Agreement concluded between the Recipient and the Agent will become effective after the approval by JICA in a written form.



d) Payment Methods

The Agent Agreement will stipulate that "Regarding all transfers of the fund to the Agent, the Recipient will designate the Agent to act on behalf of the Recipient and issue a Blanket Disbursement Authorization ("the BDA") to conduct the transfer of the fund (hereinafter referred to as "the Advances") to the Procurement Account from the Recipient Account.

The Agent Agreement will clearly state that the payment to the Agent will be made in Japanese yen from the Advances and that the final payment to the Agent will be made when the total remaining amount become less than three percent (3%) of the Grant and its accrued interests excluding the Agent's fees.

i) Blanket Disbursement Authorization (BDA)

By issuing the "Blanket Disbursement Authorization (BDA)" by the Government of the recipient country to the Bank, the Government of the recipient country designates a procurement agent as the representative authorized to act in the name of the recipient country concerning all transfers of the Grant to an account in the name of the procurement agent.

e) Products and Services Eligible for Procurement

Products and services to be procured will be selected from those defined in the G/A.

f) Method of Procurement

When conducting the procurement, sufficient attention will be paid to transparency in selecting the firms and for this purpose, competitive tendering will be employed in principle.

g) Additional procurement

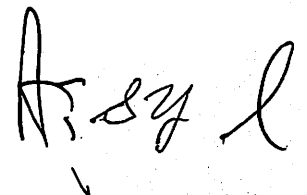
If there is any remaining balance after the competitive and/or selective tendering and/or direct negotiation for a contract, and if the Recipient would like to procure additional items, the Agent is allowed to conduct this additional procurement, following the points mentioned below:

i) Procurement of same products and services

When the products and services to be additionally procured are identical with the initial tender and a competitive tendering is judged not efficient, additional procurement can be conducted by a negotiated contract with the successful tenderer of the initial tender.

ii) Other procurements

When products and services other than those mentioned above in i) are to be procured, the procurement should be conducted through competitive tendering. In



this case, the products and services for additional procurement will be selected from among those in accordance with the G/A.

h) Conclusion of the Contracts

In order to procure products and services in accordance with the guideline, the Agent will conclude contracts with firms selected by tendering or other methods.

(7) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority 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, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(8) Major undertakings to be taken by 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 Annex-6.

(9) Proper Use

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

(10) Export and Re-export

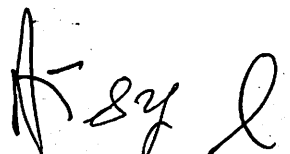
The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(11) Social and Environmental Considerations

A recipient country must carefully consider the social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

Attachment 1 Flow Chart of Japan's Grant Aid Procedures

Attachment 2 Flow of Funds & Services for the Implementation of Japan's Grant Aid Scheme
for utilizing Procurement Agent



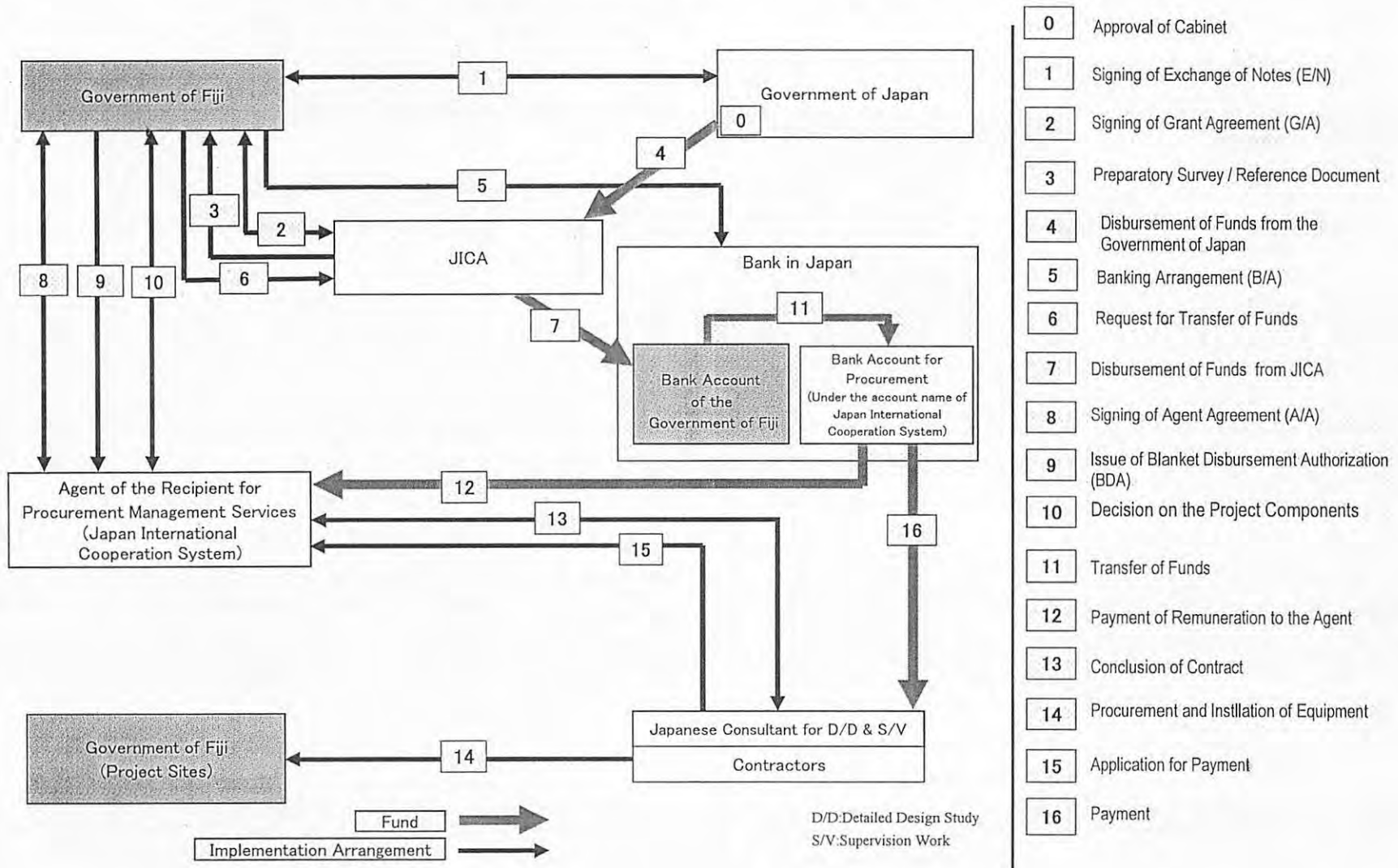
Flow Chart of Japan's Grant Aid Procedures

Stage	Work-Flow & Procedures	Recipient Government	Japanese Government	JICA	Agent (JICS)	Consultant	Contractor	Others
Application	Request	○						
	Screening of Project		○	○				
Project Formulation & Preparation	Preparatory Survey			○		○		
	Explanation of Draft Report & Reference Documents for Tender	○		○		○		
Appraisal & Approval	Appraisal of Project		○					
	Inter-Ministerial Consultation		○					
	Presentation of Draft Notes	○	○					
	Approval by the Cabinet		○					
Implementation	E/N and Agreed Minutes (E/N : Exchange of Notes)	○	○					
	G/A (G/A : Grant Agreement)	○		○				
	Banking Arrangement	○						★
	Agent Agreement	○		○	○			
	Approval by JICA							
	Issuance of BDA (BDA : Blanket Disbursement Authorization)	○			○			★
	Consultant Contract	○		○	○	○		
	Review & Preparation of Tender Documents	○		○	○	○		
	Approval by Recipient Government							
	Preparation for Tender							
	Tendering & Evaluation	○		○	○	○	○	
	Procurement Contract	○		○	○	○	○	
	Procurement	○		○	○	○	○	
Completion Certificate by Recipient Government								
Operation	○		○					
Post Evaluation Study	○							
Evaluation & Follow up	Ex-Post Evaluation	○	○	○				
	Follow up							

★ Bank in Japan

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Flow of Funds & Services for the Implementation of Japan's Grant Aid Scheme for utilizing Procurement Agent



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Major Undertakings to be Taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure lots of land necessary for the implementation of the Project and to clear the sites		●
2	To construct the facilities if necessary and install the equipment at the site	(●)	(●)
	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the sites		●
3	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products		
	1) Marine (Air) transportation of the Products from Japan to the recipient country	●	
	2) Tax assumption and custom clearance of the Products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	(●)	(●)
4	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services as well as the employment of the Agent be borne by the Authority without using the Grant and its accrued interest.		●
5	To accord Japanese nationals and / or nationals of third countries, including such nationals employed by the Agent, whose services may be required in connection with the supply of the products and the services such facilities may be necessary for their entry into the recipient country and stay therein for the performance of their work (The term "nationals" whenever used in the G/A means Japanese physical persons or Japanese juridical persons controlled by Japanese physical persons in the case of Japanese nationals, and physical or juridical persons of third countries in the case of nationals of third countries.)		●
6	To ensure that the products be maintained and used properly and effectively for the implementation of the Project		●
7	To bear all the expenses, other than those covered by the Grant and its accrued interest, necessary for the implementation of the Project		●
8	To bear commissions paid to the Japanese bank for banking services based upon the B/A		
9	To give due environmental and social consideration in the implementation of the Project		●

(B/A : Banking Arrangement)

Tentative Impementation Schedule

Year		2012										2013								
(Japanese Fiscal Year)		JFY 2012										JFY 2013								
Item	Month	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8		
Preparatory Survey (OD DFR DD)				█																
									DF/R	▼		▼	F/R							
Implementation Achelue	Contract	Exchange of Notes (E/N)	▼	E/N																
		Grant Agreement (G/A)	▼	G/A																
		Banking Arrangement (B/A)				▼	B/A													
		Agent Agreement (A/A)										A/A	▼							
		Final Selection of the Products and the Services										▼								
		Consultant Contract											▼							
	Procurement	Review & Preparation of Tender Documents											█							
		Approval of Tender Documents by Recipient Government												▼						
		Tender Notice												▼						
		Tender Closing																▼		
		Tender Evaluation															█			
		Supply Contract																	▼	

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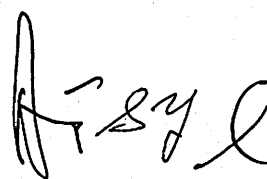
Terms of Reference and Members of the Consultative Committee

1. Terms of Reference of the Consultative Committee

- (1) To confirm the implementation schedule of the Project for the speedy and effective utilization of the Grant and its accrued interest;
- (2) To discuss modifications of the Project, including modifications of designs of the Facilities;
- (3) To exchange views on allocations of the Grant and its accrued interest as well as on potential end-users;
- (4) To identify problems which may delay the utilization of the Grant and its accrued interest, and to explore solutions to such problems;
- (5) To exchange views on publicity related to the utilization of the Grant and its accrued interest; and
- (6) To discuss any other matters that may arise from or in connection with the G/A.

2. Members of the Consultative Committee

- (1) Fijian Side : Ministry of Works, Transport and
Public Utilities
Fiji Meteorological Service (FMS)
- (2) Japanese Side : JICA Fiji Office
- (3) Observer : Embassy of Japan
- (4) Advisor: : The Procurement Agent (JICS)



(2) Explanation of Draft Outline Design

**MINUTES OF DISCUSSIONS
ON
PREPARATORY STUDY
ON
THE PROJECT FOR IMPROVEMENT OF EQUIPMENT
FOR DISASTER RISK MANAGEMENT
IN
REPUBLIC OF FIJI
(Explanation of Draft Outline Design Report)**

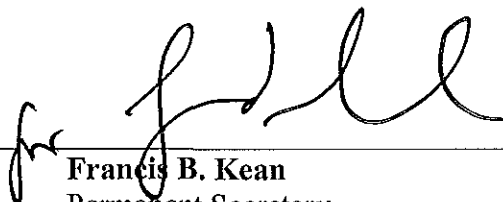
In July 2012, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Study Team on the Project for Improvement of Equipment for Disaster Risk Management (hereinafter referred to as "the Project") to Republic of Fiji (hereinafter referred to as "Fiji"), and through discussions, field survey and technical examination of the results in Japan, JICA prepared the Draft Outline Design report of the study.

In order to explain and to consult with the concerned officials of the Government of Fiji on the components of the Draft Report, JICA sent the Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Noriaki Nagatomo, Senior Advisor to Director General, Global Environment Department, JICA, to Fiji, from January 15 to 25, 2013. As a result of discussions, both sides confirmed the main items described in the attached sheets.

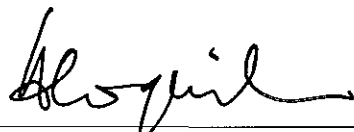
Suva, 24th January, 2013



Noriaki Nagatomo
Leader of Draft Report Explanation Team
Japan International Cooperation Agency
Japan



Francis B. Kean
Permanent Secretary
Ministry of Works, Transport and Public
Utilities
Republic of Fiji



Alipate Waqaicelua
Director
Fiji Meteorological Service
Republic of Fiji

ATTACHMENT

1. Components of the Draft Report

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

The Team explained and the Fijian side understood that the Draft Outline Design Report is the result of the Preparatory Study and there is a possibility to change the component of it because of the external factor like price rise or change of price estimation of the each equipment and so on.

The locations of the Project sites are shown in Annex-1 and the Project Components are shown in Annex-2.

2. Cost Estimation of the Project

2-1. The Team explained the cost estimation of the Project as described in Annex-3.

2-2. Both sides agreed that cost estimation of the Project as attached in Annex-3 should never be duplicated or released to any third parties before the signing of all the contract(s) for the Project.

2-3. The Fijian side understood that cost estimation of the Project described in Annex-3 is a provisional one as a result of the study and could be subject to change according to further examination or situation changed.

3. Special Consideration of the Project

3-1. Both sides confirmed again the contents of article 7 "Special Consideration" in the minutes of discussion signed on 4th July, 2012 (hereinafter referred to as "the previous M/D").

3-2. The Fijian side accepted that the equipment described in Annex-4 will be procured under the Special Consideration in order to contribute to reconstruction of industry in "Specified Disaster Affected Area" in Japan. The team promised to inform the change of equipment in case the equipment list in Annex-4 will be modified.

3-3. The Fijian side understood that the cost of equipment described in Annex-4 was estimated under the Special Consideration.



4. Undertakings to be taken by the Fijian side

Both sides confirmed that the Fijian side would complete the following undertakings through FMS shown in accordance with the implementation schedule of the Project in addition to Annex-6 of the Previous M/D;

- To obtain an agreement letter(s) from the owner of the pier in Vatia, Viti Levu for installation of the Tide Observation System and the owners of the sites in Rakiraki, Viti Levu and Matei, Taveuni for installation of the Lightning Detection System, about approval of its use by the end of February 2013 in order to secure necessary land;
- To ensure leveling and removing obstacles on the Project sites for installation of the equipment;
- To prepare access roads to the Project sites (if necessary);
- To conduct periodic cleaning of the equipment and the Project sites (including PV panels);
- To install security fences, gates and guardhouses in and around the Project sites;
- To obtain an approval for use of Data Collection Platform (DCP) from Japan Meteorological Agency (JMA) necessary for data transmission of the Tide Observation System by the end of June 2013;
- To remove wooden floor and beams (Approx. 3m x 3m) on the existing pier in Vatia, Viti Levu by the end of March 2014;
- To share observed data by the Tide Observation System with Mineral Resources Department (MRD) as and when the need arises through appropriate means;
- To secure VSAT communication services required for VSAT Communication System and Lightning Detection System by the end of March 2014 and bear the cost of the VSAT communication services;
- To secure BGAN services required for Tide Observation System and Automatic Weather Station (AWS) System by the end of March 2014 and bear the cost of the BGAN services;
- To provide network connection and power supply for Wind Profiler System by the end of March 2014;
- To carry out initial uploading of observed data and information to GTS (Global Telecommunication System) operated by WMO (World Meteorological Organization) for sharing those data and information with international organizations, Japan and neighboring countries after acceptance testing and commissioning;
- To conduct proper disposing of spent batteries; and
- To publicize achievements delivered from the observation data acquired from the Project equipment.

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5. Scheme of Japan's Grant Aid for Disaster Prevention and Reconstruction (GADPR)

Both sides reconfirmed the Scheme of Japan's Grant Aid for Disaster Prevention and Reconstruction (hereinafter referred to as "GADPR") and major undertakings to be taken by each side under GADPR, as described in article 6 in the previous M/D.

6. Implementation Structure

6-1. Both sides reconfirmed that there is no change in responsible agency and implementation agencies which were confirmed in the previous M/D.

6-2. Both sides reconfirmed that Ministry of Works, Transport and Public Utilities (hereinafter referred to as "MWTPU") shall be the focal point for the coordination with implementation and related agencies in the Consultative Committee which was agreed to establish in the previous M/D. The Fijian side explained that the Consultative Committee would be held properly to accomplish the terms of reference of this committee described in Annex-8 in the previous M/D.

7. Tentative Schedule of the Project

7-1. The Team will complete the Final Outline Design Report in English and send it to the Fiji in April 2013.

7-2. Both sides confirmed the Project will be carried out in accordance with the tentative schedule as shown in Annex-5.

7-3. Both sides confirmed that the tender notice would be delayed or the exclusion of the Project components would be considered if undertakings by the Fijian side mentioned in Article 4 are not met by the designated timing.

8. Other Relevant Issues

8-1. Social and Environmental Considerations

The Fijian side promised to clear necessary procedures for social and environmental considerations and obtain a necessary approval by relevant authorities before commencement of the procurement in accordance with the relevant guidelines in Fiji, including Environmental Impact Assessment (EIA) if required.

8-2. Responsibility for the Tender Documents

The Team promised to send the Technical Specifications for the equipment to be procured in the Project as a result of the study to the Fijian side.

The Fijian side understood that the Fijian side shall review and complete the entire Tender Documents including the Technical Specifications of the equipment in cooperation with the procurement agent. And then the Fijian side is responsible for project implementation and the output of the Project executed.

8-3. A Use for Remaining Budget after Tender

Both sides confirmed to consider the possibility that the equipment for the sites which is not included in the component in Annex-2 will be purchased according to the priority in the Preparatory Survey Report, in case the Project has a remaining budget by a result of the tender.

8-4. Public Relations

The Fijian side expressed that the Project would contribute to disaster risk management, mainly in the aspects related to preparation process, and therefore to protect human lives and private and public property, since the equipment to be procured for the Project would improve not only precision in observation but also the quality, in terms of accuracy and timeliness, of the information disseminated to the people.

As a natural disaster-prone country and in special consideration of the Project described, the Fijian side expressed their appreciation to the Japanese Government and promised to conduct public relations for the Project in order to let the people understand that the Project is assisted by Japan.

The Team appreciated that the Fijian side understood the background of the Project affirmatively.

8-5. Confidentiality of the Survey Report

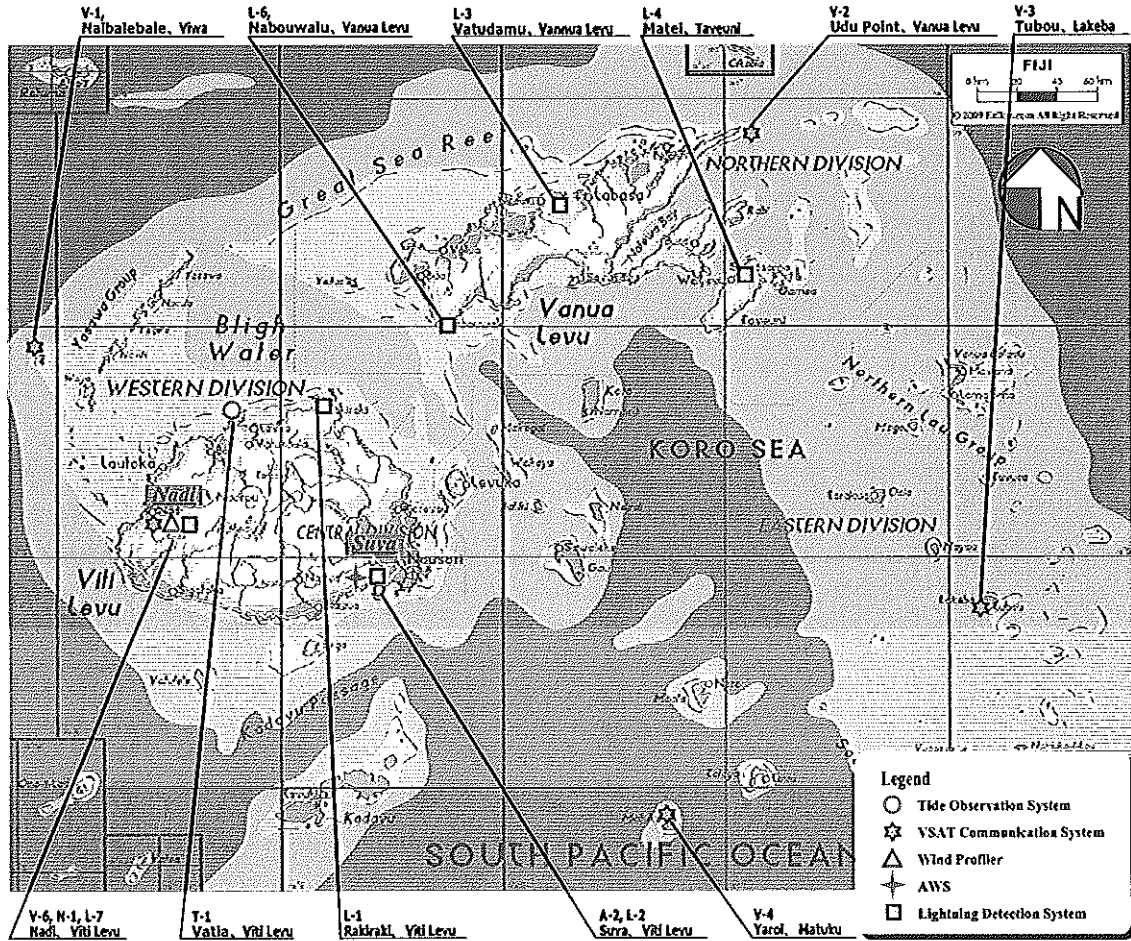
The Team explained that the Preparatory Survey Report to be prepared at the end of the Survey would be disclosed to the public in principle in Japan. However the Team also explained that a confidential part which might affect tendering process such as cost estimation should be kept undisclosed until the tendering has completed.

9. Force of Law

These Minutes of Discussions on the Preparatory Study for the Project (hereinafter referred to as "Minutes") are not legally binding unless parties enter into a signed written agreement (Grant Agreement) incorporating the matters outlined in the Minutes.

- Annex-1 Project Sites**
- Annex-2 Project Components**
- Annex-3 Project Cost Estimates**
- Annex-4 Equipment to be procured under special consideration**
- Annex-5 Tentative Schedule**

Project Sites



Project Components

No.	Description	Q'ty
1	Tide Observation System (Vatia)	1 site
2	VSAT Communication System (Naibalebale, Udu Point, Tubou, Yaroi, Nadi)	5 sites
3	Wind Profiler System (Nadi)	1 site
4	Automatic Weather Station (Suva)	1 site
5	Calibration Equipment (Nadi)	
5.1	Calibration Equipment for Barometer	1 set
5.2	Calibration Equipment for Thermometer	1 set
5.3	Calibration Equipment for Hygrometer	1 set
5.4	Laptop	1 set
6	Lightning Detection System (Rakiraki, Suva, Vatudamu, Matei, Nabouwalu, Nadi)	6 sites

1. Project Cost to be borne by Japan's Grant Aid

This section is closed due to confidentiality

2. Project Cost to be borne by the Fijian side

<Cost for the first year of the Project>

No.	Undertakings	Estimated Cost (US\$)	Notes
1	Exemption or payment of value-added tax (VAT) on equipment procured from Japan or third countries and local equipment	330,000	VAT: 15% of the total equipment cost (Approx. US\$2.2 million)
2	Exemption or payment of fiscal duty on equipment procured from Japan or third countries	110,000	Fiscal duty: 5% of the total equipment cost (Approx. US\$2.2 million)
3	Payment of bank commissions based upon the Banking Arrangement	3,750	Estimated amount
4	Application to use BGAN to INMARSAT in USA and bearing charges of BGAN		
	(1) Tide Observation System	506	FJ\$74/month x 12 months x 1 site = FJ\$888 = US\$506
	(2) Automatic Weather Station (AWS)	506	FJ\$74/month x 12 months x 1 site = FJ\$888 = US\$506
5	Application to use VSAT to Telecom Fiji Limited and bearing charges of VSAT		
	(1) VSAT Communication System	5,404	FJ\$158/month x 12 months x 5 sites = FJ\$9,480 = US\$5,404
	(2) Lightning Detection System	6,484	FJ\$158/month x 12 months x 6 sites = FJ\$11,376 = US\$6,484
	Total	456,650	US\$0.57/FJ\$ (As of January 2013)

<Annual Operation & Maintenance Cost from the 2nd year of the Project>

No.	Undertakings	Estimated Cost (US\$)	Notes
1	Bearing charges of BGAN to INMARSAT in USA		
	(1) Tide Observation System	506	FJ\$74/month x 12 months x 1 site = FJ\$888 = US\$506
	(2) Automatic Weather Station (AWS)	506	FJ\$74/month x 12 months x 1 site = FJ\$888 = US\$506
2	Bearing charges of VSAT to Telecom Fiji Limited		
	(1) VSAT Communication System	5,404	FJ\$158/month x 12 months x 5 sites = FJ\$9,480 = US\$5,404
	(2) Lightning Detection System	6,484	FJ\$158/month x 12 months x 6 sites = FJ\$11,376 = US\$6,484
	Total	12,900	US\$0.57/FJ\$(As of January 2013)

Notes: Specific items are shown in the draft Outline Design report.

Equipment to be procured under special consideration

1. Tide Observation System
Tidal Gauge
2. Automatic Weather Station (AWS)
Actinometer
Barometer
Anemoscope
Pluviometer
Thermometer
Hygrometer
Data Logger
3. Calibration Equipment
Calibration Equipment for Barometer
Calibration Equipment for Thermometer
Calibration Equipment for Hygrometer
4. Lightning Detection System
Lightning Sensor



Tentative Schedule of the Project

Item	Year		2013												2014								
	Japanese Fiscal Year	Month	2012			2013									2014								
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7		
Preparatory Survey			-----▶				▼																
						F/R																	
Implementation Schedule	Contract	EN / GA (Made on 20th April 2012) / BA (Made in 2012)																					
		Agent Agreement (AA)	▼																				
		Final Selection of the Products and the Services					▬																
		Consultant Contracts					▼																
	Procurement	Review & Preparation of Tender Documents					▬																
		Approval of Tender Documents by Recipient Government						■															
		Tender Notice								▼													
		Tender Closing									▼												
		Tender Evaluation										■											
		Supply Contract											▼										
		Equipment Fabrication and Pre-shipment Inspection												▬									
		Transportation of Equipment																				▬	
		Installation Work and Training																					▬
		Handing-over																					▼

A-4-32

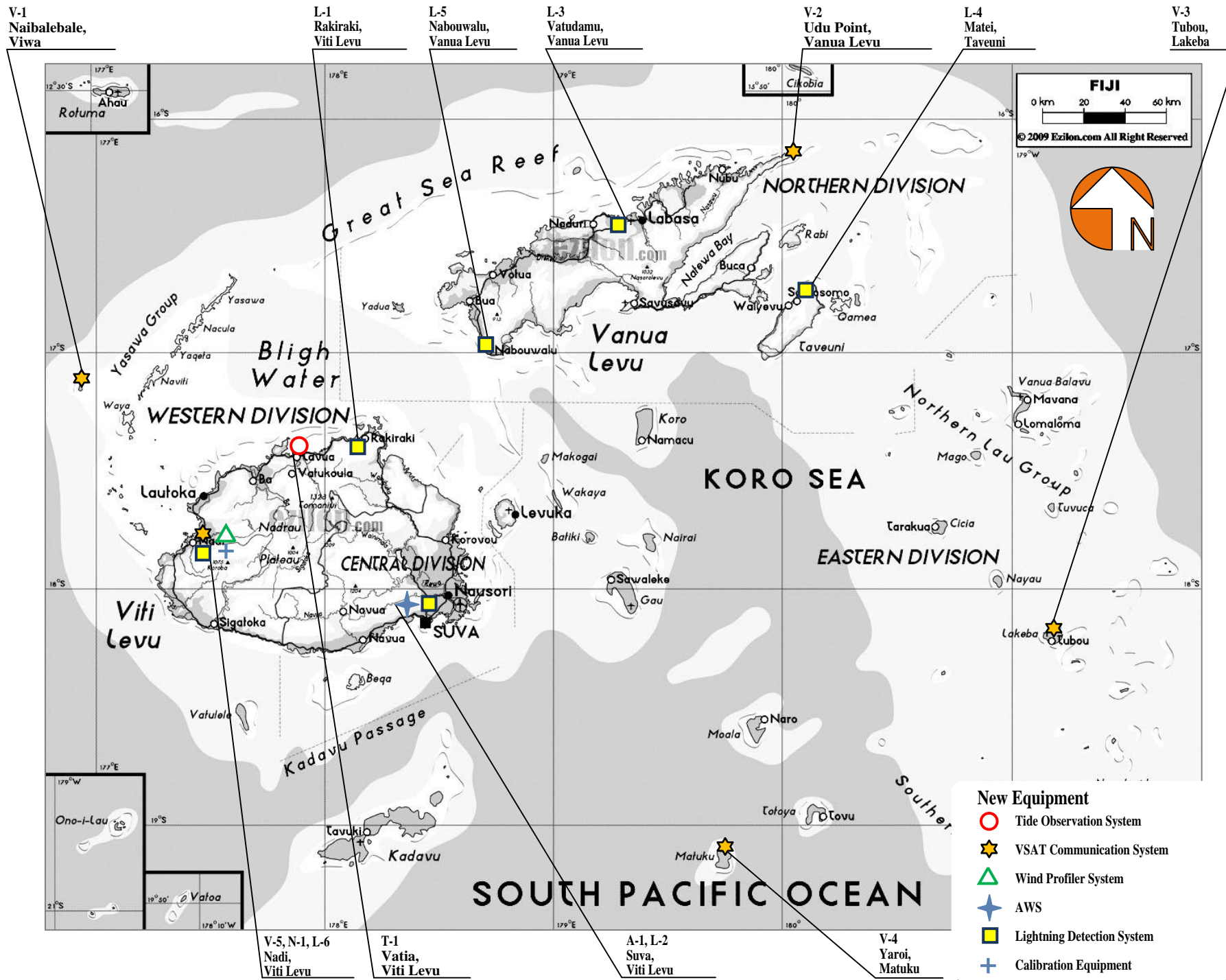
Handwritten notes:
 m
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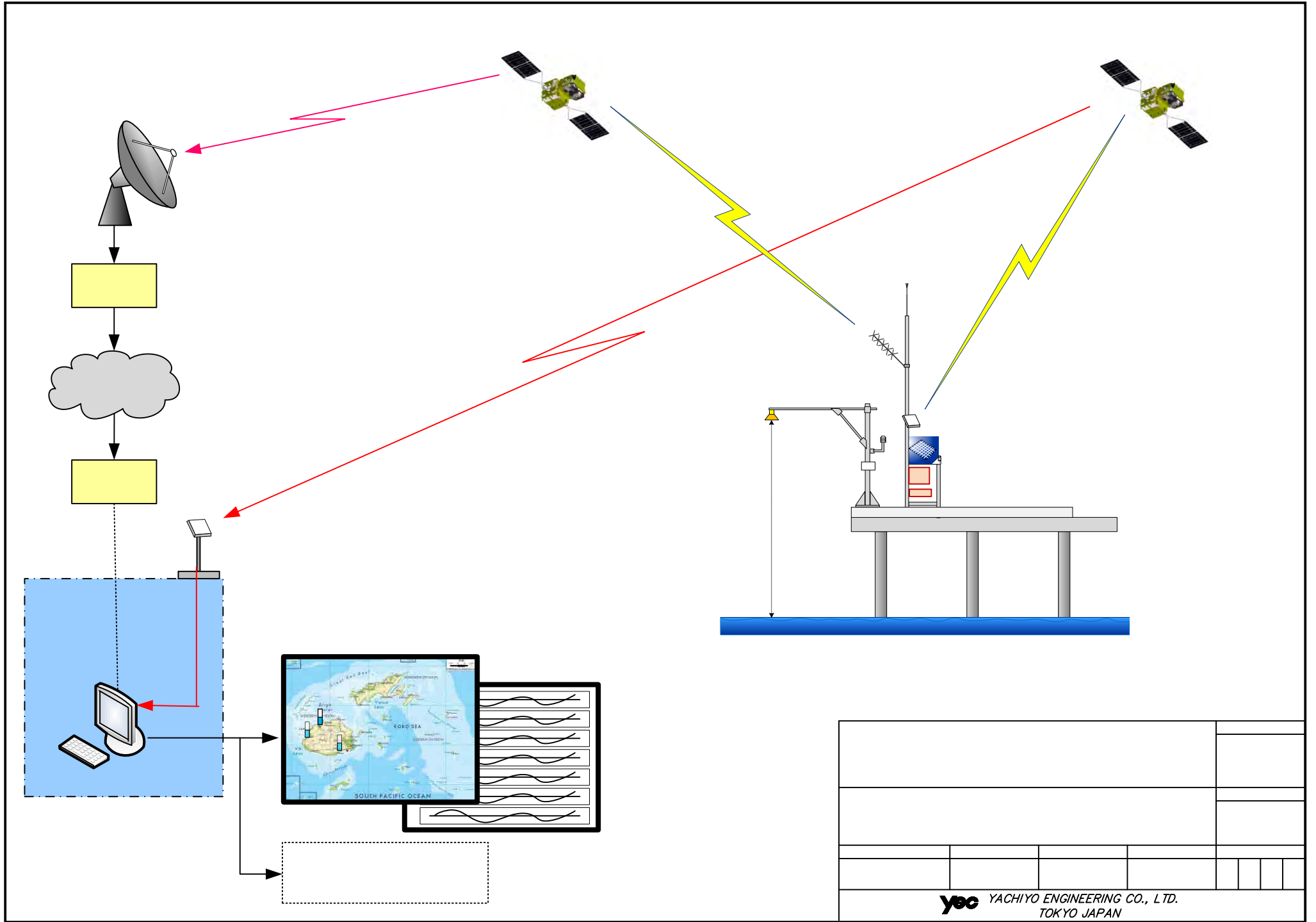
Appendices -5. Outline Design Drawings

5. Outline Design Drawing

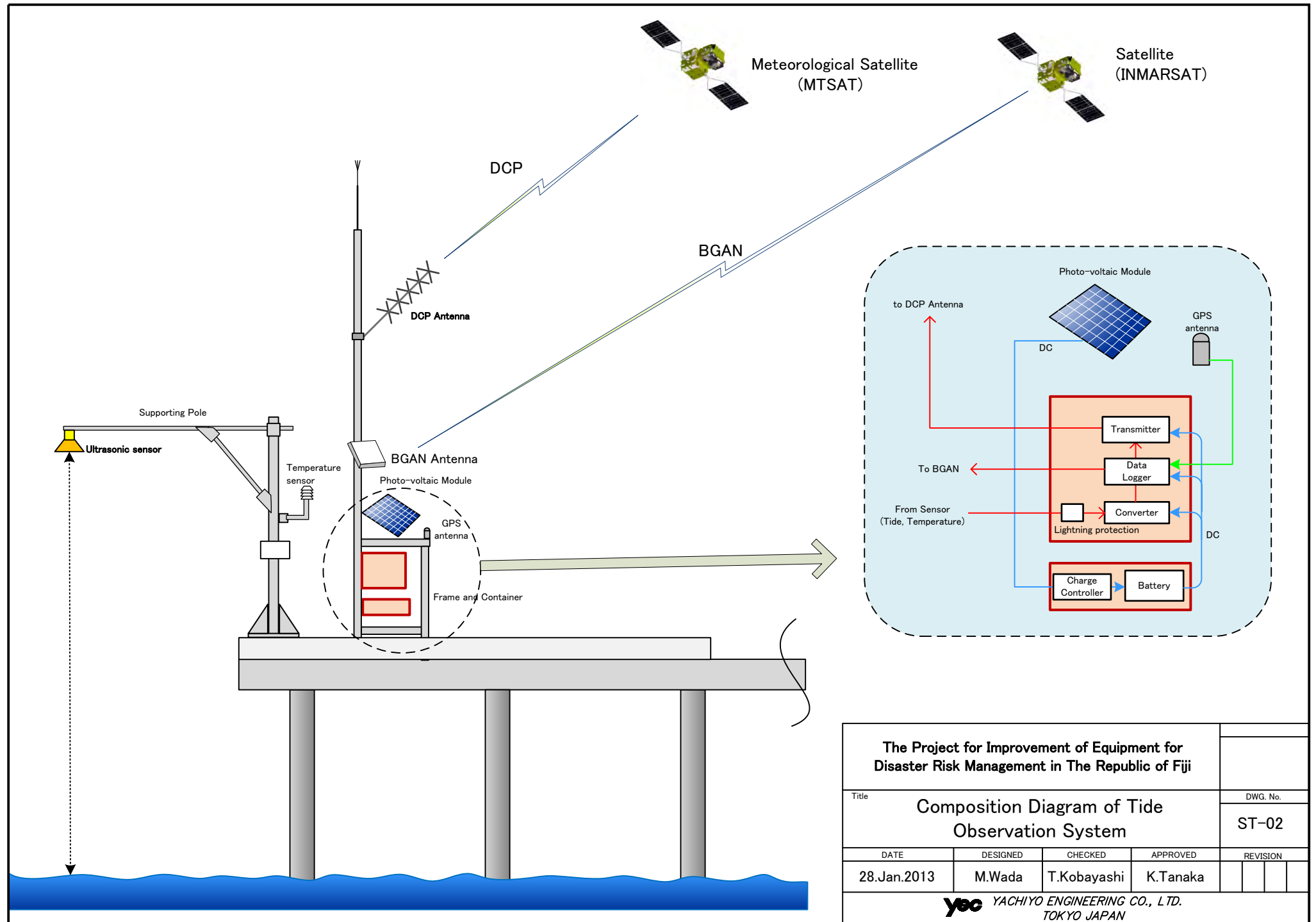
Dwg no	Title
G-01	Location Map of the Project Sites
ST-01	System Diagram of Tide Observation System
ST-02	Composition Diagram of Tide Observation System
SV-01	System Diagram of VSAT Communication System
SN-01	System Diagram of Wind Profiler System
SA-01	System Diagram of Automatic Weather Station (AWS)
SA-02	System Diagram of AWS Network System
SL-01	System Diagram of Lightning Detection System
SL-02	Location Map of Lightning Detection Coverage
LT-01	Location of the Site and Survey Photos of Vatia, Viti Levu
LV-03	Location of the Site and Survey Photos of Tubou, Lakeba
LA-01	Location of the Site and Survey Photos of Suva, Viti Levu
LL-01	Location of the Site and Survey Photos of Rakiraki, Viti Levu
LL-02	Location of the Site and Survey Photos of Suva, Viti Levu
LL-03	Location of the Site and Survey Photos of Vatudamu, Vanua Levu
LL-04	Location of the Site and Survey Photos of Matei, Taveuni
LL-05	Location of the Site and Survey Photos of Nabouwalu, Vanua Levu
LND-01	Layout Plan at FMS Headquarters Nadi, Viti Levu
LND-02	Location of the Site and Survey Photos of Nadi, Viti Levu

G-01 Location Map of the Project Sites

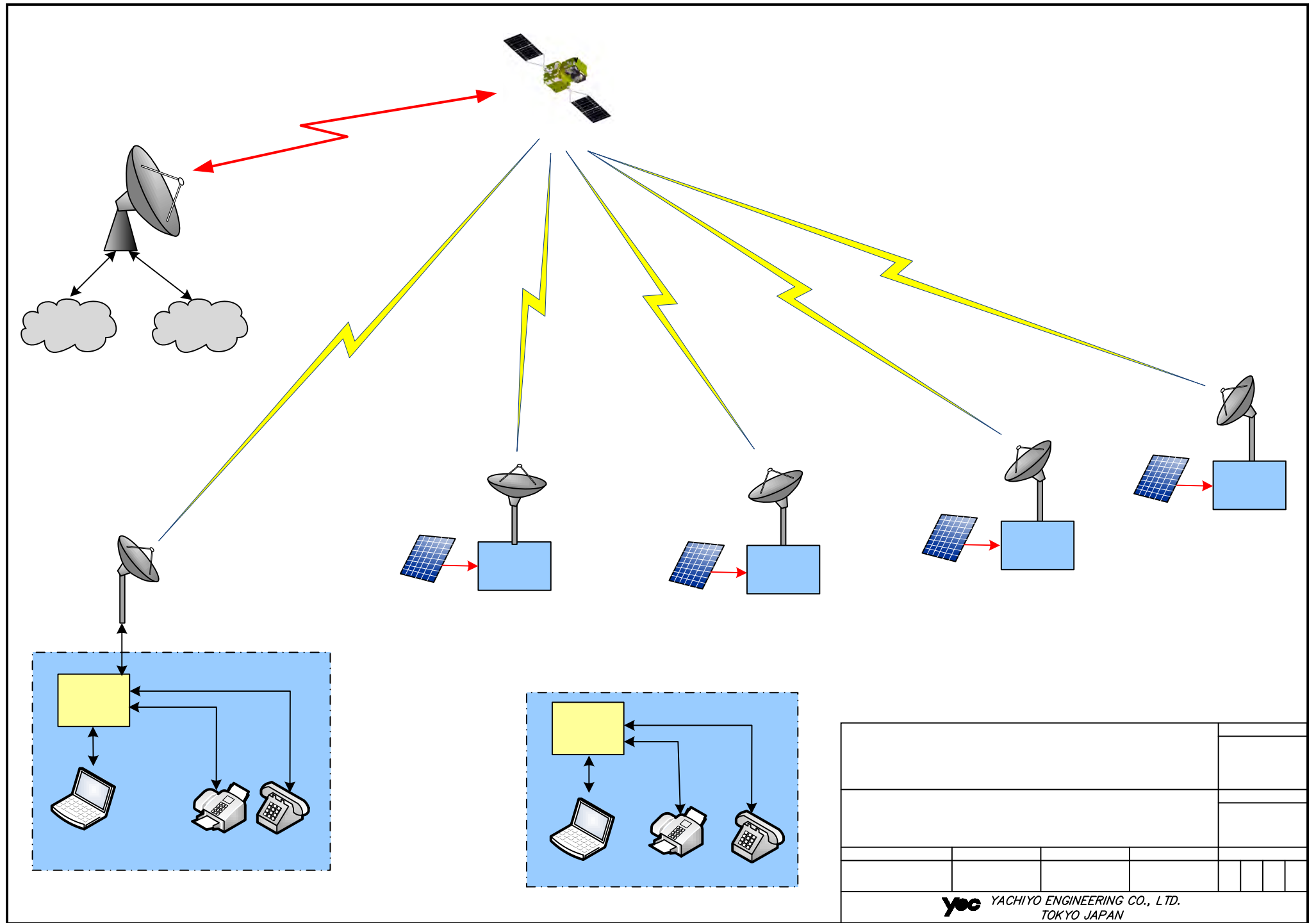




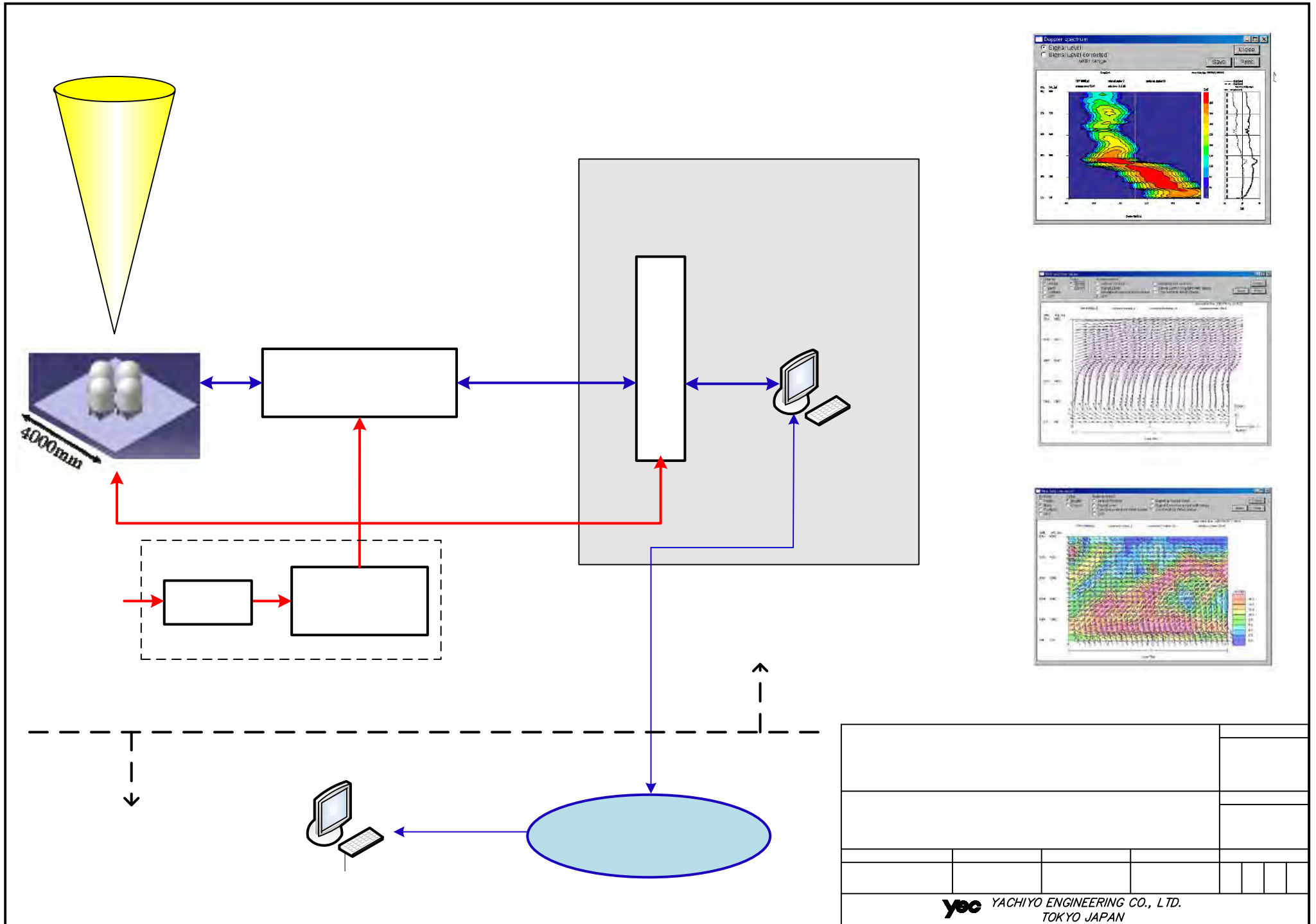
yec YACHIYO ENGINEERING CO., LTD. TOKYO JAPAN				



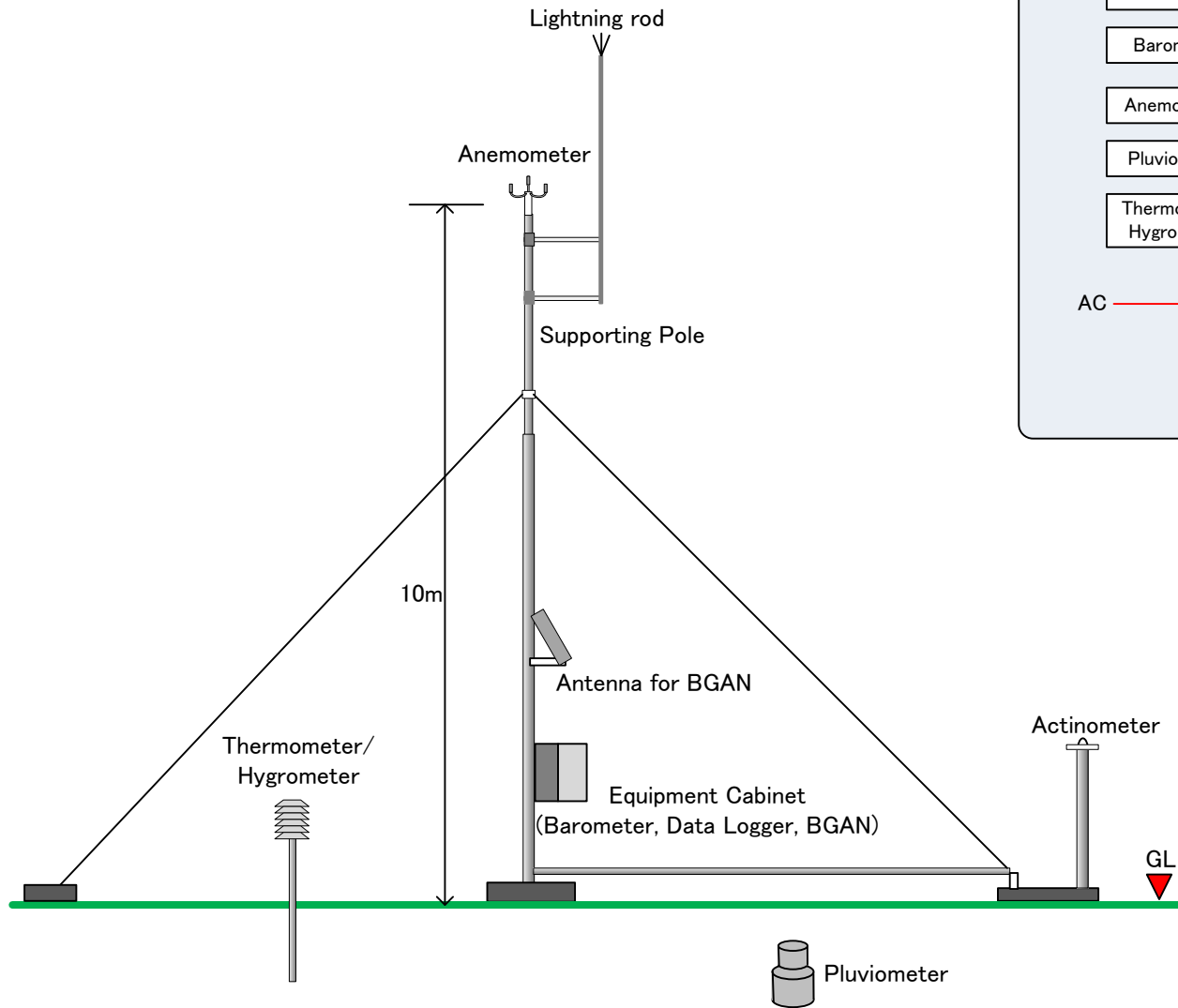
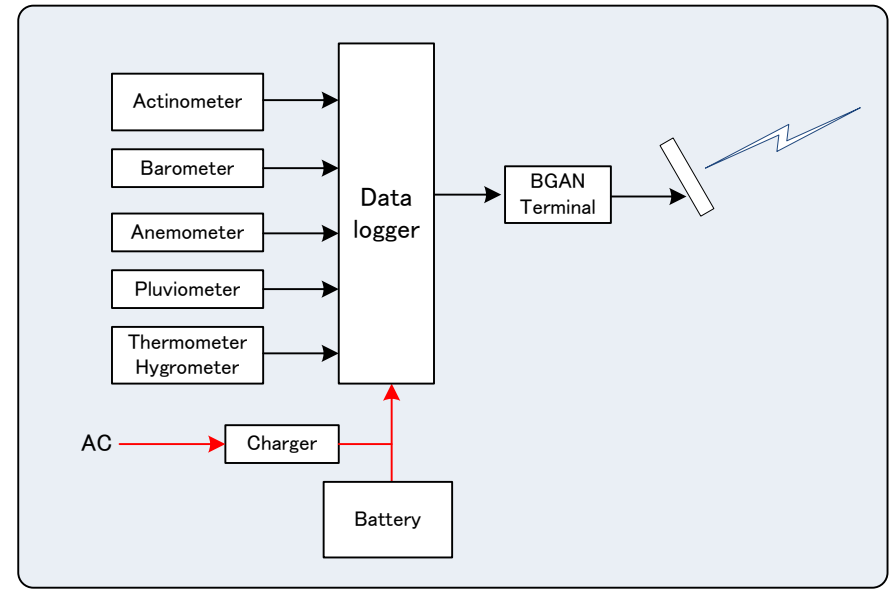
The Project for Improvement of Equipment for Disaster Risk Management in The Republic of Fiji				
Title				DWG. No.
Composition Diagram of Tide Observation System				ST-02
DATE	DESIGNED	CHECKED	APPROVED	REVISION
28.Jan.2013	M.Wada	T.Kobayashi	K.Tanaka	
YACHIYO ENGINEERING CO., LTD. TOKYO JAPAN				



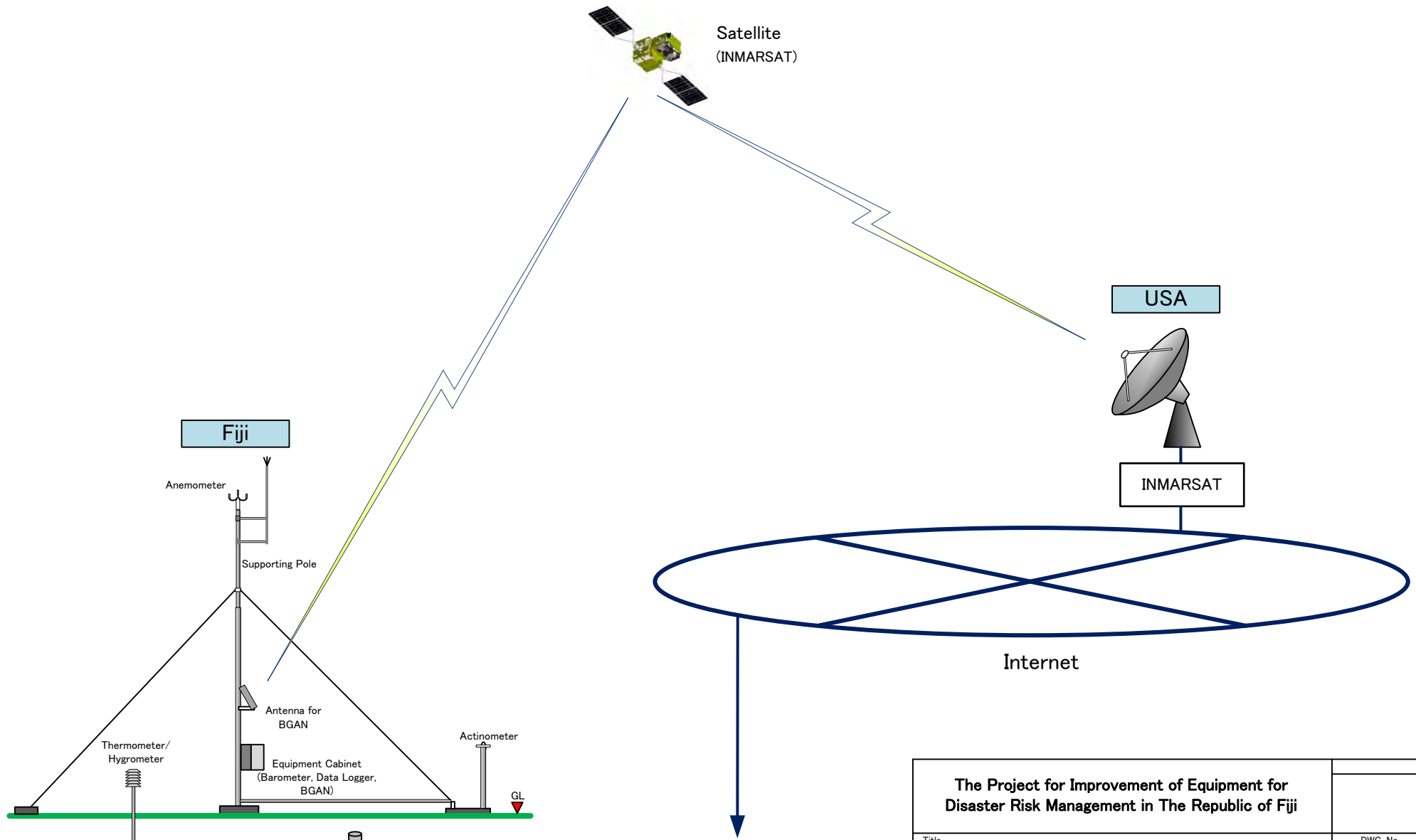
A-5-6




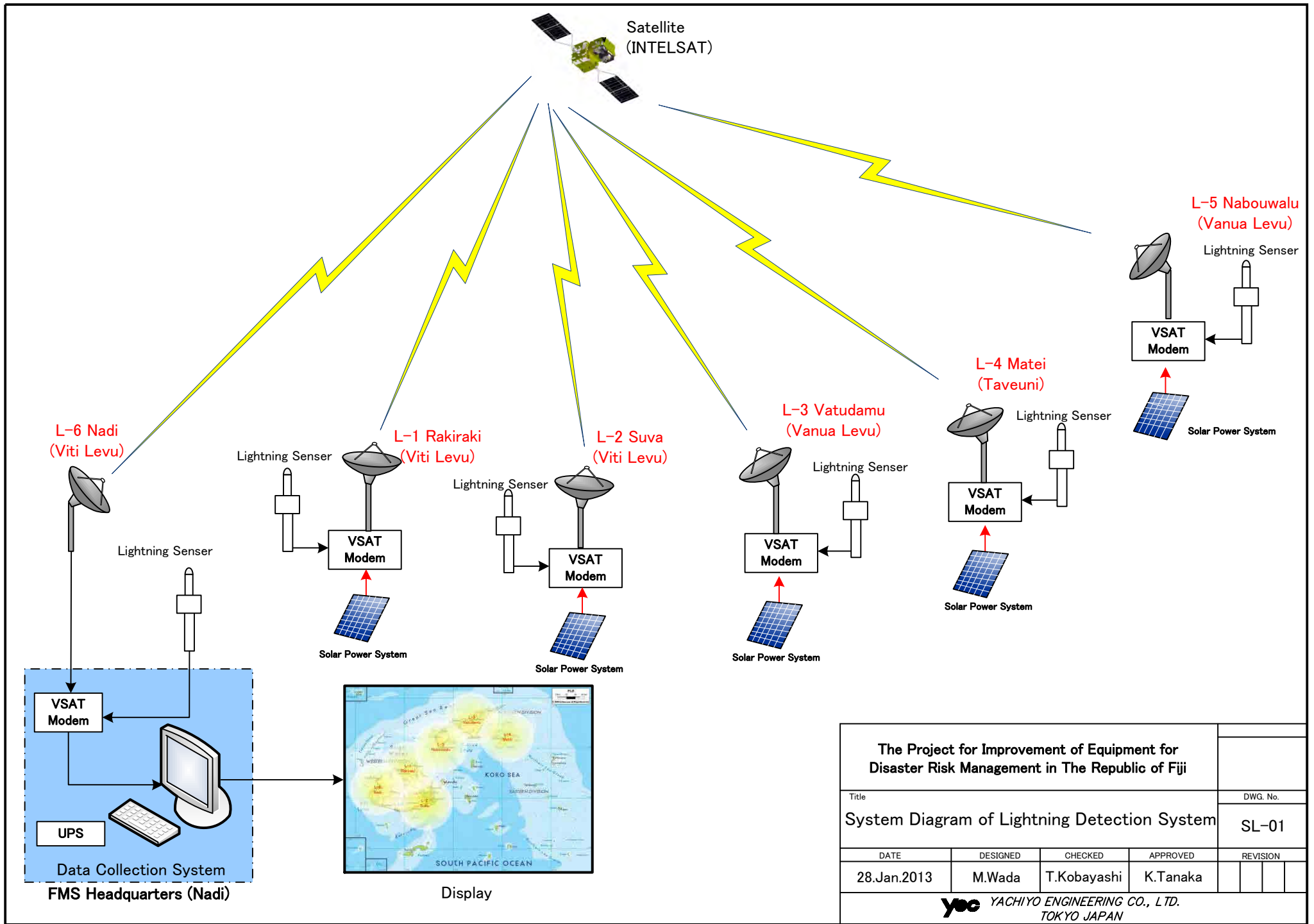
System Diagram of AWS




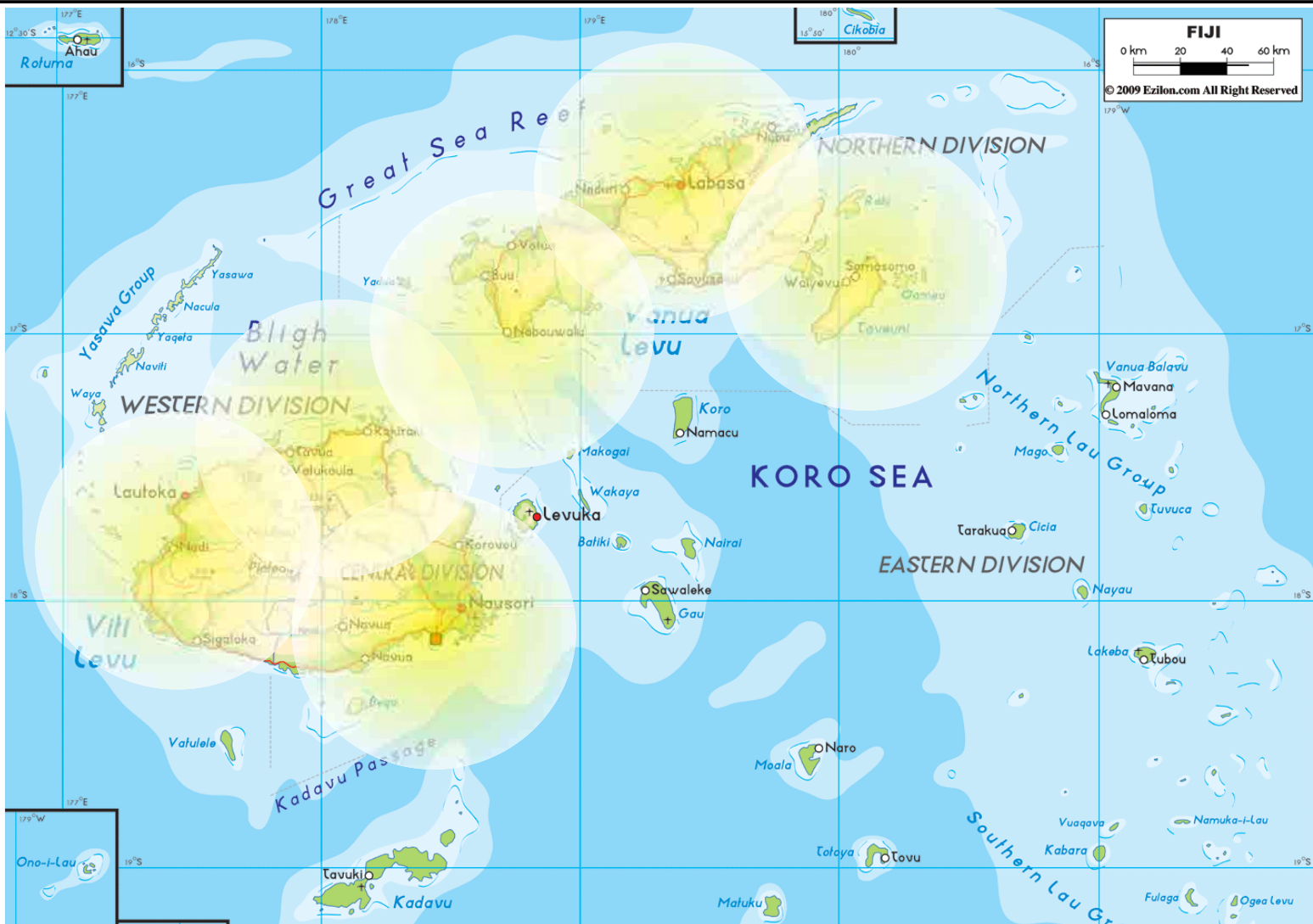
The Project for Improvement of Equipment for Disaster Risk Management in The Republic of Fiji				
Title				DWG. No.
System Diagram of Automatic Weather Station (AWS)				SA-01
DATE	DESIGNED	CHECKED	APPROVED	REVISION
28.Jan.2013	M.Wada	T.Kobayashi	K.Tanaka	
YACHIYO ENGINEERING CO., LTD. TOKYO JAPAN				



The Project for Improvement of Equipment for Disaster Risk Management in The Republic of Fiji				
Title				DWG. No.
System Diagram of AWS Network System				SA-02
DATE	DESIGNED	CHECKED	APPROVED	REVISION
28.Jan.2013	M.Wada	T.Kobayashi	K.Tanaka	
 YACHIYO ENGINEERING CO., LTD. TOKYO JAPAN				



The Project for Improvement of Equipment for Disaster Risk Management in The Republic of Fiji				
Title				DWG. No.
System Diagram of Lightning Detection System				SL-01
DATE	DESIGNED	CHECKED	APPROVED	REVISION
28.Jan.2013	M.Wada	T.Kobayashi	K.Tanaka	
 YACHIYO ENGINEERING CO., LTD. TOKYO JAPAN				



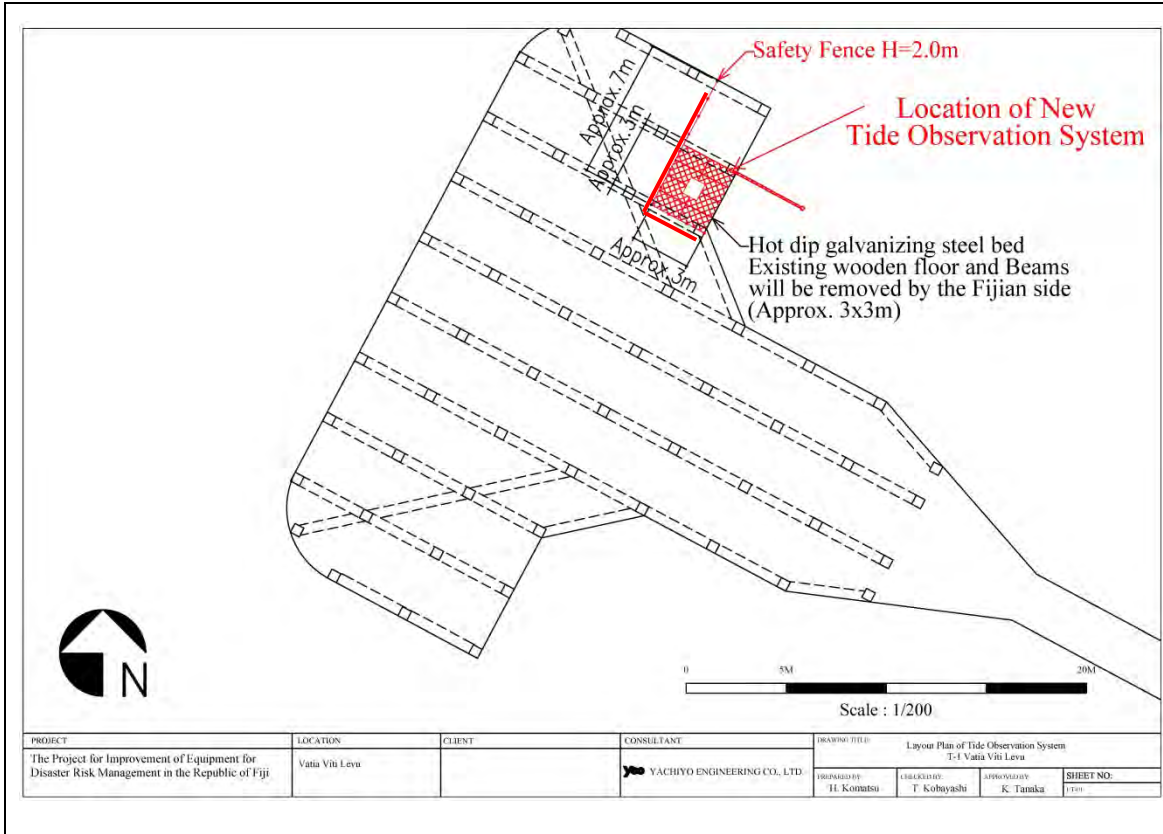
yec YACHIYO ENGINEERING CO., LTD. TOKYO JAPAN					

LT-01: Location of the Site and Survey Photos

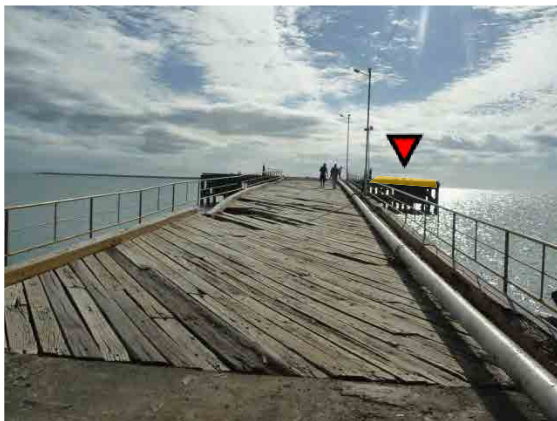
T-1: Vatia, Viti Levu

---Tide Observation System

Date	10/July/2012	15:30
L/L	S 17°23'51.5"	E 177°45'39.8"



Location of the Site



Distant View



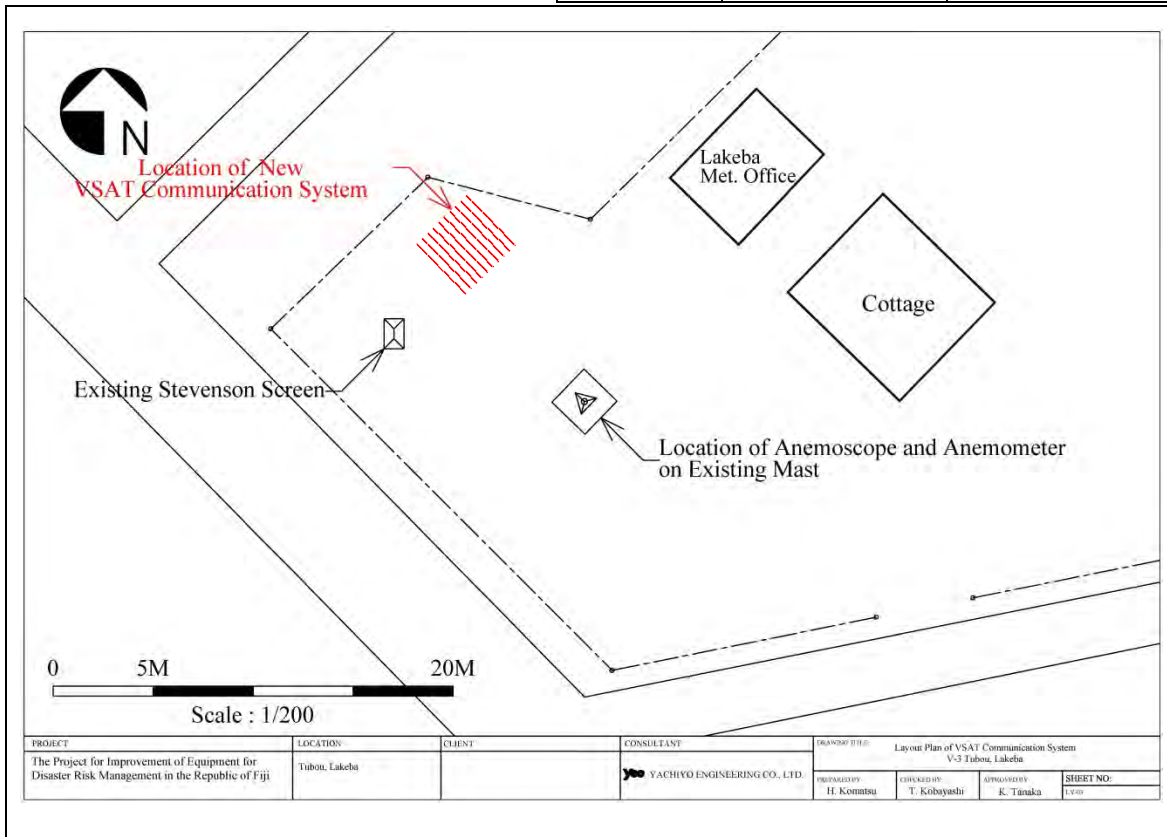
Install Area of Tide Observation System

LV-03: Location of the Site and Survey Photos

V-3: Tubou, Lakeba

--VSAT Communication System

Date	1/August/2012	11:00
L/L	S 18°14'21.5"	E 178°48'21.2"



Location of the Site



Distant View



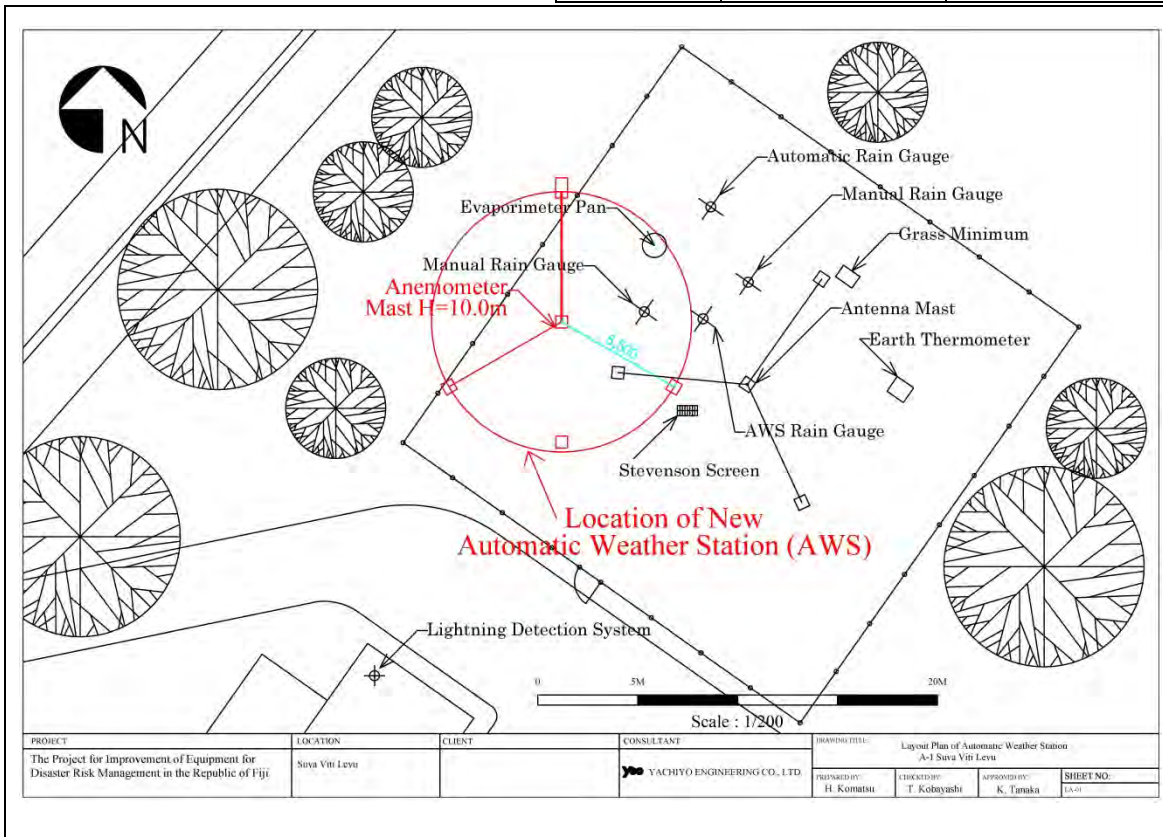
Install Area of VSAT Communication System

LA-01: Location of the Site and Survey Photos

A-1: Suva, Viti Levu

---Automatic Weather Station (AWS)

Date	2/August/2012	
L/L	S 18°08'51.02"	E 178°27'12.78"



Location of the Site



Distant View



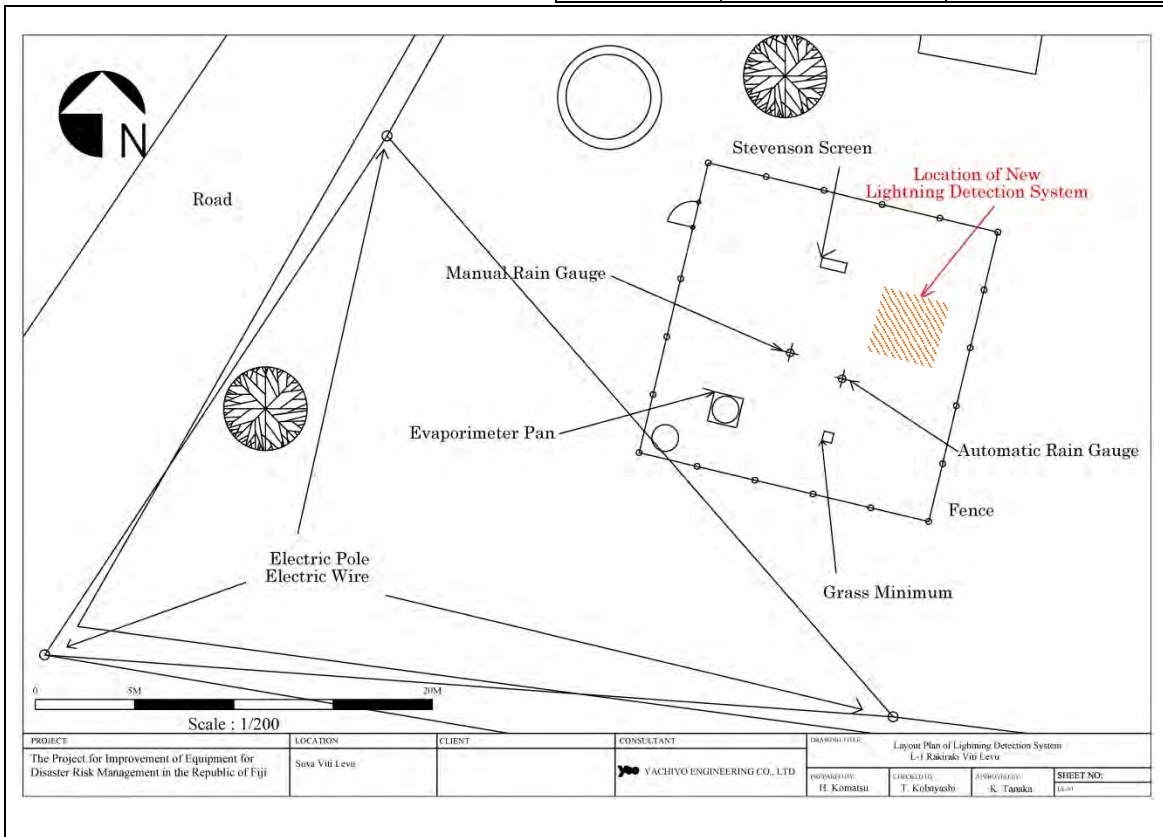
Install Area of Automatic Weather Station

LL-01: Location of the Site and Survey Photos

L-1: Rakiraki, Viti Levu

---Lightning Detection System

Date	19/January/2013	11:30
L/L	S 17°22'25.6"	E 178°10'17.7"



Location of the Site



Distant View



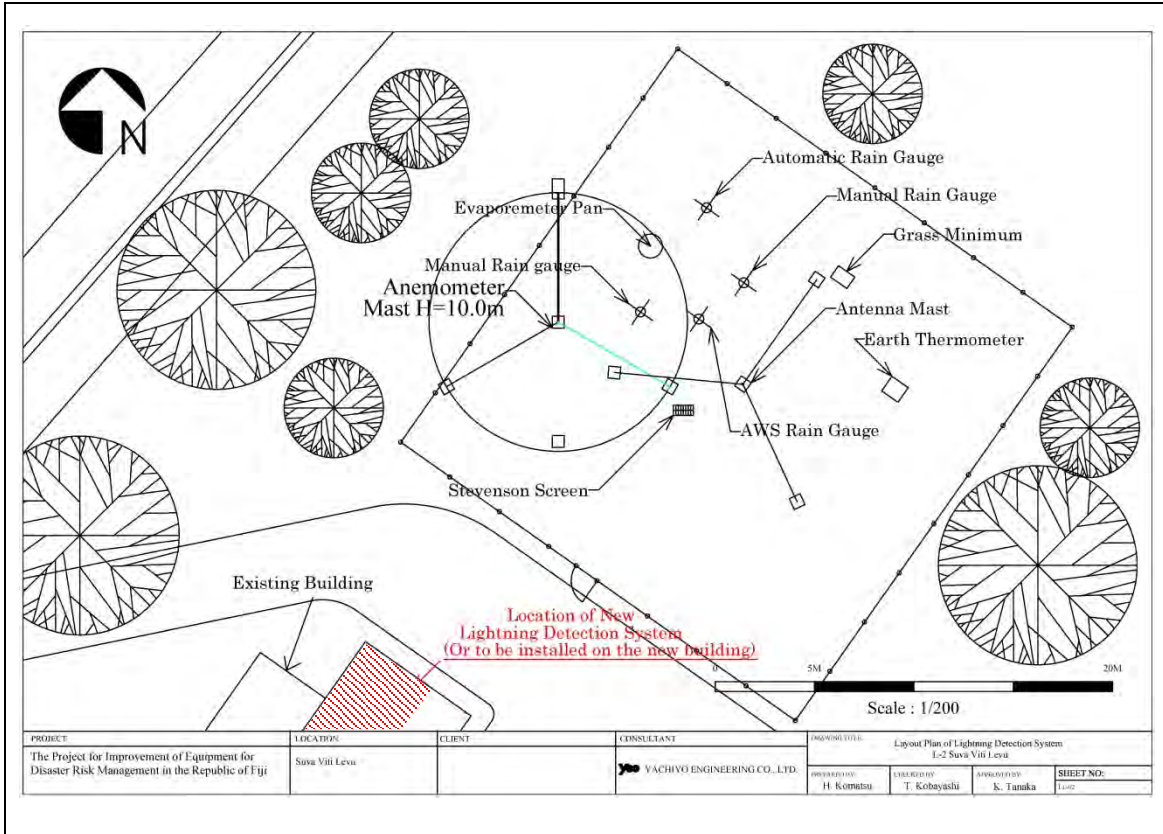
Install Area of Lightning Detection System

LL-02: Location of the Site and Survey Photos

L-2: Suva, Viti Levu

--- Lightning Detection System

Date	2/August/2012	
L/L	S 18°08'51.02"	E 178°27'12.78"



Location of the Site



Distant View



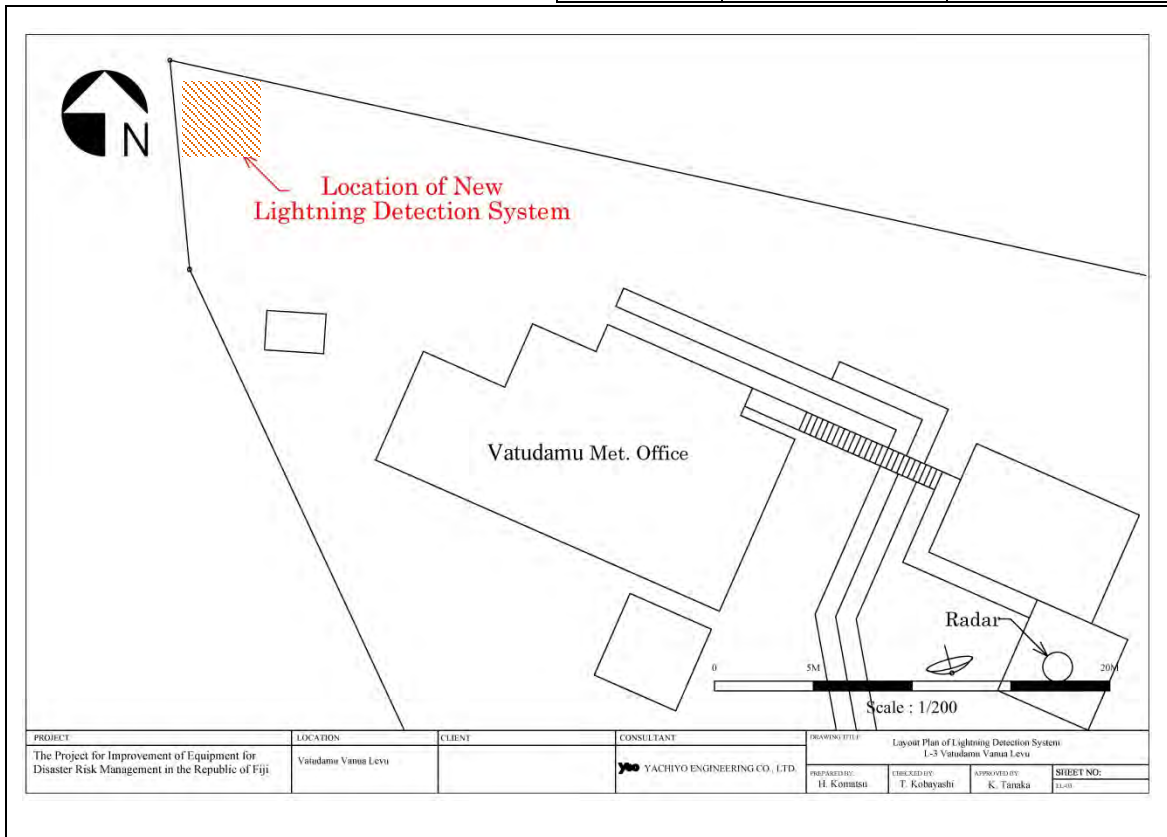
Install Area of Lightning Detection System

LL-03: Location of the Site and Survey Photos

L-3: Vatudamu, Vanua Levu

---Lightning Detection System

Date	3/July/2012	
L/L	S 16°25'54.50"	E 179°16'15.20"



Location of the Site



Distant View



Install Area of Lightning Detection System

LL-04: Location of the Site and Survey Photos

L-4: Matei, Taveuni

--- Lightning Detection System

Date		
L/L	S 16°41'16.28"	E 179°52'51.20"



Install area

Location of the Site



Install location

Satellite View of the Site

LL-05: Location of the Site and Survey Photos

L-5: Nabouwalu, Vanua Levu

--- Lightning Detection System

Date	3/July/2012	
L/L	S 16°59'37.81"	E 178°41'21.70"



Install area

Location of the Site



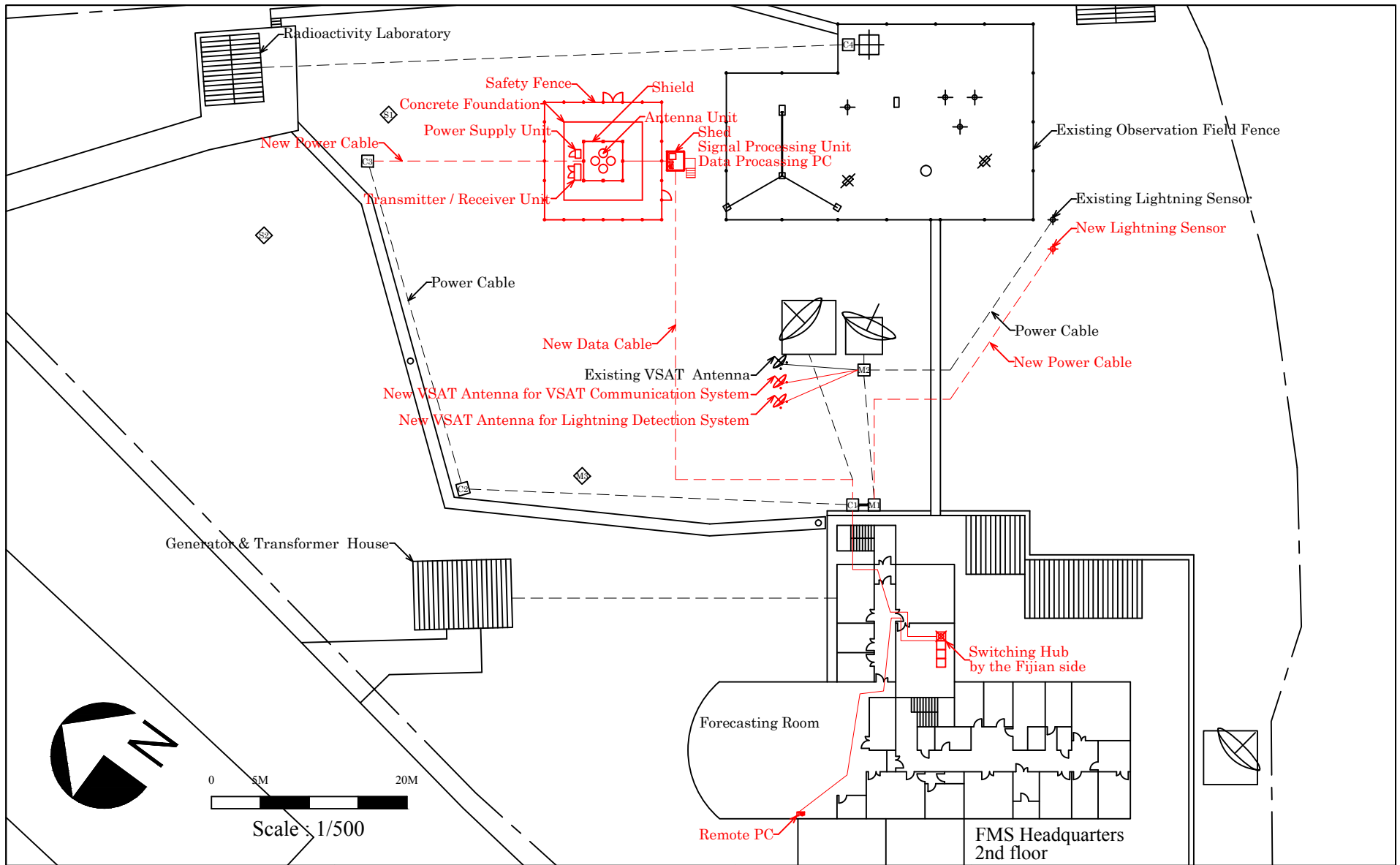
Install location
Install area



Distant View



Install Area of Lightning Detection System



PROJECT	LOCATION	CLIENT	CONSULTANT	DRAWING TITLE: Layout Plan at FMS Headquarters V-5, N-1, and L-6 Nadi Viti Levu		
The Project for Improvement of Equipment for Disaster Risk Management in the Republic of Fiji	Nadi Viti Levu		Y&E YACHIYO ENGINEERING CO., LTD.	PREPARED BY: H. Komatsu	CHECKED BY: T. Kobayashi	APPROVED BY: K. Tanaka
				SHEET NO:	LND-01	

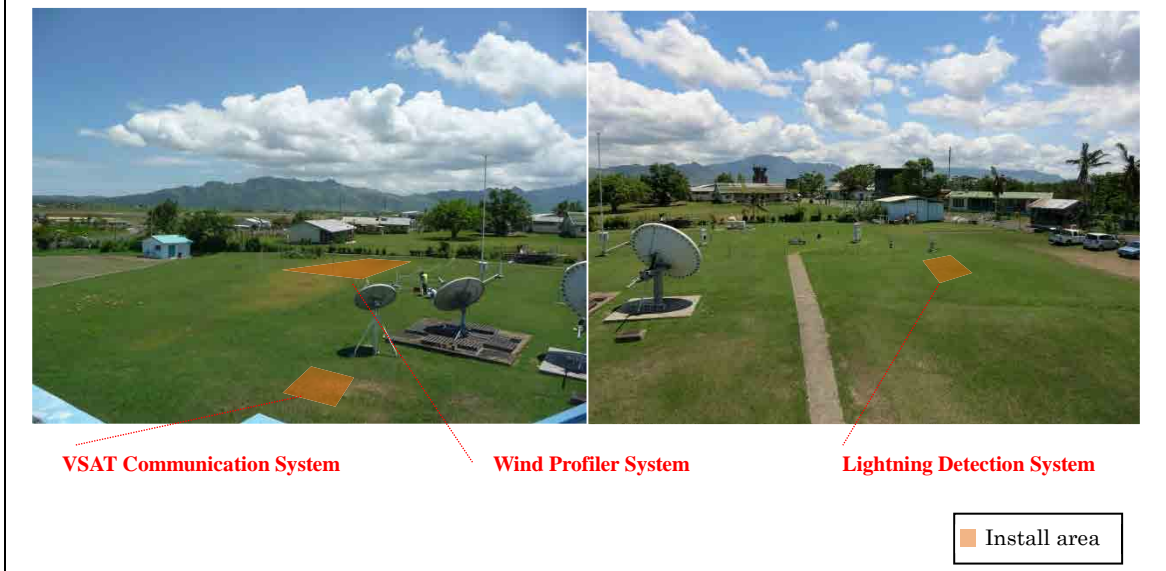
LND-02: Location of the Site and Survey Photos

V-5, N-1, L-6: Nadi, Viti Levu

Date	3/August/2012	
L/L	S 17°45'34.9"	E 177°26'40.8"



Location of the Site



Distant View



Appendices -6. Official Letter about Agreement of
Land Use

6. Official Letter about Agreement of Land Use

Priority on M/D	Site No.	Site Name (English)
S	Tide Observation System	
	T-1	Vatia, Viti Levu
	cancelled	Natovi, Viti Levu
	cancelled	Sigatoka Yanua Island, Viti Levu
	cancelled	Malau, Vanua Levu
	cancelled	Nabouwalu, Vanua Levu
S	VSAT Communication System	
	V-1	Naibalebale, Viwa
	V-2	Udu Point, Vanua Levu
	V-3	Tubou, Lakeba
	V-4	Yaroi, Matuku
	V-5	Nadi, Viti Levu
	cancelled	Nukuni, Ono-I-Lau
A	Wind Profiler System	
	N-1	Nadi, Viti Levu
A	Automatic Weather Station (AWS)	
	A-1	Suva, Viti Levu
	cancelled	Vatudamu, Vanua Levu
A	Calibration Equipment	
	C-1	Nadi, Viti Levu
A	Lightning Detection System	
	L-1	Rakiraki, Viti Levu
	L-2	Suva, Viti Levu
	L-3	Vatudamu, Vanua Levu
	L-4	Matei, Taveuni
	L-5	Nabouwalu, Vanua Levu
	L-6	Nadi, Viti Levu
	cancelled	Namacu, Koro

AGREEMENT for the INSTALLATION OF a TIDAL GAUGE INSTRUMENT

BETWEEN: **THE MINISTRY OF WORKS, TRANSPORT & PUBLIC UTILITIES for FIJI METEOROLOGICAL SERVICE** on behalf of the Republic Of Fiji (hereinafter referred to as “FMS”) having its registered offices at Korowai Road, Namaka, Nadi;

AND: **LION’S DEN(FIJI) LIMITED** (hereinafter referred to as “LDFL”) having its registered offices at Lot 1 and 6 Legalega Industrial Sub-Division, Kabani Road, Waimalika, Nadi.

FMS and LDFL are hereinafter each referred to as “**the Party**” and jointly as “**the Parties**”.

WHEREAS:

- A. FMS wishes to install a tidal gauge instrument at the Vatia Wharf, Tavua, which is constructed on land leased by LDFL; and
- B. LDFL grants consent and licence to FMS to install the tidal gauge instrument subject to the terms and conditions of this Agreement.

NOW THEREFORE THE PARTIES HAVE REACHED THE FOLLOWING AGREEMENT–

[1] DEFINITIONS

“**Agreement**” means the entire Agreement between the Parties and includes any variations, amendments and schedule; and

“**Parties**” mean the FMS and LDFL collectively.

In this Agreement, unless the context otherwise requires–

- (a) headings are inserted for convenience;
- (b) a reference to any law or any provision of any law includes that law or provision as from time to time amended, re-enacted or substituted and any statutory instruments, regulations and orders enacted or substituted and any such law or provision;

- (c) reference to any document includes reference to that document (and, where applicable, any of its provisions) as amended, notated, supplemented, or replaced from time to time;
- (d) reference to an "Annexure" is a reference to the relevant schedule to this Agreement unless in each case stated otherwise;
- (e) the Annexure to this Agreement form part of this Agreement;
- (f) in the event of any ambiguity or inconsistency between a provision in this Agreement and the provision of any other document referred to in this Agreement, this Agreement shall prevail; and reference to "dollars" or "\$" is to Fiji dollars

[2] LOCATION AND DESCRIPTION OF PROPERTIES

- 2.1 The site is situated within the Lion's Den (Fiji) Limited State lease commonly known as the Vatia Wharf (Pt Of) being shown as Lot 1 on Survey Plan comprising an approximate area of 10mx10m as contained in reference LD4/4/167 CL in the District of Tavua, Province of Ba, Island of Viti Levu as shown on site plan on **Annexure 1**(hereafter "the Premises").

[3] COMMENCEMENT, DURATION AND RENEWAL

- 3.1 This Agreement shall commence on the date it is signed by both Parties and shall be effective for a period five (5) years.
- 3.2 The Agreement may be renewed by mutual consent by the Parties in writing.

[4] PAYMENT

- 4.1 It is understood by the Parties and agreed by LDFL that there is no payment by FMS for use of the site for the initial term of five (5) years.
- 4.2 LDFL will be able to utilise data gathered from the tidal instrument for its own usage. These data shall be provided to LDFL by FMS upon their written request

[5] OBLIGATIONS OF FMS

- 5.1 FMS shall not–
 - 5.1.1 Use the Premises for any purpose other than for installing and operating the tidal gauge instrument.

- 5.1.2 Allow use of the Premises to any third party, unless it is with the written approval of LDFL.
 - 5.1.3 Let any portion of the Premises for payment to third parties or permit any business or trade to be carried on from the Premises.
 - 5.1.4 Permit or allow to be done on the Premises any act which may be a nuisance, obstruction, damage or annoyance to LDFL or to the occupiers of neighbouring Premises.
 - 5.1.5 Obstruct or interfere with any entrances of adjoining property.
 - 5.1.6 Use the Premises for any illegal or immoral purpose nor use the premises in an offensive manner.
- 5.2 FMS shall –
- 5.2.1 Report to LDFL any damage to the property belonging to LDFL on the premises.
 - 5.2.2 Agree to keep the Premises clean and duly maintained during the term of this Agreement and not engage in any conduct that may cause annoyance or in any way interfere with the other services and use or comfort of adjoining properties.

[6] OBLIGATIONS OF LDFL

- 6.1 LDFL agrees that FMS shall have full use and occupation of the property during the term of this Agreement without undue interruption or disturbance from LDFL.
- 6.2 FMS should provide a survey plan of premises to LDFL for future developments.

[7] COMPLIANCE WITH LAWS

- 7.1 Both Parties shall comply with all statutory and any other legal instruments of the national municipal authorities relating to the use of the Premises that may be required for the purpose of installation and operation of the tidal gauge instrument.

[8] INDEMNITY

- 8.1 All Parties shall indemnify the others against any claim or proceeding that is made or commenced against a Party and any liability, loss (including consequential loss) damage and expense that is incurred or suffered as a result of a breach of this Agreement by any negligence or other wrongful act or omission of its employees, Sub-Contractors or any other persons for whose acts or omissions the party is vicariously liable

[9] DISPUTE RESOLUTION

- 9.1 Any dispute arising under this Agreement shall be resolved in the following manner–
- (a) *Amicable dispute settlement:* The Parties shall attempt in good faith to resolve the dispute by negotiation;
 - (b) *Mediation:* If the dispute is not resolved by negotiation, the Parties may choose mediation through a neutral third party mediator, to be mutually agreed by the Parties; and
 - (c) *Arbitration:* If the dispute has not been settled by negotiation or mediation, then the matter will be referred to a single arbitrator, pursuant to the provisions of the Arbitration Act [Cap. 38]. The Arbitrator may take the opinion of registered legal practitioners and experts, as he or she thinks fit on any facts or law and adopt any opinion so taken. However, the final determination of the matter is at the Arbitrator's discretion.

[10] SAFETY OF THE PREMISES

- 10.1 FMS acknowledges that the tidal gauge instrument is electrical in nature and agrees to reduce risk to neighbouring occupiers by fully enclosing the equipment with fencing around the machine.
- 10.2 FMS shall further post clearly visible notices to warn the public to keep away from the Premises.

[11] PERFORMANCE

- 11.1 The Parties agree to abide by the terms, conditions, responsibilities and undertakings stipulated in this Agreement and further agree to liaise on all the matters covered under

this Agreement to ensure the effective and efficient performance of their respective responsibilities and undertakings.

[12] ASSIGNMENT

12.1 The Parties agree that the rights or interests of this Agreement shall not be assigned to a third party.

[13] CONFIDENTIALITY

13.1 The Parties shall not disclose or distribute any confidential information, documents or data received or supplied to the other party in the course of the implementation of this Agreement to any third party except by authorisation in writing by the requested party.

[14] VARIATIONS, AMENDMENTS AND WAIVERS

14.1 Any variation shall be made by written agreement between the Parties and each Party shall give due consideration to any proposals for variations made by the other Party.

14.2 Any amendments shall be incorporated in writing by mutual consent between the Parties.

14.3 A waiver by either party in respect of any breach of a condition or provision of this Agreement shall not be deemed to be a waiver of any continuing or subsequent breach of that provision or breach of any other provision. The failure of either party to enforce at any time any of the provisions of this Agreement shall in no way be interpreted as a waiver of such provision.

[15] SEVERABILITY

15.1 If any provision of this Contract is determined by law to be illegal, invalid, void or voidable, the legality or validity of the remainder of this Contract shall not be affected and shall continue to be in force and full effect.

[16] FORCE MAJEURE

- 16.1 Any Party shall not be liable for any delays or failure to perform its obligations under this Agreement if it is due to *force majeure*.
- 16.2 For the purpose of this Contract, *force majeure* means any event beyond the control of the Parties or not involving the Party's fault or negligence. Such events may include but are not limited to wars, revolutions, strikes, civil commotions, earthquakes, tempest, fires, floods and other natural disasters.
- 16.3 Unless otherwise agreed in writing each Party shall continue to perform its obligations under this Agreement as far as it is reasonably practicable and shall seek all reasonable alternative means of performance not prevented by *force majeure*.

[17] TERMINATION

- 17.1 FMS may, at its own discretion, by at least one (1) months' written notice to LDFL terminate this Agreement if LDFL–
- (a) breaches his/her obligations under this Agreement and does not remedy the breach within fourteen (14) days of receiving a written notice from FMS; or
 - (b) becomes bankrupt.
- 17.2 LDFL may, at its own discretion, by at least one (1) months' written notice to FMS terminate this Agreement if FMS breaches his/her obligations under this Agreement and does not remedy the breach within fourteen (14) days of receiving a written notice from LDFL.

[18] CONSENT

- 18.1 This Agreement is subject to the consent of the Director of Lands and this consent shall be obtained by FMS prior to installation of the tidal gauge instrument

[19] NOTICES

- 19.1 All correspondence regarding this Agreement shall be as follows:

FMS:
Fiji Meteorological Service
Private Mail Bag
Nadi Airport
Facsimile: (679) 6720430
Email: fms@met.gov.fj

LDFL:
Lions Den (Fiji) Limited
P.O. Box 11112
Nadi Airport
Facsimile: (679) 672 8417
Email: moape.n@liononeltd.com

IN WITNESS WHEREOF the duly authorised signatories of the Parties hereby have signed and sealed this Agreement:

DATED at this day of 2013.

SIGNED for and on behalf of the Ministry of Works, Transport and Public Utilities

ALIPATE WADACELUT, DIRECTOR

Representative Name and Designation


Representative Signature

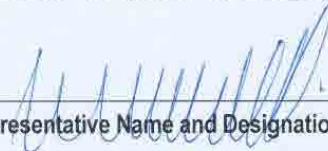
MARICA RATUKI

Witness Name


Witness Signature

Date

SIGNED for and on behalf of Lion's Den Fiji Limited

 x
Representative Name and Designation

WALTER BERICOFF
Representative Signature

SHARLEEN BURR
Witness Name


Witness Signature

File 6/4

Date: 15.11.12

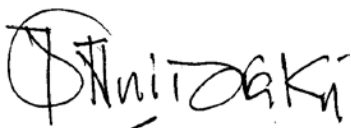
Acknowledgement

To whom it may concern

Fiji Meteorological Service agree to the use of weather station site for VTSAT Communication Systems for:

1. Viwa Weather Station
2. Udu Point Weather Station, Vanualevu
3. Lakbe weathet station, Tubou, Lau
4. Matuku weather station, Yaroi, Lau
5. Ono-i-lau weather station, Lau
6. Nadi weather station, HQ, Nadi

as the project site for installation under **THE PROJECT FOR IMPROVEMENT OF EQUIPMENT FOR DISASTER RISK MANAGEMENT IN THE REPUBLIC OF FIJI.**



Aminiasi Tuidraki – Network/System
Manager
For Director
Fiji Meteorological Service



DEPARTMENT OF METEOROLOGY

Korowai Road, Namaka, Nadi Private Mail Bag NAP 0351, NADI AIRPORT, FIJI
FAX : 6720430, 6720190 Web: www.met.gov.fj
E-MAIL: fms@met.gov.fj

TELEPHONE: 6724888

File: 6/4

Date: 16.10.12

Acknowledgement

To whom it may concern

Fiji Meteorological Service agree to the use of the;

1. Nadi Meteorological HQ Station, Viti Levu,

as the project site for installation of **WIND PROFILER SYSTEM** under **THE PROJECT FOR IMPROVEMENT OF EQUIPMENT FOR DISASTER RISK MANAGEMENT IN THE REPUBLIC OF FIJI.**

Aminiasi Tuidraki – Network/System
Manager
For Director
Fiji Meteorological Service

FIJI METEOROLOGICAL SERVICE



DEPARTMENT OF METEOROLOGY

Korowai Road, Namaka, Nadi Private Mail Bag NAP 0351, NADI AIRPORT, FIJI
FAX : 6720430, 6720190 Web: www.met.gov.fj
E-MAIL: fms@met.gov.fj

TELEPHONE: 6724888

File: 6/4

Date; 16.10.12

Acknowledgement

To whom it may concern

Fiji Meteorological Service agree to the use of the;

1. Suva Weather Station, Viti Levu
2. Vatudamu Radar Station, Vanua Levu
3. Nadi Meteorological HQ Station, Viti Levu

as the project site for installation of the **Automatic Weather Station** under **THE PROJECT FOR IMPROVEMENT OF EQUIPMENT FOR DISASTER RISK MANAGEMENT IN THE REPUBLIC OF FIJI** with

Aminiasi Tuidraki – Network/System
Manager
For Director
Fiji Meteorological Service

FIJI METEOROLOGICAL SERVICE



DEPARTMENT OF METEOROLOGY

Korowai Road, Namaka, Nadi Private Mail Bag NAP 0351, NADI AIRPORT, FIJI
FAX : 6720430, 6720190 Web: www.met.gov.fj
E-MAIL: fms@met.gov.fj

TELEPHONE: 6724888

File: 6/4

Date: 16.10.12

Acknowledgement

To whom it may concern

Fiji Meteorological Service agree to the use of the;

1. Suva Weather Station, Viti Levu
2. Vatudamu Radar station, Vanua Levu
3. Nabouwalu Weather station, Vanua Levu
4. Nadi Meteorological HQ station, Viti Levu

as the project site for installation of **Lightning Detector System** under **THE PROJECT FOR IMPROVEMENT OF EQUIPMENT FOR DISASTER RISK MANAGEMENT IN THE REPUBLIC OF FIJI.**

Aminiasi Tuidraki – Network/System
Manager
For Director
Fiji Meteorological Service

FIJI METEOROLOGICAL SERVICE

MEMORANDUM OF AGREEMENT

The Fiji Sugar Corporation Limited Trading as FSC, having its registered office at Lautoka, Fiji hereby grant The Fiji Meteorological Services (FMS) having its registered office in Nadi, Fiji Islands to install a lightening Detecting Machine within the boundaries of the Rain Gauge Weather station.

The site is situated within the corporation premises commonly known as koro No1 described in the attached site as CT11574 lot 23 on DP2788 for a period of a period of five (5) years subject for renewal from the day of sanctioned in accordance to the following terms and conditions

1. **That** FMS shall only be granted to use the said premises for the purpose of installing the lightening detecting machine and not to use it or any part of it for other purpose nor to allow anyone to do on their behalf.
2. **That** FMS shall be not be part with the possession of the said land or may part thereof.
3. **That** FMS shall not receive paying guests or carry on or permit to be carried on any business trade or possession on or from the said land.
4. **That** FSM shall not permit or suffer to be done on the land any act or things which may be a nuisance, damage or annoyance to FSC or to the occupiers of neighbouring premises.
5. **That** FMS shall not use the lands for any illegal or immoral purpose.
6. **That** FMS shall comply with the statutory and other requirements of the national municipal authorities relating to the said land.

7. That FMS shall pay and compensate FSC fully for any cost, expenses, losses or damage incurred or suffered by FSC as a consequences of any breach of any covenant or condition in this agreement and FSC shall be indemnified from and against all actions, claims and liabilities in that respect.

8. That In the event of any breach by FMS of any provisions or conditions of this agreement which is not remedied by FMS within a reasonable time after written notice thereafter FSC may enter upon and take possession of the said land.

9. That This agreement may be terminated by either party The Fiji Meteorological Services (FMS) or The Fiji Sugar Corporation Limited (FSC) upon one month's written notice.

The Fiji Meteorological service accepts this agreement subject to the conditions, restrictions and covenants henceforth.

Dated this 25th day of February 2013

The Common Seal of The Fiji Sugar Corporation Limited was hereunto affixed in our presence and we certify that we are the proper officers by whom and in whose presence the said seal is to be affixed.

Taito Kava



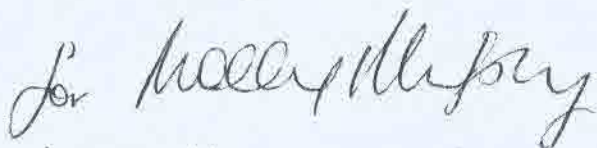
Production Manager

The Common Seal of The Fiji Meteorological Services (FMS) was hereunto affixed in our presence and we certify that we are the proper officers by whom and in whose presence the said seal is to be affixed.

Furthermore, the subject area falls within the noise contours for this airport (d) and if the proposed installation proceeds, AFL shall not be deemed liable for any compensation including noise and other derived nuisance due to:

1. Damage caused by vibration of structure and objects presumed caused by aircraft using the airport.
2. Interruption or disturbance to radio and television reception, which may be presumed caused by aircraft using the airport.

Yours faithfully



Lawrence Liew
General Manager Airports
Airports Fiji Limited
NADI AIRPORT

c.c. Civil Aviation Authority of the Fiji Islands