SUPPORTING REPORT Q

DISASTER MANAGEMENT INFORMATION SYSTEM

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1. GENERAL

1.1 INTRODUCTION

An integrated disaster prevention master plan was formulated to minimize a damage caused by disasters and to protect a life of residents in the Study. The plan consists of structural and non-structural measures for disaster prevention and the latter one is the main component of the plan for the city of Tegucigalpa.

For effective implementation of the structural and non-structural measures, the good coordination among various governmental agencies is essential as the disaster prevention projects are always inter-ministerial operation. Presently, the coordination among such governmental agencies are not satisfactory because of lack of common conception and communication tool to tackle the problems.

During the present Study, GIS based database has been prepared and it was utilized to formulate the Master Plan. The data base includes the administrative boundaries, population, land use, as well as topographical and geological conditions related to disasters. The GIS data base is supposed to be delivered to all the counterpart agencies of the Study for future planning and implementation of the projects.

However, the present ability of maintenance of GIS system varies from one agency to another. COPECO is already working on detail emergency action plan by using the data base produced in the Study, while SOPTRAVI does not have any section or personnel to run GIS for disaster prevention. Therefore, it is necessary to build up the certain level of ability on GIS among all the related agencies.

Thus the two main problems exist as follows;

- Lack of common data base and communication tool among the related agencies
- Variation of GIS abilities among the related agencies

In order to solve these problems, it is proposed to establish an information system to manage the disasters, which will have a common data base and a communication system among the related agencies. The system is called as a “Disaster Management Information System (DMIS)” and is proposed as a part of the non-structural measures of the Plan.

1.2 DISASTER MANAGEMENT AND INFORMATION SYSTEM

In general, the functions of the organization which manage the disaster (tentatively named as Disaster Management Agency: DMA) should be;

- collecting, storing, processing and distributing of information on disasters,
- making a plan and conducting a research for disaster preparedness,
- carrying out a emergency response activities in case of disaster,
- coordinating among the related agencies, and
- conducting a public relations, education and enlightening to the inhabitants.

DMIS is a system to support the functions mentioned above by managing the disaster related

information properly. Meanwhile, it is known that proper management of disaster information might reduce the disaster damage, therefore, the DMIS will be one of the most effective tools for decreasing the damage by giving the necessary information in time.

The DMIS will be composed four independent systems namely, 1) Information Collection and Transmission System, 2) Database System, 3) Information Processing System, 4) Decision-support System, and 5) Information Distribution System.

The functions of each system are as follows:

1) Information Collection and Transmission System (CTS)
   - To collect the hydrological and meteorological information and transmitting to DMA
   - To collect and transmit the disaster (damage) information to DMA
2) Database System (DB)
   - To store the information related to disasters using GIS.
3) Information Processing System (PS)
   - To process the information for research and study, formulation of disaster mitigation plan, decision-support in case of disaster, etc.
4) Decision-support System (DSS)
   - Supporting decision by automated alert using pre-set criteria
5) Information Distribution System (IDS)
   - Distributing the monitored and processed information, announcement, etc. to public and/or related agencies.

To set up the DMIS, the followings have been taken into account:

- Kinds of disaster
- Disaster situation
- Information to be handled
- Systems to be constructed
- Organizations involved

2. DISASTERS TO BE CORRESPONDED

The system should be constructed to correspond to any kinds of disasters. However, the system proposed in this Study will be correspond to the flooding and Landslide/slope failure as a part of whole system, because the present Study not includes other disasters. The characteristics of each disaster from the viewpoint of construction of DMIS will be described in the following sub-sections.

2.1 FLOOD

The flood is mainly caused by heavy rainfall and it is possible to predict an event and to prepare a response plan before occurrence of the event using a weather forecast, monitoring data and hydrological and hydraulic simulation system. Since hazardous areas of flood are extended widely in the low-laying areas along the river, the sub-system, especially CTS and IDS, should cover the whole possible inundation area to mitigate the damage of flooding.

The sub-system for flood disaster should include following components:

- CTS: Hydrological monitoring system, Damage monitoring system, etc.
- DB: Hydrological database, Flood risk database, Evacuation support database, etc.
- PS: Hydrological/Hydraulic simulation model, Evacuation simulation model, etc.
- DSS: Automated Alert System using pre-set threshold (rainfall, water level, etc.)
- IDS: Warning system (Wireless communication, Mass media, Internet, etc.)

2.2 LANDSLIDE/SLOPE FAILURE

Although the hazardous areas of landslide/slope failure spread widely in the Study Area, the landslide/slope failure will not occur in the same time except the event of heavy rainfall. Thus, the extent of damage will usually be limited. In addition, it is possible to predict the occurrence of disasters, especially landslide, with appropriate monitoring system. Since, in the proposed Master Plan, the damage of landslide/slope failure will mainly be mitigated by the non-structural measures, the system should cover the whole areas of landslide/slope failure.

The sub-system for flood disaster should include following components:

- CTS: Hydrological monitoring system, Landslide movement monitoring system
- DB: Geological database, Risk database, Evacuation support database, etc.
- PS: Movement analysis model
- DSS: Automated Alert System using pre-set threshold (rainfall, groundwater level, etc.)
- IDS: Warning system (Wireless communication, Mass media, Internet, etc.)

3. DISASTER SITUATION

As for the disaster management, three situations, namely "Normal", "Pre-emergency" and "Emergency" should be considered. *Table O.3.1* summarizes the role of DIMS in each disaster situation.

Table O.3.1 Role of DMIS

Disaster Situation		Activities DMA	Role of DMIS
Normal		• Disaster Prevention by Structural and Non-Structural Measures • Emergency Drill • Education/Enlightening	• Establish information of risk • Support emeergency drill • Support education/enlightening activities
Pre-emergency		• Transimission of forecasting and warning • Early detect of symptoms • Evacuation Support	• Collect and transimit information • Announcement of warning
Emergency	E-1: situation just after the event	• Collection of Infromation and confirmation of damage • Formulation of rescue system	• Confirm damage rapidly and correctly • Support of decision making • Unify and share information
	E-2: situation after a while the event happening	• Resucue support • Decision of countermeasures with priority • Announcement of directions • Confirmation of damage	

Since DMIS should be corresponded to each situation appropriately, the system has three (N: Normal, P: Pre-emergency, E: Emergency) information flows (see *Figure Q.3.1*). Details are described in the followings.

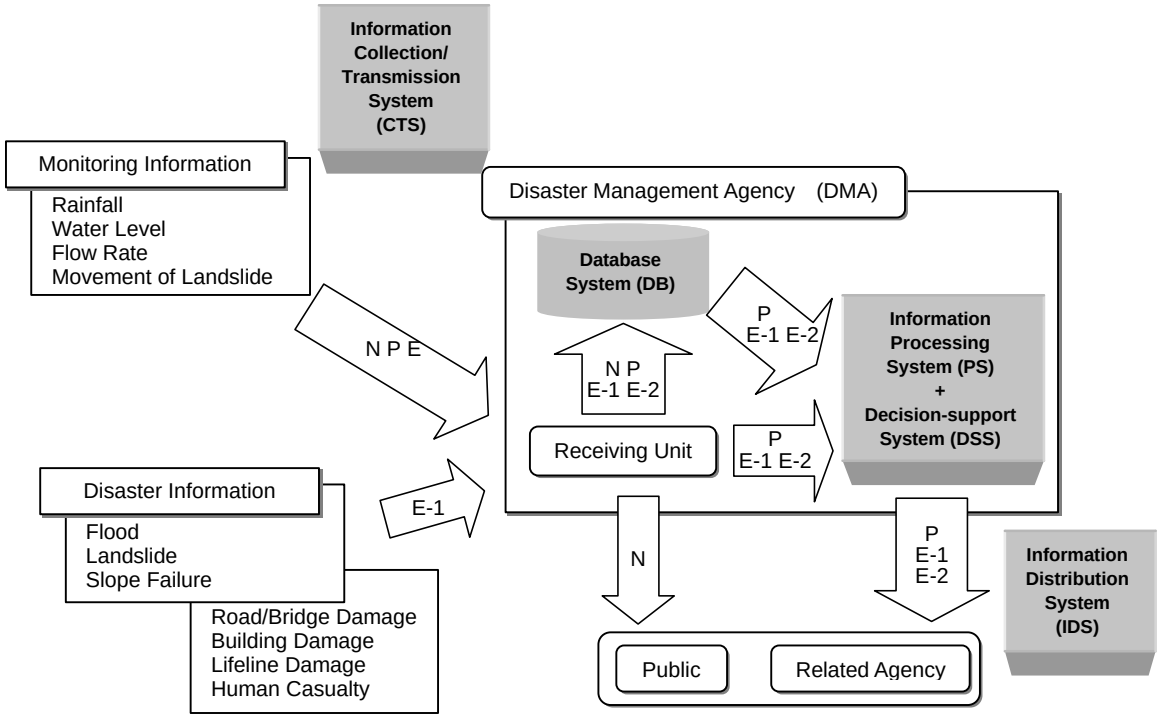

Figure Q.3.1 Flow of Information

3.1 NORMAL

In the Normal Situation, the main functions of the DMIS are collecting/monitoring the information related to the disasters (e.g. hydrological data, movement of landslide, etc.) and storing of collected information to the database.

The information collected by CTS is stored to DB (arrow with "N" in *Figure Q.3.1*) for further usage (for study and analysis). The collected information is processed by PS as soon as the information reached to the DMA as well. When the monitored or processed value of information exceeds the pre-set standards (e.g. rainfall amount, amount of movement of landslide, etc.), DMIS give an alert to the officials in charge as pre-emergency situation.

3.2 PRE-EMERGENCY

This situation is one that happening of disaster is predicted in near future (e.g. expecting a flood, a new movement of landslide due to the heavy rainfall, etc.). The DMA should prepare appropriate corresponding plan against the disaster, and announce the warning on disasters. Therefore, the system should provide the useful information to the officials for the prompt action.

In this situation, the collected information should be monitored by the officials in the real time and stored to DB as well. The information is processed by PS and is provided to the officials through DSS. Official announcements and monitored/processed information are distributed through IDS (arrow with "P" in *Figure Q.3.1*).

3.3 EMERGENCY

"Emergency" is a situation which the disaster happens. To act promptly and properly against the disaster, it is important to unify the information and to share the same and correct one among the agencies related to disaster response.

The emergency situation can be classified into two (2) phases, namely just after the event happening (Phase E-1) and the situation after a while (E-2).

In the phase E-1, the main activities of DMA will be collection of the information and confirmation of damage distribution in the area. It is, therefore, CTS, and PS (arrow with "E-1" in *Figure Q.3.1*) will be assigned as a main function of DMIS. Using the information collected, and the information stored in the DB, PS and DSS, the officials can prepare the information for emergency response.

In the situation of "E-2", the main activities of DMA will be analyzing the information, deciding a countermeasures which is correspond to the disaster with priority and announcement of directions from DMA headquarters to local office(s)/damaged site(s)/public through IDS (arrow "E-2" in *Figure Q.3.1*).

IDS includes a direct inform distribution system to public, therefore, IDS to public should have continuous distribution system using various interfaces such as mass media (e.g. TV, Radio), Internet, wireless communication, etc.

Figure Q.3.2 shows characteristics of information flow from the local office(s)/disaster site(s) to DMA and DMA to local office(s)/disaster site(s).

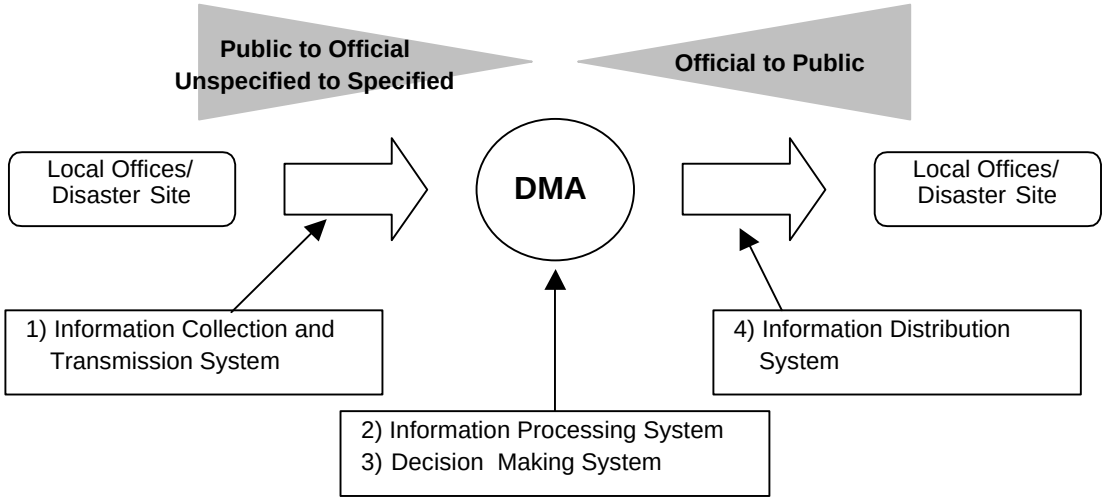

Figure Q.3.2 Characteristics of Information Flow

As shown in the figure, in the emergency situation, public (various kinds of source and way) will transmit the information to DMA. Therefore, the system should have a capability to handle large amount and various kinds of information with same format.

In this situation, it is necessary to distribute the reliable information from DMA to the public rapidly, therefore, IDS should suite for various distribution method and be constructed with consideration of the social system.

4. INFORMATION TO BE HANDLED

The system should handle many kinds of information, e.g. hydrological data, disaster information by telephone, radio (voice), digital photo/movie at site through Internet, etc. The information to be handled is changed by the kinds of disasters and disaster situation. The interval of acquisition and transmission of information are also changed by the type of disaster and situation. It is, therefore, necessary to select the suitable data transmission method by the types of information and disasters.

Table Q.4.1 shows the information to be handled on DMIS, and the interval and method suit for collection and transmission of information.

5. SYSTEMS TO BE CONSTRUCTED

As described in Section 1, the systems to be constructed are as follows:

- Information Collection and Transmission System (CTS)
- Database System (DB)
- Information Processing (PS) / Decision-support System (DSS)
- Information Distribution System (IDS)

The sub-systems will be set up according to the purpose and disaster situation. The summary of sub-systems is shown in *Table Q.5.1*.

These sub-systems should be constructed independently as a component to minimize threadbare of system, however, the sub-systems should be related to other sub-systems and should function as a part of integrated system.

6 PROPOSED DISASTER MANAGEMENT INFORMATION SYSTEM

6.1 BASIC CONCEPT FOR DMIS

The proposed DMIS will be constructed with the basic concepts as follows:

The system should:

- be a disaster proof,
- be one ensuring the collection and unifying the information,
- be able to transfer the information rapidly without any error,
- provide useful information to decision maker(s) as quick as possible, and
- be a system which can be utilize the experience of administration on past disasters.

Since no DMIS exists in Tegucigalpa, the system proposed should be a principal of whole system of DMIS. Therefore, the proposed DMIS should have a capability of expanding to other disasters.

To achieve the basic concept mentioned above, the technology summarized in *Table Q.6.1* will be applied.

Table Q.6.1 Technology Applied to DMIS

Appricable Technology	Description
WEB Technology	Establishment of system using exsisting network, terminal units and servers.
Browser Technology	Standarization of operation with easy to use (application of Internet technology)
Mapping Technology	Visualization of risk, plan, countermeasures, damage, etc. using digital mapping technology and GIS

6.2 PROPOSED DMIS

Figure Q.6.1 shows the organizational image of proposed DMIS.

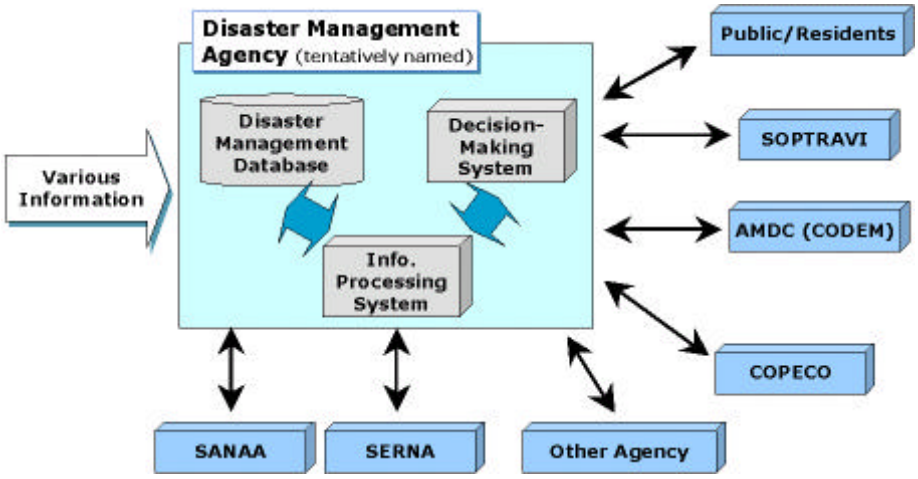

Figure Q.6.1 Organizational Image of DMIS

AMDC (CODEM) is a one of the users of DMIS in *Figure Q.6.1*. However, it is proposed that Main system of DMIS will be installed in the office of CODEM-DC and managed by CODEM-DC, because CODEM-DC is the responsible agency of disaster prevention in Tegucigalpa Area.

The GIS based database prepared by this Study should be a base of proposed DMIS. Only the database with GIS system will be a good tool for making plan for disaster prevention, materials for public relations/education, etc.

However, development of application program for sub-systems such as CTS PS/DSS and IDS described in Sections 1 and 5, is necessary for complete system of DMIS in order to provide the various information to governmental agencies and public both in normal and emergency situation because one of the important role of DMIS is to open the information and to the public.

The image of DMIS is shown in *Figure Q.6.2*.

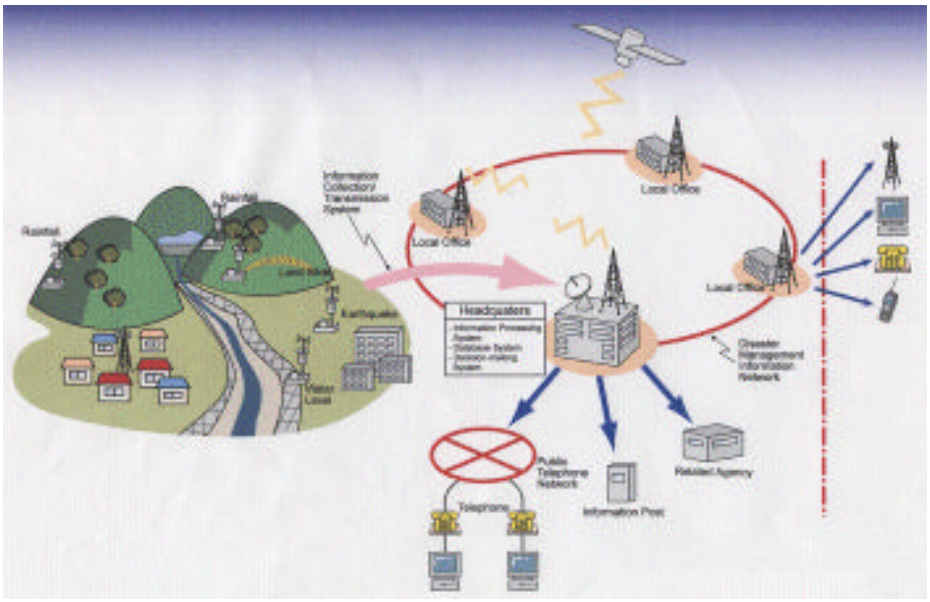

Figure Q.6.2 Image of DMIS

It is also important to update the current database periodically. The application might be an old-fashioned due to the progress of technology, however, the data stored in the database will be a great possessions for relating entities of disaster management.

Although it is proposed that main system is placed in CODEM-DC, it is impossible to update all the information of the database by CODEM-DC. The updating of database should be done by each responsible agency to keep, share and exchange the latest information.

To enable updating work by responsible agencies, the main system placed in CODEM-DC can be accessed from satellite system installed in other related agencies through network (Internet or exclusive line).

The responsible agencies data update are summarized in *Table Q.6.2*.

6.3 NECESSARY ACTIVITIES AND IMPLEMENTATION PROGRAM

6.3.1 NECESSARY ACTIVITIES

To establish DMIS, the following activities should be done.

1st Step: Share and exchange the information in the database with GIS software
(Priority Project-1)

- Installation of Main System including Data Server in CODEM-DC
- Installation of Satellite System in related Agencies
- Networking of CODEM-DC and related Agencies
- Necessary Update of Database
- Training of Staff to handle the database

2nd Step: Establishment of DMIS for Flood and Landslide
(Priority Project-2)

- Preparation of Concepts for Complete DMIS
- Consideration of Systems to be Established in Detail
- Construction of Sub-systems and Development of Application Programs for Flood and Landslide
- Development of other Application Programs for Main and Sub-systems
- Training of Staff to handle DMIS

3rd Step: Establishment of Complete DMIS

- Construction of Sub-systems for other disasters
- Training of Staff to handle DMIS

6.3.2 IMPLEMENTATION PROGRAM

Proposed implementation schedule of establishment of DMIS is shown in *Table Q.6.3*.

Table Q.6.3 Implementation Schedule

	2002 to 2006	2007 to 2011	2012 to 2015
1st Step			
Installation of Main and Satellite Systems			
Networking among Agencies			
Necessary Update of Database			
2nd Step			
Preparation of Concepts whole DMIS			
Consideration of System in Detail			
Sub-systems and Appli. Programs for Flood/Landslide			
Other Appli. Programs for Main and Sub-systems			
3rd Step			
Construction of Sub-systems for other disasters			
Database Update			
Training			

Table Q.4.1 Information to be Handled

Collection and Transmission System				
Kinds of Disaster	***Information***	***Transmission Method***	***Situation***	***Frequency***
Flood	Rainfall	Telemeter	Normal	10 min. Event monitoring
			Pre-emergency	1 min.
			Emergency	1 min.
	Water level	Telemeter	Normal	2 times/day
			Pre-emergency	30 min.
			Emergency	10 min.
Landslide	Movement of landslide mass	Telemeter	Normal	10 min. Event monitoring
			Pre-emergency	5 min.
	Rainfall	Telemeter	Normal	10 min. Event monitoring
			Pre-emergency	10 min.
	Groundwater level	Telemeter	Normal	2 times/day
			Pre-emergency	5 min.
Common	Damage on Human	Telephone Fax Radio Internet	Emergency	
	Damage on Building			
	Damage on Infrastructure			
	Damage on Lifeline			

Distribution System				
Information	***Target Person***	***Transmission Method***	***Situation***	***Frequency***
Warning	Public	Radio Internet	Pre-emergency Emergency	
Direction	Official	Telephone Internet	Pre-emergency Emergency	
Actual Situation	Public/Official	Mass Media Board Internet	Emergency	Continuous

Table Q.5.1 Summary of Sub-systems

Name of system	Name of Sub-system	Handling Information	Method	Situation to be Considered
Information Collection System	Monitoring System	Movement of Landslide Groundwater Level Rainfall Water Level Etc.	Telemeter	Normal Pre-emergency Emergency
	Damage Information System	Human Building Infrastructure Lifeline	Telephone Fax Radio Internet	Emergency
Database System	Risk Database	Risk Map on Landslide Flooding	GIS/Relational Database	
	Damage Database	Damages on Human Building Infrastructure Lifeline	Relational Database	
	Resource Database	Resources on Firefighting Doctor/Hospital Facilities Location Etc.	GIS/Relational Database	
Information Processing System	Flood	Rainfall Water Level Flood run-off Simulation Program Flood Risk Database Damage Database	Hydrological/ Hydraulic Simulation	Normal Pre-emergency Emergency
	Landslide	Movement of Landslide Rainfall Groundwater Level Landslide Risk Database Damage Database		
Decision-Supprot System	Sub-system for Flood Landslide Evacuation Logistics	Disaster Forecast Disaster Situation Damage Situation	GIS/Relational Database	Pre-emergency Emergency
Information Distribution System	Center to sub-center	Warning Direction Etc.	Telephone Fax Mass media Wireless Internet	Normal Pre-emergency Emergency
	Center to related agency	Monitoring/Processed Information Waring Direction Etc.		
	Center to public	Warning Etc.		
	Sub-center to public			

Table Q.6.2 Responsible Agency of Updating of Data

Data/Infromation	Responsible Agency	Remarks
Topography	IGN	
Geology	IGN, SERNA	
Administrative Boundary	AMDC	
Population	AMDC	
Land Use	AMDC	
Important Building	AMDC	
Road and its facilities	SOPTRAVI/AMDC	
Rivers and its facilities	SOPTRAVI/AMDC	
Bridges	SOPTRAVI/AMDC	
Water Supply System	SANNA	
Sewerage System	SANNA	
Electoricity and its facilities	ENEE	
Telephone and its facilities	HONDUTEL	
Landslide Hazard	SERNA/SOPTRAVI	
Slope Hazard	SERNA/SOPTRAVI	
Flood Hazard	SOPTRAVI	
Evacuation Loacation	CODEM-DC/COPECO	
Resource for Disaster Management	CODEM-DC/COPECO	CODEM-DC wil be a coordinating agency.