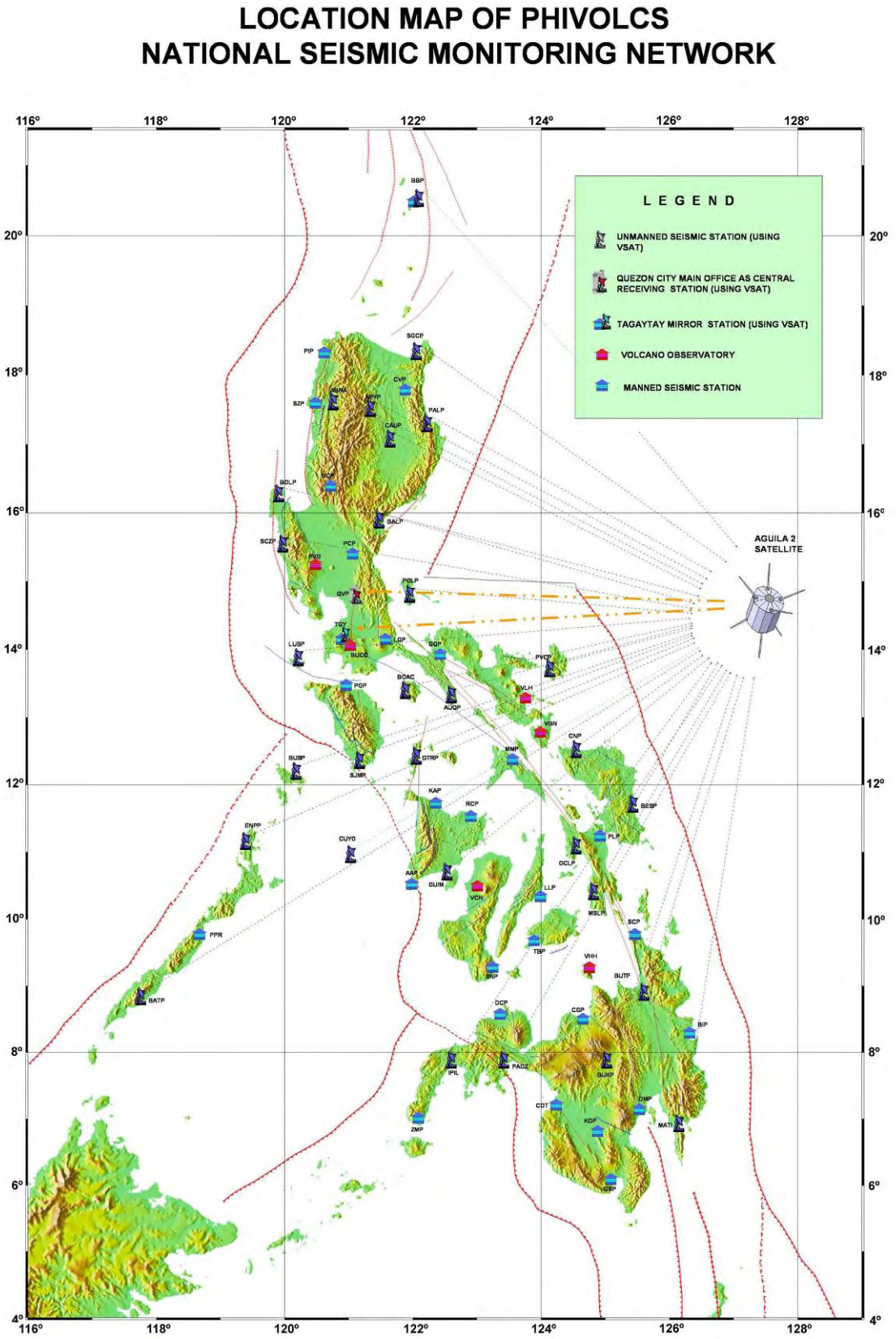
## 付属資料

付属資料 1　PHIVOLCS 火山モニタリング・ネットワーク図
付属資料 2　PHIVOLCS 地震・火山観測所リスト
付属資料 3　PHIVOLCS・海外研究機関との共同研究プロジェクト・リスト
付属資料 4　PHIVOLCS 実施中プロジェクト概要
付属資料 5　災害情報フローチャート
付属資料 6　カウンターパート・リスト
付属資料 7　協議議事録

付属資料 1　PHIVOLCS 火山モニタリング・ネットワーク図



付属資料 2　PHIVOLCS 地震・火山観測所リスト

PHIVOLCS National Monitoring Network

A. Manned Seismic Stations

1. Basco, Batanes *(with satellite communication)*
2. Pasuquin, Ilocos Norte
3. Santa, Ilocos Sur
4. Callao, Penablanca, Cagayan
5. Baguio City
6. Palayan City, Nueva Ecija
7. Tagaytay City
8. Lucban, Quezon
9. Guinayangan, Quezon
10. Puerto Galera, Oriental Mindoro
11. Puerto Princesa City, Palawan
12. Masbate, Masbate
13. Roxas City, Capiz
14. Kalibo, Aklan
15. Anini-y, Antique
16. Lapu-lapu City, Cebu
17. Sibulan, Negros Oriental
18. Tagbilaran City, Bohol
19. Palo, Leyte
20. Dipolog City, Zamboanga del Norte
21. Zamboanga City
22. Cotabato City
23. General Santos City
24. Kidapawan City, North Cotabato
25. Davao City
26. Cagayan de Oro City
27. Surigao City
28. Bislig, Surigao del Sur
29. Quezon City Main Office

B. Remote Seismic Stations with Satellite Communications

1. Santa Clara. Gonzaga, Cagayan
2. Palanan, Isabela
3. Coron, Palawan
4. Brooke’s Point, Palawan
5. Maasin, Southern Leyte
6. Baler, Aurora
7. Santa Cruz, Zambales
8. Boac, Marinduque
9. Borongan, Eastern Samar
10. Ormoc City, Leyte
11. Odiongan, Romblon
12. Virac, Catanduanes
13. Catarman, Northern Samar
14. San Andres, Quezon
15. Looc, Occidental Mindoro

16. Jordan, Guimaras
17. Pagadian City
18. San Jose, Occidental Mindoro
19. El Nido, Palawan
20. Cauayan City, Isabela
21. Conner, Apayao
22. Dolores, Abra
23. Sibugay, Zamboanga del Sur
24. Cuyo Island, Palawan
25. Butuan City
26. Musuan Peak, Bukidnon
27. Mati City
28. Polillo Island, Quezon
29. Bolinao, Pangasinan
30. Basco, Batanes (also listed under manned station)

C. Manned Volcano Observatories

1. Clark Airbase, Pampanga - Pinatubo Volcano
2. Talisay, Batangas - Taal Volcano
3. Legaspi City - Mayon Volcano
4. Irosin, Sorsogon - Bulusan Volcano
5. Canlaon City, Negros Oriental - Kanlaon Volcano
6. Mambajao, Camiguin Island - Hibok-hibok Volcano

付属資料 3　PHIVOLCS・海外研究機関との共同研究プロジェクト・リスト

| Country | Name of Institution | Title | Description | Date of Engagement | |
|---|---|---|---|---|---|
| | | | | Start | End |
| Austria | Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization | Operation and maintenance of a Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) auxiliary seismic station | PHIVOLCS operates and maintains the CTBTO auxiliary seismic station in Tagaytay City according to the technical specifications of the International Monitoring System of CTBTO as well as the provisions of the Comprehensive Nuclear Test Ban Treaty. | 2002 | Continuing |
| Australia | CSCAND, AusAID, Geoscience Australia | Strengthening Natural Hazard Risk Assessment Capacity in the Philippines | This project has 2 components:　a) development of national exposure data and vulnerability modeling for effective disaster management, and b) ash fall simulation modeling using open source system for Southeast Asian volcanoes (study areas: Philippines and Indonesia) | 2009 | 2010 |

| Country | Name of Institution | Title | Description | Date of Engagement | |
|---|---|---|---|---|---|
| | | | | Start | End |
| Australia | CSCAND, UNDP, AusAID | Hazards Mapping and Assessment for Effective Community Disaster Risk Management (READY Project) | The project is expected to undertake the following: (1) conduct multi-hazard identification, specifically through mapping of hydro-meteorological hazards (flood, storm surge, rain-induced landslide) and geological hazards (ground rupture, ground shaking, liquefaction, earthquake-induced landslide and tsunami) and assessment of the risks arising from these hazards; (2) develop early warning systems and intensify information, education and communication activities; and (3) initiate mainstreaming of disaster risk management into local development planning. | 2006 | 2011 |
| France | Bureau de Recherches Geologiques et Minieres and other scientific organizations | Mitigate and assess risk from volcanic impact on terrain and human activities (MIA-VITA Project) | The objective of this project is to develop integrated tools and cost effective methodologies to mitigate risks from various hazards on Kanlaon Volcano (vulnerability and resilience assessment, prevention and crisis management). | 2008 | 2013 |

| Country | Name of Institution | Title | Description | Date of Engagement | |
|---|---|---|---|---|---|
| | | | | Start | End |
| Japan | Kagoshima University | Tephrochronological studies of Luzon volcanoes | This project aims to a) determine and characterize eruption styles of Mayon Volcano through tephrochronology; b) establish the stratigraphy of tephra sequences and correlate them; and c) determine the eruptive ages of tephra sequences. | 2005 | 2009 |
| Japan | Kyoto University | Collaborative project on regional earthquake monitoring using very broadband seismographs | This project aims primarily to record intermediate to deep earthquakes for the study of the internal structure of the earth along the Pacific Region. Very broadband instruments are installed in Guinayangan, Quezon and Palayan City as part of this collaborative project. | | Continuing |
| Japan | Kyoto University | Segmentation and paleoseismology of the Philippine Fault Zone | The goal of this project is to evaluate the seismic potential of the Philippine fault zone based on geological investigations on the past seismic history of the fault zone. | 2003 | Continuing |
| Japan | Tokyo Institute of Technology | Development of Metro Manila Strong Motion Array | Under this collaborative project, digital strong-motion accelerographs are installed in strategically located sites in Metro Manila in order to record strong seismic events from active earthquake generators around the metropolis. | 2002 | Continuing |

| Country | Name of Institution | Title | Description | Date of Engagement | |
|---|---|---|---|---|---|
| | | | | Start | End |
| Japan | Tokyo Institute of Technology | Monitoring of the creeping fault segment of the Valley Fault System | Under this project, deformation surveys are conducted to determine the nature, triggering mechanism(s), and future behavior of the creeping segment of the Valley Fault System. | 1998 | Continuing |
| Japan | University of Tokyo and Japan Agency for Marine-Earth Science and Technology (JAMSTEC) | Ocean hemisphere project | This project involves the operation of very broadband seismograph in the Baguio Mirador Station with real-time access. | | Continuing |
| Japan / France | EMSEV Working Group of International Union for Geophysics and Geodesy, Tokai University and Observatoire de Physique du Globe de Clermont-Ferrand | Understanding of the geotectonics, seismicity and volcanism of the Southern Luzon Region (EMSEV Project) | This project aims to study the tectonically and volcanically active regions in Southern Luzon. Joint geophysical, geochemical and geological surveys/ monitoring are being conducted at Taal Volcano. | 2004 | Continuing |
| Malaysia | Malaysian Meteorological Department | RP-Malaysia Tsunami Buoy Project | This project aims to install a deep pressure gauge in Cagayancillo Island in Palawan in order to monitor and detect tsunami waves generated by earthquakes along Negros and Sulu Trenches. | Under Negotiation | |
| Norway | Norway Geotechnical Institute | Tsunami hazard and risk assessment | Under this project, tsunami hazard and risk assessment will be undertaken in selected areas in the Philippines. | 2008 | 2010 |

| Country | Name of Institution | Title | Description | Date of Engagement | |
|---|---|---|---|---|---|
| | | | | Start | End |
| Spain | Fundacion Canaria ITER | Diffuse $CO_2$ and $H_2S$ emission at Philippine volcanoes | This project is also known as "SpanishAID contribution to strengthen the early warning system of volcanic activity in the Philippines". Under this project, collaborative research on volcanic gas emission from Philippine volcanoes will be conducted. | 2008 | Continuing |
| Taiwan | Academia Sinica | Establishment of broadband stations in Northern Luzon | Five broadband seismographs will be installed in Northern Luzon to understand the seismic activity in Northern Luzon and Southern Taiwan. | Not yet implemented | |
| Taiwan | National Cheng Kung University and The Institute of Earth Science, Academia Sinica | Seismotectonic, geodynamic, seismological and volcanological study of the Philippines and Taiwan Regions | Under this project, studies that will lead to the understanding of the subsurface condition, precursory patterns and behavior of Taal Volcano will be conducted. Gas and ash samples will be repeatedly collected and analyzed while a dense broadband seismic network and a continuous GPS network will be established and operated at Taal Volcano and other parts of Luzon. | 2007 | Continuing |
| Taiwan | The Institute of Earth Science, Academia Sinica | Ground deformation studies along the Philippine Fault using Global Positioning System | The principal objective of this project survey is to evaluate the mechanical behavior and deformational patterns of the Philippine Fault and of other active crustal structures in the region. | 1996 | Continuing |

| Country | Name of Institution | Title | Description | Date of Engagement | |
|---|---|---|---|---|---|
| | | | | Start | End |
| Thailand | Asian Disaster Preparedness Center (ADPC) | Cooperation on early warning arrangement, preparedness and mitigation on natural hazards | Areas of cooperation include a) early warning arrangement, preparedness, and mitigation of natural hazards for assisting participating countries in the Indian Ocean and South East Asia region, and b) establishment of cooperative linkages between ADPC and PHIVOLCS. | 2006 | Continuing |

付属資料 4　PHIVOLCS 実施中プロジェクト概要

| Project Title: | **Seismotectonic, geodynamic, seismological and volcanological study of the　Philippines and Taiwan Regions** |
|---|---|
| Project Duration: | 2007 to 2012 |

Collaboration with National Cheng Kung University and The Institute of Earth Science, Academia Sinica of Taiwan

Objectives:

- To study the plumbing system, position and size of the magma reservoir of Taal volcano.
- To study the relationship of thermal and geochemical parameters, seismicity and ground deformation patterns to the activity of the volcano.
- To study the interactions of local faults in the area and their influence to the activity of the volcano
- To determine precursory signs and patterns　and develop procedures for forecasting the activity of Taal volcano
- Comparative study of observed parameters and results in Taal to that of different volcanic areas in Taiwan

Studies:

- Seismicity study of Taal using a network of broadband stations
- Ground deformation study by continuous GPS Measurements along the Valley Fault System
- Lake temperature　and Geochemical study of lake sediments

| Project Title: | **Monitoring of the creeping fault segment of the Valley Fault System** |
|---|---|
| Project Duration: | 1998 to present |

Collaboration with Tokyo Institute of Technology

Objective:

- To determine the nature, triggering mechanism(s), and future behavior of the creeping segment of the Valley Fault System.

Activities:

- Periodic precise measurement of deformation
- Data retrieval and maintenance operation of the continuous creep recording instrument

| Project Title: | **Ground deformation studies along the Philippine Fault using Global Positioning System** |
|---|---|
| Project Duration: | 1996 to present |

Collaboration with The Institute of Earth Science, Academia Sinica of Taiwan

Objective:

- To evaluate the mechanical behavior and deformational patterns of the Philippine Fault and of other active crustal structures in the region

Activities:

- Establishment of a network of Global Positioning Systems benchmarks in Luzon
- GPS surveys in Luzon since 1996

| Project Title: | **Strengthening Natural Hazard Risk Assessment Capacity in the Philippines** |
|---|---|
| Project Duration: | 2009 to 2011 |

Collaboration with Geoscience Australia

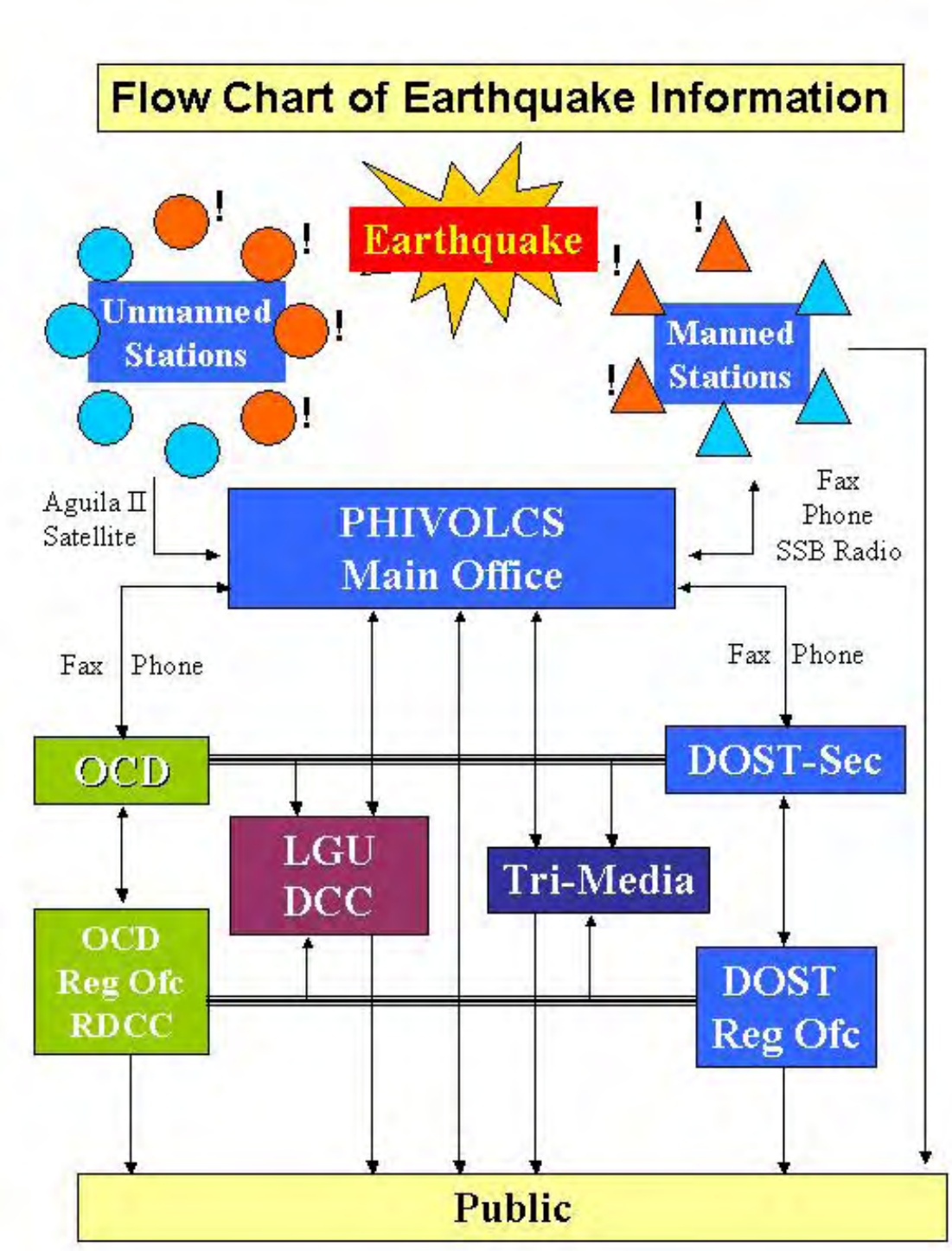
Project Components:

- Development of national exposure data and vulnerability modeling for effective disaster management
- Development of an open-source volcanic ash impact computational model for Asia

Objectives:

- To reduce the natural disaster risk of vulnerable communities in the Philippines
- To increase the capacity of PHIVOLCS to assess the risk and potential impact from earthquakes. This objective will be achieved through the implementation of a pilot project in a selected municipality or city in the Philippines
- To enhance relationships between Geoscience Australia and PHIVOLCS, including in particular to collaboratively enhance the PHIVOLCS Rapid Earthquake Damage Assessment System (REDAS) tool to provide detailed damage and risk estimate for earthquakes

付属資料 5　災害情報フローチャート



付属資料 6　カウンターパート・リスト

**Bartolome C. Bautista**　Deputy Director, PHIVOLCS
**Jaime S. Sincioco**　OIC, Volcano Monitoring and Eruption Prediction Division
**Ishmael C. Narag**　OIC, Seismological Observation and Earthquake Prediction Division
**Perla J. Delos Reyes**　OIC, Geology and Geophysics Research and Development Division
**Ma. Mylene M. Villegas**　Chief, Geologic Disaster Awareness and Preparedness Division
**Ma. Leonila P. Bautista**　Associate Scientist
**Teresito C. Bacolcol**　Associate Scientist
**Jeffrey S. Perez**　Science Research Specialist I
**Mabelline T. Cahulogan**　Science Research Specialist I
**Babyjane T. Punongbayan**　Supervising Science Research Specialist
**Arnaldo A. Melosantos**　Senior Science Research Specialist
**Melquiades S. Figueroa II**　Science Research Specialist
**Angelito G. Lanuza**　Senior Science Research Specialist
**Melchor P. Lasala**　Science Research Specialist I
**Julio P. Sabit**　Supervising Science Research Specialist
**Eduardo P. Laguerta**　Senior Science Research Specialist
**Rudy A.Lacson, Jr.**　Science Research Specialist II
**Paul Karson B. Alanis**　Science Research Specialist I

付属資料 7　協議議事録

# MINUTES OF MEETING
# BETWEEN JAPANESE DETAILED PLANNING SURVEY TEAM AND AUTHORITIES CONCERNED OF THE GOVERNMENT OF THE REPUBLIC OF THE PHILIPPINES ON JAPANESE TECHNICAL COOPERATION FOR ENHANCEMENT OF EARTHQUAKE AND VOLCANO MONITORING AND EFFECTIVE UTILIZATION OF DISASTER MITIGATION INFORMATION IN THE PHILIPPINES

In response to the request of the Government of Republic of the Philippines (hereinafter referred to as "GOP"), the Japanese Detailed Planning Survey Team (hereinafter referred to as "the Team") organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Kazuo Sudo, visited the Republic of The Philippines from September 2 to 17, 2009 for the purpose of clarifying the framework of the technical cooperation for Enhancement of Earthquake and Volcano Monitoring and Effective Utilization of Disaster Mitigation Information in the Philippines(hereinafter referred to as "the Project") in the Republic of the Philippines.

During its stay in the Republic of The Philippines, the Team exchanged views and opinions and had a series of discussions with the Philippine authorities concerned with respect to desirable measures to be taken by JICA and GOP for the successful implementation of the Project.

As a result of the discussions, the Team and the Philippine authorities concerned agreed on the matters referred to in the document attached hereto.

September 17, 2009
Quezon City, Philippines

Mr. Kazuo Sudo

Senior Adviser
Japan International Cooperation Agency

Dr. Graciano P. Yumul, Jr.

Undersecretary
Department of Science and Technology
Republic of the Philippines

Dr. Renato U. Solidum, Jr

Director
Philippine Institute of Volcanology and Seismology, Department of Science and Technology

## I. BACKGROUD OF THE PROJECT

The Philippines is prone to a wide range of natural hazards that threaten lives, properties and food supplies, and whose effects are particularly adverse on the marginalized sectors of the society.

GOP thus continues to provide timely information, monitoring and prediction services on volcanic eruptions, earthquakes, tsunami and related natural phenomena. It also conducts activities such as hazard identification and mapping and vulnerability and risk assessment in hazards related to volcanic and earthquake events associated with active volcanoes and faults of the country. The potential disastrous events that can be expected from the source active volcanoes and faults will continue to be studied.

Philippine Institute of Volcanology and Seismology - Department of Science and Technology (PHIVOLCS-DOST) currently maintains a nationwide network of seismic and volcano monitoring stations. To be able to respond more quickly and effectively to emergency situations, GOP, PHIVOLCS requested to GOJ to upgrade its prediction capabilities, warning systems and quick response mechanism.

## II. SUMMARY OF THE PROJECT

The Project will install real-time networks of broadband seismometers, strong motion accelerometers, and seismic intensity meters to automatically estimate ground shaking and damage when an earthquake occurs in the Philippines. It will also measure crustal deformations and conduct geomorphological and geological surveys to evaluate the potential of large earthquakes. An integrated real-time volcano monitoring system will be installed at Taal and Mayon volcanoes. The Project aims to provide the earthquake and volcano disaster information through an Internet portal site and promote its utilization to contribute to disaster preparedness and emergency responses of the national and local governments and communities of the Philippines.

## III. THE FRAMEWORK OF THE PROJECT

The Project will be carried out under the normal procedure of technical cooperation between the two governments. During the meeting, the Team and the Philippine authorities discussed and confirmed the framework of the Project as follows;

### 1. Title of the Project

It was agreed that the title of the Project will be changed from "Enhancement of Monitoring Capabilities and Source Process Studies of Earthquakes and Volcanoes in the Philippines" to "Enhancement of Earthquake and Volcano Monitoring and Effective Utilization of Disaster Mitigation Information in the Philippines".

### 2. Project Implementing Agency

Philippine Institute of Volcanology and Seismology - Department of Science and Technology (PHIVOLCS - DOST)

### 3. Target Area

The Philippines

### 4. Target group

PHIVOLCS

### 5. Cooperation Period of the Project

Five (5) years.

### 6. The Master Plan of the Project

**Overall goal**

Capabilities of disaster management authorities and related organizations which respond to earthquake and volcanic disasters are enhanced.

**Project purpose**

Earthquake and volcano monitoring capabilities of PHIVOLCS are enhanced and improved disaster mitigation information is utilized by the disaster management authorities and related

organizations.

**Outputs**

1. Improved earthquake information is obtained in real time.
2. Accuracy of evaluation of earthquake generation potential is improved.
3. Integrated volcano monitoring information is obtained in real time.
4. Improved disaster mitigation information is provided through a portal site.

**Activities**

(Activities for Output 1)

1-1-1 To install broadband and strong-motion seismometers and to establish the network.
1-1-2 To install and operate advanced and rapid earthquake source analysis system.

1-2-1 To install real-time intensity meters and to carry out a pilot observation in Manila.
1-2-2 To conduct a nationwide pilot observation based on the result of 1-2-1.

(Activities for Output 2)

2-1-1 To carry out GPS campaign observation.
2-1-2 To carry out GPS continuous observation.

2-2-1 To conduct geomorphological and geological surveys of inland earthquakes.
2-2-2 To conduct geomorphological and geological surveys of subduction earthquakes.

(Activities for Output 3)

3-1-1 To install broadband seismometers and infrasonic sensors at Taal and Mayon volcanoes.
3-1-2 To install and operate real-time transmission and analysis system of seismic and infrasonic data.

3-2-1 To install GPS receivers at Taal and Mayon volcanoes.
3-2-2 To install and operate real-time transmission and analysis system of GPS data.

3-3-1 To install magneto-telluric meter and total intensity magnetometers at Taal volcano.
3-3-2 To install and operate real-time transmission and analysis system of magneto-telluric and total intensity magnetic data.

(Activities for Output 4)

4-1-1 To construct a portal site of earthquake and volcano disaster mitigation information.
4-1-2 To enhance REDAS to utilize the results from the activities for Output 1 and Output 2.
4-1-3 To develop a simple diagnostic tool for earthquake resistance of houses.
4-1-4 To provide earthquake and volcano information obtained by the project through the portal site.
4-2 To conduct seminars and trainings on utilizations of the portal site.

## IV. RECORD OF DISCUSSIONS

The draft of the Record of Discussions (hereinafter referred to as "R/D") shown in ANNEX A, which stipulates the framework of the Project, will be finalized and signed by the representatives of the GOP and JICA Philippines Office after notification of approval for implementation of the Project by JICA Headquarters.

## V. TENTATIVE PLAN OF OPERATION

The tentative Plan of Operation (hereinafter referred to as "PO") for the whole project period is shown in ANNEX B. The activities of the Project are subject to change within the scope of the R/D with mutual consultation when necessity arises in the course of implementation of the Project.

## VI. MEASURES TO BE TAKEN BY THE PHILIPPINES SIDE

Both sides agreed following things;

-The Philippine side provides office space in the PHIVOLCS central office and its electricity,

water supply, Internet, telephone line, furniture and the like.

-The Philippine side secures the budget for expenses necessary for the transportation within the Republic of the Philippines of the equipment as well as for the installation, operation and maintenance thereof.

-The Philippine side bears customs duties, internal taxes and any other charges, imposed in the Republic of the Philippines on the equipment.

-The Philippine side bears running expenses necessary for the implementation of the Project.

## VII. SCIENCE AND TECHNOLOGY RESEARCH PARTNERSHIP FOR SUSTAINABLE DEVELOPMENT

Both sides confirmed that the Project will be implemented under the 'Science and Technology Research Partnership for Sustainable Development*' promoted by JICA and Japan Science and Technology Agency (JST) in collaboration.

JICA will take necessary measures for the technical cooperation such as dispatch of Japanese experts, provision of equipment and training of personnel, and other supports related to the Project in the Philippines. JST will support the Japanese research institute/researchers for the project activities in Japan.

*'Science and Technology Research Partnership for Sustainable Development' aims to develop new technology and its applications for tackling global issues, and also aims at capacity development of researchers and research institutes in both countries.

## VIII. AGREEMENT BETWEEN JAPANESE AND PHILIPPINE INSTITUTES

Both sides agreed that the research institutes in Japan and the Philippines should reach an agreement to execute the collaborative research in accordance with the Master Plan of the Project. The agreed document should contain the following items;

a. Objective and Plan
b. Implementation
c. Confidentiality and Intellectual Property Rights
d. Publication
e. Dispute Resolution
f. Duration of the Agreement
g. Compliance with Laws and Regulations

*The items described on the document are subject to change according to the contents of the research.

ANNEX A DRAFT RECORD OF DISCUSSIONS
ANNEX B TENTATIVE PLAN OF OPERATION
ANNEX C ATTENDANCE LIST

ANNEX A

# (DRAFT)
# RECORD OF DISCUSSIONS
# BETWEEN
# JAPAN INTERNATIONAL COOPERATION AGENCY
# AND
# AUTHORITIES CONCERNED OF THE GOVERNMENT OF THE REPUBLIC OF THE PHILIPPINES
# ON
# JAPANESE TECHNICAL COOPERATION PROJECT
# ON
# ENHANCEMENT OF EARTHQUAKE AND VOLCANO MONITORING AND EFFECTIVE UTILIZATION OF DISASTER MITIGATION INFORMATION IN THE PHILIPPINES

In response to the request of the Government of the Republic of the Philippines, the Government of Japan has decided to conduct the technical cooperation project on Enhancement of Earthquake and Volcano Monitoring and Effective Utilization of Disaster Mitigation Information in the Philippines (hereinafter referred to as "the Project").

The Japanese International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation scheme of the Government of Japan, will cooperate with the authorities concerned of the Government of the Republic of the Philippines for the Project.

JICA and the Philippine authorities concerned had a series of discussions on the framework of the Project. As a result of the discussions, JICA and the Philippine authorities concerned agreed on the matters referred to in the documents attached hereto.

MM DD , YYYY
PLACE, Philippines

Mr. Norio Matsuda
Chief Representative
JICA Philippines Office
Japan International Cooperation Agency

Dr. Graciano P. Yumul, Jr.
Undersecretary
Department of Science and Technology
Republic of the Philippines

Dr. Renato U. Solidum, Jr.
Director
Philippine Institute of Volcanology and Seismology - Department of Science and Technology

## ATTACHED DOCUMENT

## I. COOPERATION BETWEEN JICA AND THE GOVERNMENT OF THE REPUBLIC OF THE PHILIPPINES

1. The Government of the Republic of the Philippines will implement the Project in cooperation with JICA.
2. The Project will be implemented in accordance with the Master Plan shown in Annex I.

## II. MEASURES TO BE TAKEN BY JICA

In accordance with the laws and regulations in force in Japan, JICA will take, at its own expense, the following measures according to the normal procedures under the Colombo Plan Technical Cooperation Scheme.

1. Dispatch of Japanese Experts
   JICA will provide the services of the Japanese experts as listed in Annex II.

2. Provision of machinery and equipment
   JICA will provide equipment and other materials as showed in Annex V (hereinafter referred to as "the Equipment") necessary for the implementation of the Project. The Equipment will become the property of the Government of the Republic of the Philippines upon being delivered C.I.F.(cost, insurance and freight) to the Philippine authorities concerned at the ports and/or airports of disembarkation.

3. Training of Philippine personnel in Japan
   JICA will receive the Philippine personnel connected with the Project for technical training in Japan.

## III. MEASURES TO BE TAKEN BY THE GOVERNMENT OF THE REPUBLIC OF THE PHILIPPINES

1. The Government of the Republic of the Philippines will take necessary measures to ensure that the self-reliant operation of the Project will be sustained during and after the period of Japanese technical cooperation through full and active involvement in the Project by all related authorities, beneficiary groups and institutions.

2. The Government of the Republic of the Philippines will ensure that the technologies and knowledge acquired by the Philippine nationals as a result of Japanese technical cooperation will contribute to the economic and social development of the Republic of the Philippines.

3. The Government of the Republic of the Philippines will grant privileges, exemptions and benefits to the Japanese experts mentioned in Annex II and their families, which are no less favorable than those accorded to experts of third countries working in the Republic of the Philippines under the Colombo Plan Technical Cooperation Scheme, and as provided under applicable laws, regulations, or policies of the Republic of the Philippines.

4. The Government of the Republic of the Philippines will ensure that the Equipment will be utilized effectively for the implementation of the Project in consultation with the Japanese experts referred to in Annex II.

5. The Government of the Republic of the Philippines will take necessary measures to ensure that the knowledge and experience acquired by Philippine personnel from technical training in Japan will be utilized effectively in the implementation of the Project.

6. In accordance with the laws and regulations in force in the Republic of the Philippines, the Government of the Republic of the Philippines will take necessary measures to provide at its own expense:
   (1) Assignment of the Philippines counterpart personnel and administrative personnel as listed in the Annex III;
   (2) Office and its electricity, water supply, internet, telephone and other office facilities ; and
   (3) Supply or replacement of machinery, equipment , instruments, vehicles, tools, spare parts, and any other materials necessary for the implementation of the Project except for the Equipment provided by JICA.

7. In accordance with the laws and regulations in force in the Republic of the Philippines, the Government of the Republic of the Philippines will take necessary measures to meet:
   (1) Expenses necessary for the transportation within the Republic of the Philippines of the Equipment as well as for the installation, operation and maintenance thereof;
   (2) Customs duties, internal taxes and any other charges, imposed in the Republic of the Philippines on the Equipment; and
   (3) Running expenses necessary for the implementation of the Project.

## IV. ADMINISTRATION OF THE PROJECT

1. Undersecretary of Department of Science and Technology, as the Project Director, will bear overall responsibility for the administration and implementation of the Project.

2. Director Philippine Institute of Volcanology and Seismology, Department of Science and Technology, as the Project Manager, will be responsible for the managerial and technical matters of the Project.

3. The Leader of the Japanese expert team will provide necessary recommendations and advice to the Director and Manager of the Project on any matters pertaining to the implementation of the Project.

4. The Japanese experts will provide necessary technical guidance and advice to the Philippine counterpart personnel on technical matters pertaining to the implementation of the Project.

5. Counterpart personnel and Japanese experts will hold monthly meeting for smooth implementation of the Project. The results of the meeting will be reported to the Director of the Project.

6. For the effective and successful implementation of the Project, a Joint Coordinating Committee (hereinafter referred to as "JCC") will be established whose functions and composition are described in Annex IV. The overall policy decision, coordination and progress monitoring of the Project will be conducted through the JCC jointly by JICA and the Philippine authorities concerned.

## V. JOINT EVALUATION

Evaluation of the Project will be conducted jointly by JICA and the Philippine authorities concerned at the middle and during the last six months of the cooperation term in order to evaluate the level of achievement and monitor the progress of the Project.

## VI. CLAIMS AGAINST JAPANESE EXPERTS

The Government of the Republic of the Philippines, through its implementing agency, shall bear claims, if any arises, against the Japanese experts engaged in the technical cooperation for the Project, resulting from or occurring in the course of the performance of their duties, except when, after consultation between that implementing agency and JICA, it is established that such claims arise from the willful misconduct or gross negligence of the Japanese experts.

## VII. MUTUAL CONSULTATION

There will be mutual consultation between JICA and the Government of the Republic of the Philippines on any major issues arising from, or in connection with this Attached Document.

## VIII. MEASURES TO PROMOTE UNDERSTANDING OF AND SUPPORT FOR THE TECHNICAL COOPERATION

For the purpose of promoting support for the Project among the people of the Philippines, the Government of the Republic of the Philippines will take appropriate measures to make the Technical Cooperation widely known to the people of the Philippines.

## IX. TERM OF COOPERATION

The duration of the Project under this Attached Document will be five (5) years from the date when the first Japanese expert is dispatched.

### List of Annex

| | |
|---|---|
| Annex I. | Master Plan |
| Annex II. | List of Japanese Experts |
| Annex III. | List of Philippine Counterpart and Administrative Personnel |
| Annex IV. | Joint Coordinating Committee |
| Annex V. | List of Equipment |

## Annex I. Master Plan

**Overall goal**

Capabilities of disaster management authorities and related organizations which respond to earthquake and volcanic disasters are enhanced

**Project purpose**

Earthquake and volcano monitoring capabilities of PHIVOLCS are enhanced and improved disaster mitigation information is utilized by the disaster management authorities and related organizations.

**Outputs**

1. Improved earthquake information is obtained in real time.
2. Accuracy of evaluation of earthquake generation potential is improved.
3. Integrated volcano monitoring information is obtained in real time.
4. Improved disaster mitigation information is provided through a portal site.

**Activities**

(Activities for Output 1)

1-1-1 To install broadband and strong-motion seismometers and to establish the network.

1-1-2 To install and operate advanced and rapid earthquake source analysis system.

1-2-1 To install real-time intensity meters and to carry out a pilot observation in Manila.

1-2-2 To conduct a nationwide pilot observation based on the result of 1-2-1.

(Activities for Output 2)

2-1-1 To carry out GPS campaign observation.

2-1-2 To carry out GPS continuous observation.

2-2-1 To conduct geomorphological and geological surveys of inland earthquakes.

2-2-2 To conduct geomorphological and geological surveys of subduction earthquakes.

(Activities for Output 3)

3-1-1 To install broadband seismometers and infrasonic sensors at Taal and Mayon volcanoes.

3-1-2 To install and operate real-time transmission and analysis system of seismic and infrasonic data.

3-2-1 To install GPS receivers at Taal and Mayon volcanoes.

3-2-2 To install and operate real-time transmission and analysis system of GPS data.

3-3-1 To install magneto-telluric meter and total intensity magnetometers at Taal volcano.

3-3-2 To install and operate real-time transmission and analysis system of magneto-telluric and total intensity magnetic data.

(Activities for Output 4)

4-1-1 To construct a portal site of earthquake and volcano disaster mitigation information.

4-1-2 To enhance REDAS to utilize the results from the activities for Output 1 and Output 2.

4-1-3 To develop a simple diagnostic tool for earthquake resistance of houses.

4-1-4 To provide earthquake and volcano information obtained by the project through the portal site.

4-2 To conduct seminars and trainings on utilizations of the portal site.

*Note: In case the Master Plan needs to be modified, both sides will agree on and confirm such modifications in minutes of meetings.*

**Annex II. List of Japanese Experts**

- Project Leader
- Project Coordinator
- Expert(s) for Research advanced earthquake source determination system
- Expert(s) for Rapid earthquake intensity notification system
- Expert(s) for GPS observation of crustal movements
- Expert(s) for Geomorphological and geological survey of historical earthquakes
- Expert(s) for Broadband seismic and infrasonic observations at Taal and Mayon volcanoes
- Expert(s) for GPS measurements at Taal and Mayon volcanoes
- Expert(s) for Electromagnetic measurements at Taal volcano
- Expert(s) for Development and operation of disaster mitigation information portal site
- Expert(s) for Seminar and training for promotion of utilization of the portal site

*Notes: Field, number and term of assignment of experts will be decided through mutual consultation at the beginning of each Japanese fiscal year.*

**Annex III. List of Philippine Counterparts and Administrative Personnel**

1. Project Director

   **Dr. Graciano P. Yumul, Jr.**
   Undersecretary, Department of Science and Technology

2. Project Manager

   **Dr. Renato U. Solidum, Jr.**
   Director, Philippine Institute of Volcanology and Seismology (PHIVOLCS)

3. Counterpart Staff

| No. | Project Position | Organization | Related Output |
|---|---|---|---|
| 1 | Counterpart | **Bartolome C. Bautista**<br>Deputy Director, PHIVOLCS | 1,2,3,4 |
| 2 | Counterpart | **Jaime S. Sincioco**<br>OIC, Volcano Monitoring and Eruption Prediction Division | 3 |
| 3 | Counterpart | **Ishmael C. Narag**<br>OIC, Seismological Observation and Earthquake Prediction Division | 1,2,4 |
| 4 | Counterpart | **Perla J. Delos Reyes**<br>OIC, Geology and Geophysics Research and Development Division | 2 |
| 5 | Counterpart | **Ma. Mylene M. Villegas**<br>Chief, Geologic Disaster Awareness and Preparedness Division | 4 |
| 6 | Counterpart | **Ma. Leonila P. Bautista**<br>Associate Scientist | 4 |
| 7 | Counterpart | **Teresito C. Bacolcol**<br>Associate Scientist | 2 |
| 8 | Counterpart | **Jeffrey S. Perez**<br>Science Research Specialist I | 2 |

| No. | Project Position | Organization | Related Output |
|---|---|---|---|
| 9 | Counterpart | **Mabelline T. Cahulogan**<br>Science Research Specialist I | 2 |
| 10 | Counterpart | **Babyjane T. Punongbayan**<br>Supervising Science Research Specialist | 1 |
| 11 | Counterpart | **Arnaldo A. Melosantos**<br>Senior Science Research Specialist | 1 |
| 12 | Counterpart | **Angelito G. Lanuza**<br>Senior Science Research Specialist | 4 |
| 13 | Counterpart | **Melchor P. Lasala**<br>Science Research Specialist I | 1 |
| 14 | Counterpart | **Julio P. Sabit**<br>Supervising Science Research Specialist | 3 |
| 15 | Counterpart | **Rudy A.Lacson, Jr.**<br>Science Research Specialist II | 3 |
| 16 | Counterpart | **Melquiades S. Figueroa II**<br>Science Research Specialist | 1,2,4 |

4. Assistants / Supporting Staff
   a. Delfin C. Garcia - Planning Officer IV and OIC, Finance and Administrative Division
   b. Ester B. Garrido - Science Research Specialist II
   c. Charmaine Q. Villanueva - Science Research Assistant

*Notes: The Philippine side will identify each counterpart personnel by the commencement of the Project.*

## Annex IV. Joint Coordinating Committee

1. Function

   For the effective and successful implementation for the Project, the Joint Coordination Committee will be established in order to make decisions relevant to the Project. The Joint Coordination Committee will meet when necessary and at least twice a year in order to fulfill the following functions:

   (1) To supervise the annual work plan of the Project;
   (2) To review the annual and overall progress of the Project and to evaluate the accomplishment of the annual targets and achievement of the objectives;
   (3) To find out proper ways and means of solution of the major issues arising from in connection with the Project;
   (4) To evaluate the master plan during the course of the Project and suggest revision, if necessary; and
   (5) Any other related issues.

2. Committee members

   The committee will be composed of the chairperson and the members. The rules and guidelines for the management of the committee will be determined at the initial stage of the Project. The agreed composition is as follows:

   (1) Chairperson:
   - Undersecretary, Department of Science and Technology (DOST)

   (2) Members on Philippine side:
   - Director, PHIVOLCS-DOST
   - PHIVOLCS's counterparts
   - Representative(s) of Office of Civil Defense (OCD)
   - Researcher (s) of Philippine Council for Industry and Energy Research and Development

   (3) Members on Japanese side:
   - Project Leader
   - Other Japanese experts
   - Representative(s) of JICA Philippines Office
   - Member(s) of missions dispatched by JICA
   - Official(s) of the Embassy of Japan may attend the Committee meetings as observer(s).
   - Other officials of appointed by the Project Leader may attend the committee meetings as observer(s).

## Annex V. List of Equipment

- GPS receivers
- Broadband seismometers
- Strong motion seismometers
- Intensity meters
- Infrasonic sensors
- Data loggers
- Total magnetometers
- Magneto telluric meters
- Personal computer (PC) s
- PC clusters
- Data processing system
- Satellite transceivers

ANNEX B TENTATIVE PLAN OF OPERATION

| Activities | FY 2009 | FY2010 | FY2011 | FY2012 | FY2013 | FY 2014 |
|---|---|---|---|---|---|---|
| Output1. Improved earthquake information is obtained in real time | | | | | | |
| 1-1-1 To install broadband and strong-motion seismometers and to construct their network. | | | | | | |
| 1-1-2 To install and operate advanced and rapid earthquake source analysis system | | | | | | |
| 1-2-1 To install real-time intensity meters and to carry out a pilot observation in Manila | | | | | | |
| 1-2-2 To conduct a nationwide pilot observation based on the result of 1-2-1 | | | | | | |
| Output2. Accuracy of evaluation of earthquake generation potential is improved | | | | | | |
| 2-1-1 To carry out GPS campaign observation s | | | | | | |
| 2-1-3 To carry out GPS continuous observation | | | | | | |
| 2-2-1 To conduct geomorphological and geological surveys of inland earthquake | | | | | | |
| 2-2-2 To conduct geomorphological and geological surveys of subduction earthquakes | | | | | | |
| Output3. Integrated volcano monitoring information is obtained in real time | | | | | | |
| 3-1-1. To install broadband seismometers and infrasonic sensors at Taal and Mayon volcanoes | | | | | | |
| 3-1-2. To install and operate real-time transmission and analysis system of seismic and infrasonic data | | | | | | |
| 3-2-1. To install GPS receivers at Taal and Mayon volcanoes | | | | | | |
| 3-2-2. To install and operate real-time transmission and analysis system of GPS data | | | | | | |
| 3-3-1. To install magneto-telluric meter and total intensity magnetometers at Taal volcano | | | | | | |
| 3-3-2. To install and operate real-time transmission and analysis system of magneto-telluric and total intensity magnetic data | | | | | | |
| Output4. Improved disaster prevention information is provided through a portal site. | | | | | | |
| 4-1-1 To construct a portal site of earthquake and volcano disaster mitigation information | | | | | | |
| 4-1-2. To enhance REDAS to utilize the results from the activities for Output 1 and Output 2 | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4-1-3. To develop a simple diagnostic tool for earthquake resistance of houses | | ← | — | — | — | → |
| 4-1-4. To provide earthquake and volcano information obtained by the project through the portal site | | | | ← | — | → |
| 4-2. To conduct seminars and trainings on utilizations of the portal site | | | | ← | — | → |

ANNEX C ATTENDANCE LIST

**Philippine side:**

【Department of Science and Technology】

Dr. Graciano P. Yumul, Jr.
Undersecretary

【Philippine Institute of Volcanology and Seismology, Department of Science and Technology】

Dr. Renato U. Solidum, Jr,
Director

Dr. Bartolome C. Bautista
Deputy Director

Dr. Teresito C. Bacolcol
Assistant Scientist

Mr. Delfin C. Garcia
Planning Officer IV and Officer in Charge (OIC), Finance and Administrative Division

Mr. Jaime Sincioco
OIC Volcano Monitoring and Eruption Prediction Division

Ms. Perla delos Reyes
OIC Geology and Geophysical Research and Development Division

Mr. Arnold Melosantos
Senior Science Research Specialist

Mr. Ishmael Narag
OIC, Seimological Observation and Earthquake Prediction Division

Mr. Melquiades Figueroa
Science Research Specialist I

Ms. Ester Garido
Science Research Specialist II

Ms. Richell de Mesa
Administrative Aide IV

Mr. Ruben Lamela
Science Research Assistant

**Japanese side:**

Mr. Kazuo Sudo
Team Leader, Detailed Planning Survey Team, JICA

Dr. Hiroshi Inoue
Detailed Planning Survey Team, JICA

Mr. Chiaki Kobayashi
Detailed Planning Survey Team, JICA

Mr. Sugio Imamura
Detailed Planning Survey Team, JICA

Ms. Miho Sakuma
Detailed Planning Survey Team, JICA

Ms. Yoko Nomura
JICA Philippines Office

Ms. Minerva M. Dacanay
JICA Philippines Office

Dr. Yoshimori Honkura
Professor, Tokyo Institute of Technology

Dr. Koichi Tsukioka
Senior Staff, Japan Science and Technology Agency

Dr. Horoyuki Kumagai
Researcher, National Research Institute for Earth Science and Disaster Prevention

Dr. Chikahiro Minowa
Researcher, National Research Institute for Earth Science and Disaster Prevention

LOGICAL FRAMEWORK (Ver.0)

Project Title : Enhancement of Earthquake and Volcano Monitoring and Effective Utilization of Disaster Mitigation Information in the Philippines
Implementing Agency : Philippine Institute of Volcanology and Seismology
Duration: February 2010～ February 2015 (5 years)
Created on 15 September 2009

| Narrative Summary | Objective Verifiable Indicators | Means of Verification | Important Assumption |
|---|---|---|---|
| (Overall Goal)<br>Capabilities of disaster management authorities and related organizations which respond to earthquake and volcanic disasters are enhanced. | Disaster management authorities adequately respond to earthquake and volcanic disasters based on the information from PHIVOLCS. | Official documents and records of action taken by the authorities. | |
| (Project Purpose)<br>Earthquake and volcano monitoring capabilities of PHIVOLCS are enhanced and improved disaster mitigation information is utilized by the disaster management authorities and related organizations. | Quality of the bulletin sent by PHIVOLCS to the Office of Civil Defence is improved. | Bulletin | Necessary budget and manpower for PHIVOLCS, disaster management authorities, and related organizations are properly allocated. |
| | Status of utilization of the portal site by the disaster management autorities and related organizations. | Results of questionnaires and interviews | |
| | Number of access to the portal site | Portal site | |
| (Output) | | | Major natural disasters do not hinder the project activities. |
| 1. Improved earthquake information is obtained in real time. | 1-1. Improved earthquake information is determined within 15 minutes after moderate to large earthquake occurrence. | Indicators 1-1～4-4<br>Project reports, reports published by PHIVOLCS, original papers published by the project members, and portal site | |
| | 1-2. Earthquake intensity distribution can be mapped in real time. | | |
| 2. Accuracy of evaluation of earthquake generation potential is improved. | 2-1. Earthquake generation potential is evaluated through proper processes. | | Installed equipment is not stolen and/or seriously damaged intentionally or naturally. |
| | 2-2. Historical activities of inland and subduction earthquakes are clarified. | | |
| 3. Integrated volcano monitoring information is obtained in real time. | 3-1. Seismic, infrasonic, GPS, electro-magnetic, and other data can be obrained in the central office of PHIVOLCS in real time. | | Necessary budget and counterpart personnel for PHIVOLCS are properly allocated. |
| | 3-2. Source parameters of volcanic earthquakes and tremor are automatically determined. | | |
| | 3-3. Volcanic deformation can be monitored in real time. | | |
| | 3-4. Electro-magnetic anomaly can be monitored in real time. | | |
| 4. Improved disaster mitigation information is provided through a portal site. | 4-1. The results of REDAS are automatically provided through the portal site. | | |
| | 4-2. A simple diagnostic tool for earthquake resistance of houses is provided through the portal site. | | |
| | 4-3. The latest earthquake and volcano information is continuously updated and provided through the portal site. | | |
| | 4-4. The archive of the earthquake and volcano information is accessible through the portal site. | | |
| | 4-5. Seminars and trainings are conducted, and participants better understand the contents of the portal site. | Indicator 4-5<br>Results of questionnaires and interviews | |

| (Activities) | (Input) | |
|---|---|---|
| (Activities for Output 1) | Input from Japan | |
| 1-1-1 To install broadband and strong-motion seismometers and to establish the network. | ・Dispatch of long-term experts, | Major natural disasters do not hinder the project activities. |
| 1-1-2 To install and operate advanced and rapid earthquake source analysis system. | ・Dispatch of short-term experts, | |
| 1-2-1 To install real-time intensity meters and to carry out a pilot observation in Manila. | ・Provision of equipment, and<br>・Training of the counterpart personnel in Japan. | Installed equipment is not stolen and/or seriously damaged intentionally or naturally. |
| 1-2-2 To conduct a nationwide pilot observation based on the result of 1-2-1. | | |
| (Activities for Output 2) | Input from the Philippines (PHIVOLCS) | Necessary budget and counterpart personnel for PHIVOLCS are properly allocated. |
| 2-1-1 To carry out GPS campaign observation. | ・Assignment of the counterpart personnel, | |
| 2-1-2 To carry out GPS continuous observation. | ・Provision of office space and facilities necessary for the Project, and | |
| | ・Allocation of the budget necessary for the Project. | |
| 2-2-1 To conduct geomorphological and geological surveys of inland earthquakes. | | |
| 2-2-2 To conduct geomorphological and geological surveys of subduction earthquakes. | | |
| (Activities for Output 3) | | |
| 3-1-1 To install broadband seismometers and infrasonic sensors at Taal and Mayon volcanoes. | | |
| 3-1-2 To install and operate real-time transmission and analysis system of seismic and infrasonic data. | | |
| 3-2-1 To install GPS receivers at Taal and Mayon volcanoes. | | |
| 3-2-2 To install and operate real-time transmission and analysis system of GPS data. | | |
| 3-3-1 To install magneto-telluric meter and total intensity magnetometers at Taal volcano. | | |
| 3-3-2 To install and operate real-time transmission and analysis system of magneto-telluric and total intensity magnetic data. | | |
| (Activities for Output 4) | | |
| 4-1-1 To construct a portal site of earthquake and volcano disaster mitigation information. | | |
| 4-1-2 To enhance REDAS to utilize the results from the activities for Output 1 and Output 2. | | |
| 4-1-3 To develop a simple diagnostic tool for earthquake resistance of houses. | | |
| 4-1-4 To provide earthquake and volcano information obtained by the project through the portal site. | | |
| 4-2 To conduct seminars and trainings on utilizations of the portal site. | | |