資料 **5-1**

2012 年 **5** 月 **18** 日署名　テクニカルノート
（**PHIVOLCS**）

TECHNICAL NOTES

Preparatory Survey on the Project for Improvement of Equipment for Disaster Risk Management in the Republic of the Philippines

1. General

Regarding the preparatory survey on the Project for Improvement of Equipment for Disaster Risk Management in the Republic of the Philippines (hereinafter referred to as "the Project"), the Minutes of Discussions (hereinafter referred to as "M/D") was signed on 27th April, 2012 by and between the Government of the Philippines (hereinafter referred to as "the Philippines") and the Preparatory Survey Team (hereinafter referred to as "the Team") sent by Japan International Cooperation Agency (hereinafter referred to as "JICA").

This Technical Notes is made to confirm the results of discussions and field survey works for the items requested by the Philippine Institute of Volcanology and Seismology (hereinafter referred to as "PHIVOLCS").

2. Project Components for PHIVOLCS

Through a series of discussions, PHIVOLCS and the Team understood that the following items, which were deemed as high prioritized items, categorized as "Priority A", in the M/D, would be considered as the project components.

(1) Enhanced Real-time Earthquake Monitoring System

- PHIVOLCS and the Team agreed that the following items, which identified as high prioritized items, shall be included in the Project, and that further analysis and cost estimation for the items shall be conducted in Japan.
  - Ten (10) numbers of velocity broadband strong motion seismometers
  - Thirty six (36) numbers of strong motion seismometers for replacement
  - Two hundred forty (240) numbers of earthquake intensity meters (including for emergency replacement)
- Project site location map for velocity broadband strong motion seismometers and strong motion seismometers are shown in Annex-1 "Proposed Project Site Location Map (for Seismometers)" hereunder.

(2) Enhanced Tsunami Warning System

- PHIVOLCS and the Team agreed that twenty (20) numbers of sea-level monitoring systems in tsunami-prone areas shall be included in the Project. Candidate sites for the systems are shown in Annex-2 "Proposed Project Site Location Map (for Tsunami Detectors) hereunder.
- PHIVOLCS and the Team also agreed that one (1) cluster of tsunami simulation database development hardware shall be included in the Project.

3. Design Considerations to Enhanced Real-time Earthquake Monitoring System

PHIVOLCS understood that the Project is aiming to contribute to reconstruction of industry in the affected area of the Great East Japan Earthquake and to procure equipment for disaster management which developed out based on lessons learnt and technologies in Japan as confirmed in the M/D. Thus, PHIVOLCS agreed that the equipment shall be procured from Japan, while materials and services for installation works may be procured locally.

The Team explained and PHIVOLCS understood about possible options on real-time monitoring network shown in Annex-3 "Real-time Earthquake Monitoring System Diagrams", and PHIVOLCS agreed that further study and analysis shall be conducted in Japan to determine the final design of the systems to be adopted for the Project.

The Team also explained and PHIVOLCS agreed that detailed specifications and number of the equipment to be procured by the Project shall be determined as results of further study and analysis to be conducted in Japan.

(1) Velocity Broadband Strong Motion Seismometer

- PHIVOLCS and the Team agreed that velocity broadband strong motion seismometers shall be procured for and installed at ten (10) unmanned seismic stations as shown in Annex-1.
- PHIVOLCS explained and the Team confirmed that the existing foundation at each project site for the existing broadband seismometer shall be available for installation of velocity broadband strong motion seismometer to be procured by the Project.
- PHIVOLCS explained and the Team confirmed that the existing satellite data communication systems for the unmanned seismic stations shall be utilized for real-time monitoring system of the velocity broadband strong motion seismometers newly procured and installed by the Project.
- The Team requested and PHIVOLCS agreed that the detailed information of the project sites shall be provided to the Team by the end of May, 2012.

(2) Strong Motion Seismometer

- PHIVOLCS and the Team agreed that strong motion seismometers shall be procured and installed at twenty nine (29) manned seismic stations and six (6) volcano-seismic stations for replacement of the existing strong motion sensors which were installed by the past JICA grant aid projects "the Project for Improvement of Earthquake and Volcano Monitoring System, Phase I and II" and for new installation for one (1) newly established manned seismic station. The project site location is shown in Annex-1.
- PHIVOLCS explained and the Team confirmed that the existing foundation at each project site shall be available for installation of strong motion seismometer to be procured by the Project.
- PHIVOLCS and the Team agreed that satellite data communication systems for real-time monitoring network shall be established for the target manned stations where currently the systems are not available. Possible options of the satellite data communication systems are shown in Annex-3, while further study and analysis shall be conducted in Japan to determine the design of the systems to be adopted for the Project.
- The Team requested and PHIVOLCS agreed that the detailed information of the project sites shall be provided to the Team by the end of May, 2012.

(3) Earthquake Intensity Meters

- PHIVOLCS and the Team agreed that all the earthquake intensity meters shall be handed over to PHIVOLCS headquarters office, and that PHIVOLCS shall be responsible for delivery and installation of the equipment to each monitoring location.

- Both sides confirmed that Japanese side shall provide the installation manual to PHIVOLCS at the implementation stage, though technical knowledge and skills for installation and adjustment works are not required for earthquake intensity meters.

- The Team requested and PHIVOLCS agreed that PHIVOLCS shall prepare and submit the list of monitoring locations for earthquake intensity meters to the Team by the end of July, 2012.

(4) Monitoring System

- The Team explained and PHIVOLCS understood the following policies for monitoring systems for velocity broadband strong motion seismometers;

  - Data gathered from velocity broadband strong motion seismometers shall be incorporated into the existing data processing and monitoring systems.

  - Technical challenges on compatibility between the existing systems and Japanese products shall be carefully analyzed in Japan, and feasible data processing and monitoring system shall be designed.

- The Team also explained and PHIVOLCS understood the following policies for monitoring systems for strong motion seismometers;

  - Seismic intensity monitored by the strong motion seismometer shall be displayed in the office at each target site.

  - Seismic intensity shall be displayed on the map on the monitor at PHIVOLCS headquarters office.

  - Data gathered from strong motion seismometers shall be incorporated into the existing data processing and monitoring systems.

  - Same systems for PHIVOLCS headquarters may be planned for the mirror centers in Davao and Tagaytay. However, the systems for such mirror centers will be planned in considerations to the project cost, and provision of the system for Davao will be prior to the one for Tagaytay.

(5) Other Considerations

- PHIVOLCS explained and the Team confirmed that the data gathered by PHIVOLCS through real-time earthquake monitoring network will be shared to the other countries including Japan for improvement of warning systems of earthquake and tsunami disasters.

4. Design Considerations to Enhanced Tsunami Warning System

PHIVOLCS understood that the Project is aiming to contribute to reconstruction of industry in the affected area of the Great East Japan Earthquake and to procure equipment for disaster management which developed out based on lessons learnt and technologies in Japan as confirmed in the M/D. Thus, PHIVOLCS agreed that the equipment shall be procured from Japan, while materials and services for installation works may be procured locally.

The Team explained and PHIVOLCS understood about possible options on real-time monitoring network shown in Annex-4 "Real-time Sea-level Monitoring System Diagrams", and PHIVOLCS agreed that further study and analysis shall be conducted in Japan to determine the final design of the systems to be adopted for the Project.

The Team also explained and PHIVOLCS agreed that detailed specifications and number of the equipment to be procured by the Project shall be determined as results of further study and analysis to be conducted in Japan.

(1) Sea-level Monitoring System in Tsunami-prone Area

- The Team explained and PHIVOLCS agreed that the locations and numbers of sites for sea-level monitoring system shall be determined from technical point of view, based on the results of the site survey which is being implemented by the Team, while candidate sites are twenty (20) as shown in Annex-2.

- The Team requested and PHIVOLCS agreed to secure available land for the sea-level monitoring systems, and that PHIVOLCS shall be responsible for costs for land acquisition, land lease and/or office rental. PHIVOLCS also understood that copies of written evidences regarding land acquisition, land-use rights or office use permission shall be submitted to Japanese side before the tender announcement for the Project.

- The Team explained and PHIVOLCS understood that sea-level monitoring system shall consist of the following sub-components;

  - Microwave / ultrasonic type tsunami wave detector
  - Data transmission station
  - Monitoring System

- Both sides agreed that establishment of nationwide tsunami monitoring system is the first priority. In this regard, standardized microwave / ultrasonic type tsunami wave detector with 3.0 m height from existing Jetty /pier surface level shall be procured and installed at the selected locations in tsunami-prone areas.

- The Team explained and PHIVOLCS understood that the data transmission station shall be built at the higher place than the height of the tsunami wave detector.

- PHIVOLCS and the Team agreed that satellite data communication systems for real-time monitoring network shall be established for the target sea-level monitoring sites. Possible options of the satellite data communication systems are shown in Annex-4, while further study and analysis shall be conducted in Japan to determine the design of the systems to be adopted for the Project.

(2) Tsunami Simulation Database Development Hardware

- PHIVOLCS explained and the Team understood that one (1) computer cluster for tsunami simulation database development is critically needed since the existing hardware is not suitable for such computer processing.

- The Team requested and PHIVOLCS agreed that PHIVOLCS shall provide with necessary information, such as required specifications, to the Team by the end of May, 2012.

- PHIVOLCS and the Team confirmed that the detailed components and specifications for this item shall be determined as a result of further study and analysis conducted in Japan.

(3) Monitoring System

- Data storage server, software and display monitors shall be provided for PHIVOLCS headquarters office for the data gathered from the tsunami wave detectors.

- Same systems for PHIVOLCS headquarters may be planned for the mirror centers in Davao and Tagaytay. However, the systems for such mirror centers will be planned in considerations to the project cost, and provision of the system for Davao will be prior to the one for Tagaytay.

(4) Other Considerations

- PHIVOLCS and the Team agreed that the locations and numbers of the sites for tsunami wave detector and data transmission station shall be determined based on the results of the site survey being conducted by the Team. If some of the candidate sites are declined through such process and if PHIVOLCS provide data and information required for alternative sites by 8th June 2012, the Team shall consider including such alternative sites for the Project.

- PHIVOLCS explained and the Team confirmed that the data gathered by PHIVOLCS through real-time sea-level monitoring network will be shared to the other countries including Japan for improvement of warning systems of earthquake and tsunami disasters

- PHIVOLCS explained and the Team confirmed that the data gathered by PHIVOLCS through real-time sea-level monitoring network will be also utilized for the monitoring and evaluation of other coastal hazards such as storm surges and sea-level changes associated with climate change.

5. Considerations to Operation and Maintenance

(1) Operation and Maintenance Costs

- PHIVOLCS and the Team confirmed that PHIVOLCS shall be responsible for all the other necessary costs and services in operation and maintenance for the systems for earthquake monitoring and sea-level monitoring procured by the Project.

(2) Operation and Maintenance Trainings

- PHIVOLCS and the Team confirmed that the operation and maintenance trainings for earthquake monitoring systems by the Supplier shall be held at PHIVOLCS headquarters office in Manila, and that PHIVOLCS shall be responsible for the necessary arrangements and costs for its personnel who will join the operation and maintenance training.

- PHIVOLCS and the Team also confirmed that the operation and maintenance trainings for sea-level monitoring system by the Supplier shall be held at the nearest site from Manila, and that PHIVOLCS shall be responsible for the necessary arrangements and costs for its personnel who will join the operation and maintenance training.

6. Other Considerations

(1) Undertakings to be taken by PHIVOLCS

- While the major undertakings to be taken by the recipient side were confirmed in the M/D, the Team emphasized and PHIVOLCS agreed that the following items shall be undertaken by PHIVOLCS.

- Securing the required lands and/or spaces for the Project, especially for the sites for sea-level monitoring systems
- Clearance or relocation of existing obstacles on the sites, if required
- Obtaining necessary permissions from the relevant authorities for implementation of the Project
- Tax assumption and custom duties, custom clearance of the equipment at the port of disembarkation
- Securing necessary frequency for the data communication systems
- Equipment delivery and installation works in the areas with security issues (see sub-clause 6 (2) hereunder for more details)
- All other items stipulated in Annex-5 of the M/D

(2) Equipment Delivery and Installation Works in the Areas with Security Issues

- PHIVOLCS and the Team discussed and understood that PHIVOLCS shall be responsible for equipment delivery, installation and commissioning for the sites in the areas with security issues at its expense.
- Both sides agreed that the equipment for the sites in such areas shall be handed over at PHIVOLCS headquarters office.

Annex-1 Proposed Project Site Location Map (for Seismometers)

Annex-2 Proposed Project Site Location Map (for Tsunami Detectors)

Annex-3 Real-time Earthquake Monitoring System Diagrams

Annex-4 Real-time Sea-level Monitoring System Diagrams

Manila, 18th May, 2012

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Department of Science and Technology (DOST)
Republic of the Philippines

Tamiko Aramata
Deputy Chief Consultant
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Annex -1

Proposed Project Site Location Map

(for Seismometers)

Proposed Project Sites Location Map
(for Seismometers)

Annex-2

Proposed Project Site Location Map

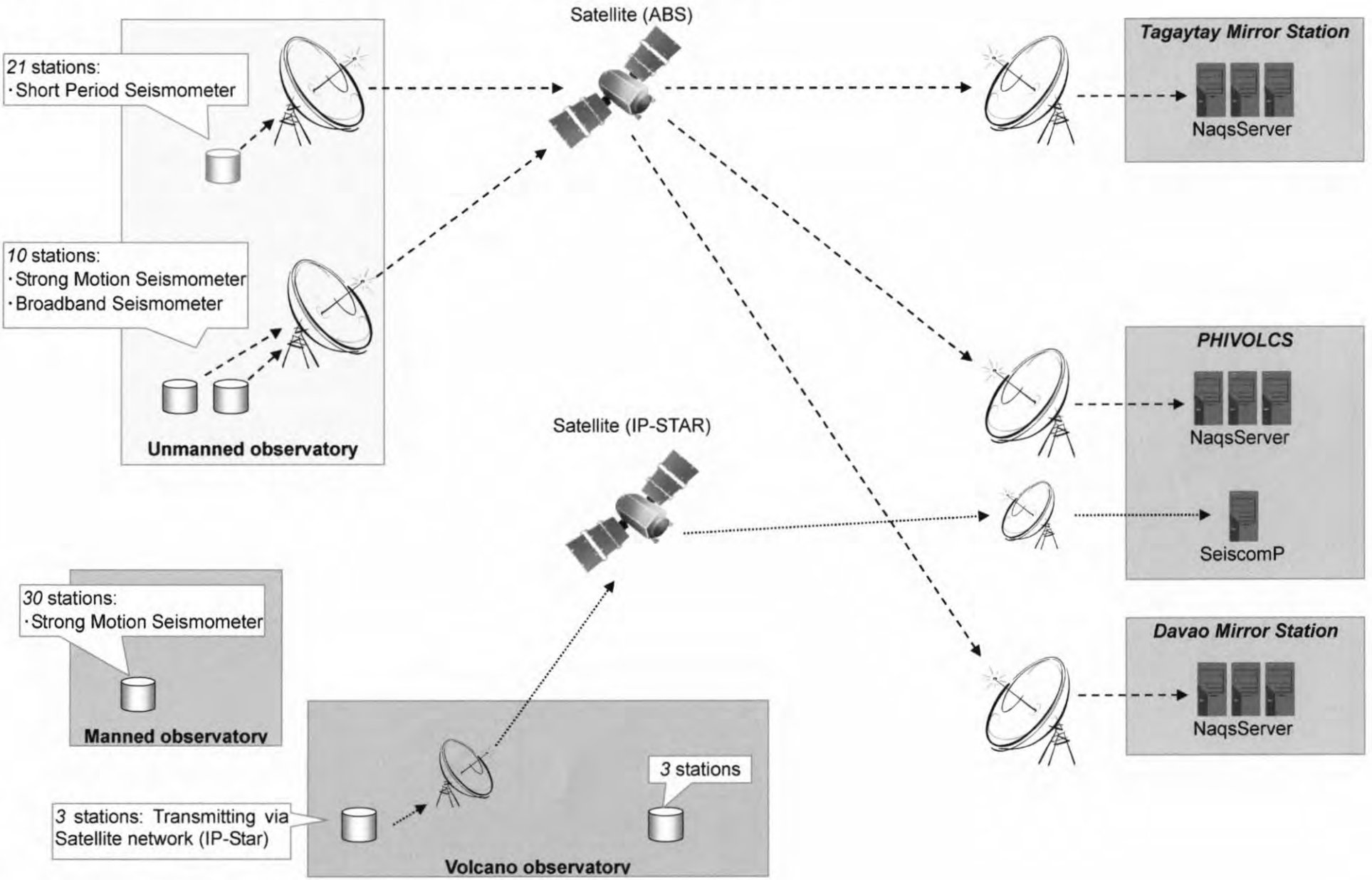
(for Tsunami Detectors)

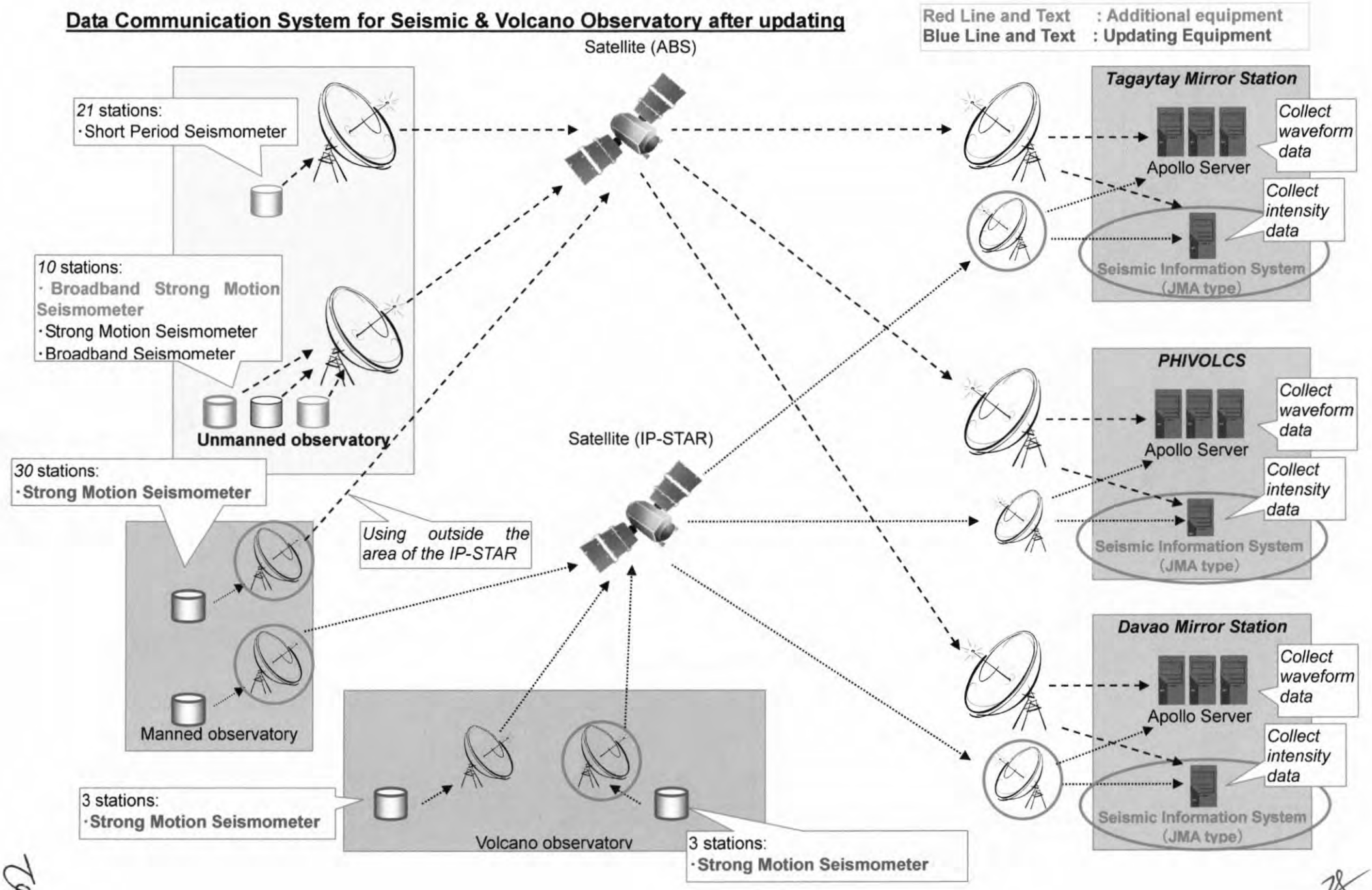
Proposed Project Sites Location Map
(for Tsunami Detectors)

Annex-3

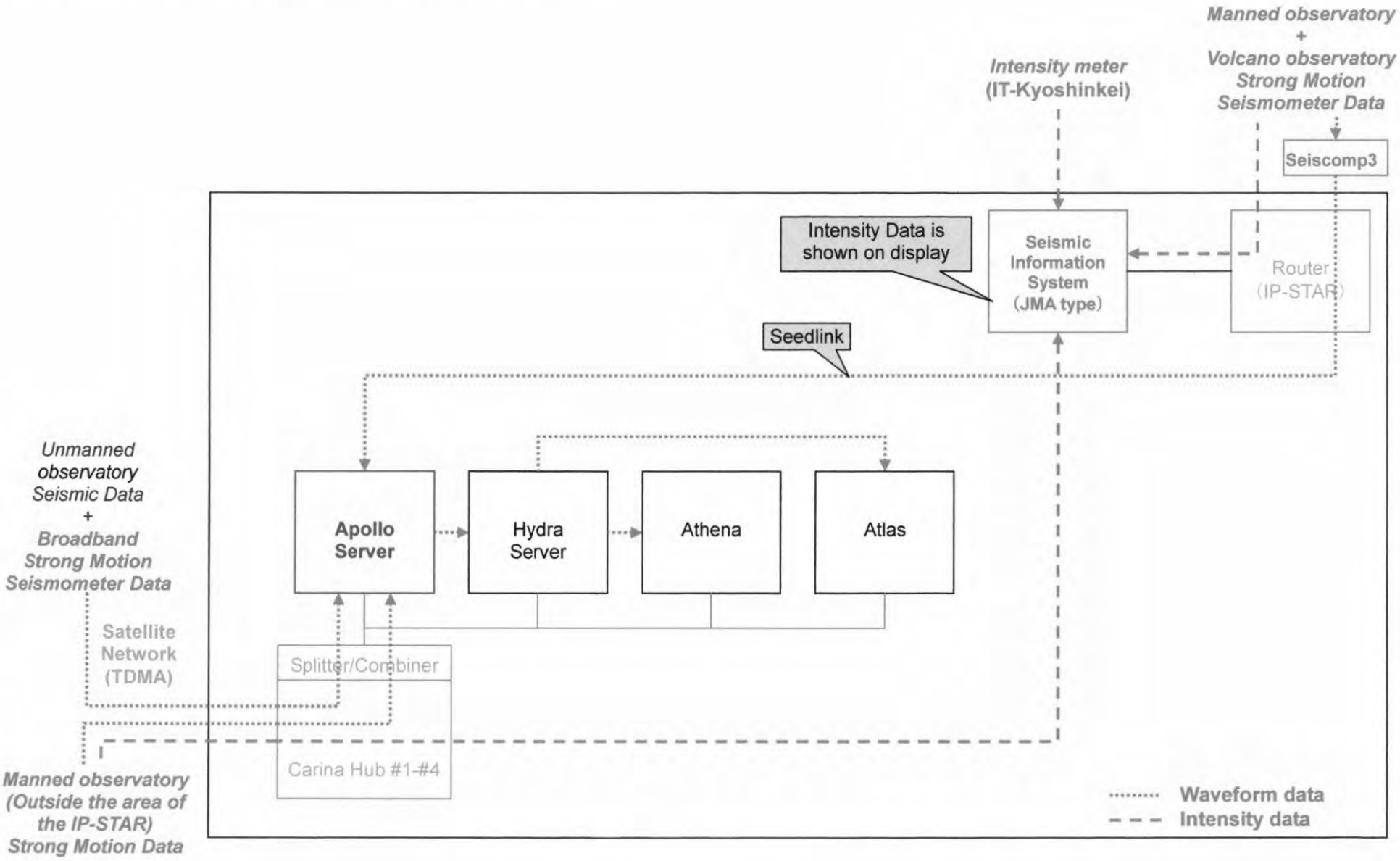
Real-time Earthquake Monitoring System Diagrams

Current Data Communication System for Seismic & Volcano Observatory




Data Communication System for Seismic & Volcano Observatory after updating
Red Line and Text : Additional equipment
Blue Line and Text : Updating Equipment
Satellite (ABS)
21 stations:
・Short Period Seismometer
10 stations:
・Broadband Strong Motion Seismometer
・Strong Motion Seismometer
・Broadband Seismometer
Unmanned observatory
30 stations:
・Strong Motion Seismometer
Using outside the area of the IP-STAR
Satellite (IP-STAR)
Manned observatory
3 stations:
・Strong Motion Seismometer
Volcano observatory
3 stations:
・Strong Motion Seismometer
Tagaytay Mirror Station
Apollo Server
Collect waveform data
Collect intensity data
Seismic Information System (JMA type)
PHIVOLCS
Apollo Server
Collect waveform data
Collect intensity data
Seismic Information System (JMA type)
Davao Mirror Station
Apollo Server
Collect waveform data
Collect intensity data
Seismic Information System (JMA type)

Flow Chart for Transmitting of Observed Seismic Data

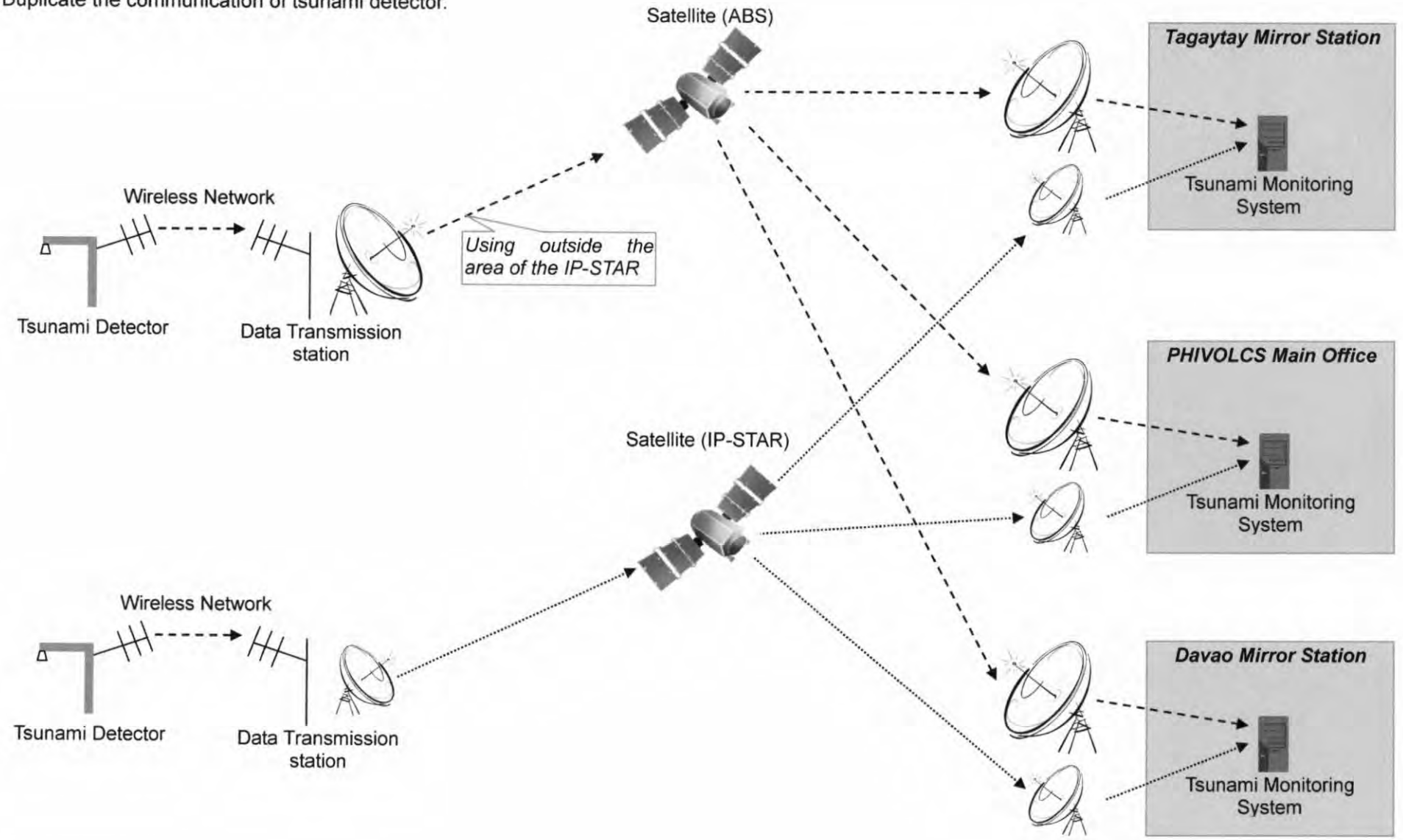


Annex-4

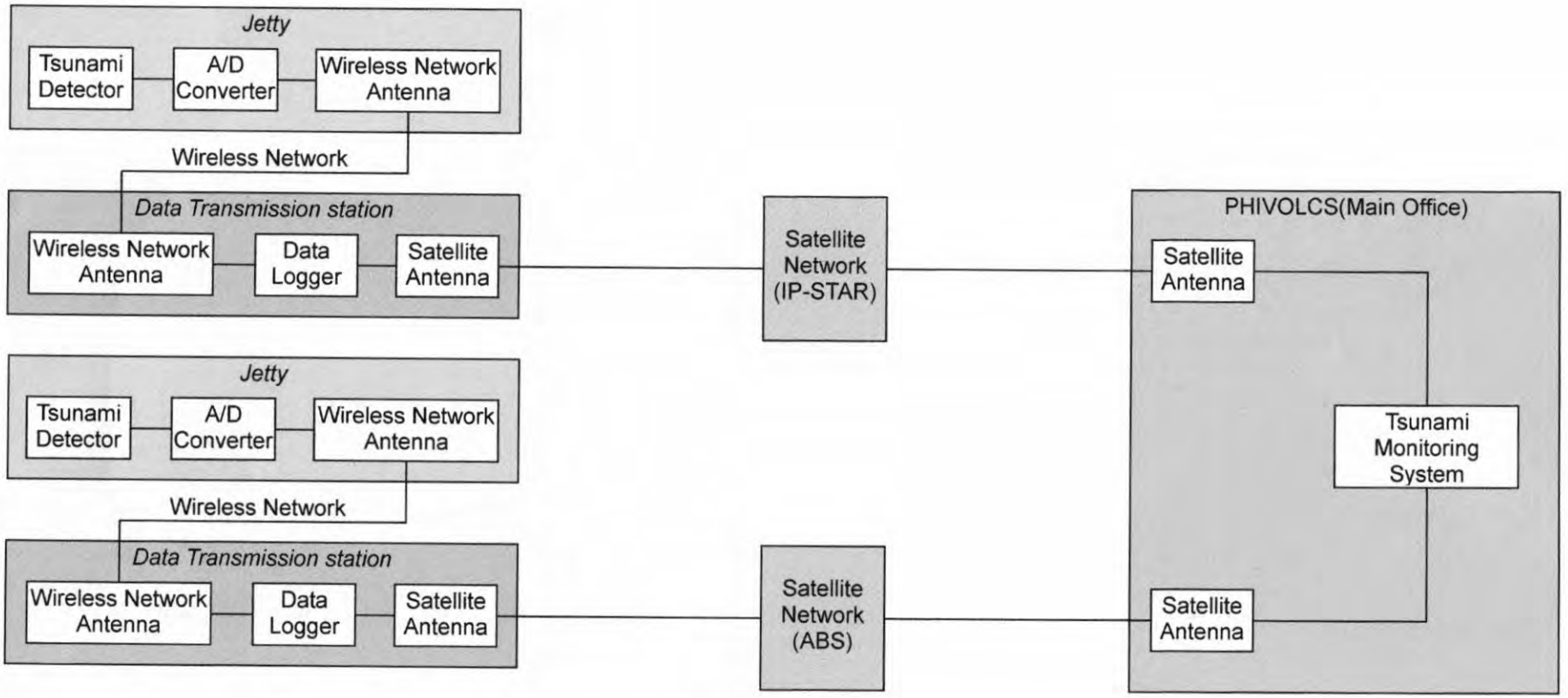
Real-time Sea-level Monitoring System Diagrams

Structure of Tsunami Warning System

Duplicate the communication of tsunami detector.



Schematic drawing of system



資料 **5-2**

2012 年 **12** 月 **7** 日署名　テクニカルノート
（**PHIVOLCS**）

TECHNICAL NOTES

Preparatory Survey on the Project for Improvement of Equipment for Disaster Risk Management in the Republic of the Philippines

1. General

Regarding the preparatory survey on the Project for Improvement of Equipment for Disaster Risk Management in the Republic of the Philippines (hereinafter referred to as "the Project"), Japan International Cooperation Agency (hereinafter referred to as "JICA") sent the Second Preparatory Survey Team (hereinafter referred to as "the Team") to the Republic of the Philippines (hereinafter referred to as "the Philippines") from December 2nd to December 8th, 2012.

This Technical Notes is made to confirm the results of technical discussions for the items for the Philippine Institute of Volcanology and Seismology (hereinafter referred to as "PHIVOLCS").

Through a series of discussions, PHIVOLCS and the Team understood that the followings.

2. Philippine Earthquake Intensity Scale (PEIS)

- PHIVOLCS provided the formula shown in Annex-1 as PEIS calculation formula (hereinafter referred to as "PEIS formula"), and PHIVOLCS and the Team confirmed that the PEIS formula will be incorporated in the equipment provided by the Project.

- PHIVOLCS requested the Team that the PGA-PGV-PEIS Table shown in Annex-2 as a sample to be incorporated in the equipment as well as the PEIS formula.

- PHIVOLCS and the Team discussed and agreed on intensity data flow diagram and demarcation between the equipment provided by the Project and Science and Technology Research Partnership for Sustainable Development project (hereinafter referred to as "SATREPS") as shown in Annex-3. Both sides agreed that the Project will provide simple and static visualization equipment for intensity mapping, while PHIVOLCS in cooperation with SATREPS will develop advanced visualization system based on long-term intensity monitoring and study.

- Both sides also discussed and agreed on equipment specifications for Seismic Intensity Meters. Annex-4 and Annex-5 show the agreed methods for parameter upgrading and XML format (sample) to be incorporated in the equipment, respectively.

- Both sides agreed that further technical study shall be conducted in Japan and that the draft final specification of the equipment shall be explained to PHIVOLCS when the Team comes for explanation on the draft report for the Project.

3. Satellite Communication System

- The Team explained possible options of satellite communication systems to PHIVOLCS. After discussions, PHIVOLCS and the Team agreed on the system, which is composed of IP-Star network for its coverage area and ABS (TDMA) Libra II network for the other area, as shown in Annex-6.

- PHIVOLCS requested the Team to install a new set of satellite communication receiver at PHIVOLCS H.Q. for the new IP-Star network established by the Project together with

considerations for redundancy, since the existing ABS network has back-up systems while the existing IP-Star one does not. The Team understood the situation and agreed to include the satellite receiver equipment in the Project.

4. Detailed Discussions on Major Equipment

- The Team explained to PHIVOLCS the specifications of the major equipment, and PHIVOLCS agreed with the specifications shown in Annex-7.
- PHIVOLCS requested the Team for further study on the specifications of Seismic Intensity Meters regarding the following points:
  - Capability of real-time forwarding of waveform for future purposes,
  - Possibility of mechanical or digital rotation of horizontal orientation, and
  - Provision of UPS.
- PHIVOLCS requested to check the following, and the Team noted:
  - Availability of local service center for PC cluster,
  - Manufacturers' warranties including on-site services, and
  - Thermal insulator/shield for temperature sensitive equipment, if any.
- PHIVOLCS understood that further technical study shall be conducted in Japan and that the draft final specification of the equipment shall be explained to PHIVOLCS when the Team comes for explanation on the draft report for the Project.

5. Confirmation of Earthquake and Tsunami Monitoring Stations covered by the Project

- The Team explained and PHIVOLCS understood the conditions for equipment installation of each Project site for Real-time Earthquake / Tsunami Monitoring Systems.
- The Team explained and PHIVOLCS understood that PHIVOLCS shall be responsible for equipment delivery, civil works, installation and commissioning for the sites in the areas with security issues at its expense. Both sides agreed that the equipment for the sites in such areas shall be handed over at PHIVOLCS headquarters office.
- PHIVOLCS and the Team confirmed the Project sites for Real-time Earthquake / Tsunami Monitoring Systems as shown in Annex-8 and Annex-9.
- The Team requested and PHIVOLCS agreed that necessary procedure to secure additional land for equipment installation shall be duly done by PHIVOLCS, if required. The Team promised to provide with information to PHIVOLCS, once necessity of additional land is identified.

6. Other Considerations

- The Team requested and PHIVOLCS agreed that PHIVOLCS shall prepare and submit the list of monitoring locations for Seismic Intensity Meters to the Team by the end of January, 2013.

Annex-1 PEIS Calculation Formula

Annex-2 PGA-PGV-PEIS Table (Sample)

Annex-3 Intensity Data Flow Diagram

Annex-4 Methods of Parameter Upgrading on Seismic Intensity Meters

Annex-5 Sample of XML Format for Seismic Intensity Meters

Annex-6 Satellite Communication Network Diagrams

Annex-7 Major Equipment Specifications

Annex-8 Location Map for Real-time Earthquake Monitoring System

Annex-9 Location Map for Real-time Tsunami Monitoring System

Manila, December 7th, 2012

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Japan

PEIS Calculation Formula

IMM by Shake Map Manual ver1.0 Wald et al. (2006)

PGA (cm/s/s) and PGV(cm/s) are larger of the two independent horizontal components

	Low intensity (Imm <5.0)	High intensity (Imm>5.0)
Imma (from PGA)	Immal = 2.20 Log(PGA) + 1.00	Immah=3.66 Log(PGA) - 1.66
Immv (from PGV)	Immvl = 2.10 Log(PGV) + 3.40	Immvh=3.47 Log(PGV) + 2.35

Imm		
Imma<5.0	5.0 <Imma<7.0	7.0< Imma
Imma	Linear transition from Imma to Immv	Immv

Conversion to Philippine Earthquake Intensity Scale (PEIS) by Bautista (2002)

$$PEIS = -0.0248(IMM)^2 + 1.14448(IMM) - 0.1626$$

Configurable PEIS using ShakeMapScheme

PGA (cm/s/s) and PGV(cm/s) are calculated from either two horizontal or three components of a band-pass filtered waveform within a specified time interval, and either from independent components or from vector sum.

	Low intensity formula	High intensity formula
Imma (from PGA)	Aal * Log(PGA) + Bal If Log(PGA) < (Bah - Bal)/(Aal - Aah)	Aah * Log(PGA) + Bah If Log(PGA) > (Bah - Bal)/(Aal - Aah)
Immv (from PGV)	Immvl = Avl * Log(PGV) + Bvl If Log(PGV) < (Bvh - Bvl)/(Avl - Avh)	Immvh = Avh* Log(PGV) + Bvh If Log(PGV) > (Bvh - Bvl)/(Avl - Avh)

Imm		
Imma < Cl	Cl < Imma < Ch	Ch < Imma
Imma	Imma*(Ch-Imma)/(Ch - Cl) + Immv*(Imma-Cl)/(Ch-Cl)	Immv

$$PEIS = P2\,(Imm)^2 + P1(Imm) + P0$$

Parameters (INI file example)

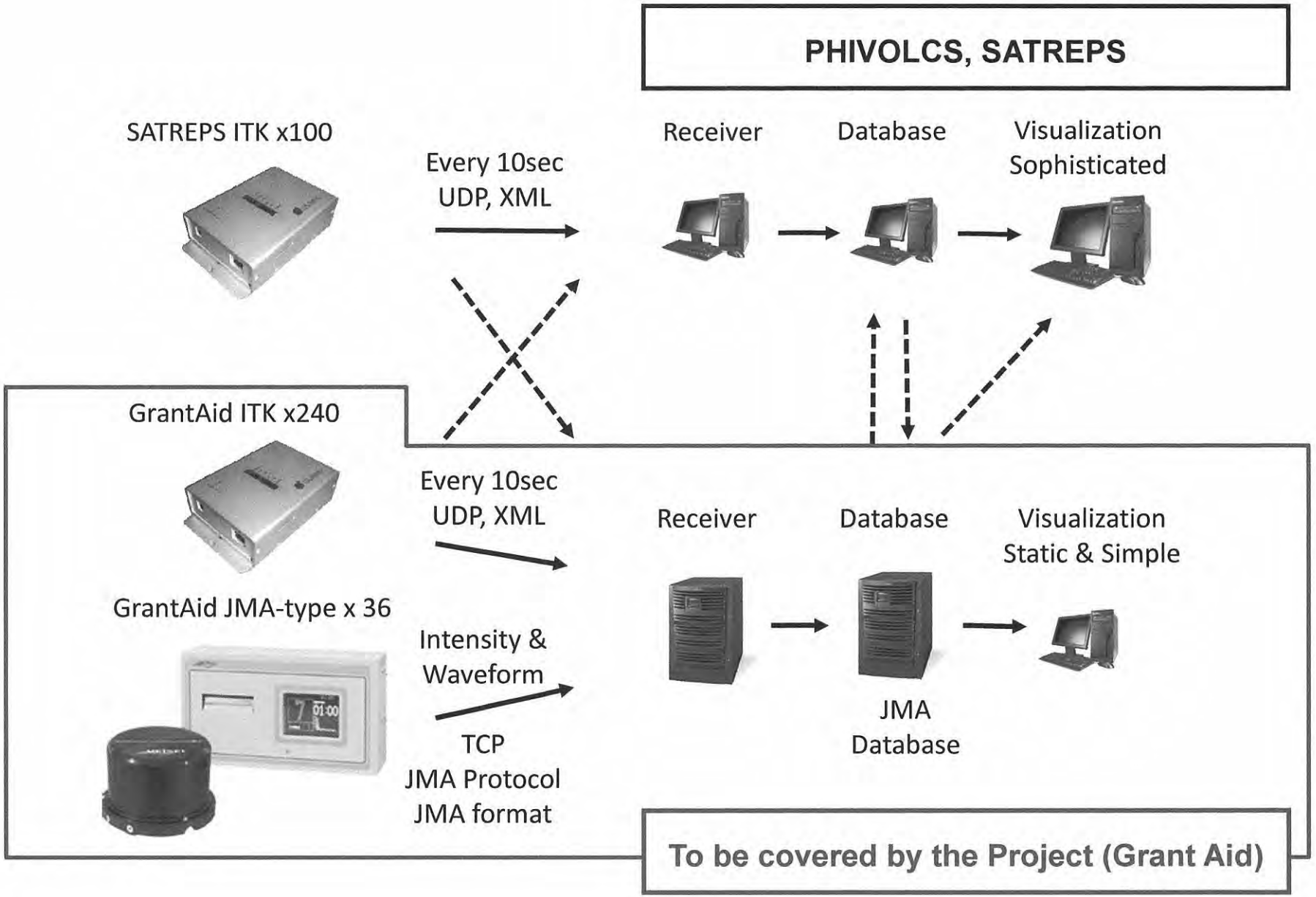
COMPONENTS=3, VECTOR=1, TIMEINTERVAL=10, FHP=0.1, FLP=5.0, FORDER=2
AAL=2.20, BAL=1.00, AAH=3.66, BAH=-1.66, AVL=2.10, BVL=3.40, AVH=3.47, BVH=2.35
CL=5.0, CH=7.0, P2=-0.0248, P1=1.14448, P0=-0.1626

PGA-PGV-PEIS Table

by USGS ShakeMap and Bautista formulas

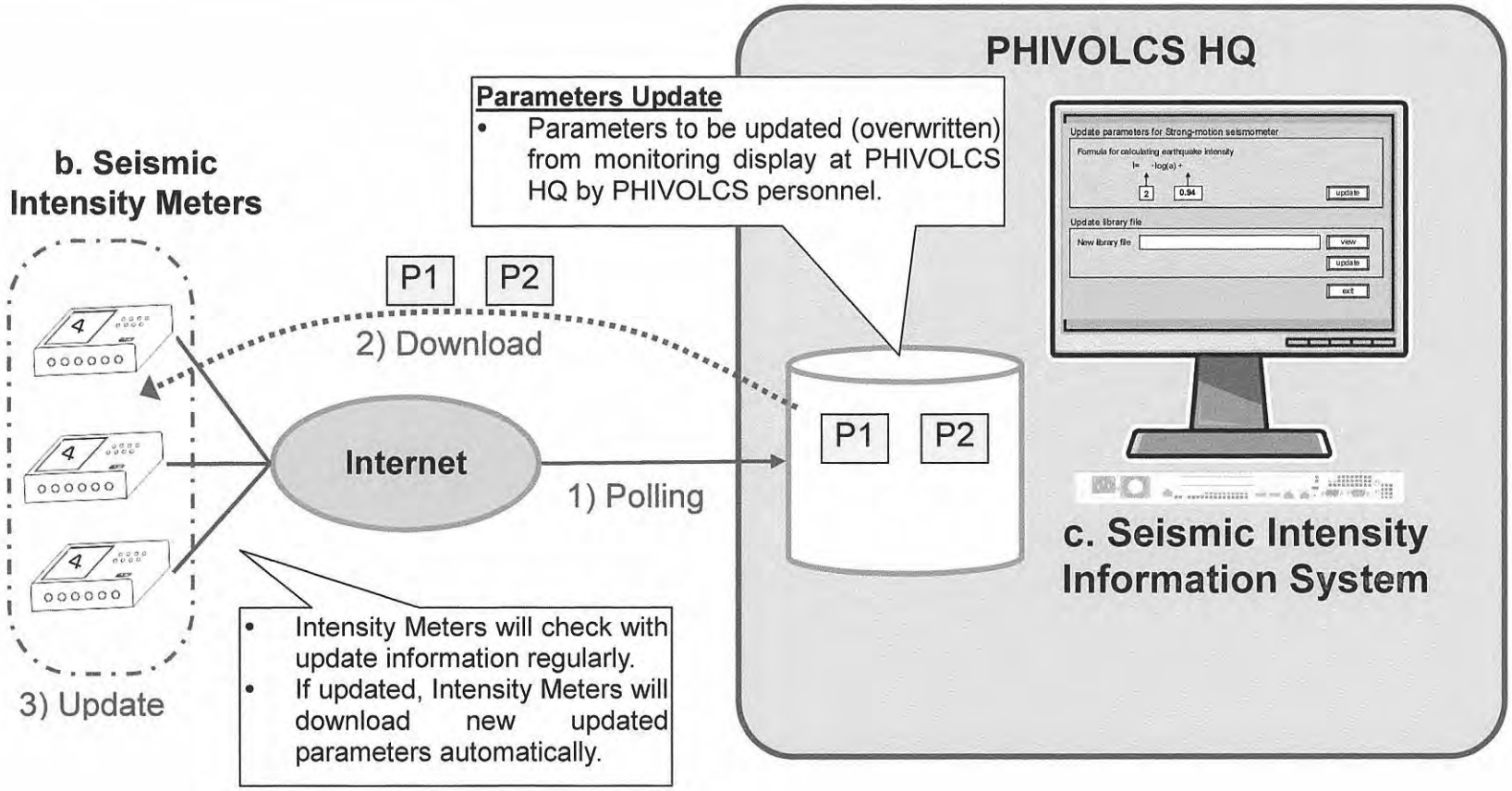
	PGA (gal)	0.3	1.0	3.2	10.0	31.6	100.0	316.2	1000.0	3162.3
PGV(kine)	0.10	-0.1	1.1	2.3	3.4	4.5	4.4	1.4	1.4	1.4
	0.32	-0.1	1.1	2.3	3.4	4.5	4.7	2.6	2.6	2.6
	1.00	-0.1	1.1	2.3	3.4	4.5	5.0	3.6	3.6	3.6
	3.16	-0.1	1.1	2.3	3.4	4.5	5.3	4.6	4.6	4.6
	10.00	-0.1	1.1	2.3	3.4	4.5	5.7	5.8	5.8	5.8
	31.62	-0.1	1.1	2.3	3.4	4.5	6.2	7.2	7.2	7.2
	100.00	-0.1	1.1	2.3	3.4	4.5	6.7	8.5	8.5	8.5
	316.23	-0.1	1.1	2.3	3.4	4.5	7.1	9.6	9.6	9.6
	1000.00	-0.1	1.1	2.3	3.4	4.5	7.6	10.6	10.6	10.6

INI file example
PGAPGVTABLE=YES



Annex-3 Intensity Data Flow Diagram

Methods of Parameter Upgrading on Seismic Intensity Meters



XML for PEIS (Sample)

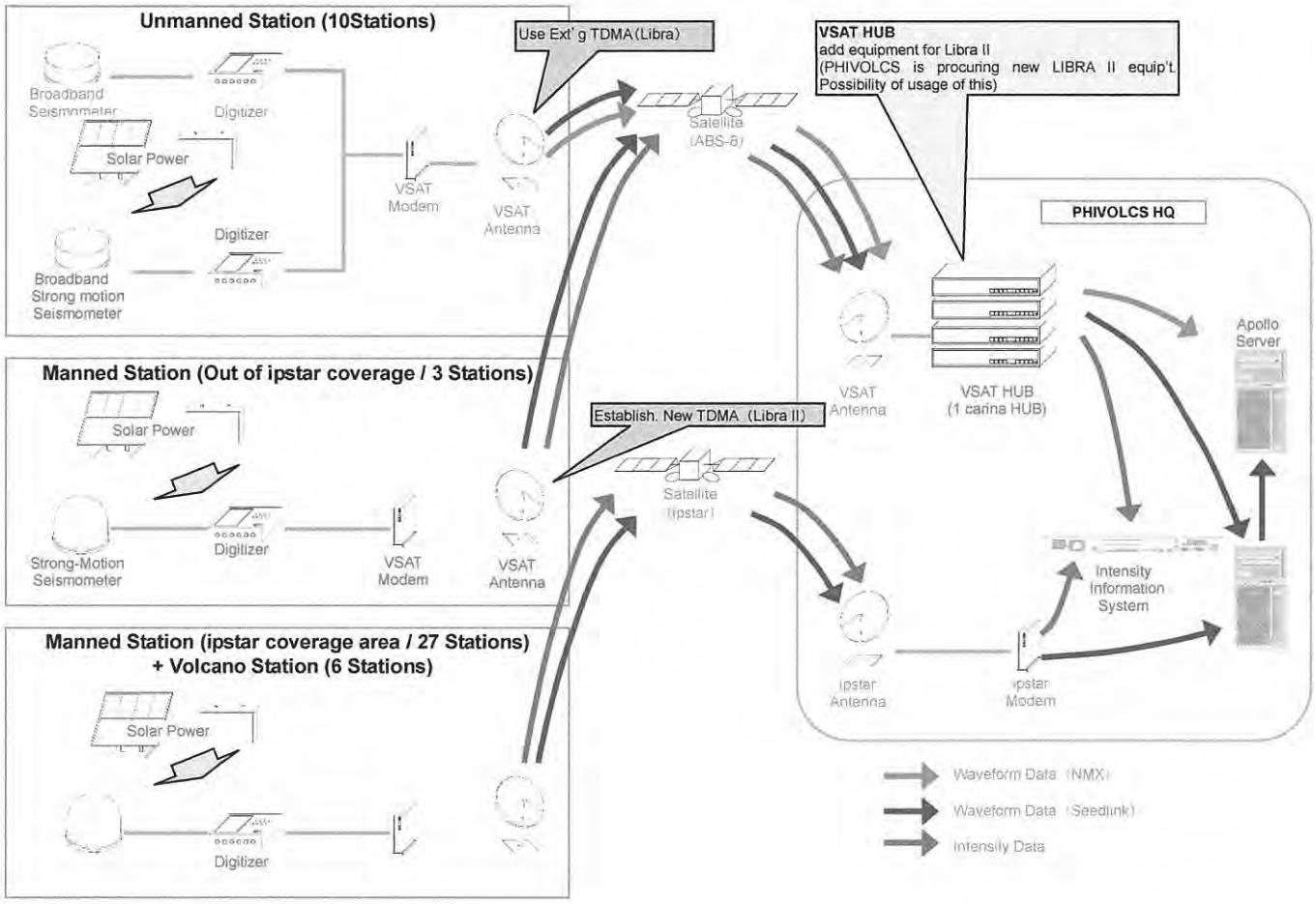
Short Information

```
<PEIS12><SF>12/12/31, 12:34:56, Tagaytay, 5.5</SF></PEIS12>
```

Full Information

```
<PEIS12>
        <MAC>XX-XX-XX-XX-XX-XX-XX</MAC>
        <StationName>Tagaytay</StationName>
        <StationCode>TGY</StationCode>
        <Location>12.345N, 123.567E</Location>
        <LocalDate>2012/12/31</LocalDate>
        <LocalTime>12h15m32s<LocalTime>
        <PGA>23,10sec</PGA>
        <PEISBautista>4.5</PEISBautista>
        <5HzPGA>234, 10sec</5HzPGA>
</PEIS12>
```

Annex-6 Satellite Communication Network Diagrams

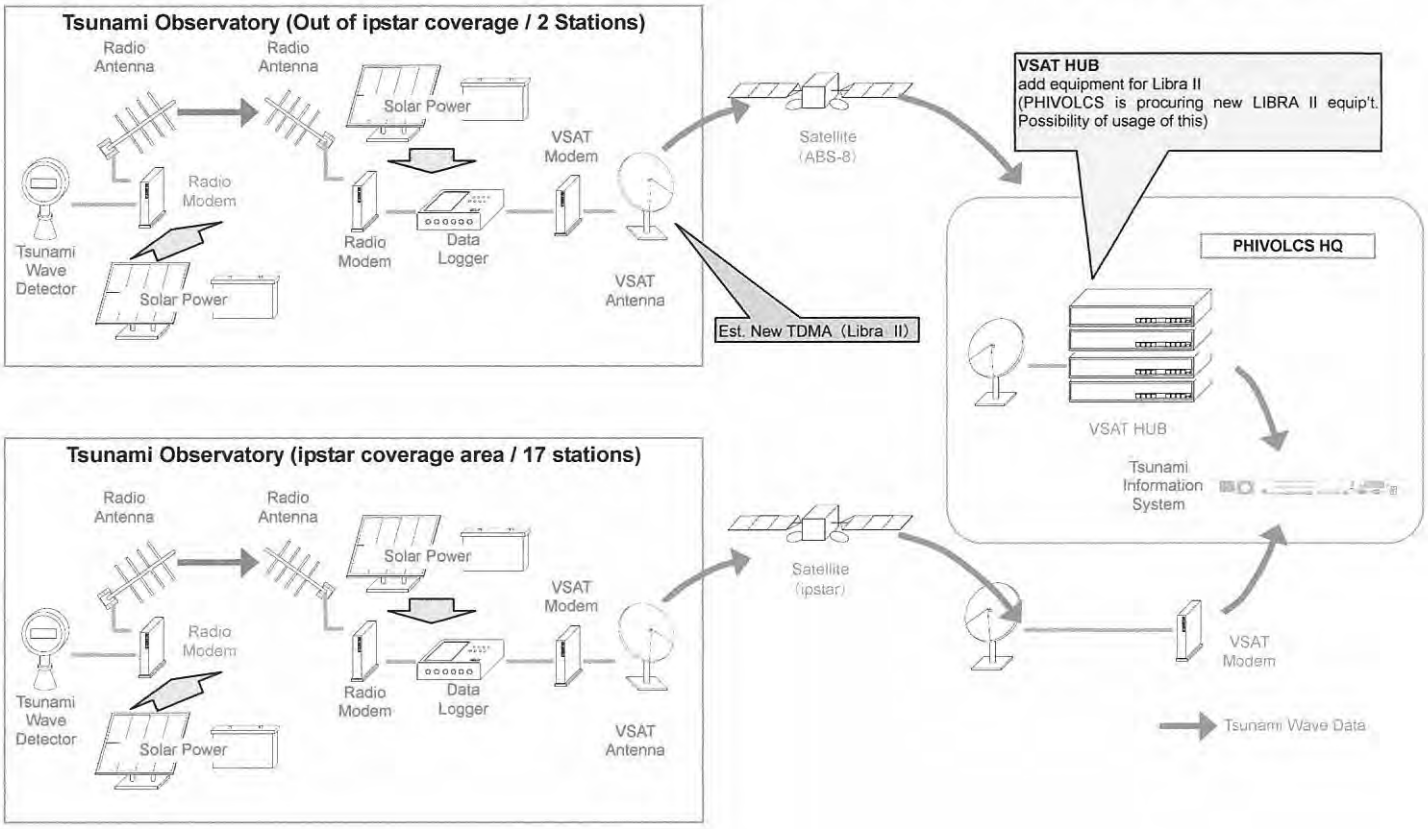


Broadband strong motion seismometer			
Code	Station Name	Libra	ipstar
BATP	Bataraza, Palawan	Ext	
BBPS	Basco Seismic Station	Ext	
BESP	Borongan, Eastern Samar	Ext	
ENPP	El Nido, Palawan	Ext	
GUIM	Jordan, Guimaras Island	Ext	
LUBP	Lubang, Occ. Mindoro	Ext	
MATI	Mati, Davao Oriental	Ext	
PAGZ	Pagadian, Zamboanga del Sur	Ext	
PVCP	Virac, Catanduanes	Ext	
SRPC	San Manuel	Ext	

Strong motion seismometer				
Code	Station Name	Vsat	Libra	ipstar
BBP	Basco Seismic Station	Libra(new)	New	
BCP	Baguio Seismic Station	Ipstar(new)		New
BIP	Bislig Seismic Station	Ipstar(new)		New
CGP	Cagayan de Oro Seismic Station	Ipstar(new)		New
CTB	Cotabato Seismic Station	Ipstar(new)		New
CVP	Callao Seismic Station	Ipstar(new)		New
DCP	Dipolog Seismic Station	Ipstar(new)		New
DMP	Davao Seismic Station	Ipstar(new)		New
GQP	Guinayangan Seismic Station	Ipstar(new)		New
GSP	General Santos Seismic Station	Ipstar(new)		New
JAP	Antique Seismic Station	Ipstar(new)		New
KAP	Kalibo Seismic Station	Ipstar(new)		New
KCP	Kidapawan Seismic Station	Ipstar(new)		New
LLP	Lapu-Lapu Seismic Station	Ipstar(new)		New
LQP	Lucban Seismic Station	Ipstar(new)		New
MMP	Masbate Seismic Station	Ipstar(new)		New
MPP	Magalan Seismic Station	Ipstar(new)		New
PCP	Palayan Seismic Station	Ipstar(new)		New
PGP	Puerto Galera Seismic Station	Ipstar(new)		New
PIP	Pasuquin Seismic Station	Ipstar(new)		New
PLP	Palo Seismic Station	Ipstar(new)		New
PPR	Puerto Princesa Seismic Station	Libra(new)	New	
QVP	PHIVOLCS Main Office	Ipstar(new)		New
RCP	Roxas Seismic Station	Ipstar(new)		New
SCP	Surigao Seismic Station	Ipstar(new)		New
SIP	Sinait Seismic Station	Ipstar(new)		New
SNP	Sibulan Seismic Station	Ipstar(new)		New
TBP	Tagbilaran Seismic Station	Ipstar(new)		New
TGY	Tagaytay Seismic Station	Ipstar(new)		New
ZMP	Zamboanga Seismic Station	Libra(new)	New	

Strong motion seismometer(volcano station)			
Code	Station Name	Libra	ipstar
Sorsogon			Ext
Pinatubo			New
Mayon			New
Hibok-Hibok			Ext
Canlaon			New
Buco			Ext

Annex-6 Satellite Communication Network Diagrams



Station Name	Libra	ipstar
Nasugbu		New
Corregidor		New
San Fernando		New
Aparri		New
Basco	New	
Baler		New
Virac		New
Borongan		New
Tacloban		New
Dapa		New
Tandag		New
Mati		New
Saranggani Bay		New
Kalamansig		New
Zamboanga City	New	
Dumaguete		New
Sipalay		New
SanJose		New

Real-time Earthquake Monitoring System

1. Broadband Strong-motion Seismometer		
1-1. Components	QTY	
A. Broadband Strong-motion Seismometer	10	unit
B. Digitizer	10	unit
C. Solar Panel	10	set
D. Battery Charge Controller	10	set
E. Battery	10	unit
F. SPD	10	set
G. Cables	10	set
1-2. Major Specifications		
A. Broadband Strong-motion Seismometer		
1) sensor type	:	servo velocity meter
2) mode of operation	:	triaxial
3) output signal	:	analog signal
4) frequency Response (+/- 3 dB)	:	including 0.01～70Hz
5) max. measuring range	:	not less than ±2m/s (±200kine)
6) dynamic range	:	not less than 145dB
7) protection of sensor	:	by the sensor cover
B. Digitizer		
1) sampling frequency	:	selectable (should include 100hz)
2) ADC resolution	:	not less than 24bit
3) ADC modulation	:	Delta-sigma modulation
4) waveform data format	:	nmx
5) data transmission protocol for waveform	:	nmx
6) power consumption	:	less than 3W
2.Strong-motion Seismometer		
2-1. Components	QTY	
A. Strong motion seismometer	36	unit
B. Digitizer	36	unit
C. Solar Panel	36	set
D. Battery Charge Controller	36	set
E. Battery	36	set
F. SPD	36	set
G. Cables	36	set
H. Satellite modem for ipstar	30	set
I. Satellite antenna for ipstar	30	set
J. Satellite modem for abs	3	set
K. Satellite antenna for abs	3	set
L. dc-ac inverter	6	unit for volcano station
M. Network switch(L2)	6	unit for volcano station
2-2. Major Specifications		
A. Strong motion seismometer		
1) Sensor type	:	Servo Accelerometer
2) Mode of operation	:	triaxial
3) output signal	:	digital
4) Max. measuring range	:	not less than ±3,000gal
5) sampling frequency	:	100Hz (JMA SPEC)
6) ADC resolution	:	not less than 24bit
7) ADC modulation	:	Delta-sigma modulation
B. Digitizer(Processor)		
1) result of the processing	:	a. intensity (PEIS) b. maximum acceleration and maximum velocity (triaxial) c. peak acceleration cycle (triaxial) d. SI (Spectral Intensity) e. prevailing frequency f. signal detection time
2) waveform data format	:	mSeed
3) data transmission protocol for waveform	:	Seedlink
4) intensity data format	:	JMA Format
5) data transmission protocol for intensity	:	JMA Protocol

3. Seismic Intensity Meter		
3-1. Components	QTY	
A. Seismic intensity meter	240	unit
B. Management server	1	unit
3-2. Major Specifications		
A. Seismic intensity meter		
1) Sensor type	:	Accelerometer
2) self noise	:	not more than 0.2gal(rms)
3) Mode of operation	:	triaxial
4) output signal	:	digital
5) Max. measuring range	:	not less than ±1,500gal
6) result of the processing	:	intensity (PEIS)
7) intensity data format	:	SATREPS format (XML)
8) data transmission protocol for intensity	:	SATREPS Protocol (UDP)
9) data acquisition	:	SD Card(not less than 16GB), acquisition data can be collected from the remote
4. Earthquake Data Aquisition System		
4-1. Components	QTY	
A. PC Workstation	2	unit
B. UPS	2	unit
C. Nanometrics Apollo Server	2	package
4-2. Major Specifications		
A. PC Workstation		
a) cpu	:	not less than xeon 4core Processor 2.0GHz
b) memory	:	not less than 12GB
c) hard disk drive	:	not less than 1TB (RAID1)
d) Removable Media Drive	:	blue-ray disk drive
e) chassis	:	rack mount or tower
f) OS	:	Windows 7 pro / 64bit
5. Earthquake Information System (for strong motion seismometer & seismic intensity meter)		
5-1. Components		
A. PC Server	2	unit
B. UPS	2	unit
C. Large monitor	1	unit
D. KVM	1	set
E. Cables	1	set
F. Earthquake information software	1	lot
5-2. Major Specifications		
A. PC Server		
a) cpu	:	not less than xeon 4core Processor 2.0GHz
b) memory	:	not less than 8GB
c) hard disk drive	:	not less than 1TB (RAID1)
d) chassis	:	rack mount
e) OS	:	Windows or Linux (depends on the earthquake information software)
f) database software	:	mySQL
g) server configuration	:	Redundant configuration
F. earthquake information software		
1) management of earthquake intensity data	:	data acquisition, recording, monitoring grouping of seismic intensity data display of seismic intensity data : table , map logging
2) management of strong motion seismometer	:	operations monitoring diagnosis, examination
	:	status management (enable and disable)
3) system management	:	time synchronization database synchronization

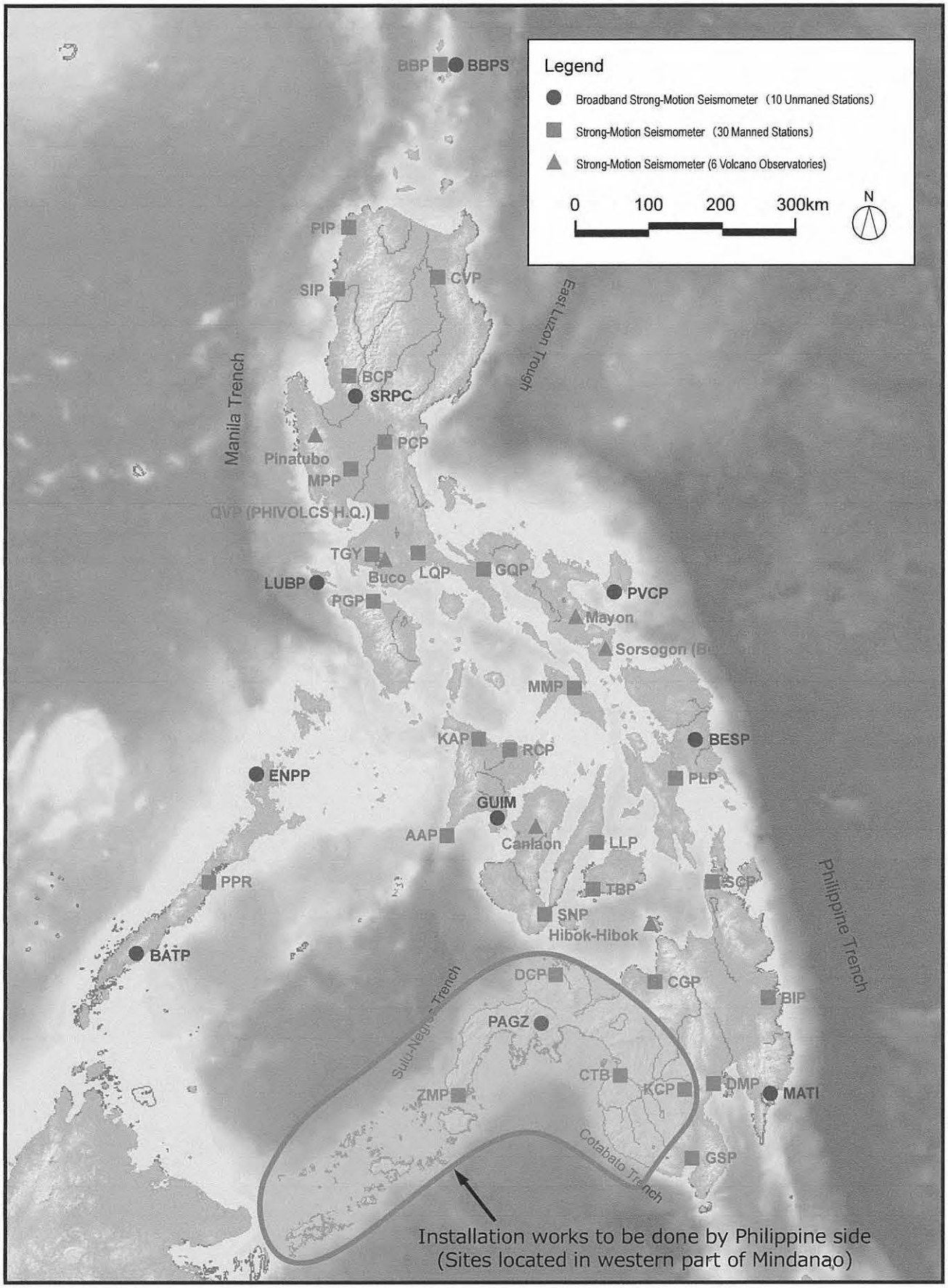
Real-time Tsunami Monitoring System

1. Tsunami Detector		
1-1. Components	QTY	
A. Tsunami detector	19	unit
B. A/D converter	19	unit
C. Radio transmitter	19	unit
D. Solar Panel	19	set
E. Battery Charge Controller	19	set
F. Battery	19	set
G. SPD	19	set
H. Cabinet	19	unit
I. Pole	19	unit
J. Cables	19	set
1-2. Major Specifications		
A. Tsunami detector		
1) sensor type	:	Radio waves or Ultrasonic
2) measurement interval	:	not less than every Second
3) measurement range	:	not less than 15m (Deadband within 1m)
4) measurement accuracy	:	±0.3% or ±3cm
5) Installation height	:	+3.0m to +3.5m from the jetty
C. Radio transmitter		
1) band	:	UHF
2) transmission range	:	not less than 1km
3) frequency Range	:	433.050-434.790MHz
4) output power	:	10mW
2. Data Transmission Station		
2-1. Components	QTY	
A. Radio transmitter	19	unit
B. Data logger	19	unit
C. Solar Panel	19	set
D. Battery Charge Controller	19	set
E. Battery	19	set
F. SPD	19	set
G. Cabinet	19	unit
H. Cables	19	set
I. Satellite modem for ipstar	17	unit
J. Satellite antenna for ipstar	17	unit
K. Satellite modem for abs	2	unit
L. Satellite antenna for abs	2	unit
2-2. Major Specifications		
A. Radio transmitter		
1) band	:	UHF
2) transmission range	:	not less than 1km
3) frequency Range	:	433.050-434.790MHz
4) output power	:	10mW
B. Data logger		
1) result of the processing	:	mean wave height (Any time average)
2) memory	:	accumulation of measurement data for one year
3) data format	:	WIN or equivalent
4) data transmission protocol	:	TCP or UDP

3. Tsunami Information System		
3-1. Components	QTY	
A. Tsunami monitoring system Server	1	unit
B. UPS	1	set
C. Large monitor	5	unit
D. KVM	1	set
E. Cables	1	set
F. Tsunami monitoring software	1	lot
G. Rack	1	unit
3-2. Major Specifications		
A. Tsunami monitoring system Server		
1) CPU	:	not less than xeon 4core Processor 2.0GHz
2) memory	:	not less than 8GB
3) hard disk drive	:	not less than 1TB(RAID1)
4) chassis	:	rack mount
5) OS	:	Windows or Linux (depends on the tsunami monitoring software)
6) server configuration	:	Redundant configuration
F. Tsunami monitoring software		
1) Management of tsunami data		
a) Retrieving	:	data acquisition, recording
b) Monitoring	:	Displays the waveform of the observed data and estimated data (display contents : currently / any period, display range:4h/12h/24h)
2) System management	:	management of tidal harmonic decomposition data for 15 days management of Lat / long data of each station over 60 observatory

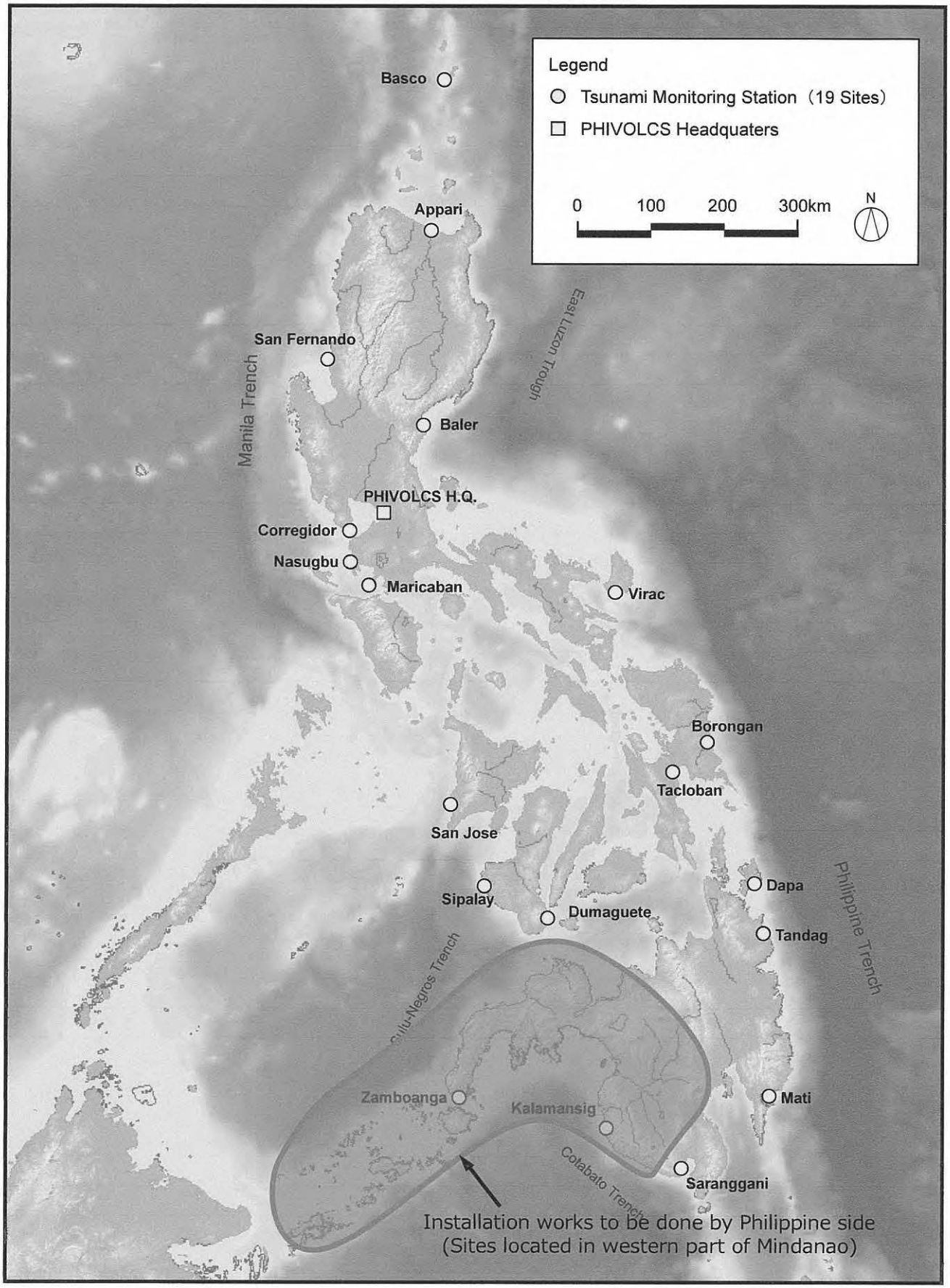
Tsunami Simulation Database development Hardware (PC Cluster)

1. PC Cluster		
1-1. Components	QTY	
A. Workstation	10	unit
B. NAS	1	unit
C. Network switch	1	unit
D. UPS	1	unit
E. KVM	1	unit
F. Cables	1	unit
G. Rack	1	unit
H. Console PC	2	unit
I. Fortran compiler	10	package
1-2. Major Specifications		
A. Workstation		
1) cpu	:	not less than Intel Xeon E5-2650(2GHz,turbo boost 2.8GHz/8core /20MB)×2
2) memory	:	not less than 48GB (DDR3 1333MHz)
3) hard disk drive	:	not less than 4TB(RAID 0)
4) chassis	:	rack mount
5) OS	:	Linux(CentOS)
B. NAS		
1) disk space	:	not less than 36TB
2) disk drive spec	:	serial ATA(7,200rpm) or SAS(2.5inch or 3.5inch ,10,000rpm)
3) chassis	:	rack mount
C. Network switch		
1) Standards	:	Gigabit Ethernet(IEEE 802.3z or IEEE 802.3ab)
2) port	:	not less than 16port
3) LAN switching	:	not less than L2 switching
4) routing	:	IPv4 or IPv6, multicast routing
5) chassis	:	rack mount
H. Console PC		
1) cpu	:	not less than Intel Core i7 3770
2) memory	:	not less than 8GB
3) hard disk drive	:	not less than 2TB(RAID 0)
4) Removable Media Drive	:	blue-ray disk drive
5) chassis	:	desktop
6) OS	:	Windows 7 pro / 64bit



LOCATION MAP
(PHIVOLCS Real-time Earthquake Monitoring System)

Annex-9 Location Map for Real-time Tsunami Monitoring System



LOCATION MAP
(PHIVOLCS Real-time Tsunami Monitoring System)

資料 **5-3**

2012 年 **5** 月 **18** 日署名　テクニカルノート
（**DPWH**）

TECHNICAL NOTES

Preparatory Survey on the Project for Improvement of Equipment for Disaster Risk Management in the Republic of the Philippines

1. General

Regarding the preparatory survey on the Project for Improvement of Equipment for Disaster Risk Management in the Republic of the Philippines (hereinafter referred to as "the Project"), the Minutes of Discussions (hereinafter referred to as "M/D") was signed on 27th April, 2012 by and between the Government of the Philippines (hereinafter referred to as "the Philippines") and the Preparatory Survey Team (hereinafter referred to as "the Team") sent by Japan International Cooperation Agency (hereinafter referred to as "JICA").

This Technical Notes is made to confirm the results of discussions and field survey works for the items requested by the Department of Public Works and Highways (hereinafter referred to as "DPWH").

2. Project Components for DPWH

Through a series of discussions and considering the focus on earthquake and tsunami disaster mitigation, DPWH and the Team understood that the following items, which were deemed as high prioritized items, categorized as "Priority A", in the M/D, would be considered as the project components.

(1) Bridge Inspection Vehicle

- Two (2) numbers of bridge inspection vehicles (hereinafter referred to as "BIV")

(2) Non-destructive Test Equipment including Operation and Maintenance Training

- Three (3) numbers of concrete rebound hammer
- Three (3) numbers of reinforced concrete detective radar
- Three (3) numbers of infrared thermal imager

(3) Mobile Drainage Pump including Operation and Maintenance Training

- Six (6) numbers of mobile drainage pump

Meanwhile, in response to the further comment form the Secretary of DPWH on the critical and urgent need for a Heli-borne Oblique Photography System which was categorized as priority B in the M/D, DPWH requested JICA to reconsider to change its priority from B to A, and include the grant of at least one (1) unit.

3. Considerations to Bridge Inspection Vehicle (BIV)

(1) Type and Quantity of BIV

- DPWH explained that there are two platform type BIVs owned by DPWH and presently stationed in Region VII (Cebu) and Region XI (Davao) regional offices, while DPWH is planning to deploy three bucket type BIVs and eleven platform type BIVs to the other fourteen regional offices to cover all the sixteen regional offices. One of the existing BIV in Davao was procured by the JICA Technical Cooperation Project for "Improvement of Quality Management for Highway and Bridge Construction and Maintenance (hereinafter referred to as "JICA-TCP"), Phase I (JICA-TCP I)", and the other one was procured by the World Bank.

- DPWH stated that the existing BIVs are properly operated and maintained by the responsible regional offices whose engineers and mechanics were involved in the trainings held by JICA-TCP I.

- DPWH understood that the Project is aiming to contribute to reconstruction of industry in the affected area of the Great East Japan Earthquake and to procure equipment for disaster management which developed based on lessons learnt and technologies in Japan as confirmed in the M/D. Thus, DPWH agreed that BIV shall be procured from Japan.

- The Team explained that platform type BIV with maximum horizontal range of approx. 7.5 m can be procured from Japan, while the database of Bridge Management System (BMS) of DPWH shows width of 94 %[1] of bridges in the whole Luzon area, where currently BIV is not deployed, are less than 15 m. Thus, both the Team and DPWH understood that Japanese made BIV with 7.5 m max horizontal range can maintain most of the bridges in Luzon, if BIV approaches from both sides of the bridges.

- DPWH explained and the Team agreed that two BIVs to be procured by the Project will be deployed to the regions in Luzon, and that the target regions are determined based on analysis of the BMS by DPWH. The Team requested and DPWH agreed to submit such analysis of the BMS by the end of June, 2012.

- The Team explained and DPWH agreed that detailed specifications and number of BIV to be procured by the Project shall be determined as results of further study and analysis to be conducted in Japan.

(2) Handing Over

- BIVs shall be handed over at the DPWH compound in Manila to be identified by DPWH.

- DPWH and the Team confirmed that DPWH shall be responsible for necessary procedure as well as purchases, such as for custom duties, custom clearance, internal transportation after handing over, vehicle registration at the Land Transportation Office (hereinafter referred to as "LTO"), and obtaining permissions required (e.g. environmental regulations).

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[1] See Annex-1 "Width of Bridges in Luzon"

(3) Operation and Maintenance

- DPWH and the Team confirmed that the O&M training for BIV by the Supplier shall be held in Luzon, and that participants of the O&M training will be the engineers, mechanics and operators who belong to the regional offices where the BIVs are procured by the Project.

- DPWH and the Team confirmed that DPWH shall be responsible for the necessary travel arrangements and per-diems of personnel who will join the O&M training in Luzon.

- DPWH and the Team confirmed that all necessary costs in O&M of the BIVs procured by the Project shall be borne by DPWH.

4. Considerations to Non-destructive Test Equipment

(1) Type and Quantity of Non-destructive Test Equipment

- DPWH explained that non-destructive test equipment, including concrete rebound hammer, reinforced concrete detective radar and infrared thermal imager, have been procured and provided to two target DPWH regional offices by JICA-TCP I, and that such equipment are well utilized and maintained.

- The Team stated and DPWH agreed that the non-destructive test equipment shall be procured from Japan to meet with special consideration described in the M/D, and that the specifications of such equipment may be similar to the ones procured by JICA-TCP I with considerations to possibilities of further O&M trainings held by JICA-TCP II.

- DPWH explained and the Team agreed that three sets of non-destructive test equipment, one each for the regions in Luzon, Visayas and Mindanao areas, respectively, to be procured by the Project, and that the target regions shall be determined based on analysis of the BMS by DPWH and informed to the Team by the end of June, 2012.

- While three sets of non-destructive test equipment were requested by DPWH, the Team explained and DPWH agreed that detailed specifications and number of non-destructive test equipment to be procured by the Project shall be determined as results of further study and analysis to be conducted in Japan.

(2) Handing Over

- Non-destructive test equipment shall be handed over at the DPWH compound in Manila to be identified by DPWH.

- DPWH and the Team confirmed that DPWH shall be responsible for necessary procedure as well as purchases after handing over, such as for custom duties, custom clearance, internal transportation after handing over.

(3) Operation and Maintenance

- DPWH and the Team confirmed that the O&M training for non-destructive test equipment by the Supplier shall be held in Manila, and that participants of the operation training will be the engineers and mechanics who belong to the regional offices where the equipment are procured by the Project.

- DPWH and the Team confirmed that DPWH shall be responsible for the necessary travel arrangements and per-diems of personnel who will join the O&M training in Manila.

- DPWH and the Team confirmed that all necessary costs in O&M of the non-destructive test equipment procured by the Project shall be borne by DPWH.

5. Considerations to Mobile Drainage Pump

(1) Type and Quantity of Mobile Drainage Pump

- DPWH and the Team agreed that mobile drainage pumps to be procured by the Project shall have drainage capacity of 10 m^3/ min.

- The Team stated and DPWH agreed that the mobile drainage pumps shall be procured from Japan to meet with special consideration described in the M/D.

- DPWH explained and the Team agreed that six mobile drainage pumps, two each for the regions in Luzon, Visayas and Mindanao areas, respectively, shall be procured by the Project, and that the target regions shall be determined based on the flood control analysis by DPWH and informed to the Team by the end of June, 2012.

- The Team explained and DPWH agreed that detailed specifications and number of mobile drainage pumps to be procured by the Project shall be determined as results of further study and analysis to be conducted in Japan.

(2) Handing Over

- Mobile drainage pumps shall be handed over at the DPWH compound in Manila to be identified by DPWH.

- DPWH and the Team confirmed that DPWH shall be responsible for necessary procedure as well as purchases after handing over, such as for custom duties, custom clearance, internal transportation after handing over, vehicle registration at the Land Transportation Office (hereinafter referred to as "LTO"), and obtaining permissions required (e.g. environmental regulations).

(3) Operation and Maintenance

- DPWH and the Team confirmed that the O&M training for mobile drainage pumps by the Supplier shall be held in Manila, and that participants of the O&M training will be the engineers and mechanics who belong to the regional offices where the mobile drainage pumps are procured by the Project.

- DPWH and the Team confirmed that DPWH shall be responsible for the necessary travel arrangements and per-diems of personnel who will join the O&M training in Manila.

- DPWH and the Team confirmed that all necessary costs in O&M of the mobile drainage pumps procured by the Project shall be borne by DPWH.

6. Spare Parts

DPWH requested to provide enough number of spare parts to ensure the sustainable use of the equipment and vehicles. The Team explained and DPWH agreed that the list of spare parts shall be prepared appropriately after further study and analysis conducted in Japan, with considerations to low availability of Japanese products' spare parts in the Philippines as well as the limit of the project budget.

Annex-1 Width of Bridges in Luzon

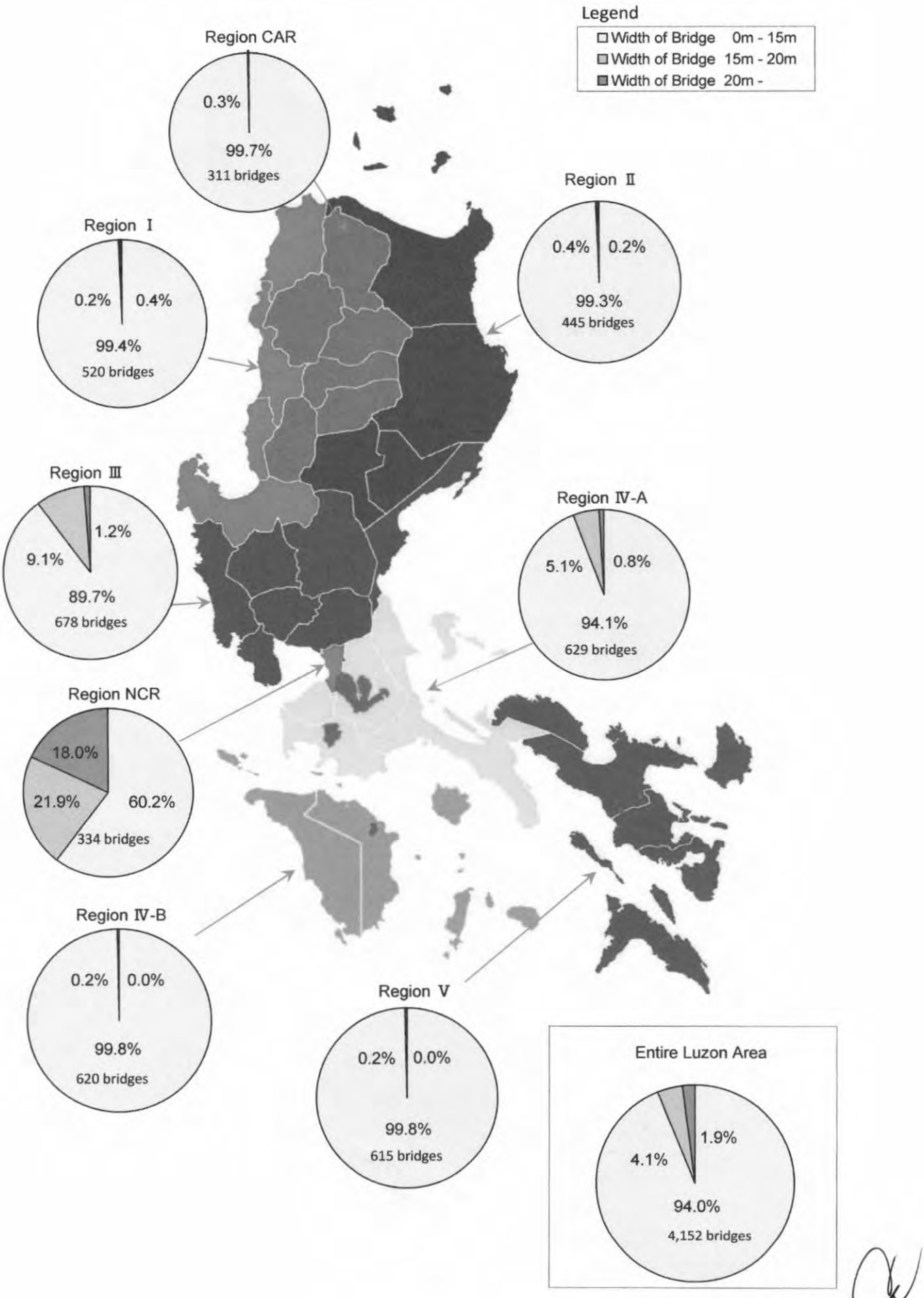
Manila, 18th May, 2012

Maria Catalina E. Cabral, Ph.D.	Tamiko Aramata
Assistant Secretary	Deputy Chief Consultant
Department of Public Works and Highways (DPWH)	Preparatory Survey Team
Republic of the Philippines	Japan International Cooperation Agency
	Japan

Annex-1

Width of Bridges in Luzon

Width of Bridges in Luzon Area



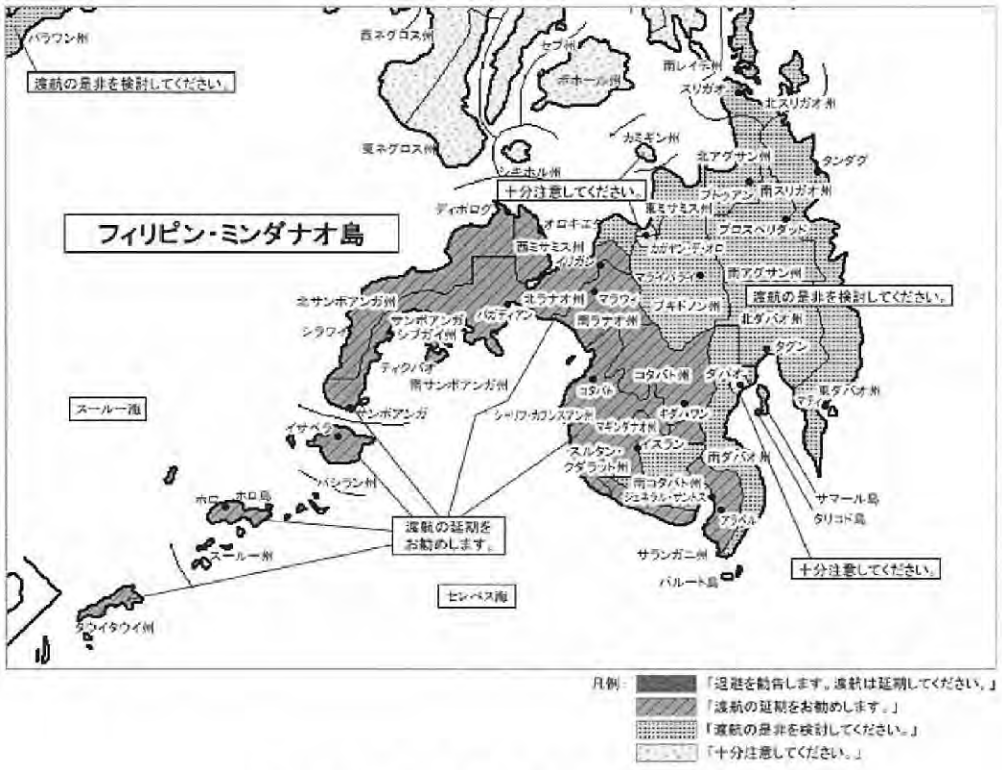
資料 **6-1**

先方負担による据付工事実施予定サイト

先方負担による据付工事実施予定サイト

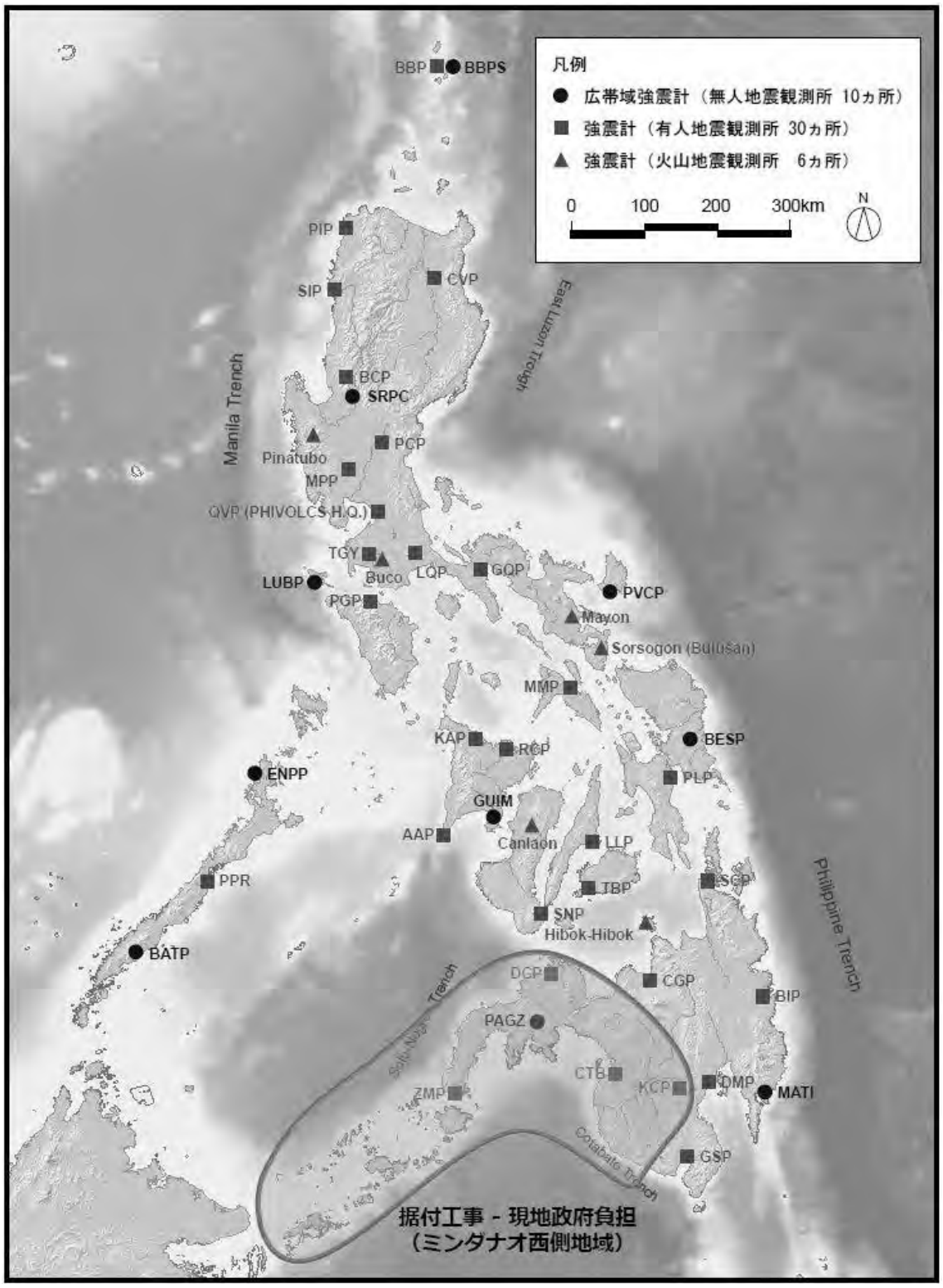
PHIVOLCS の対象サイトのうち、治安状況の悪い地域内のサイトについては、機材調達は日本側にて実施するが PHIVOLCS 本部渡しとし、それ以降の輸送、据付工事、取付・調整は PHIVOLCS の責任にて行う計画とする。

2013 年 2 月現在、外務省の渡航情報（危険情報）において「渡航延期勧告」以上の指定を受けている地域は、図 - 1 に示す通りミンダナオ島西部であり、当該地域内のサイトは、広帯域強震計サイト 1 ヵ所、強震計サイト 4 ヵ所、津波検知器サイト 2 ヵ所である（図 - 2 および図 - 3 参照)。これら 7 サイトは、日本側負担による据付工事の対象外とし、PHIVOLCS により据付工事を実施することを基本とする。ただし、治安状況の変化に伴い、外務省の渡航情報（危険情報）の指定区域に変更があった場合は、必要に応じて、据付工事範囲の見直しを行うこととする。

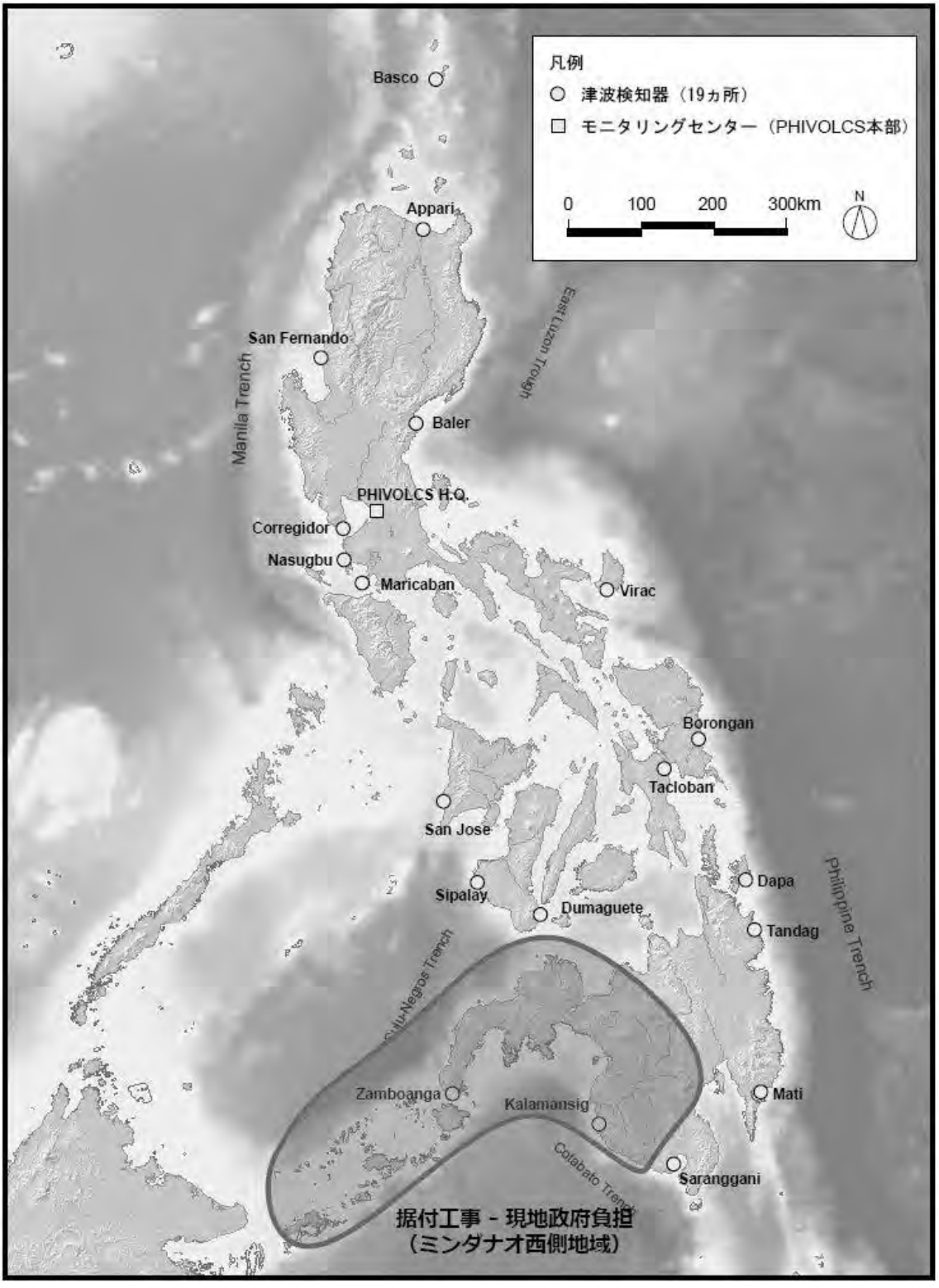


図－1　フィリピンに対する渡航情報（危険情報）の発出

（外務省　海外安全ホームページより）



図－2　据付工事の日本側および「フィ」国側負担区分
（リアルタイム地震観測システム）



図－3　据付工事の日本側および「フィ」国側負担区分
（リアルタイム津波観測システム）

資料 **6-2**

収集資料リスト

収集資料リスト

番号	名 称	形態 印刷・図書・CD等	オリジナル コピー	言語	収集先／発行機関	入手日
PHIVOLCS関連資料						
1	IP-STAR価格表	ソフトデータ	―	英語	Wit	2012/04/18
2	Atlas Version 1.3 User Guide	ソフトデータ	―	英語	Nanometrics	2012/04/19
3	Carina Manual	ソフトデータ	―	英語	Nanometrics	2012/04/19
4	Cygnus Manual	ソフトデータ	―	英語	Nanometrics	2012/04/19
5	InterNaqs Version 1.00 Use Guide	ソフトデータ	―	英語	Nanometrics	2012/04/19
6	Nanometrics UI Version 5.13 User Guide	ソフトデータ	―	英語	Nanometrics	2012/04/19
7	NAQSServer Version 2.1 User Guide	ソフトデータ	―	英語	Nanometrics	2012/04/19
8	Trident Digitiser User Guide	ソフトデータ	―	英語	Nanometrics	2012/04/19
9	TIDE AND CURRENT TABLES PHILIPPINES 2012	図書	オリジナル	英語	NAMRIA	2012/04/20
10	National Structural Code of the Philippines 2010 vol.1 Buildings, Towers and Other Vertical Structure 6th edition	印刷	コピー	英語	Association of Structural Engineers of the Philippines	2012/04/20
11	Proposed Tsunami Wave Detection Sites	ソフトデータ	―	英語	PHIVOLCS	2012/04/23
12	TENDER DOCUMENTS for THE PROJECT FOR IMPROVEMENT of EARTHQUAKE and VOLCANO MONITORING SYSTEM (PHASE II)	印刷	コピー	英語	PHIVOLCS	2012/04/23
13	ABS (Asia Broadcast Satellite) catalog	カタログ	オリジナル	英語	ABS	2012/04/25
14	Taal DATA ACQUISITION SYSTEM	印刷	コピー	英語	PHIVOLCS	2012/04/28
15	FINAL EQUIPMENT LIST (for JICA Phase II)	印刷	コピー	英語	PHIVOLCS	2012/04/28
16	Wit (IP-STAR Satellite Company) catalog	カタログ	オリジナル	英語	Wit	2012/04/30
17	List of Pier Owners	印刷	コピー	英語	PHIVOLCS	2012/05/2
18	Port Management Office – Iloilo Satellite Ports	印刷	オリジナル	英語	Philippine Ports Authority	2012/05/10
19	Port Management Office – Iloilo Port of Iloilo	印刷	オリジナル	英語	Philippine Ports Authority	2012/05/10
20	Port Management Office – Iloilo Terminal Ports	印刷	オリジナル	英語	Philippine Ports Authority	2012/05/10
21	Photos of Seismic Stations	ソフトデータ	オリジナル	―	PHIVOLCS	2012/05/14
DPWH関連資料						
1	Equipment for Emergency Response and Infrastructure Integrity Assessment	ソフトデータ	―	英語	DPWH	2012/04/16
2	Improvement of Quality Management for Highway and Bridge Construction and Maintenance	印刷	コピー	英語	DPWH	2012/04/18
3	ABC Line automatic bridege control	印刷	コピー	英語	Barin	2012/04/27
4	Offer for MOOG MBL bridge inspection unit	印刷	コピー	英語	MOOG	2012/04/27
5	Technical Specifications for bridge inspection vehicle	印刷	コピー	英語	DPWH	2012/04/27
6	Bridge Management System – Bridges in Luzon	ソフトデータ	―	英語	DPWH	2012/05/9
7	MEDIUM-TERM PUBLIC INVESTMENT PROGRAM (2005-2010)	印刷	コピー	英語	DPWH	2012/05/11
8	Project Completion Report On the Improvement of Quality Management for Highway and Bridge Construction and Maintenance	印刷	コピー	英語	DPWH Region XI	2012/05/16