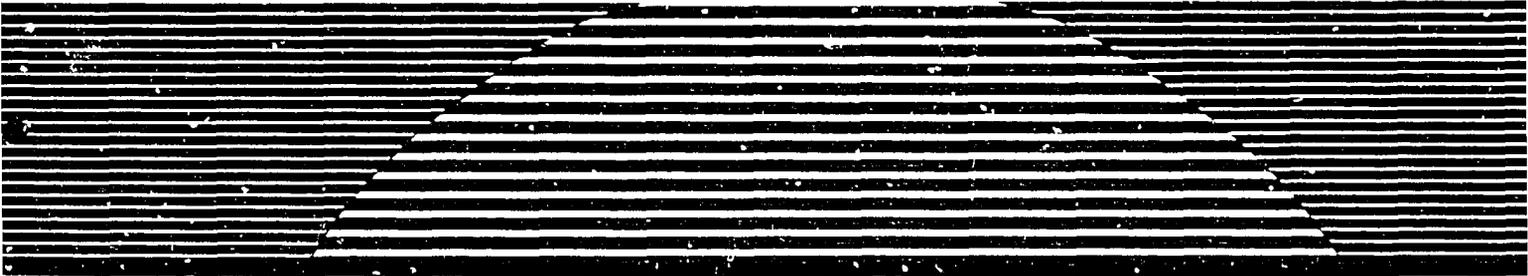
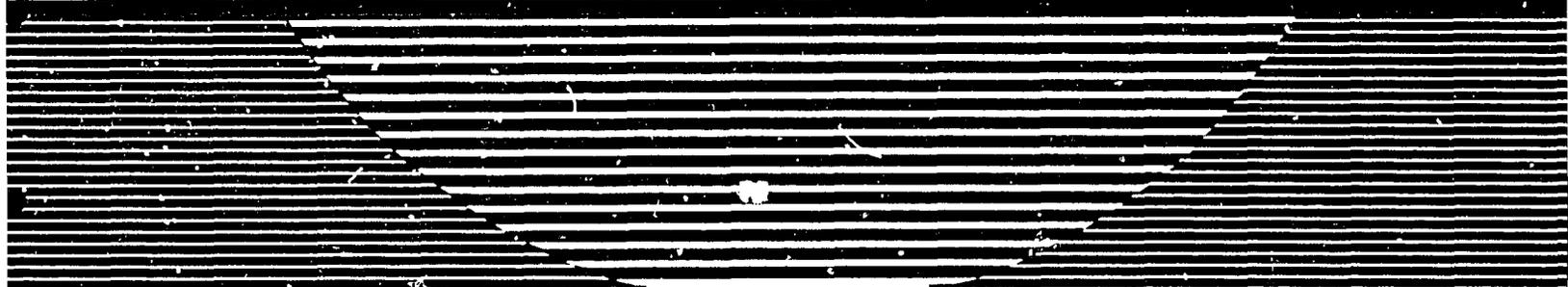


PN. ABM-191 79151



THE URBAN INSTITUTE

INTERNATIONAL ACTIVITIES



**INDONESIA HAZARD MITIGATION
STRATEGY**

by
**Milagros Nanita-Kennett and
Jelena Pantelic**

August 1992

**USAID CONTRACT NO. PDC-1008-I-00-9067-00,
Delivery Order No. 25**

U.I. Project No. 6280

**REGIONAL HOUSING AND URBAN DEVELOPMENT OFFICE
USAID/JAKARTA**

TABLE OF CONTENTS

Preface	vi
Acronyms	vii
Executive Summary	x

PART I: PROJECT OVERVIEW

1. Introduction and Project Background	1
2. Natural Disasters in Indonesia	3
2.1 Floods	3
2.2 Volcanic Eruptions and Associated Hazards	4
2.3 Landslides	5
2.4 Earthquakes	6
2.5 Mitigation Measures	8

PART II: INSTITUTIONAL ANALYSIS

3. National Institutions	10
3.1 Background	10
3.2 BAKORNAS PB: The National Coordinating Board for Disaster Management	11
3.3 A New Approach to Disaster Management	15
3.3.1 An Institutional Framework: TTRN	15
3.3.2 A Policy Framework: TKPP	18
3.3.3 An Investment Framework: IUIDP IMG	19
3.3.4 An Environmental Framework	21
4. Nationally-based Institutions	24
4.1 Japan International Cooperation Agency (JICA)	24
4.2 The World Bank	25
4.3 United Nations Development Program (UNDP)	26
4.4 Opportunities for PMP	26

PART III: KEY ELEMENTS OF NATURAL DISASTER PLANNING

5.	Increasing the Participation of Local Governments in Natural Disaster Management	27
5.1	Incorporating Natural Disaster Considerations in the Development Process of Local Governments	28
5.2	Fiscal Strategies for Natural Hazard Mitigation at the Municipal Level	34
6.	Increasing the Participation of Community-Based Organizations in Natural Disaster Management	40
6.1	Floods and the Urban Poor	40
6.2	Pilot Activities	41
6.3	The Approach to Other Hazards	47
6.4	NGOs and Natural Disasters in Indonesia	48
6.5	Government Action in Low-Income Communities	50
7.	Increasing the Participation of the Private Sector in Natural Disaster Management	52
7.1	The Banking Industry	53
7.2	The Insurance Industry	55
7.2.1	Components of Successful Disaster Insurance Programs	55
7.2.2	The Role of Insurance in Natural Disasters	57
7.3	Professional Associations: The Example of HAKI	58

PART IV: ACTION PLAN

8.	Background	61
8.1	Program Sustainability	62
8.2	Project Feasibility	62
8.3	Progress Indicators	62
8.4	Project Implementation	63

PART V: TECHNICAL ASSISTANCE PROGRAM

9.	Disaster-related Research Capabilities - Regional and Local	64
9.1	Geological Research and Development Center	64
9.1.1	Environmental Geology for Land Use Planning in Bandung	65
9.2	Institute of Human Settlements	67
9.2.1	Research Component	67
9.2.2	Education and Training	68
9.2.3	Knowledge Dissemination	69
9.2.4	Issues of Concern and Potential Areas of Improvement	69
9.3	Asia Disaster Preparedness Center (ADPC), Asia Institute of Technology (AIT)	70
9.3.1	Special Courses	70
9.3.2	New Activities	71
9.3.3	Other Areas of Interest	72
9.3.4	The UN-GRID Program	72
9.3.5	Issues of Concern and Potential Areas of Improvement	73
9.3.6	Proposed Arrangements for Identified Research Institutions	73
10.	Proposed Technical Assistance	74
10.1	Proposed Activities	75
10.1.1	Central Government Level	75
10.1.2	Local Government Level	75
10.1.3	Community-Based Organizations Level	76
10.1.4	Private Sector Level	76
10.1.5	Institutional Level	77
10.2	Staffing	77
10.3	The Roles of Identified Research Institutions	79

10.4 Local Counterparts and PMP Advisor 79

11. Project Budget 79

Bibliography 85

PREFACE

This project was designed by The Urban Institute for the USAID Office of Housing and Urban Programs and its Regional Office of Housing and Urban Development for Jakarta (RHUDO/Jakarta). The project is based on field work in Indonesia in August 1992.

William Frej, RHUDO/Jakarta Director and Michael Lee, RHUDO/Advisor provided overall direction and substantive guidance to the project. David Hollister, Program Coordinator for the Asian Disaster Preparedness Center in Bangkok accompanied the designing team during field work in Bangkok and Jakarta and provided important insights used during the preparation of this Report. The Indonesian staff of the USAID Urban Policy Division provided substantive support to the field preparation of this Report.

We are especially appreciative of the cooperation provided by GOI public officials and private sector institutions.

Milagros Nanita-Kennett
Jalena Pantelic

ACRONYMS

ADPC	Asian Disaster Preparedness Center
AIT	Asian Institute of Technology
ANDAL	Analisa Mengenai Dampak Lingkungan [detailed environmental assessment]
BAKORNAS PB	Badan Koordinasi Nasional Penanggulangan Bencana
BAPEDAL	Badan Pengendalian Dampak Lingkungan (National Environmental Impact Management Agency)
BAPINDO	Indonesia Development Bank
BAPPEDAS	[Local Planning Boards]
BAPPEKA	[Planning Boards at the Kabupaten level]
BAPPEKO	[Planning Boards at the Kotamadya level]
BAPPENAS	Minister of National Development Planning
BASARNAS	National Search and Rescue Organization
BBD	Land, Forest and Plantation Bank
BDN	National Trading Bank
BNI	National Bank
BRI	Rural Bank
BTN	Housing and Mortgage Bank
CIPTA KARYA	Directorate of Human Settlements of the Ministry of Public Works
DATI I	Central Government Level
DATI II	Municipal/Provincial Level
DATI III	Village Level
DINA	[Municipal sectorial agencies of the local government]
DKI	[single unitary authority in Jakarta comprised of both a provincial and Kotamadya status]
DPRD	People's Local Representative Councils
EMC	Environmental Management Center
GO	General Obligation Bond
GOI	Government of Indonesia
GRDC	Geological Research and Development Center
HAKI	Indonesian Society of Structural Engineers
HGL	Housing Guaranty Loan
IDMC	Indonesian Disaster Management Center

IHMS	Indonesia Hazard Mitigation Strategy
IHS	Institute of Human Settlements
IMG	Interdepartmental Management Group
IPP	Intensive Community-based Counseling
ITB	Bandung Institute of Technology
IUIDP	Integrated Urban Investment Development Program
JICA	Japanese International Cooperation Agency
KIP	Kampung Improvement Program
KLH	Ministry for Population and the Environment
LAPAN	LANSAT imagery collection station
NFIP	National Flood Insurance Program
NGO	Non-Governmental Organization
OECD	Japanese Overseas Economic Cooperation Fund
OFDA	Office of Foreign Disaster Assistance
PDAM	[self-sustaining local water company]
PIL	Preliminary Environmental Information Report
PJM	[medium-long term programs which constitute part of routine project preparation of IUIDP]
PML	Probable Maximum Loss
PMP	Prevention, Mitigation and Preparedness
PUSPITEK	Research Facility of the Department of Research and Technology
RDA	Regional Development Account
RKL and RPS	[mitigatory measures and monitoring plans]
RT	Rukun Tetangga [brotherhoods of neighbors]
RW	Rukun Warga [brotherhoods of citizens]
SATGAS	[special task forces]
SATLAK PB	Satuan Pelaksana Penanggulangan Bencana [provincial agencies for disaster management]
TA	Technical Assistance
TKPP	Team Koordinasi Pembangunan Perkotaan [coordinating team for urban development]
TTRN	Tim Tata Ruang Nasional [National Spatial Planning Committee]
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Office

UNICEF

United Nations Children's Education Fund

USAID

U.S. Agency for International Development

USAID/RHUDO

USAID Regional Housing and Urban Development Office

EXECUTIVE SUMMARY

PROJECT BACKGROUND

This report reviews and recommends Prevention, Mitigation and Preparedness (PMP) Strategies for the design of a new Housing Guaranty Loan (HGL) program: the *Municipal Finance for Environmental Infrastructure Project*. The purpose of this report is to assist the Government of Indonesia (GOI) and the USAID Mission, Jakarta, in improving planning capabilities to reduce human suffering and economic losses associated with natural disasters, and to deliver hazard-resistant and environmentally sound shelter-related infrastructure.

As development takes place, the need for GOI to introduce long-term strategies that will minimize the possible effect of natural hazards in the built environment can be understood in the light of protecting future investments: GOI has made a major commitment to invest in urban infrastructure up to Rp 1.5 trillion per year over the course of Repelita V (see section 3.1 for more details). By placing urban systems in areas exposed to floods, ground shaking in earthquakes, subsidence, landslides, volcanic eruptions, and tsunamis, there is a risk for a great loss of this public investment as well as lives. Moreover, GOI is increasing its reliance on local governments to invest and finance their own urban services and encouraging the active participation of the private sector in the provision of these services. The destruction of a major municipal and/or privately-owned infrastructure project during a disaster could seriously set back municipal and private capital investment in these areas. The pace of economic growth could thus be slowed down for the country at large, given that GOI would have to divert precious development resources for relief, recovery and reconstruction.

The rationale contained in this report is based on the philosophy of preventing and mitigating natural disasters before they occur, rather than relying on the traditional practice of delivering relief supplies and investing large amounts of funds in recovery after the destruction has occurred. Not uncommonly, the expenditure necessary to replace the lost infrastructure frequently surpasses the existing capabilities of affected societies. Prudent building practices, application of building codes, and adequate construction supervision, can significantly improve the performance of the built environment in disasters such as earthquakes and high winds. Similarly, appropriate land-use practices can additionally protect costly property from landslides, volcanic eruptions and floods.

This report is built upon a set of urban, environmental, and natural hazard interrelations that can have a practical use within Indonesia's normal development process. Specifically, the major objectives of this report are: to introduce natural disaster preparedness and

mitigation as integral components into long-term development planning; to enhance the participation of municipal governments, private sector, and community-based organizations in disaster planning; and to increase general awareness of the possible capital losses that might result from natural disasters.

INSTITUTIONAL ANALYSIS

When reviewing the institutional support system and the development process of Indonesia, it becomes obvious that disaster preparedness and mitigation are the issues that cut across the programmatic agenda of government institutions. BAKORNAS PB's organizational structure is most adequate to embrace the comprehensive activities in natural hazard management. This agency has access to institutional networks capable of operating at central, municipal and community levels.

BAKORNAS PB is a non-structural government board which formulates policies, issues directives and guidelines in the areas of disaster prevention, mitigation, relief, rehabilitation, and reconstruction, both at the national and the local level.

Major limitation of BAKORNAS PB are the lack of inter-sectoral planning; BAKORNAS PB's basic activity is directed almost exclusively to respond to disasters rather than to undertake long-term strategies designed to minimize the effects of damaging events. At the provincial level the situation is very similar. SATLAK PBs are weak and have limited capacity for planning and implementing long-term mitigation programs. They lack trained personnel, office space, and sufficient budgetary support.

At present, GOI is constructing a new building to house BAKORNAS PB. This fact seems to suggest that there is an increasing commitment of GOI to natural hazards management and that future plans might include changing BAKORNAS PB from a non-structural to a structural institution. This could open wide opportunities for the implementation of the recommendations made in this Report.

The following institutional recommendations were identified to provide the foundation for the incorporation of natural hazard management activities as an integral component of the normal Indonesian development process.

- A member of BAKORNAS should become responsible for introducing natural hazards mitigation strategies within the TTRN. The TTRN is a permanent committee whose main mandate is to operate as a forum for the development and institutionalization of all policies, guidelines and strategies related specifically to both urban and rural spatial planning.

The performance of urban infrastructure during a disaster is very much interrelated to the spatial planning processes of a country; it deals with policies on where and how urban infrastructure is being built. The fact that natural disasters

are having a much higher socio-economic impact on developing nations than on industrialized countries is partially a consequence of the limited capacity of developing nations to plan for future disasters.

- **BAKORNAS PB** should be included as an institutional member of **TKPP**. **TKPP** is a monitoring and review body which serves as a focal point for communication with foreign donors in the urban sector. Through its planning board, **TKPP** can serve as a policy review body for the introduction of policies related to natural hazard management considerations.

The clearest **GOI** statement on decentralization and privatization is reflected in the **TKPP** policies regarding urban development of Indonesia. Municipalities are the central institutions for disaster management. This approach is already present within Indonesia's current natural disaster management structure: **SATLAK PBs** operate under **Walikota** or **Bupati**, which brings the entire disaster management operation into the responsibility of the local government.

- Natural disaster management considerations should be incorporated within the **IUIDP** and **IMG** membership. **IUIDP** is an improved cross-sectorial concept for investment, programming, implementation, operation, and maintenance of urban infrastructure. It integrates the seven **Cipta Karya** sub-sectors into multi-year investment plans, thus constituting an inter-disciplinary approach to project planning. **IMG** is a managerial group, which is crucial to the functioning of **IUIDP**.

The need for this framework -- which emphasizes the need for sound investments -- is clearly established by a long chronology of natural disasters that have dramatically affected urban infrastructure in Indonesia and throughout the world.

- Inter-institutional relations between **BAKORNAS PB** and **BAPEDAL** (the National Environmental Impact Management Agency) should be strengthened. Mutually reinforcing activities between these institutions should be initiated.

This report contends that the activities related to natural hazard management are, in fact, an extension or a complement of environment-related activities and programs; and that the implementation of a natural hazard program should support the many activities and concerns related to mitigating environmental degradation. The effects of development are taking their toll on the environment, which in turn affects the frequency and extent of disasters. Disasters destroy existing development efforts, thus completing this vicious circle.

KEY ELEMENTS OF NATURAL DISASTER PLANNING

To increase the participation of municipalities, community-based organizations and private sector in natural disaster management activities is considered crucial for the implementation of a natural hazard management program.

As major cities grow rapidly, the role of local government in protecting and delivering sound urban infrastructure becomes critical. Thus, a well designed natural hazard program must focus on the delivery systems of local governments in providing sound environmental infrastructure.

Several actions were identified during the preparation of this report that can lead to the integration of natural hazard mitigation within the planning process at provincial level. For example, literature research and field work indicate that natural hazard impact assessments should become an integral component of capital investments and be undertaken at an early stage in project design in order to protect capital investments in urban infrastructure. In addition, the incorporation of natural hazard considerations in PJMs -- which are medium and long term programs -- is also considered essential for long term investment planning.

In Indonesia there is a large number of institutions that regulate land use planning. This fragmentation of responsibilities has led to a virtual impasse in land-use related matters and an obstacle in introducing sound land use planning approaches at the local level. BAPPEDAs can be the most effective institution influencing future land use planning in Indonesia; it would be most appropriate to provide support to BAPPEDAs for strengthening their capacity for land use planning and facilitating the inclusion of natural hazard mitigation measures within the development process of municipal governments.

Another important element to consider when strengthening municipal capacity is the fact that urban infrastructure investments should be neither planned nor implemented without natural hazard mitigation considerations. In this sense, local master plans should include natural hazard strategies. Given that BAPPEDAs are the local planning units for the development of master, spatial and investment plans, it is one of the major recommendations of this Report that BAPPEDAs incorporate disaster information into their master planning process.

Infrastructure and shelter vulnerability can be correlated to a large extent with the use and enforcement of adequate codes and standards. However, to introduce hazard-resistant measures to improve the performance of the physical environment can be costly and may demand a highly specialized and non-existent local expertise. Accordingly, it is necessary that through decentralized agencies of Cipta Karya, local governments review the present nature of local codes and standards and their enforcement process. This exercise should improve and/or update codes and standards to include state-of-the-art hazard-resistance mitigation measures.

Another important aspect of local governments is their ability to manage fiscal policies, which can serve a double function: first fiscal policies might monitor development activities and second, they might increase local government revenue.

Since the process of restructuring in Indonesia is a powerful one, the integration of advanced fiscal tools in land management into disaster mitigation planning might be possible. Such measures can include local taxes, municipal bond issues and development impact fees. For example, property taxes may be included when the private sector chooses to locate in documented hazardous zones, without applying appropriate hazard reduction measures.

An important form of municipal borrowing in connection with disaster mitigation may be to lend the money to the private sector, in order to encourage the application of PMP strategies in the development process. In respect to the current project's theme (environmental infrastructure), municipalities would loan the money collected through bond issue to the members of the private sector to build infrastructure components, and to apply sound hazard mitigation practices.

Since the process of decentralization in Indonesia counts on a more pronounced role of the private sector in sharing the burden of infrastructure development, and since the country is faced with a set of serious natural hazards, municipalities should consider all the options available to protect their communities and assets. Local taxes, municipal bond issues and development fees can be adopted as fiscal mechanisms to regulate against environmental degradation (e.g., air or water pollution, development in watershed areas), and importantly, to raise revenue for mitigation against natural hazards.

Increasing the Participation of Community-Based Organization in Natural Disaster Management

As development takes place, low-income communities are experiencing a substantial deterioration in their quality of life. Both population growth and poverty are factors that irreversibly increase community vulnerability to natural hazards. In Indonesia, large families and households each day have fewer opportunities to live in a safe environment and successfully recover from future natural disasters.

When reviewing community-based participation in natural management, it is essential to incorporate non-governmental organizations (NGOs). In Indonesia, NGOs are widely perceived as appropriate organizations to address the key community concerns and needs. NGOs range from small, unsophisticated grassroots organizations working at the community level to medium and large established organizations operating as fairly well developed consulting firms.

However, during the field investigation no NGOs were identified that were exclusively engaged in hazard preparedness and mitigation programs. Instead, a large number of community-based organizations were identified which were committed to the reduction of environmental degradation, and whose members are working toward the development of appropriate technologies and self-help housing. Since environmental degradation and housing are overlapping issues with hazard preparedness and mitigation, it seems plausible to deliver hazard preparedness and mitigation programs through NGOs already active in similar development-related fields.

An important element identified during the preparation of this Report is that throughout Indonesia, floods have an extreme adverse impact for the urban poor. Kampung Kapuk Muara shares with many other low income communities scattered around Jakarta, the shortcomings of an accelerated process of urbanization. This kampung is exposed to recurrent floods from an extremely polluted river. Available land in this kampung (present population over 200,000) is practically non-existent. Fragile shacks, constructed of locally woven bamboo, emerge directly over heavily polluted watersheds. This report identified Kapuk Muara as a potential site to undertake pilot project activities for the delivery of hazard preparedness and mitigation strategies.

Other pilot activities should be also considered in Indonesia to cover other types of hazards (e.g., earthquakes and fire that may follow after earthquakes, volcanic eruptions, and landslides). For example, Bandung and Majalengka are strongly suggested as locations for carrying out future pilot activities. Other locations that could be considered are Jakarta Utara and Kodya Balikpapan which are Kotamadyas identified by BAKORNAS PB as high risk areas. BAKORNAS PB might become responsible for the selection of sites in the implementation of future pilot activities throughout Indonesia.

Another strategy that can serve as a mechanism to improve natural hazard mitigation consideration in low-income communities is the Kampung Improvement Program (KIP). It is probably the only program that provides infrastructure for low income neighborhoods in Indonesia. Through these improvements appropriate standards and criteria intended to reduce vulnerability to natural hazards (e.g., land use measures, building codes, and retrofitting techniques) can be effectively introduced. Equally important are the opportunities to educate communities to prepare for disasters, so that they can learn to reduce the impact of natural hazards through IPP projects. This report recommends the identification of effective avenues that might lead to this programmatic and comprehensive approach. Such coordination can be promoted in Jakarta through the cooperation of BAKORNAS PB and Cipta Karya, and in the provinces through the cooperation of SATLAK PBs and respective local governments.

Increasing the Participation of the Private Sector in Natural Disaster Management

Each day it becomes more obvious that disaster management activities, by necessity, cannot count solely on substantial financial participation by central and local

governments, but rather must seek the involvement of other sectors. The need of involving the private sector in PMP activities is becoming increasingly essential. Currently, the private sector's interest in participating in urban infrastructure and service provision has been growing, especially since all levels of government have joined in a concerted effort to attract private sector participation. The key needs for infrastructure continue to be water and transportation, followed by sewer and waste disposal. It is these infrastructure domains that concretely affect environmental quality, and through private sector's active involvement, disaster prevention, mitigation and preparedness measures should become a part of the development process.

One of the most important elements in the private sector is the financial institutional system. The current context of Indonesia's banking industry is that of deregulation and an increasing competitiveness among individual banks. Since 1984, when deregulation began, until July 1992 when a law was passed allowing the previously state-owned banks to form limited companies and setting free up to 20 percent of banks' assets to be potentially owned by foreign capital, the competitive environment have brought about significant boost to private sector investment. The private sector's participation in infrastructure development, however, has been lacking. Major reasons are the usually large volume of funds needed for infrastructure financing, and the long-, rather than short-term nature, of return on investment in infrastructure development.

This report recommends that Jakarta-Bandung Jalan Toll Road be considered as a pilot activity to incorporate disaster PMP strategies. This project is about to be initiated by BAPINDO (Indonesia Development Bank). A consortium of three major private sector construction companies have been selected in a competitive process to construct this road. This project is suggested because of its size and importance for the future economic development in Indonesia.

Another element of importance within private sector in terms of natural disaster management is the insurance industry. Although insurance markets have been slow to respond to the new trends of rapidly growing economic losses in disasters, they are an important component, especially in the light of public/private partnerships. Insurance can be highly desirable to distributes the risks over the entire country and throughout all building sectors. Given the link between the government and the private sector, Indonesia's vulnerability to a host of natural hazards, and the current decentralization process in the country, it is appropriate to consider a plan for sharing the cost of protecting the increasingly sophisticated and costly municipal infrastructure systems across the nation. Importantly, cost-sharing will also reduce local communities' dependency on central government relief following disasters. It should be understood that these advanced tools are recommended as potential actions for GOI to consider, given the relatively undeveloped insurance sector in Indonesia.

Since the implementation of the Policy Action Plan under the HGL-002 will further increase the value of Indonesia's municipal infrastructure portfolio, the level of

infrastructure exposure to natural disasters will simultaneously rise – unless appropriate strategies are used to protect this investment. Insurance strategies should in the future become more attractive as generic investment protection tools, and as conduits for PMP actions.

For the implementation of the *Indonesia Hazard Mitigation Strategy* an Action Plan has been prepared. A number of substantive goals, steps and indicators in natural hazard management are identified and introduced under the current policy theme of the Action Plan of HGL on Municipal Finance for Environmental Infrastructure. To implement these PMP goals – as part of the Policy Agenda – continued support from USAID and other donors support will be necessary and welcome to support the execution of the proposed project. Specific roles may be foreseen for the donors who at the time of the initiation of this program have in Indonesia the projects of their own which could both enhance the current program and, in turn, be enhanced by it. The Volcanic Sabo Technical Center (VSTC) in Yogyakarta – and sponsored by JICA – illustrates well this point. Clearly, it would be important that some technical assistance activities of the current project be directly related to, or performed in conjunction with VSTC, which is an outcome of a long-standing practice of reducing the hazards posed by mudflows, landslides and floods. The proposed program would benefit from the previous experience of VSTC in hazard mitigation, but by the same token VSTC would improve its own standing if it becomes a part of a national policy, and not an isolated case – however successful and effective it may have been in the past.

The feasibility of the project is linked to the fact that GOI has been receptive to the adoption of policies leading to the delivery of a sound environmental infrastructure. The goals introduced in this report are an additional step which guarantees the future protection of projected public and private capital investments in urban infrastructure.

A technical assistance program has been developed which is, sine qua non, the core element for the full implementation of the goals and objectives identified throughout this Report.

PART I. PROJECT OVERVIEW

1. Introduction and Project Background

This Report reviews and recommends disaster Prevention, Mitigation and Preparedness (PMP) Strategies for the design of a new Housing Guaranty Loan (HGL) program: the *Municipal Finance for Environmental Infrastructure Project*. This project follows an approach similar to that of a prior HGL for Indonesia, but contributes new substantive goals and actions in concert with Indonesia's progress toward decentralization and implementing a full system for urban environmental quality. The purpose of this Report is to assist the Government of Indonesia (GOI) and the USAID Mission, Jakarta, to improve planning capabilities to reduce human suffering and economic losses associated with natural disasters, and to deliver hazard-resistant and environmentally sound shelter-related infrastructure.

It is appropriate in this context to build a case for adopting the philosophy of preventing and mitigating natural disasters before they occur, rather than relying on the traditional practice of delivering relief supplies and investing large amounts of funds in recovery after the destruction has already occurred. This is particularly important in the context of the still prevailing attitudes in many parts of the world that disasters are "acts of God," and that humans can do little to prevent their impacts. The past decade has demonstrated, however, that the effects of these so-called natural disasters are to a great extent acts of men and their activities.

In the period between 1960 and 1980, the frequency of major natural disasters has increased five times, while total economic losses grew by a factor of 3.3 (Berz, 1991). The impacts of these disasters is especially pronounced in the developing countries. According to some estimates, about 95 percent of life loss in disasters every year occur in developing countries (UNDRO, 1991). The reasons for this unprecedented growth in disaster-related economic losses can be found in population growth accompanied by increased urban densities, concentration of economic assets in urban areas, an increase in the occupation of high risk areas that tend to be more vulnerable to natural disasters, as well as unregulated or substandard construction techniques. Urban agglomerations in the developing countries (such as Mexico City and Jakarta) are among the fastest growing, and at the same time also most vulnerable, metropolises in the world.

Not uncommonly, the expenditure necessary to replace the lost infrastructure frequently surpasses the capabilities of affected societies. Material losses of recent urban earthquakes are counted in the billions of dollars: more than US \$6 billion was lost in the Mexico City 1985 earthquake, and approximately US \$13 billion in the Armenian earthquake of 1988 and approximately US \$20 billion in the recent 1992 hurricane Andrew disaster. A great deal indeed can be done to minimize many aspects of disaster effects: saving lives and reducing human suffering, and protecting valuable economic

assets and investment. Simple measures incorporated into the normal, day-to-day development process may result in making the difference between life and death, prosperity and destitution.

Prudent building practices, application of proper building codes, and adequate construction supervision, can significantly improve the performance of the built environment in disasters such as earthquakes and high winds. Similarly, appropriate land-use practices can protect costly property from landslides, volcanic eruptions and floods. Indeed, a recent USAID/OFDA document quotes that an investment of US \$ 40 billion in disaster mitigation over a period of ten years could save more than US \$280 billion in projected losses (USAID/OFDA, 1991).

The rationale for GOI to incorporate the PMP strategies into its normal development process are rooted in a growing recognition that urban growth, economic development, environmental preservation, and natural hazards are not fragmented issues, neatly compartmentalized between sectors, but that they are, in fact, intimately interrelated. As development takes place, the need for GOI to introduce long-term strategies that will minimize the possible effect of natural hazards in the built environment can be understood in the light of future investments: GOI has made a major commitment to invest in urban infrastructure up to Rp 1.5 trillion per year over the course of Repelita V (see section 3.1 for more details). By placing urban systems in areas exposed to floods, ground shaking in earthquakes, subsidence, landslides, volcanic eruptions, and tsunamis, there is a risk for great loss of life and public investment. Moreover, GOI is increasing its reliance on local governments to invest and finance their own urban services and encouraging the active participation of the private sector in the provision of these services. The destruction of a major municipal and/or privately-owned infrastructure project during a disaster can seriously set back municipal and private capital investment in these areas. The pace of economic growth can thus be slowed down for the country at large, given that GOI would have to divert precious development resources for relief, recovery and reconstruction.

This Report is based upon a set of urban, environmental, and natural hazard interrelationships that have a practical use within Indonesia's normal development process. Specifically, the major objectives of this Report are: to introduce natural disaster preparedness and mitigation as integral components into long-term development planning; to enhance the participation of municipal governments, private sector, and community-based organizations in disaster planning; and to increase general awareness of the possible capital losses that might result from natural disasters.

Five major parts constitute the primary sections of this report. Part I addresses project background and discusses Indonesia's hazard vulnerability. Part II analyzes the institutional framework of natural hazard management in Indonesia. It makes specific recommendations in terms of avenues available for strengthening the institutional capacity of the leading agency for natural disaster management and its inter-sectorial

coordination. Part III identifies three elements of natural hazard disaster planning: municipal governments, community-based organizations, and the private sector. It focus on the need to increase the participation of these sectors in natural disaster management and identifies recommendations to incorporate disaster mitigation measures within sectorial agendas. Pilot activities are identified within these elements of natural disaster planning. Part IV addresses an Action Plan and defines a technical assistance program to support the activities identified in the Action Plan. The Action Plan provides a subordinated agenda to the *Action Plan of HGL on Municipal Finance for Environmental Infrastructure*. For this purpose medium-term goals, actions, steps and indicators are identified.

2. Natural Disasters in Indonesia

2.1 Floods

The islands of Indonesian archipelago are prone to many kinds of natural disasters, but the greatest hazards to human life and property come from flooding that affects one area or the other every year. Two main types of floods (banjir) occur regularly.

Rainwater floods are caused by heavy rainfall occurring over floodplain and terrace areas during the "west monsoon" or the wet season. However, the transitional periods between the wet and dry season in this region, of the so-called inter-tropical convergence zone, may bring additional rainfall. Inter-monsoon rains are frequently stronger than the monsoon rains proper (Donner, 1987). The worst flood ever recorded in Indonesia happened in 1861 in Eastern Java, when four days of continued rain caused some rivers to swell 12-18m above their mean level. Plantations and gardens were destroyed, irrigated rice fields (sawah) washed away and fields and pastures in the plains covered with mud and rubble in some places one meter deep. Fortunately, not all floods reach such catastrophic proportions, mainly due to the fact that island watersheds are relatively small. Yet the consequences of many minor disasters are still serious, especially since flooding always brings significant disruption in economic activity and every-day life.

The second type of flooding that brings devastation to Indonesian coastal regions are the so-called storm-surges, raised sea-levels, caused by a combination of low barometric pressure and strong onshore winds. They cause sudden, but temporary, flooding along the coast with sea water or brackish estuarine water for a few kilometers inland. Many settlements in the low-lying coastal regions that are also most heavily populated are the primary victims of storm-surges. The mitigation measures they require differ from those occurring on river floodplains so they can almost be viewed as two kinds of natural hazards. Kampung Kapuk Muara, Jakarta, described in this report is subject precisely to this type of flooding. While Kampung Improvement Program succeeded in upgrading many urban villages, not all of them have become the recipients of such programs. Flooding still remains the most serious hazard facing both the urban and the rural poor.

2.2 Volcanic Eruptions and Associated Hazards

Indonesian Archipelago is one of the most active volcanic regions of the world, with its 128¹ volcanoes (Siswamidjono, 1988). The greatest known volcanic eruption in the recorded history worldwide occurred in 1815 in Indonesia, when the top of Tambora volcano on the Island of Sumbawa exploded, killing over 90,000 people (Munich Re, 1984). Indeed, Indonesian islands head the list of world regions at high risk of explosive eruptions. Moreover, when the map of active volcanoes is superimposed on the population density maps, Indonesia together with Japan emerges as the area with the highest volcanic risk. About ten percent of Indonesian population live in the vicinity of active volcanoes, and about three million people live in the actual danger zones. Seventy-eight of Indonesia's volcanoes have been active since 1600 AD, twenty-two of which are considered dormant (that is, presently quiet, but expected to erupt again), and twenty-eight extinct – i.e., not expected to erupt again (Siswamidjono, 1988). However, these distinctions – although widely used – are unsatisfactory and have little scientific basis. A volcano may remain quiet for centuries, even millennia, between eruptions – a time interval longer than human memory. Indeed, the longer the period of quiescence, the greater the likelihood for large-volume explosive eruptions (Tilling, 1990).

Volcanology has greatly advanced in the twentieth century. Geoscientists now have a good general understanding how volcanoes work, and important refinements have been made in the methods of volcano monitoring and hazard assessment. Yet corresponding advances in reducing volcanic risk have not been achieved globally. The fact that the 1980s have suffered the most eruption-caused deaths and economic loss since the beginning of this century, and the 1902 eruption of Mt. Pele, Martinique, may mean that the progress in scientific understanding of volcanic activity has been surpassed by explosive population growth.

Volcanologists agree that the most pressing problem in mitigating volcanic hazards on a global scale, is that the most dangerous volcanoes are the least studied. Most of the world's high-risk volcanoes are in the densely populated countries that lack the economic and scientific resources or political will to study and monitor them adequately. Although this problem afflicts both developed and developing countries, it is especially acute for the latter. Future technological advances alone cannot cope with the growing problem of volcanic and associated hazards. Experienced volcanologists contend that a strategy of wider application of currently available technology to little studied and poorly understood volcanoes holds the key to effective mitigation of these hazards. Equally important, in order for this strategy to work, scientists must become more active in educating government officials, the media, and the population at risk, on the nature of volcanic hazards and how to plan for and respond to them.

¹Some sources quote 129 volcanoes in Indonesia.

In addition to the primary risks associated with volcanic eruptions (which include smoke and gas releases, ashfall, lava flow, and nuee ardente – glowing cloud eruptions), volcanic eruptions may also be accompanied by earthquakes and tsunamis, as well as by mudflows (also called lahars). Mudflows are created when thick deposits of ash are mixed with water from rainfall for example. The saturated deposits begin to slide down volcano's slopes, sometimes reaching high speeds of approximately 100 miles per hour. Given the high speeds and long traveling distances mudflows are sometimes more hazardous to human settlements than lava flows. For example Kelud, a volcano on the island of Java, has been known to empty its crater lake periodically, creating mudflows. In 1919, the Kelud lahars affected an area of 200 sq kilometers of farmland and killed 5,000 people (Munich Re, 1984).

Public education and preparedness planning are crucial elements of a strategy to avoid heavy casualties and economic loss. In Indonesia, as elsewhere in the world, the pressure for economic development in order to accommodate requirements of expanding social needs is great, and the development may frequently lead to neglecting real danger. For example, the southeastern coast of Lampung, which was entirely destroyed by the famous Krakatau eruption of 1883 is currently being proposed for tourist development. Krakatau has had a series of minor eruptions ever since 1883, but the attractiveness of its site turned it into a very prominent tourist development target. Information dissemination about the volcanic hazard, preparedness planning and prudent economic development should become a part of the overall development process.

2.3 Landslides

Landslides are a consequence of diverse geologic processes that affect many mountainous regions of the world. Asia is especially prone to landsliding. Indeed, the first historical landslide typologies were developed in the second century B.C. in China (Brabb, 1991). Landslides represent movement of earth deposits, and while some landslides may move very slowly, others may move at a speed of hundreds of kilometers per hour, destroying everything in their path. Most commonly landslides are caused by rainfall, but they can also be associated with volcanic eruptions and earthquakes. Lethal landslide effects are frequently masked by the damage caused by earthquake and volcanic activity, which in turn contributes to a widespread ignorance about this hazard, and relatively few landslide hazard mitigation programs in the world.

Among Asian countries Indonesia is particularly vulnerable to landslides, foremostly due to its mountainous topography and a large number of active volcanoes. The latter type of landslides (mudflows or lahars) have already been discussed. Other landslides in Indonesia are almost exclusively tied to precipitation. Chronic landslides that creep imperceptibly in the dry season would suddenly increase their speed in the rainy season (Santoso, 1989). Agricultural practices (e.g., through deforestation and farming of hill

slopes) contribute to the landsliding problem especially in Java, which is the country's most populous island. Other land-use practices, such as road construction may intensify landslide vulnerability. When roads are built without attention to drainage and stabilization of slopes, dirt banks and ditches are left unprotected, all of which gives potential for earth movement (Jeffery, 1981).

2.4 Earthquakes

The most recent earthquake in Indonesia occurred on July 6, 1990 in Majalengka, affecting approximately 100,000 people in a mainly rural region. In addition to Majalengka and its 122 villages, two other regencies – Sumerdang with forty villages, and Kuningan with ten villages – were affected. Almost 100 government buildings were heavily damaged or collapsed, as was the case with 107 school buildings, 257 mosques, and 9,000 residential buildings. While no casualties occurred, a total of 10,090 families were left homeless, and 117 persons were injured. Given the numbers of damaged and collapsed high occupancy buildings, deaths would have occurred had the earthquake not happen early in the morning, at 7:15 AM. The total cost of material damage caused by this earthquake was estimated over Rp.15.5 billion (BAKORNAS BP, 1991)

According to the recommendations of the *Indonesian Earthquake Study* of 1981, Indonesia is divided into six expected earthquake intensity zones. Zone 1 depicts the areas of highest, while zone 6 is an indication of the least earthquake risk). When major urban centers are superimposed on this map it becomes clear that many cities are in the high earthquake risk areas – Yogyakarta, Semarang, Bandung and Manado, to name a few. Others, like Jakarta, are located in the zones of moderate seismic risk. This, however, does not mean that the damage in a future earthquake in Jakarta will be universally moderate. Modern, well designed and constructed structures will probably remain undamaged, while poorer, substandard city sections may be devastated. Previous experience has shown that this damage distribution in earthquakes, where the more affluent groups remain unscarred, and the poor pay disproportionately more, is widespread across the developing countries. Given high urban densities in Jakarta it is very likely that human toll would be very high even in a moderate earthquake.

(In this context it is appropriate to note that even the Muria Peninsula, the site of the proposed Indonesian nuclear power plants is in the zone of moderate earthquake risk. Environmental impact studies are now being done to determine the level of risk.)

Vulnerability to earthquakes, however, must be understood in relative terms, since Indonesia's most frequent and costly hazards are floods. Volcanic eruptions, mudflows and landslides also appear to occur more frequently than earthquakes. Long recurring periods of earthquakes have created a false impression in the public at large and, importantly, among the public officials that earthquakes pose an insignificant threat in Indonesia.

Low saliency of earthquake issues is neither a new phenomenon, nor a feature only of Indonesia. In the high seismic risk areas across the world earthquakes are ignored or underestimated, because neither the folk, nor the institutional memory retains the last seismic event. Furthermore, the continuing needs of the day-to-day life put high demands on the social resources. Only earthquake destruction brings home forcefully the need to prepare for future events, to mitigate against future losses and invest into retrofitting the old and vulnerable building stock. Rural earthquakes, such as the 1990 Majalengka disaster, ironically appear to be insufficiently dramatic events to prompt concerted public action.

Experience and research, however, suggest that when a country also faces another frequently recurring hazard – or a set of hazards – it is possible to use the salience of these latter issues to introduce earthquake vulnerability as a subject of mitigation programs.² In Indonesia exists a particularly favorable climate to achieve this. Not only is this country annually visited by dozens of floods and landslides, but volcanic eruptions, too, represent a frequent occurrence. This means that the country has a significant experience in implementing mitigation measures to abate the effects of floods, landslides and volcanic activity. The precedence in terms of existing hazard mitigation programs is beneficial, since it means that political decision-makers would be receptive to incorporate another disaster type into multi-hazard reduction programs. Indonesia is fortunate that it has the leaders that recognize the need for disaster mitigation and are willing to take appropriate action. Last, but not least, Indonesia has in place a complete institutional structure for introducing natural hazard mitigation strategies into the regular development process.

Therefore, it can be reiterated that Indonesia already has all the necessary components for implementing a natural disaster reduction program which would prominently include earthquakes. The necessary components in Indonesia's case are:³

- willingness of key actors in public office to implement PMP strategies;
- country-wide experience in mitigating against some types of natural hazards;
- institutional structure in place;
- knowledge of what to do; and
- strategy for incorporating the infrequently recurring hazard types into a multiple hazard reduction program ("piggy-backing").

²This process is usually referred to as "piggy-backing."

³Rubin, Saperstein and Barbbie (1985) identified three essential components for the communities to recover after major disasters: personal leadership, ability to act, and knowledge of what to do.

Fire must be mentioned as a permanent companion of earthquakes, especially in countries where building stock is frequently built of wood. Both in the San Francisco 1906 earthquake as in the Great Kanto earthquake of 1923 that destroyed Tokyo, fire was the major culprit, not the earthquake. In Indonesia, urban fires are an everyday risk and frequent occurrence. It is expected that following an earthquake in a major urban center fire would claim its toll. That is why it is important to prepare adequate response and fire fighting capability, and to develop realistic scenarios for preparedness planning purposes.

2.5 Mitigation Measures⁴

Kockelman (1990) identified five generic components necessary for successful natural hazard reduction programs:

- "Conducting scientific and engineering studies of the physical processes of natural phenomena that may be hazardous – source, location, size, recurrence interval, severity, triggering mechanism, path, ground response, and structure response.
- "Translating the results of such studies into reports and onto maps so that the nature and extent of the hazards or their effects are understood by nontechnical users.
- "Transferring this translated information to those who will or are required to use it and assisting them in its use through educational, advisory and review services.
- "Selecting and using appropriate hazard-reduction techniques – legislation, regulations, design criteria, financial incentives, and public or corporate policies.
- "Reviewing the effectiveness of the hazard-reduction techniques after they have been in use for a requisite amount of time and revising as necessary. Review of the entire program as well as the other components – studies, translation, and transfer – may also be undertaken" (p. 91).

⁴In the current discussion of disaster prevention, mitigation and preparedness measures, it must be understood that the expression "PMP strategies" are interchangeably used with the term "disaster management."

Regarding particular mitigation measures that can be applied to abate the risks of volcanic eruptions, it is important to note that losses can be prevented and reduced by limiting the use of land in the highly exposed areas. In terms of building construction, buildings should be massive and stable to resist earthquakes that may accompany the eruption; building roofs should be sloped to allow for shedding excess ash; fire safety should be of primary importance, and buildings should be built of fire-proof materials. Additionally, artificial barriers can be built to divert the flow of lava or mud into the safe locations. However, careful land-use planning is probably the safest method available, and relocation is one of the long-term strategies to free the most dangerous zones of population and capital investment. However, this is not always easy to achieve, since the lands close to volcanoes are very attractive for a variety of uses, foremostly agricultural. For example, attempts have been continuously made in the past thirty years to induce the population to move from Java to the outer islands and ease the pressure on both urban and agricultural land on this overpopulated island. These attempts were not successful, however. In the period between 1961 and 1976, the policy of transmigrasi (transmigration) resulted in only 1.2 million people leaving Java, but another .5 million moved in (Donner, 1987).

Apparently, out migration (relocation) as a tool to increase population's safety in natural disasters is not a viable proposition in Indonesia. Rich land, in the vicinity of volcanoes and prone to landslides is always "attracting people and consequently [these slopes] are densely populated" (Jeffery, 1981). Moreover, previous research has established a correlation between the distribution of young volcanic materials, soil fertility and population density in Java. The peasants know that volcanic soils are rich and they "would rather risk the danger of eruption than move to less fertile regions where they may have to worry about food shortage" (Pelzen, 1963). Similarly in the cities, for the poor and the low-income earners who live in sometimes highly vulnerable kampungs (urban villages) it is very difficult to find an economic rationale to move back to the rural areas that might be healthier or safer in natural disasters. Despite the health risks, overcrowding and other drawbacks, the urban poor in Indonesia still have more economic opportunities for the support of their families than do their rural relatives.

To mitigate against landslides, prudent land-use measures are the most effective strategies. Changing the uses of endangered zones, planting the trees on hazardous slopes, application of sophisticated farming methods, mapping and assessing the hazard of landslide zones. Similarly, land-use planning is a very effective tool to mitigate against earthquakes, especially when combined with seismic microzonation techniques. Structural mitigation of buildings and non-building structures is still the most widely used earthquake mitigation strategy. Earthquake preparedness planning and public education have started to emerge as very effective long-term techniques of changing the complacent attitudes. The strategies which could be used in order to bring about these hazard reduction practices are the subject of this Report.

PART II. INSTITUTIONAL ANALYSIS

3. National Institutions

While research has established the link between disasters and development, governments and development agencies have not yet systematically integrated natural hazard considerations into project planning and implementation. In practice, disaster management continues to be little recognized as a pivotal issue of development theory, in spite of the negative impacts disasters have on countries' employment rates, balance of trade, foreign debt, and other key elements of economic growth.

However, when reviewing the institutional support system and the development process of Indonesia, it becomes obvious that disaster preparedness and mitigation are issues that cut across the programmatic agenda of government institutions. This section of the Report proposes concrete actions on how to strengthen the institutional framework for natural hazard management in Indonesia and how to incorporate disaster mitigation measures into the development and planning process of the country.

3.1 Background

The system of regional administration in Indonesia is characterized by two ongoing and distinctive processes – specifically, deconcentration and decentralization. The former refers to the process of granting rights for local autonomy; the latter is concerned with the devolution of certain governmental functions and decision-making powers to local authorities. Within this framework GOI has made a commitment to transfer both the responsibility and authority for the leading public sector institutions in urban development to local governments, and substantially to improve local management capacity for resource mobilization throughout the country.

Indonesia's current spatial and administrative structure is characterized by two levels of government (Exhibit 1). Regional government [Kelapah Darah] consists of the head of the region and the local representative council. A second level [Dati II] includes a system of local governments divided into 54 cities [Kotamadya] governed by mayors [Walikota], and 241 regencies [Kabupaten] governed by regents [Bupati]. The People's Local Representative Councils [DPRD] constitute the elective assemblies at this level. The Kabupaten and the Kotamadya are divided into administrative subdistricts known as Kecamatan. There are 3,539 Kecamatan in Indonesia headed by Camats. DKI Jakarta, however, is administered in a different way: it comprises both the provincial and the Kotamadya status in a single unitary authority.

A third level of government [Dati III] comprises a dual system of villages. Under this system there are 4,945 urban villages [Kelurahan] headed by village chiefs [Lurah]. The rural system consists of 61,228 villages [Desa] headed by village chiefs [Kaluradesa].

Both systems are assisted by a People's Representative Assembly [Lembaga Ketahanan Masyarakat Desa]. The Kelurahan is divided in Lingkungan (environs) and each Lingkungan is headed by a chief [Kepala Lingkungan].

For social support, households are grouped into "brotherhoods of citizens" [Rukun Warga] (RW), which encompass "brotherhoods of neighbors" [Rukun Tetangga] (RT). Each RT includes up to 30 households in Desas and 25 households in Kelurahan. Finally, the Kampung⁵ system, comprising the Kelurahan, the Rws and the Rts completes Indonesia's complex spatial system.

Repelita, or the five year development program, is the most important program of GOI, since it provides precise guidelines for state policy. GOI is well on its way to completion of Repelita V (1989-1994), which stresses the development of human settlements and the improvement of social welfare. Past Repelitas stressed: the rehabilitation of existing urban infrastructure and the preparation of the technical-technological aspects of housing development (Repelita I – 1969-1974); the expansion of water supply facilities and the provision of affordable housing (Repelita II – 1974-1979); intensification of human settlements development and equitable distribution of growth (Repelita III – 1979-1984); and the participation of local governments, the private sector and communities in the planning, financing, implementation and maintenance process of urban infrastructure development (Repelita IV – 1984-1989).

3.2 BAKORNAS PB: The National Coordinating Board for Disaster Management

Badan Koordinasi Nasional Penanggulangan Bencana (BAKORNAS PB) is a non-structural government board which formulates policies, issues directives and guidelines in the areas of disaster prevention, mitigation, relief, rehabilitation, and reconstruction, both at the national and the local levels. Its legal framework was a subject of a Presidential Decision issued in 1979 and modified later by a Presidential Decree in 1990.

The Board is directly accountable to the President through its Chairman, the Minister Coordinator for People's Welfare. The main activities of BAKORNAS PB are supported by an array of institutions that perform distinctive functions in disaster management. These institutions become operational as needed and act in accordance with the needs and priorities identified by BAKORNAS PB. Members of BAKORNAS PB meet at least four times a year.

⁵Kampung may be identified as urban village. It corresponds to an older urban structure which existed before the present structure introduced in this subsection.

Other board members of BAKORNAS PB are the Ministers of Social Welfare, Home Affairs, Health, and the Commander of the Armed Forces. When a disaster strikes, the Governor of the affected province also becomes a member of BAKORNAS PB. In addition, officials of the Defence and Security Department, Mining and Energy Department and non-governmental organizations may be mobilized to become part of BAKORNAS PB'S inter-institutional support.

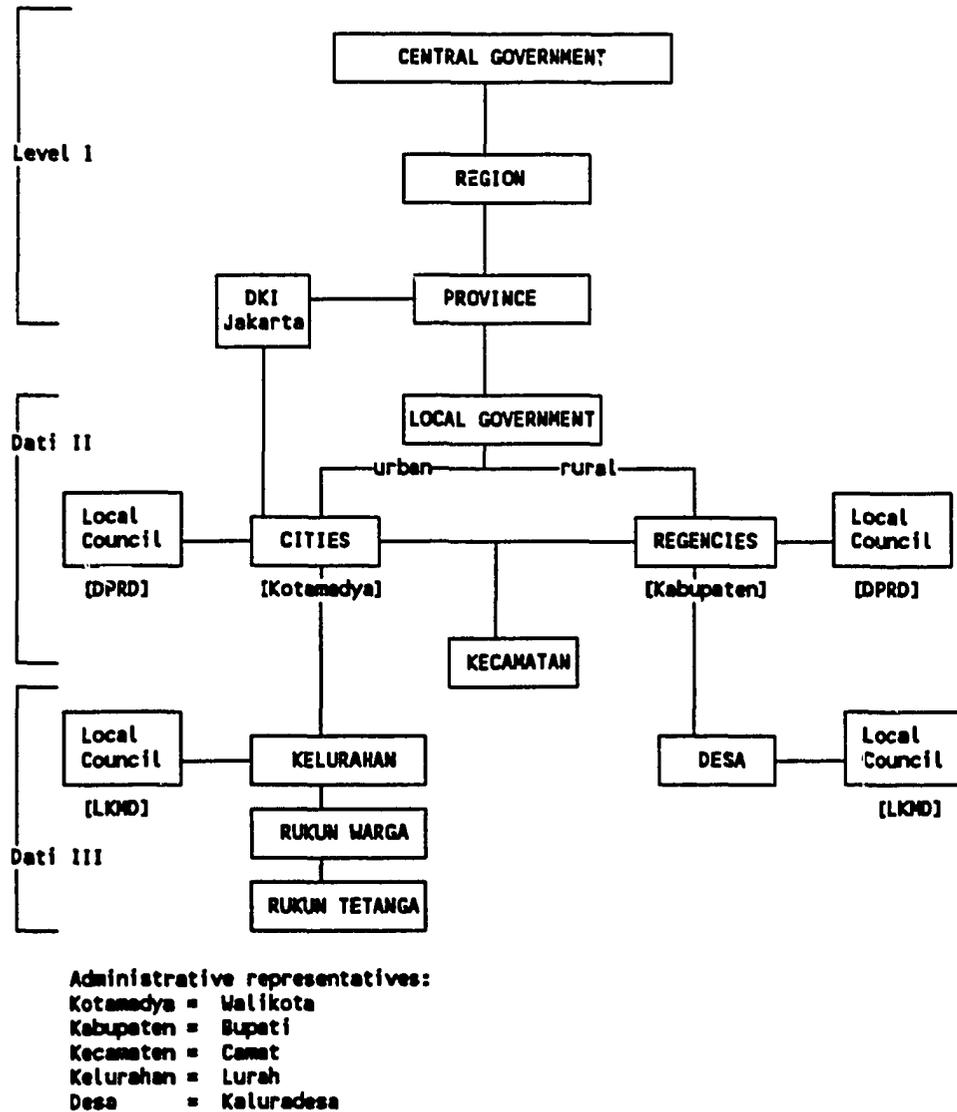


EXHIBIT 1. Spatial Distribution of Indonesia

Secretariat of BAKORNAS PB is under the authority of the Directorate for Disaster Relief, and is located in the Directorate General for Social Assistance for Development, Department of Social Affairs. The Secretariat has its headquarters in the Indonesian Disaster Management Center (IDMC) in Jakarta.

At present, GOI is constructing a new building to house BAKORNAS PB. Although GOI's concrete plans for the future direction of BAKORNAS PB were not possible to obtain during field preparation of this Report, the fact that a new building is being constructed for BAKORNAS PB, seems to suggest that there is an increasing commitment of GOI to natural hazards management and that future plans might include changing BAKORNAS PB from a non-structural to a structural institution. This could open wide opportunities for implementation of the recommendations made throughout this Report.

In addition, GOI intends to expand its activities in disaster management, through one of the projects sponsored by UNDP. The project entitled "Strengthening Disaster Management in Indonesia" is in its second phase, and US\$930,560 is currently budgeted for technical assistance. The project aims to achieve an integrated and multi-sectoral approach to disaster management at national and subnational levels. For this purpose, the project is being designed along three components: implementation of pilot disaster management activities in North Sulawesi Province; raising the capacity of BAKORNAS PB to act as an information clearinghouse for its members; and enabling the BAKORNAS PB membership to identify and prioritize initiatives in their respective sectors in terms of hazard management activities.

At the provincial level the agencies for Disaster Management (Satuan Pelaksana Penanggulangan Bencana [SATLAK PBs]) operate under the Walikota in urban, or Bupati in rural areas. SATLAK PBs consist of the local representatives of the departments of Social Affairs, Home Affairs, Health, Communications, and the Armed Forces. The Head of the local Civil Defence Unit is SATLAK PB secretary. In disaster situations, SATLAK PBs establish special task forces (SATGAS) to respond to the specific problems of disaster affected communities.

BAKORNAS PB's organizational structure is most adequate to embrace the comprehensive activities in natural hazard management, especially in view of the potential institutional consolidation of BAKORNAS PB. This agency has access to institutional networks capable of operating at central, municipal and community levels. In addition, BAKORNAS, through the Indonesian Disaster Management Center (IDMC), has training resources, office equipment, transportation vehicles, a disaster management library, and communication capabilities.

However, BAKORNAS PB's basic activity is directed almost exclusively to respond to disasters [*becana alam*], rather than to undertake long-term strategies designed to minimize the effects of damaging events. At the provincial level the situation is very

similar. SATLAK PBs are weak and have limited capacity for planning and implementing long-term mitigation programs. They lack trained personnel, office space, and sufficient budgetary support.

One of the major findings of the UNDP study of Indonesia's disaster management system is the lack of BAKORNAS PB's inter-sectoral planning. The current diversity of multi-sectoral interventions in disaster management can be understood from the following activities carried out by various Indonesian institutions directly or indirectly related to BAKORNAS PB:

- The Department of People's Welfare is responsible for mobilizing emergency assistance and social services in support of disaster victims and for creating social organizations and task forces to cope with disaster situations.
- The Department of Social Affairs covers the social sector and is responsible for providing guidance to regional governments in coping with natural disasters.
- The Department of Public Works is responsible for mobilizing its technical capabilities for recovery and reconstruction following disasters and has implemented programs on flood control, and volcanic lava and debris.
- The Department of Health is responsible for mobilizing the necessary health facilities and services to assist disaster victims.
- The Meteorological and Geographical Center (Department of Communication) addresses meteorological aspects, and is also responsible for geophysical monitoring.
- The Department of Mines and Energy encompasses three hazard-related Directorates: Environmental Geology dealing with landslides and soil movement, Volcanology for monitoring volcanic eruptions, and Geologic Research and Development Center for the investigation of earthquakes.
- The Department of Telecommunications oversees the National Search and Rescue Organization [BASARNAS].
- The Department of Home Affairs is responsible for defining national policies on natural disasters and is responsible for activating the 3,600,000 members of the Civil Defense.

In addition, several technical departments conduct activities bearing on disaster management, including: the Palapa Domestic Satellite program; the LANDSAT imagery collection station [LAPAN] (which processes data from the Japanese geostationary satellite GMS and the US NOAA satellites); the research facility PUSPITEK of the

Department of Research and Technology; and the Bandung Institute of Technology (BIT). In addition several NGOs, such as the Red Cross, also undertake significant disaster related work.

The remaining parts of this section are directed at identifying avenues available for strengthening the institutional capacity and inter-institutional coordination of BAKORNAS PB, to ensure that natural hazard considerations become an integral part of the development process in Indonesia.

3.3 A New Approach to Disaster Management

The main objective of this subsection is to identify an inter-institutional framework that can serve as support for the long-term planning of natural hazard management activities as an integral component of the normal Indonesian development process. The underlining concepts of this approach are that a) to undertake a comprehensive approach in terms of disasters, natural hazard management needs to become an integral part of the socio-economic planning processes in Indonesia; b) key planning institutions need to focus on natural disaster long-term planning; and c) more effective inter-institutional coordination is needed within those agencies that are directly or indirectly involved in natural hazard mitigation planning.

3.3.1 An Institutional Framework: TTRN

The performance of urban infrastructure during a disaster is very much interrelated to the spatial planning processes of a particular country; it deals with policies on where and how urban infrastructure is being built. The fact that natural disasters are having a much higher socio-economic impact on developing nations than on industrialized countries is partially a consequence of the limited capacity of developing nations to anticipate future disasters. It is a well-known fact that developing nations are confronted with a large number of critical issues that require immediate attention; long-term spatial planning which anticipates future disasters that might or might not occur within a foreseeable future may well be a secondary concern. The delivery of well-placed suitable land for urban development complying at the same time with hazard mitigation requirements and sound environmental practices increasingly constitutes a major challenge for developing nations.

The National Spatial Planning Committee (Tim Tata Ruang Nasional [TTRN]) is an ideal vehicle for introducing natural hazard mitigation measures within the spatial planning and implementation processes of urban infrastructure throughout Indonesia.

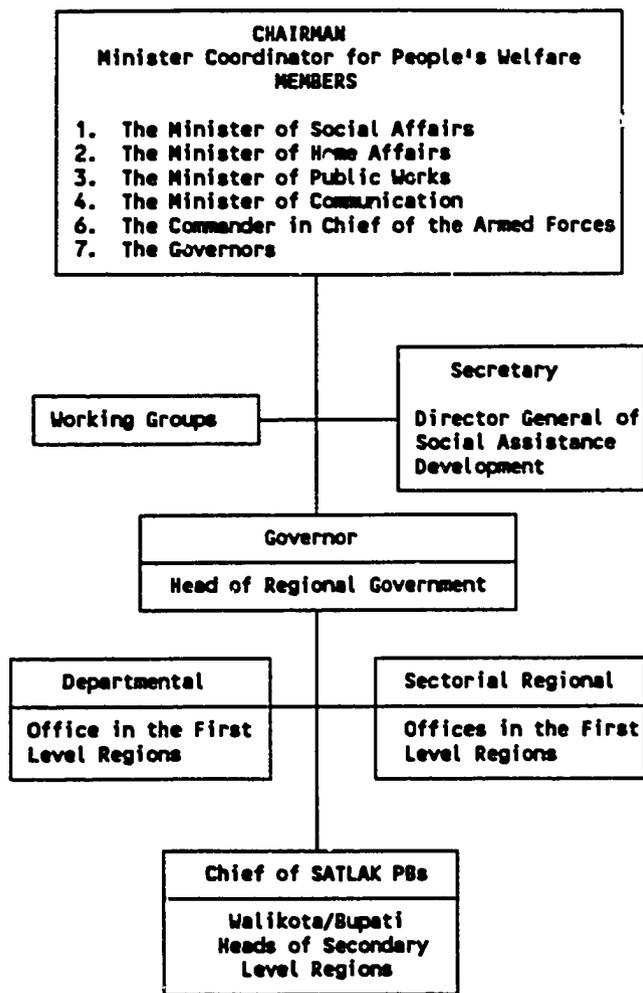


EXHIBIT 2: BAKORNAS PB'S INSTITUTIONAL FRAMEWORK

The TTRN is a permanent committee that was formally established in 1990 by presidential decree number 57. The TTRN is chaired by the Minister of National Developments Planning. In addition, its members institutions include BAPPENAS⁶, BAPEDAL⁷, Home Affairs, Human Settlements, and Ministry of Public Works (Exhibit 3)

TTRN's main mandate is to operate as a forum for the development and institutionalization of all policies, guidelines and strategies related specifically to both urban and rural spatial planning. The law that regulates this Committee and specifies that TTRN responsibilities must transcend beyond policy and should include effective logistics and implementing processes for identified policies, is what makes this committee most appropriate for introducing practical natural hazard mitigation measures within the current spatial planning processes of the country. This Report recommends that natural hazard mitigation strategies can be conceptualized and discussed within the TTRN membership and results can then be transferred to appropriate planning institutions. This Report recommends that urban infrastructure investment should be neither planned nor implemented without natural hazard mitigation considerations; to do so otherwise will be to increase the risk of GOI investments in urban infrastructure.

To achieve this objective this Report recommends that a member of BAKORNAS should be responsible for introducing natural hazards mitigation strategies within the TTRN. This suggestion is applicable for the present and future (if modified) structural organization of BAKORNAS PB.

Sample Activities

- o Pursue strong inter-sectoral support for spatial planning of urban infrastructure with natural hazard mitigation measures.
- o Include BAKORNAS PB as an institutional member of TTRN.⁸
- o Introduce mitigation measures within the long-term spatial planning of urban infrastructure throughout Indonesia.

⁶National Planning Ministry [BAPPENAS] is a planning board, responsible for preparing a five year plan. It provides assistance to local governments for planning and budgeting.

⁷The National Environmental Impact Management Agency

⁸Under the present institutional arrangements of BAKORNAS PB, a board member should be selected and made responsible for introducing natural hazards mitigation strategies within the TTRN. If BAKORNAS PB is re-structured in the future, members of the new institutions should become permanent members of TTRN. This clarification applies to other similar situations endorsed by this section (see Policy and Environmental Frameworks).

3.3.2 A Policy Framework: TKPP

The underlining rationale of this Report is that municipalities are the primary institutions for implementing disaster management. They are crucial to the country's system of government, since they provide the necessary means for collective well-being; contribute to the protection of local interests; and, plan and promote community development and physical planning. The rationale for this approach is already present within Indonesia's current natural disaster management structure: SATLAK PBs operate under Walikota or Bupati, which brings the entire disaster management operation into the responsibility of the local government.

The need to enhance the participation of other sectors, such as community-based organizations and the private sector, is also critical for an effective disaster management operation. Municipal governments, and other institutions that operate at the provincial level, are equipped to carry out functions under normal circumstances, but typically do not have the resources to respond to the massive demands of the community when major disasters strike.

The ideal institution under which to include the long-term natural disaster management goals and integrate them into the development planning process of Indonesia is the Coordinating Team for Urban Development [Team Koordinasi Pembangunan Perkotaan's] TKPP.

TKPP was formally established by a decree of BAPPENAS which sets up TKPP as a temporary committee whose responsibility extends indefinitely. It operates at the Director General level and has set up special committees in areas such as finance, institutional development, etc. It is intended to "serve as the urban policy forum, a monitoring and review body and as a focal point for communication with foreign donors in the urban sector" (RTI, 1990). It was originally formed to manage the implementation of overall policy and planning issues related to the decentralization of urban services, but it recently has become more involved in the day to day coordination and problem solving required by the decentralization process and its role as a policy forum for the decentralization of urban services has diminished.

TKPP can provide a policy forum conducive to the implementation of natural hazard concerns. The clearest GOI statement of policies on decentralization and privatization is reflected in the TKPP policies regarding the urban development of Indonesia. TKPP's policy statements entail the transfer of the responsibility and the authority for the leading public sector role in urban development to local governments, the improvement of local management capacity and resource mobilization, and a development of a sound base for expanding private sector participation in urban services. The TKPP Policy Action Plan (explained further in section IV) provides the framework for achieving these ends.

Furthermore, given the high degree of coordination that must occur for an effective disaster management program, TKPP – through its planning board – can serve as a policy review body and a focal point of communication for government agencies and donors in the natural hazard management field. TKPP is chaired by a BAPPENAS member and it includes representatives from the Ministry of Public Works, Ministry of Home Affairs, and Ministry of Finance.

Sample activities

- o Include BAKORNAS PB as an institutional member of TKPP.
- o Redefine and clarify the role of BAKORNAS PB and introduce a well-defined long-term planning mitigation component within its agenda.
- o Pursue a strong inter-sectoral planning activity among the institutions that provide central support to BAKORNAS PB and, at the provincial level, to SATLAK PBs.
- o Redefine and clarify the role of municipalities in disaster management activities.
- o Enhance the participation of other sectors, such as community-based organizations, and private sector in natural disaster management activities.
- o Identify new resources for natural disaster management and planning and the delivery of appropriate infrastructure. For example: creation of new taxes when construction takes place in high risk areas; issuing of government bonds for the construction of urban infrastructure that serves to mitigate natural hazards; increase of service charges for construction permits and plan revisions in high risk areas.

3.3.3 An Investment Planning Framework: IUIDP-IMG

The relationship between urban infrastructure and hazard management has been clearly established throughout a long chronology of natural disasters. For instance, during the 1985 Mexico City earthquake, almost one percent of all buildings damaged were hospitals, resulting in tremendous costs and high levels of disruption in the city. In the 1989 Loma Prieta (U.S.) earthquake not one high-rise building in the most affected area failed catastrophically; the main problems experienced were primarily limited to the general lifeline systems (i.e., collapses of the upper deck of the San Francisco-Oakland Bay Bridge and the Cypress Street double-deck highway). The usual disaster impact on urban systems is very high, since urban infrastructure is composed of numerous sophisticated subsystems, and any damage to a weak subsystem can cause serious disruption or complete failure of the entire system.

IUIDP is an improved concept for investment, programming, implementation, operation, and maintenance of urban infrastructure. It integrates the seven Cipta Karya sub-sectors into multi-year investment plans, thus constituting an inter-disciplinary approach to project planning. IUIDP has been implemented nation-wide under the guidelines issued in 1987 (TKPP 1987b).

Although the inter-institutional relations between Cipta Karya and BAKORNAS PB should not be disregarded in terms of natural disaster management planning (Cipta Karya is still the focus of national professional skills regarding physical infrastructure, and will be responsible for delivering large infrastructure projects) more emphasis should be given to the future inter-sectoral relations between BAKORNAS PB/IDMC and the project-planning capabilities of the IUIDP. The inclusion of natural disaster management considerations and impact assessments within the IUIDP standard-setting process is key to decreasing the potential capital losses in urban infrastructure as a consequence of disasters.

The Interdepartmental Management Group (IMG), established to support TKPP in the implementation of IUIDP-IMG consists of the representatives from the Director level and regularly handles operational coordination of the IUIDP investment program based on policy guidance from TKPP. In addition to operational coordination functions IMG makes recommendations of policies and strategies for IUIDP, prepares guidelines and manuals for preparation and implements IUIDP investment programs and provides IUIDP training.

IMG as a managerial group, is crucial to the functioning of IUIDP. This group acting as a task force operating at the national level, includes two members from BAPPENAS, one of whom chairs the IMG; two members from the Ministry of Home Affairs; one member from the Ministry of Finance; and one from the Ministry of Public Works. Senior staff from other institutions participate in the IMG meetings as appropriate. All IMG members are also members of TKPP.

This Report contends that IMG is the most logical vehicle for incorporating natural disaster concerns into the IUIDP investment and development process (Suselo, 1992).

Sample Activities

- o Include natural disaster management considerations within the IUIDP standard-setting process.**
- o Include IDMC as an institutional member of IMG.**
- o Include natural disaster management considerations within the IMG standard-setting process.**

3.3.4 An Environmental Framework

Bencana alam (natural disasters) and environmental degradation are mutually reinforcing. The effects of development are taking their toll on the environment, which in turn affects the frequency and extent of disasters. Disasters destroy existing development efforts, thus completing this vicious circle. For example, disasters such as floods, droughts, and famines are more a result of indiscriminate farming and the cutting of fuel-woods, than of the excess or lack of rainfall in a particular area; bare slopes cannot hold the rainfall that should replenish the water tables – instead, the water streams off rapidly into the rivers and seas. Environmental destruction of sea-front dunes, coral reefs and mangrove forests increase the vulnerability of coastal villages to floods, tsunamis and coastal waves. The destructive effects of typhoons and wind storms are aggravated by increasing deforestation which reduces the natural buffering effects of forests on substandard settlements. The impact of geological disasters, such as earthquakes, landslides, tsunamis, and volcanic eruptions (some of the richest agricultural lands are clustered in active volcanic zones) are magnified by unwise human actions, such as the cutting of trees and the location of development on active faults or highly eroded slopes. The proliferation of unregulated neighborhoods, lacking adequate infrastructure, has increased the adverse effects of earthquakes, landslides, and erosion in urban agglomerations.

In Indonesia, water and water-related issues (wastewater, flooding, erosion, and groundwater levels) are probably the most serious development and environmental concerns facing the country. Most cities in Indonesia have evolved around coastal valleys or tidal floodplains. The accumulation of solid waste, blocking the flow of water in canals and drainage channels, is increasing the exposure of large populated areas to flooding of heavy polluted waters, causing severe health problems. Data shows the devastating effects of these trends; eighty percent of infant deaths are caused by water-related disease (infant mortality is estimated at the rate of 90 per 1,000 live births). These trends do not seem likely to reverse in the near future.

This Report contends that the activities related to natural hazard management are, in fact, an extension or a complement of environment-related activities and programs; and that the implementation of a natural hazard program should support the many activities and concerns related to mitigating environmental degradation.

In 1976, GOI established the Ministry for Population and the Environment [KLH]. Its main responsibilities are planning and strategic development for environmentally damaged areas. This ministry has substantial resources for collecting population statistics, national resource management for land use planning and formulation of environmental policy.

The National Environmental Impact Management Agency [Badan Pengendalian Dampak Lingkungan] (BAPEDAL) was established in 1990, with a mandate to formulate policies on pollution control, and hazardous waste management; and to promote public participation in environmental issues. After the creation of BAPEDAL, many environmental regulatory functions and staff previously assigned to KLH were transferred to this new organization.

Due to the strong interrelation that exists between *bencana alam* and environmental degradation, this Report strongly recommends strengthening inter-institutional relations between the national environmental institutions and BAKORNAS PB. In particular, inter-institutional relations should be strengthened between BAKORNAS PB and BAPEDAL.

As an example, BAPEDAL could include natural disaster considerations in existing or future standard procedures, which may assist in the incorporation of mitigation measures into project analysis. By the same token, BAKORNAS PB could observe environmental issues in the light of disaster preparedness, mitigation, and prevention planning. Mutual support between these institutions could occur in the form of exchanging information and data on natural resources, land use planning, statistics, planning methodologies, and formulation of policies that affect both environmental degradation and *bencana alam*. Training activities for the BAPEDAL staff, when appropriate, should include key members of BAKORNAS PB. Importantly, a representative of BAPEDAL should become a member of BAKORNAS PB.

Sample Activities

- o Include a representative of BAPEDAL in the membership of BAKORNAS PB.
- o Include natural hazards considerations in existing and future standard procedures of BAPEDAL.
- o Include environmental consideration in existing and future standard procedures of BAKORNAS PB.
- o Support and exchange mutually reinforcing training activities between BAPEDAL and BAKORNAS PB.
- o Exchange relevant information and data between BAPEDAL and BAKORNAS PB.

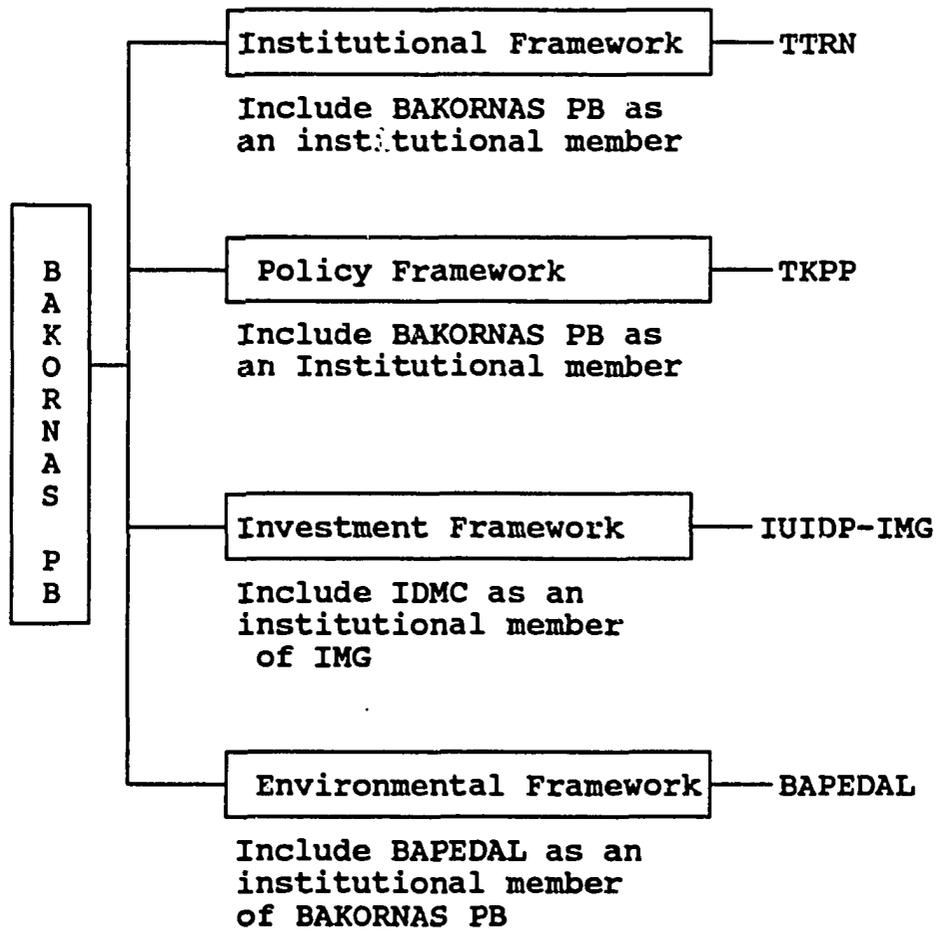


EXHIBIT 3: BAKORNAS PB'S PROPOSED INSTITUTIONAL FRAMEWORK

4. Nationally-based Institutions

Indonesia is a developing country that has an experience in cooperating with foreign development agencies and is attractive for assistance investment by a number of international donors. The cooperation has usually been successful, demonstrating the kind of international development partnerships that may be pursued elsewhere in the world. While this section of the Report is not an exhaustive review of all Indonesia-based international donor agencies, it describes at some length the selected projects of the major foreign donors (other than US AID), Japan International Cooperation Agency (JICA), the World Bank and United Nations Development Programme (UNDP). This selection has been made on the basis of their programs' pertinence for the current PMP project.

4.1 Japan International Cooperation Agency (JICA)

Japan International Cooperation Agency's (JICA) involvement in Indonesia is a part of Japan's major assistance program to the developing countries of the world, and especially those located in the zone of the Pacific Rim. Currently, JICA is sponsoring 213 Japanese experts on medium- and long-term assignments in Indonesia, and thirteen "junior experts" on short-term technical assistance assignments. They are engaged in a variety of projects throughout the country, including Watershed Management project in South Sulawesi (1988-1993), the Volcanic Sabo Technical Center (VSTC, 1992-1997) and the construction of the Environmental Management Center (EMC) in Serpong, West Java (1992-1993).

The construction of the Environmental Management Center has begun in mid-1992, and is expected to be completed in 1993. The establishment of EMC is a direct result of the need identified by GOI to "promote sustainable development and control environmental pollution" in the course of its current Repelita. The Center is designed to be the central institution for "establishing future environmental administration by further promoting research in environmental policies, development of environmental management technologies, information data analysis and training for administrative officials and engineers in private corporations" (JICA, n.d.).

EMC is situated on the campus of the National Center for Research, Science and Technology (PUSPIPTEK) in Serpong, West Java, which is about 30 miles away from Jakarta. EMC's facilities will include research and administrative buildings to be built in the course of the first phase, and training facilities (second phase). The Center's tasks will be twofold: practical research on environmental quality monitoring, and the development of human resources through technical education and training for staff of relevant agencies and members of the private sector. Environmental Impact Management Agency (BAPEDAL) will be the owner of the new Center. In substantive terms, EMC will focus on the investigation of water and soils, air and noise, as well as toxic

substances. In addition to the provision of training in these same areas, courses will also be offered in overall environmental management.

When completed, EMC will certainly be the most important research institution in Indonesia to take on the challenge of mitigating against environmental risks. Given the existence of other related research institutions (specifically, Geological Research and Development Center and the Institute of Human Settlements), it would be appropriate to establish cooperative relationships among them, especially in the area of education and training. Given EMC's proximity to Jakarta, the new Center can become a foremost training ground for a variety of professionals and members of the public in environmental management. Therefore, it will be important to develop educational and training curricula to take fully into account the relevance of environmental management for disaster mitigation.

The Volcanic Sabo Technical Center (VSTC) in Yogyakarta is one of the most significant project supported by the Japanese government in Indonesia. VSTC has been under the management of the Department of Public Works, and is the result of a long-standing cooperation (begun in 1970) between the Government of Japan and GOI in mitigating the effects of volcanic eruptions, mudflows, slides, and floods. Protective ("sabo") structures include check-dams, channels, sand-pockets, embankments, and dikes. The Directorate of Rivers in the Directorate General of Water Resources Development is in charge of surveying, planning and construction of these protective structures, while the Institute of Hydraulic Engineering of the Agency for Research and Development, is in charge of VSTC training.

4.2 The World Bank

The World Bank has been active in assisting the process of building the urban infrastructure in the national capital district (Jakarta DKI) since 1975. The World Bank has implemented five urban projects, and is now involved in two continuing loans: first, for East Java and Bali, and second for Sulawesi and Irian Jaya.

The flagships of the World Bank's involvement in Indonesian urban infrastructure development, however, are the Kampung Improvement Programs (KIP). From the first two urban projects KIPs evolved into Drainage Improvement Programs (DRIP), and Solid Waste Improvement Programs (SWIP). Since KIPs are discussed in the next section of this Report, it will be mentioned here that some of the policies that were applied in kampung improvement program may reinforce hazard susceptibility of these very densely populated and poor settlements. For example, the decision to keep alleyways and public "streets" sufficiently narrow in order to discourage the congestion by vehicular traffic, at the same time increases the vulnerability of the kampung population to fires. This hazard cannot be effectively fought without fire trucks which cannot enter narrow alleys. By the same token, the narrowness of the passages endangers any evacuation procedure. It is

important, therefore, to incorporate natural hazards other than floods as part of the criteria for improving the numerous kampungs in Indonesia.

4.3 United Nations Development Program (UNDP), and Other Donors

In comparison with other donors, UNDP's involvement in Indonesia is minor. Indeed, UNDP frequently serves as an agency that takes on and continues a project initiated by another, major, donor: e.g., UNDP co-sponsored (with the World Bank and the Government of the Netherlands) an IUIDP Implementation Support Program, and is currently overseeing this project for the two other donors.

Alternately, UNDP shares the cost of a single project with another donor. For example, in 1985-1989 US AID and UNDP shared the cost of establishing Indonesian Disaster Management Center (IDMC). Recently, UNDP co-sponsored with the Government of Finland the project on strengthening Indonesian national shelter strategy.

Asian Development Bank (ADB) has been involved in infrastructure projects for the cities of Semarang (Central Java) and Bandung, the scope of which included water supply, sewerage, drainage and solid waste disposal. And Government of France has been assisting with the Land Information System in the city of Semarang.

4.4 Opportunities for PMP

On the basis of an analysis of other donors' involvement in Indonesia, an important opportunity becomes apparent for facilitating the incorporation of multiple hazard prevention, mitigation and preparedness strategies into the regular infrastructure development process. This opportunity is the existence of a concrete and well rooted tradition in Indonesia of implementing the structural mitigation measures against the effects of volcanic activity, mud-flows and floods (in the form of "sabo" works). Given the current establishment of VSTC, it is appropriate to consider disseminating the information about and seeking institutional support for various non-structural disaster mitigation measures discussed in this Report in the context of existent, societally and politically accepted structural volcanic and flood protective measures. Indonesian remarkable successes in abating some effects of volcanic activity, and considerable efforts that are being invested into river regulation and flood control in this country, can serve as appropriate vehicles for introducing the less visible – hence, less salient but equally destructive – hazards such as earthquakes. In fact, research findings from other parts of the world support the strategy of "piggy-backing" disaster issues of lower salience to the problems that command public attention.

PART III. KEY ELEMENTS OF NATURAL DISASTER PLANNING

This section focuses on increasing the participation of municipalities, community-based organizations and private sector in natural disaster management activities. It also identifies several avenues to incorporate natural hazard mitigation concerns within their sectorial agendas.

5. Increasing the Participation of Local Governments in Natural Disaster Management

Urban growth is usually triggered by economic development, mainly through the agglomeration of industries and human settlements. As cities begin to grow rapidly, demand on urban services increases, as do environmental degradation and exposure to natural hazards. In Indonesia, the urban growth rate is 5.4 percent and is one of the highest in the world. The United Nations' estimates show that the population of Jakarta grew from about 2.8 million in 1960 to nearly 9.5 million in 1990, and that it will surpass 12 million by the end of the 1990s; Medan grew from less than 500,000 in 1960 to about 3 million in 1990; and Surabaya's population increased from less than one million in 1960 to about 2.7 million in 1990. By the year 2025, the urban population of Indonesia will reach 152 million, fifty five percent of whom will be living in urban areas (only 40 percent in 1990).

With rapid urbanization, the responsibility of local governments to provide basic services increases. The need for local governments to provide capital infrastructure can be ascertained by reviewing the existing demands: in Indonesia the majority of urban residents still do not have access to piped drinking water, only about 38 percent of the total population are covered with safe water; sewer systems reach less than five percent of the population; 68 percent of the capital's residents use septic tanks. A network of canals and rivers provide the main means of water disposal. Due to these inadequacies, a large part of Jakarta's population is continually exposed to flooding of highly polluted river systems and to severe health and environmental problems.

As major cities grow rapidly, the protection of future public and private investments in basic infrastructure becomes critical. However, the delivery of infrastructure complying to hazard mitigation requirements and sound environmental practices constitute a major challenge.

This section argues that long-term mitigation measures need to become an integral component of the planning process of local governments. The rationale of this argument is based on the fact that to include natural hazard mitigation within municipal government planning is essential for the delivery of sound infrastructure. In this sense, Walikota and Bupati should be considered as key elements of planned natural hazard management programs. Following a description of the institutional support system of municipalities, a set of development strategies is introduced as a potential vehicle for

promoting natural hazard reduction. In addition, local taxes, municipal bonds and development impact fees are examined, principally from their potential in furthering disaster mitigation efforts. It is acknowledged, however, that at this time these fiscal mechanisms may not be readily usable for Indonesia. Given the country's fast pace of both urbanization and economic growth, it is very likely that GOI, through the municipal governments, may want to explore these fiscal mechanisms in greater detail in the future. The same rationale is valid for the use of insurance mechanisms (discussed in greater detail in the section 7.2) to reduce the impacts of hazards.

5.1 Incorporating Natural Disaster Considerations in the Development Process of Local Governments

During the 1960s and 1970s Indonesia has experienced a dramatic increase in financial resources available for capital investment as a result of the rise in oil prices. This increase in resources allowed GOI to expand local infrastructure in all parts of the country through direct financing. For example, the expansion of routine grants to regional and local governments rose from Rp 44 billion in 1969/70 to Rp 976 billion in 1980/81 (Devas 1987). However, during the mid-1980s oil revenues declined rapidly, causing a halt in the centrally funded infrastructure projects. GOI realized that it was not possible to continue the supply of basic infrastructure to satisfy the demands of an increasing urbanization process.

As a result, the GOI adopted a decentralization and deconcentration process in order to deliver better urban infrastructure to the people. Through Government Regulation No. 14 of 1987, GOI assigned responsibility to municipal level [DATI II] for the development of urban infrastructure and services. This transfer of responsibilities to the local level is crucial for integrating natural disaster management issues into the spatial and development planning process. As the process of decentralization progresses, a large number of public institutions are also advancing in the same direction. For example, Cipta Karya has transferred its responsibility for planning and executing infrastructure projects to vertical agencies that operate at the provincial level [Kanwil Pu or Kepala]. BAPPENAS is the national board, responsible for preparing the national budget and a master five year plan. This institution has already created 27 offices (BAPPEDAS) at the provincial level [DATI II]; and 240 at DATI III level (namely, BAPPEKO in Kotamadyas and BAPPEKA in Kabupatens). BAPPEDAS together with the Cipta Karya's decentralized offices constitute the DINAs which are municipal sectoral agencies of the local governments. The legislation that created BAPEDAL call for regional BAPEDALDA in each province and local BAPEDALDA at the municipal level. In addition, potable water provision has also been decentralized through the creation of self-sustaining local water companies (PDAMs).

By integrating disaster mitigation activities at this level, it appears almost certain that future infrastructure development can include effective disaster reduction activities.

The following discussion includes activities that should be considered for promoting the integration of natural hazard mitigation within the planning process of local governments.

Preparing Natural Hazards Impact Assessments

Article 16 of the Environmental Management Act of 1982, Law 4/82 provides the legal basis for environmental assessments in Indonesia, [Analisa Mengenai Dampak Lingkungan] (ANDAL). This process entails:

- a screening process to determine if projects need preliminary environmental information reports (PILs); and
- a decision on whether the detailed environmental assessments (ANDALs) are needed (on the basis of PIL's previous determination).

This Report recommends that similar routine analyses be undertaken to decide if the level of a municipality's exposure to natural disasters warrants procedures similar to PIL and ANDAL for disaster PMP actions.

Integrating Natural Hazards Impact Assessments into the Cipta Karya Development Process

The introduction of natural hazard mitigation considerations within the Cipta Karya development process should stress the need to include -- as a routine procedure within Cipta Karya's project cycle -- a hazard impact analysis in the form of PILs (a screening process to determine if projects need preliminary environmental information reports) and more complete assessments [Analisa Mengenai Dampak Lingkungan] (ANDALs).

Integrating Natural Hazards Impact Assessments into the Project Cycle

One of the main constraints experienced with the implementation of PILs and ANDALs is that they are not well integrated into the project cycle. "By the time mitigatory measures and monitoring plans (RKLs and RPS) are ready, most projects have already reached the stage of land acquisition and completion of detailed designs. The costs of unexpected changes at this point are often unacceptable, whatever the environmental impact" (Ferguson, 1992).

Since the solution to most disaster mitigation problems will depend on improved urban infrastructure and services, it is clear that sustainable long-term planning will only be achieved if environmental issues and disaster mitigation are strongly integrated into the

project cycle. **This Report proposes a set of sample guidelines to integrate disaster mitigation measures as an integral part of project formulation and implementation. This set of guidelines may be viewed as standard procedures recommended to PRE/H for integration into USAID Disaster and Development Programs (Florida A & M, 1991-draft). The rationale of this approach is that in high-risk areas, sustainable development is only possible to the extent that development planning decisions, in both the public and private sector, address the destructive potential of natural hazards. The following is a list of guidelines:**

- **During the feasibility study of the development project, a determination should be made as to the range and extent of natural hazards that could effect the development project site. This information should be incorporated into the process of project selection to ensure that the cost-effective protection of the project is adequately reviewed during project evaluation.**
- **During the feasibility study phase a preliminary identification should be made of the availability of sources for hazards data and information on prior disasters that could effect the development project site.**
- **During the project design phase (development of the action plan) recommendations should be developed for institutional actions that would reduce the risk of disasters to the development project.**
- **During project design mitigation and prevention strategies and monitoring plans should be identified that, if enacted, would protect the project from disaster impact.**
- **During the project design the accessibility and sufficiency of applicable and local hazards data and information should be evaluated; costs and actions should be projected for the capture of such information if it is not readily available.**
- **During project implementation all relevant and accessible information on site specific hazards should be captured, and hazards map and risk assessment of the project should be prepared.**
- **Based on this assessment, appropriate disaster strategies and monitoring procedures should be identified and selected for incorporation into project implementation.**

Incorporating the Natural Hazard Considerations into PJMs

PJMs are medium and long term programs which constitute part of the routine project preparation of IUIDP. The importance of PJMs can be understood when a large number of PJMs that have been prepared or are in the process of preparation are taken into account.

As of December 1991, 80 PJMs had been completed and another 96 were in preparation. In addition, the use of PJMs is growing in significance in terms of their impact on central agencies. For example, the Ministry of Home Affairs now regularly requires that local governments develop PJMs as the basis for their submission in the traditional annual budget negotiations with the central government; the instructions of the Ministry of Public Works now require that its agencies base their own investment plans to PJMs where they exist.

The inclusion of disaster management considerations should become standard procedures during PJM preparation. Moreover, IUIDP is the adequate setting for developing and integrating *bencana alam* impact assessments into the normal project cycle of urban infrastructure planning and development.

Land Use Planning

In Indonesia there are a large number of institutions that regulate land use planning. Among the most important are:

The Directorate General of Agraria in the Ministry of Home Affairs is responsible for taking the lead in developing a comprehensive land use plan. In practice, however, Agraria has been mainly involved in land use mapping and land registration, and since the 1980s, has had a limited role in macro-planning.

Cipta Karya has a strong role in land use and physical planning in urban areas and is the strongest advocate for spatial planning.

The Soils Research Center in the Ministry of Agriculture is responsible for determining land suitability for agriculture. Until recently, however, the agency has been underfunded, understaffed and overcentralized. Its main function to date has been largely investigating soil types and recommending appropriate farming systems.

BAPPEDAS is directly concerned with land use planning at the provincial planning level. However, BAPPEDAS' lack of desegregated data and staff with adequate skills to influence land use planning are limiting factors.

This fragmentation of responsibilities has led to a virtual impasse in land-use related matters (World Bank 1989) and probably will be an obstacle in introducing sound land use planning approaches regarding natural hazards.

BAPPEDAS can be the most effective institution influencing future land use planning in Indonesia. It would be appropriate to provide support to BAPPEDAS for strengthening its capacity for land use planning and the inclusion of natural hazard mitigation measures within this process.

Developing Master Plans which include Natural Hazard Considerations

Master plans usually address a wide range of issues important for a community, such as land use, traffic, housing, open space, geological and safety issues. One of the main problems of natural disaster management programs is that mitigation considerations are overlooked usually in the preparation of master plans. This gap is caused by:

- a lack of information on the potential hazard;
- a lack of understanding of potential disasters (e.g., in the case of earthquakes, long return periods decrease the awareness of community and local officials);
- a perception that the inclusion of mitigation issues might increase construction costs, and consequently, costs of development; and
- an anticipation of a difficult enforcement process.

However the inclusion of disaster measures into master plans is a critical requirement for long term natural disaster management and planning.

Given that BAPPEDAS are the local planning units for the development of master, spatial and investment plans, it is one of the major recommendations of this Report that BAPPEDAS incorporate disaster information into their master planning processes.

Designing for Sensitive Sites: Building Codes and Standards Development and Enforcement

Although the identification of urban infrastructure erected in major risk areas is beyond the scope of work of this Report, it is a plausible assumption to assert that, in Indonesia, existing development is placed in areas exposed to earthquake, landslides, floods, and erosion and that future development will also be located and designed in similar ways.

Infrastructure and shelter vulnerability can be correlated to a large extent with the use and enforcement of adequate codes and standards. However, to introduce hazard-resistant measures to improve the performance of the physical environment can be costly and may demand a highly specialized and non-existent local expertise.

The latest building code that was adopted in Indonesia was the 1991 Concrete Code. A seismic code was adopted in 1981 and has not been modified since. (No special building regulation exists for construction in flood-prone areas.) The seismic code is the result of *Indonesian Earthquake Study*, prepared by Beca, Carter, Hollings and Ferner LTD. and the Indonesian Counterpart Team, under the direction of the New Zealand Steering Committee, and as a part of the New Zealand Bilateral Assistance Programme to Indonesia. This study, which consists of seven independent volumes, divides the country into six zones of expected earthquake severity (zone 1 being the most vulnerable, and zone 6 being the least vulnerable to earthquakes).

The preparation of building codes can involve a great complexity of issues. For example, in most developing countries, building codes are not specifically tailored to local conditions (i.e., earthquake codes can be imported from other countries). As a result, structures can be over-designed resulting in higher costs.

However for high risk areas the preparation and enforcement of appropriate codes are essential to preserve future investments. This Report recommends that through decentralized agencies of Cipta Karya, local governments review the present nature of local codes and standards and their enforcement process. This exercise should aim to improve and/or update codes and standards to include state-of-the-art hazard-resistance mitigation measures.

Sample Activities

- o Disseminate information to public officials about the necessity of including PMP components in order to protect infrastructure projects.
- o Strengthen and clarify the role of local government in natural disaster management.
- o Prepare guidelines for natural hazards impact assessments in the form of PILs and ANDALs and introduce them into the project cycle.
- o Include natural hazard data and considerations in the preparation of PJMs.
- o Coordinate with BAPPEDAS in the preparation of master plans that include natural disaster mitigation measures.

- o Strengthen BAPPEDAS's capacity for land use planning and the inclusion of natural hazard mitigation measures within this process.
- o Coordinate with decentralized agencies of Cipta Karya the preparation of codes and standards that include natural hazard mitigation considerations.
- o Coordinate with the decentralized agencies of Cipta Karya guidelines for the preparation of building permits that include natural hazard mitigation considerations.

5.2 Fiscal Strategies for Natural Hazard Mitigation at the Municipal Level

Since Indonesia's process of decentralization includes, inter alia, an emphasis on the role of the private sector in infrastructure financing, it is appropriate to examine the financial tools available to municipalities to address natural disaster prevention, mitigation and preparedness (PMP). Protecting these costly investments from disaster impacts can be achieved in a variety of ways, and a redundancy of applied PMP measures is probably the most certain guarantee of achieving actual reduction in natural hazard exposure. Municipalities in Indonesia are already following the avenue of increased local authority and responsibility for capital investment. The following discussion will highlight some of the fiscal tools that local governments may want to explore to protect infrastructure investment in their communities. Three types of strategies (property tax, municipal bonds and development impact fees) are reviewed through an analysis of experiences from other countries.

Local Taxes

Property tax is an annual tax on the values of real estate, and in the United States it is almost exclusively collected by local governments. Local governments usually use property taxes to finance services in their communities. And although municipalities have other options available to raise revenue, property taxes still appear as the most important source of funding for local services.

Some properties, or owners, are exempt from paying property taxes. Partial or complete exemptions are granted either on the basis of the use of property (such as properties used for hospitals, schools or religious institutions), or the owners' status (e.g., veterans, low-income earners, the elderly). Tax exemptions and abatements are increasingly becoming a popular measure to steer local development in the desired direction. For example, tax abatements can be used as an incentive for the construction of job-generating production plants, low-income housing, preservation of green spaces or important historic buildings (PADCO, 1991). Although advantages of tax abatement and

exemptions are sufficiently powerful tools to warrant their use in land-use planning, disadvantages of their application should not be neglected either. They principally include the loss of local revenue, which in some circumstances may entirely offset the advantages of the measure.

In addition to tax abatements and exemptions, there are other specific types of property taxes, which can be used as effective land-use planning tools. Some of them are: *use value assessment* (land is assessed through its current use, rather than its fair market value, in order to encourage preservation of agricultural land or historical buildings); *site value assessment* (land is assessed according to its "highest and best use," which may also include "vacant land" tax to encourage development); *land valorization* (fees are assessed for private land that had benefitted from public improvements); *land readjustment* (a percentage of the total land area of the proposed development is reserved for the public sector, which can choose to use some of it for public infrastructure, and/or sell other portions to fund infrastructure development).

Similarly to other fiscal tools used in land-use planning to be discussed later in this Report (i.e., municipal bonds and development impact fees), levying of local taxes is not at this time sufficiently developed in Indonesia, to represent a tool ready to be effectively used either in growth management or in natural disaster mitigation. For example, Kingsley and Peterson (1992) show that general tax rates in Indonesia are very low (they are imposed at an effective rate of 0.1 percent). Moreover, taxes are not always collected from all the tax-payers. This complex condition is accountable, inter alia, for the inability of local governments to cover the cost of local services and to recover the cost of loans used for either general improvements or economic development projects.

However, since the process of restructuring in Indonesia is a powerful one, this Report endorses the integration of advanced fiscal tools in land management into disaster mitigation planning. Such measures can include, for instance, the use of property taxes when the private sector chooses to locate in documented hazardous zones, *without applying appropriate hazard reduction measures*.

Municipal Bonds

Local governments borrow money for capital investment (e.g., infrastructure), to lend the money to the private sector, and to deal with their own cash-flow problems. Given the scope of this Report (i.e., introduction of PMP strategies into shelter-related infrastructure development in Indonesia), current discussion will be limited to borrowing through municipal bond issued for capital facilities and for the use of the private sector. In both of these cases borrowed funds are repaid over long periods of time, usually between fifteen and thirty years. The experience that this subsection draws on is mainly from the U.S. local government borrowing, which has become one of the most visible aspects of public sector borrowing: in 1980 local governments had acquired a debt of \$53.3 billion in long-term loans. While variety of local governments (e.g., municipalities,

counties, special districts and statutory authorities) in the U.S. is unique, as is their financial and policy-making independence, the financial mechanisms that they use to raise funds to finance their community needs are transferrable to other societies. For example, it is likely that Indonesia will explore some aspects of local government borrowing through a system of Regional Development Account (RDA) established to assist in incremental decentralization and lead to genuinely market-based types of borrowing.

Municipal borrowing occurs within the framework of issuing and selling municipal bonds (for long-term funds), and municipal notes (for short-term funds, not discussed here). General obligation bonds (GO) are the oldest type of municipal bonds and are issued by general-purpose governments (or school districts). Voter approval is frequently needed for GO issue. Revenue bonds are a more recent type of municipal bonds. They are not backed by the taxing power of the issuer, rather they are backed by the expected income from the constructed project or future service. They are issued by both general-purpose governments (for the revenue-producing activities) or special-purpose governments, and they do not require approval of voters. GOs are commonly issued to finance construction of roads, libraries and schools (if these elements of infrastructure are tax-supported).

Revenue bonds, however, are typically issued to cover the cost of facilities for the use of which user charges are imposed – for example, these are toll roads, water and sewer systems, hospitals, harbors, airports and electrical power systems. While in the late sixties general obligation bonds accounted for 60 percent of all municipal bonds, in the early eighties they accounted for only 30 percent. The existence of both primary market (which deals with new bond issues) and especially of a well established secondary bond market (which includes networks of dealers buying and selling municipal bonds) is extremely important, because they enable buying and selling of municipal securities, i.e. an access to ready cash.

Current primary and secondary municipal bond markets in Indonesia are underdeveloped. This is especially true of the secondary market, the vitality of which is a prerequisite for smooth functioning of municipal borrowing (Suguiandono, 1992). Given that the process of decentralization in the country is only in its infancy, old patterns in the functioning of local governments are slow to disappear: municipal governments still look to the central government as a source of all capital investment and are slow to decide to borrow. At the root of the matter appears to be a cultural barrier in Indonesia against borrowing (Suselo, 1992). Thus, on the one hand local government officials are reluctant to break off their dependency ties with the central government. On the other, some central government practices are not supportive of the intended local governments' self-reliance. For example, central government lends the money to municipalities at greatly subsidized interest rates, a practice which – if continued – may undermine incremental progress of local governments towards market forms of financing.

Kingsley and Peterson (1992) identified the principal constraints to municipal borrowing: municipalities' inability to repay loans from local revenue sources, and their inability to pay market interest rates. The establishment of a consolidated loan fund called Regional Development Account (RDA), was meant to be the main link between the municipalities and market-driven borrowing.⁹ It appears, however, that at the time of writing this Report (August 1992), loan application to RDA is being discouraged due to lack of funds in the account. Therefore, it is important that RDA have continuous capitalization in order to serve the important function it was created for.

Assuming that the recommendations contained in Annex 2, Municipal Finance for Environmental Infrastructure are implemented, i.e. that the conditions for market-driven municipal borrowing will occur, it is appropriate to consider municipal bond issue as a vehicle for natural disaster mitigation. This mechanism has successfully been used in California both before and following the Loma Prieta 1989 earthquake. With overwhelming voter approval, since 1986, the City of San Francisco has passed five bonds totaling approximately \$200 million. One of these bond issues was for upgrading the fire-fighting capability in the city, including the retrofit of fire stations and improving the auxiliary water supply system. Another had the purpose of strengthening the city's older buildings. The city has thus obtained the funds to mitigate earthquake hazard in all of its fire stations – facilities intended to benefit the community at large and regularly financed from the city's tax revenues.

In order for the municipal bond mechanism to function successfully in Indonesia, it is necessary that natural hazard threat be well established (i.e., that multi-hazard assessments are done), that key municipal actors be aware of the threat and the consequences of disaster impact on their community, and that they are willing to take action. Municipal borrowing with the purpose of financing mitigation of some aspects of the prevailing natural hazard in the community would be one form of such action. Indeed, before demand-driven credit for local governments becomes well established, using RDA loans for mitigating natural disaster threat to new infrastructure projects should be seriously considered.

Another form of municipal borrowing in connection with disaster mitigation may be to lend the money to the private sector, in order to encourage the application of PMP strategies in the development process. In respect to the current project's theme (environmental infrastructure), municipalities would loan the money collected through bond issue to the members of the private sector to build infrastructure components, and to apply sound hazard mitigation practices.

⁹ See "The Role of Municipal Credit: A Strategy for Strengthening RDA" by George Peterson (1992), located in Annex 2 to *Municipal Finance for Environmental Infrastructure* by T. Kingsley and G. Peterson, Draft 8/14/92.

Development Impact Fees

Given the high cost of infrastructure facilities – water, sewer, drainage, and electrical power systems, streets, parks, police and fire stations, schools and libraries – municipal governments find it increasingly difficult to support the cost of their development from their own general funds or central government grants. In the United States and Canada communities have begun to rely on the development impact fees to transfer the cost of paying for urban infrastructure from the public to the private sector members who are most interested in the proposed development – that is, the developers and the new residents. Beginning as a partnership between the local governments and the developers, by the 1940s the private sector in the U.S. had become fully responsible for the on-site infrastructure. Yet, until a decade ago, the costs of land for and the construction of schools, libraries and parks were covered from the governments' coffers, which included still abundant federal funds and local general funds, as well as the monies collected through municipal tax-exempt obligation bond issues. The basic assumption was that growth is ultimately beneficial for all members of the community.

The benefits of growth began to be vocally challenged in the 1960s by many communities in the United States, when it became clear that an unchecked expansion of the local tax base can create numerous social costs – not only the revenue for the improvement of the community quality of life. Indeed, growth was credited with air pollution, traffic congestion, increasing crime, and an overall decline in the quality of life in communities (Dowall, 1980). Moreover, on the financial side it was also observed that, contrary to expectations, an expansion of the fiscal base led not to the lowering of per capita cost for infrastructure and services, but rather to its increase. Simultaneously with the prevailing of such anti-growth sentiments, funds for capital spending began to decline on all levels of government.

While negotiated exactions for a privilege to build in a rapidly growing community have encountered the criticism both from the developers and the public officials for their unpredictability and project delays, *development impact fees* have been adopted by many communities as a direct shift of the burden for infrastructure financing from the public to the private sector parties most motivated to support growth, i.e. the developers, the residents of new housing developments and commercial enterprises interested in expansion. Impact fees are usually collected at the permit stage, and are also assessed on the projects that do not include land subdivision, such as apartment and condominium complexes. Having originated in California and Florida, development impact fees have become a popular source of funding for new infrastructure development in the rapidly growing communities (Frank & Downing, 1987).

Although a great deal of development in the U.S. occurs in the areas that are vulnerable to natural hazards, development impact fees have not yet been used as an instrument of either hazard reduction, or of altering the patterns of development behavior as it relates to hazards. Nevertheless, similar strategies of intervening into the development decisions in disaster-prone areas exist in the U.S.: residents of flood plains who opt not to

purchase federal flood insurance and apply flood mitigation measures to their properties, are not eligible for post-flood assistance from the state and federal funds. Given a set of conditions in the State of California – first, the tradition of legally regulating seismic safety issues, second, the experience in using the development impact fees, and third, the rise in earthquake activity – it is very likely that impact fees will be used in California's communities to deal with earthquake hazard.

Since the process of decentralization in Indonesia counts on a more pronounced role of the private sector in sharing the burden of infrastructure development, and since the country is faced with a set of serious natural hazards, municipalities should consider all the options available to protect their communities and assets. Development fees can be adopted as fiscal mechanisms to regulate against environmental degradation (e.g., air or water pollution, development in watershed areas), and importantly, to raise revenue for mitigation against natural hazards. For example, development in flood plains, in the proximity of faults, or within the reach of volcanic ash fall or lava flow, may become subject of impact fees. Revenue collected from the fees would be used to mitigate the most pronounced hazards in the community – to erect river embankments, retrofit critical facilities to withstand better ground shaking in earthquakes, launch public disaster education campaigns, or train the disaster response personnel (fire fighters, members of police force, medical personnel) in search and rescue techniques.

Sample Activities

- o Enable RDA structure to include PMP components in infrastructure financing, and motivate municipal governments to apply for RDA loans for financing their infrastructure projects (which would include appropriate PMP strategies).
- o On the basis of natural hazard assessments for individual municipalities, encourage local governments to include risk exposure as a component of property tax assessment.
- o Collect development impact fees from the private sector developers who choose to locate in zones that are considered as hazardous.
- o Encourage municipal governments to lend money to the private sector for infrastructure development under the condition that so financed projects include appropriate PMP strategies.
- o Offer property tax abatements for the members of the private sector who voluntarily locate in zones of lower risk, and/or apply structural hazard mitigation strategies.

- o Employ use value assessment tax to preserve hazardous sites as parks and open spaces intended for public use (e.g., recreation). For example, soft and alluvial soils in flood plains should be kept free of capital investment, as should be the zones next to identified faults, potential volcanic ash-fall and lava flow.
- o Use site value assessment tax to direct development into the desired zones of the municipality, i.e. the areas that are documented to be the least hazardous.
- o On the basis of the revenue raised from local taxes, and/or municipal bonds and/or development impact fees, establish funds to be used for:
 - o financing detailed multi-hazard assessments;
 - o developing detailed plans for risk mitigation in the public sector, especially in the so-called critical facilities – fire stations, electrical power plants, hospitals and clinics, water distribution systems, and so forth;
 - o disaster response planning, especially in case of threat of volcanic eruption; specifically, enable local SATLAKs to prepare community evacuation plans;
 - o creating public natural hazard education campaigns.

6. Increasing the Participation of Community-Based Organizations in Natural Disaster Management

As development takes place, low-income communities are experiencing a substantial deterioration in their quality of life. Both population growth and poverty are factors that irreversibly increase community vulnerability to natural hazards. In Indonesia, large families and households each day have fewer opportunities to live in a safe environment and successfully recover from future natural disasters.

6.1 Floods and the Urban Poor

Historically, in many rural-agricultural societies, floods are seen as a blessing. From ancient Egypt and periodical flooding of the Nile valley, to Bangladesh and the Barsha festival, communities celebrate and welcome the flood season. The positive outlook to floods is rooted in the effects that this phenomenon may bring to agricultural production: as the river flows, it brings along sediments or soil particles from distant mountain slopes and other topsoils. The richer those sediments, the more fertile agricultural land is formed downstream, usually in the form of thick layers of loess or as alluvial plains.

In contrast, floods have an adverse effect on the urban poor. To the low-income families, floods bring death, destruction and destitution. Although, historically people have avoided floodplains for their urban settlements, as population grows, jobless and landless migrants move into the cities, creating great pressure for urban land. As a result, an increasing number of families are forced to build their habitats in areas of extreme risks of floods.

For urban dwellers the most important functions of rivers are the supply of drinking water and the service that they provide in supporting income earning activities. Ironically, the quality of drinking water is rapidly declining due to the combination of urbanization effects and economic growth. Untreated domestic and industrial waste thrown directly into river is turning substantial portions of the watersheds in heavy polluted systems that can no longer be meaningfully utilized. For example, in Jakarta, the amount of human waste thrown directly into rivers is estimated to be 147 tons a day; in Indonesia country-wide, the amount of human waste received by the rivers is estimated at 1,647 tons a day (Ferguson, 1992).

As rivers become more polluted and their banks erode, their natural regulative functions start to diminish. Thus, the difference between wet and dry seasons become highly pronounced and in some instances severe. Large quantities of domestic waste directly thrown into the water are left to accumulate, which leads to exceeding the acceptance and the resilience capacity of water sources. This phenomenon compounds a new element of risk for urban areas: since waters are heavily polluted, increasing segments of the population are exposed to severe health problems caused by flooding. It is only fair to say, that, as the present patterns of development take place, the urban poor become more exposed to natural disasters and have less opportunity to live in safe environments.

6.2 Pilot Activities

Kampung Kapuk Muara shares with many other low income communities scattered around Jakarta, the shortcomings of an accelerated process of urbanization. Substandard housing and high population densities escalate at the same pace that a lack of drinking water and sewage systems, as well as accumulation of solid waste, become more critical.

The conditions of Kapuk Muara are not isolated. Jakarta is already the eighth largest urban agglomeration in the world. Areas on the periphery of Jakarta are expanding at a rate of 10 percent p.a. (World Bank 1989). This growth along coastal zones and river banks has created intense pressure on the environment and exacerbate the risk to natural disasters.

Low-income housing can be typified as follows (Chifos, 1991):

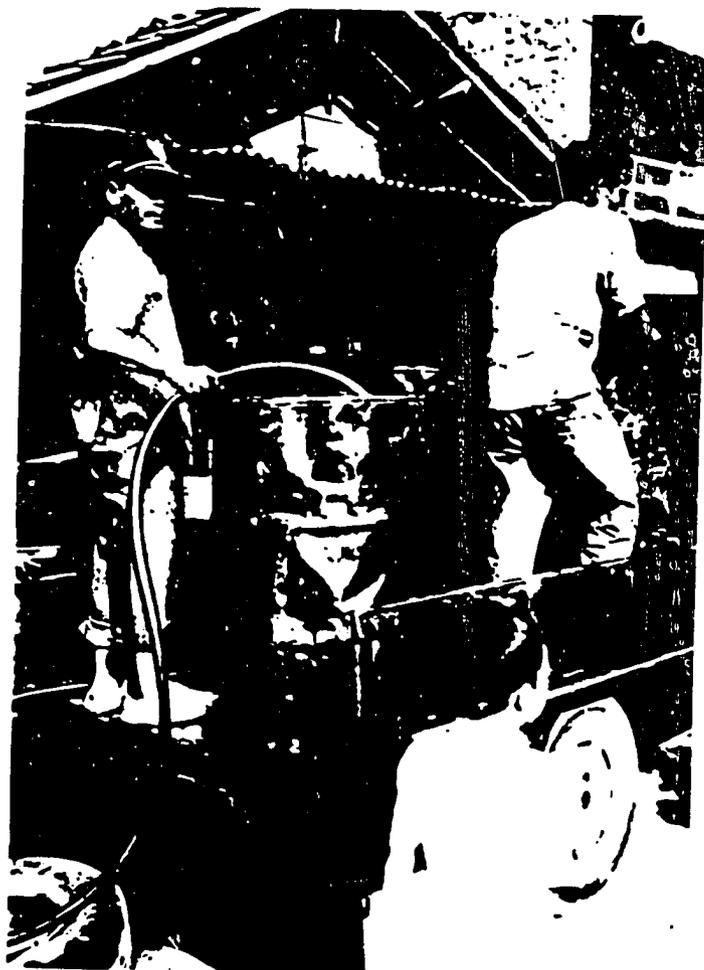
- **Kampungs connected with commercial activities. These are very high density and closely integrated and such activities.**
- **The kampungs in the periphery areas. These areas are mainly older kampungs with lots of green space and related to agricultural activities. There are less economic opportunities in these areas.**
- **New kampungs appearing on marginal land such as river banks, flood overflow areas of canals, railroad, and electric line easements. These are built as temporary and the government has not plans to develop.**

Kapuk Muara is located in Northwest in the coastal region of Jakarta. Available land in this kampung (present population over 200,000) is practically non-existent. At present, fragile shacks, constructed of local woven bamboo, emerge directly over heavily polluted watersheds.

The living conditions of Kapuk Muara is further worsened by the recurrent floods from one of multiple canal systems that irrigate the Jakarta. The Ciliwung River is one of the major rivers of the city. Water in the upstream part of the Ciliwung River can still be used for all purposes except drinking; but when the river cuts across the dense urban areas of Jakarta, the water can no longer be utilized for any purpose (Prokasih 1990). The negative effects and the number of these floods are increasing as inadequate systems of drainage, blockage of drainage systems with solid waste, poorly planned flood control which prevents floods in one area while causing floods in new areas, and over-building without compensating for the natural loss of drainage become more pronounced.



Caption:
The most serious problem is water pollution which is accelerating with urbanization. As more untreated waste is discharged into rivers and streams, ground water resources are also contaminated.



Caption:

Future trends for drinking water show that by the year 2000 an increase in demand of 32.7 percent is expected as compared to 1980. Water supply for industry for the same year is expected to be 70.1 over that in 1980.



Caption:
One municipal water tank serves around 500 people. Water vendors succeed in charging the households 5 to 10 times the price charged by PDAM.

This Report recommends that a pilot project be initiated in Kampung Kaput Muara for the delivery of hazard preparedness and mitigation strategies. This Kampung has four elements which are indicative of a potential successful implementation of PMP goals:

- The community has been continuously affected by recurring floods. Therefore, the community is acutely aware of the risks posed by this hazard. The level of awareness is especially high now, when construction is taking place directly over river waters.
- The community members realize that by learning how to mitigate the effects of floods, their quality of life will be improving, specifically through a reduction of future social and economic losses caused by recurrent floods.
- The community has a strong sense of self-sufficiency. In spite of the difficult living conditions of Kapuk Muara, the community is very well organized. Several grassroots organizations have initiated various community programs. The most outstanding among them is the solid waste recycling project which is run by a local cooperative, Ksu Kapuk Muara. This project, implemented through self-help, has increased its member's daily income to Rp 3,000 per day (minimum wage of Rp 2,100 per day is about US\$1.05).
- In the near future, the community is expected to become the recipient of several projects sponsored by agencies and organizations such as the World Bank. Mitigation strategies could become complementary activities of such projects.

This activity can be coordinated in Jakarta by IDMC, the municipalities, and local NGOs.

6.3 The Approach to Other Hazards

Other pilot activities should be initiated in Indonesia covering other types of hazards (e.g., earthquakes and fire that may follow earthquakes, volcanic eruptions, and landslides). Bandung and Majalengka are strongly suggested as locations for carrying out future pilot activities. BAKORNAS PB could become responsible for the selection of sites in the implementation of future pilot activities throughout Indonesia.

The initiation of pilot activities in Bandung is important due to several activities and programs that are currently taking place in this city (see sections 9.1 and 9.2)

Future locations can be Jakarta Utara and Kodya Balikpapan which are Kotamadyas identified by BAKORNAS PB as high risk areas. Other high risk areas are located in the following kabupatens (SATLAK PBs exist in these regencies):

PROVINCE:	KABUPATEN
Aceh:	Aceh Tengah, Aceh Tenggara
Sumatera Utara:	Tapanuli Utara
Sumatera Barat:	Solok
Riau:	Kampar
Jambi:	Tanjung Jaixing
Barat:	Bandung, Majalengka
Jawa Tengah:	Magelang, Banjar Negara
D.I. Yogyakarta:	Wonosari
Jawa Timur:	Blitar, Bojonegoro
Sulawesi Utara:	Minahasa, Gorontalo
Nusa Tenggara Barat:	Lombok Tengah
Nusa Tenggara Timur:	Alor, Flores Timur
Maluku:	Maluku Utara
Irian Jaya:	Jayawijaya

6.4 NGOs and Natural Disasters in Indonesia

The number of NGOs working in Indonesia is imprecise. The structure of these organizations differs from most well-known NGOs operating, for instance, in the Philippines and throughout Latin America. NGOs in Indonesia, range from small, unsophisticated grassroots organizations working at the community level to medium and large established organizations operating as fairly well developed consulting firms. To pursue their main activities they seek support from public funds through "ongoing dialogue and low-key lobbying efforts" (USAID, 1987).

The majority of NGOs in Indonesia receive their funding from the government, which acts as an intermediary between these community-based organizations and international donors; NGOs have had strong encouragement of the government to flourish, and have indeed flourished in many areas of economic development, including the environment. Many have argued that NGOs' economic dependency on government funding might inhibit the evolutionary process that usually characterizes these organizations or turn them into parastatals working among the socio-economic segments not necessarily identified by community members. Typically, however, NGOs go through a long-term evolutionary process during which they tend to overcome their early shortcomings. In fact, extensive literature suggests that NGOs in Indonesia are widely perceived as appropriate organizations to address the key community concerns and needs.

During the field investigation no NGOs were identified that were exclusively engaged in hazard preparedness and mitigation programs. Instead, a large number of community-based organizations were identified which were committed to the reduction of environmental degradation, and whose members are working toward the development of appropriate technologies and self-help housing. Since environmental degradation and housing are overlapping issues with hazard preparedness and mitigation, it seems a plausible approach to deliver hazard preparedness and mitigation programs through NGOs already active in similar development-related fields.

There are hundreds of NGOs which have a role in development-related fields, however only a handful seem to be considered seriously. The limitation of some NGOs seem to be related to their lack of technical and managerial skills. The majority of NGOs view themselves as facilitator between government and the people. Typically, they emphasize community awareness and training, thus becoming the framework for improving the living conditions and development of the community through self-reliance.

During the field trips to Jakarta and Bandung, the following NGOs were visited:

- **Yayasan Indonesia Sejahtera** is dedicated to the enhancement of community based development and participation. Since 1974 this NGO has been involved in more than a hundred field programs. Currently, it is carrying out more than 20 programs in major areas of specialization, such as, training, health care, nutrition, demography, infrastructure development, income-generating activities, and agriculture. It has worked extensively with UNICEF and is very willing to undertake new programs in natural hazard preparedness and mitigation. This NGO was responsible for organizing a field visit to Kampung Kapuk Muara.
- **WALHI** is one of the best well-known and most powerful NGOs in Indonesia. It is an umbrella organization for more than 300 NGOs working in environmental issues. The number of NGOs working in areas related to the environment has been steadily growing since the Ministry of Population and the Environment was established in 1978.
- **The Forum Perumahan Bandung** is an association of five community-based cooperatives whose main activities are housing and community development, as well as, income-generation projects. This NGO has participated in several KIP programs in the areas of solid waste and recycling. In addition, this organization has worked in Majalengka in the landslide recovery and emergency program. The Forum Perumahan Bandung assisted the community in a relocation program supervised by the local SATLAK PBs, and provided disaster preparedness and training for the community. In addition, they have worked in fire reduction techniques, clean water supply, drainage system improvement, solid waste collection, sanitation, and smaller scale river embankment projects.

- **INDECO De Unie NGO Training Program on Urban Development** encompasses approximately 300 NGOs involved in environmental activities. Bandung Forum and INDECO De Unie representatives strongly believe that a natural hazard program is of extreme importance for future community development, especially in the areas of floods, fires, landslides, and earthquakes, and thus expressed an interest in undertaking these type of activities. They felt that natural hazard and environmental concerns ought to be perceived in similar ways.
- **The Community Based Low-Cost Housing** is an organization whose main concerns are to provide assistance to other community groups in the development of housing, infrastructure, and institutional resources. This NGO has worked extensively with the Ministry of Public Works and the Human Settlements Research Division. At present it is associated with the Bandung Institute of Technology.
- **The Housing and Urban Development** emerged to assist several cooperatives in pursuing the development and ownership of houses for their members. To date, more than 1,000 units have been built in Bandung. Encouraged by the local authorities, this NGO is planning to develop larger projects through a process of land consolidation. In the near future, this community-based organization will be involved in a large relocation program.
- **The Yayasan Bina Karya** has built about 600 houses since its establishment in 1988. Its first large project consisted of 120 houses funded by a Dutch private voluntary organization. This NGO has approached the Housing and Mortgage Bank [BTN], in pursuit of new financing avenues for the construction of housing units in low-income neighborhoods. However, BTN cannot allocate any funding to Yayasan Bina Karya since this NGO does not keep good tracking records of its development activities. After the completion of the current project, BTN has agreed, in principle, to finance subsequent projects subject to BTN's normal review and approval process. Yayasan Bina Karya claims that they are able to build houses for about half the price of those provided by BTN, of the same quality and level of services.
- **The Development Consultants Process's** is a new NGO whose main objective is training. Currently, they are providing training to 20 individuals from several communities potentially eligible for KIP. Five most promising participants from this training program will become part of the staff of this NGO.

6.5 Government Action in Low-income Communities

The Kampung Improvement Program (KIP) is probably the only program that provides infrastructure for low income neighborhoods in Indonesia. This program emerged as a result of a World Bank project aiming to assist the process of consolidation and renewal

of low income neighborhoods. As it stands now, Cipta Karya is responsible for KIP in Jakarta while municipal governments are responsible for the implementation of KIPs in their jurisdictions.

The primary objective of KIP is the delivery and/or upgrading of roads, footpaths, drainage systems, sanitation projects, drinking water, health clinics, and schools. The primary importance for potential implementation of natural hazard management programs is that KIP has a national outreach and is at the same time an implementation unit for programs that have an impact in long-term mitigation activities. Moreover, since the mid-1980s KIP has adopted a more community-based participatory approach. Experimental Intensive Community-based Counseling (IPP) is responsible for undertaking basically the same projects as KIP but with an additional strong community component.

Important impacts on community development in terms of natural hazards prevention will be possible if individual KIPs are conceived and implemented with appropriate standards and criteria for reducing the vulnerability to natural hazards (e.g., land use measures, building codes, and retrofitting techniques). Equally important are the opportunities to educate communities to prepare for disasters, so that they can learn to reduce the impact of natural hazards through IPP projects. This Report recommends the identification of effective avenues that can lead to this approach. Such coordination can be promoted in Jakarta through the cooperation of BAKORNAS PB and Cipta Karya, and in the provinces through the cooperation of SATLAK PBs and respective local governments.

Sample Activities

- o Acknowledge the importance of flood mitigation programs in kampung areas by initiating pilot activities in Kapuk Muara through IDMC, Jakarta corresponding municipality, and local NGOs.
- o Prioritize the impact of hazards other than floods in kampung areas and define future pilot project activities. IDMC in Jakarta, and local SATLAK PBs and municipalities in the provinces, should coordinate these activities
- o Organize a network of NGOs willing to work in community disaster preparedness and mitigation activities. This activity can be carried out through BAKORNAS PB on the national, and SATLAK PBs on the local level.
- o Identify new avenues for coordinating activities with KIP and IPP in their project implementation. Such coordination can be promoted in Jakarta through the cooperation of BAKORNAS PB and Cipta Karya, and in the provinces through the cooperation of SATLAK PBs and local governments.

7. Increasing the Participation of the Private Sector in Natural Disaster Management

The current Policy Action Plan of *Project Design for Indonesia: Municipal Finance for Environmental Infrastructure* specifies as one of its policies enhancing local government resource mobilization, financial management, and involvement of the private sector in infrastructure and service delivery (Kingsley and Peterson, 1992, emphasis added). In HG-002 private sector participation in service delivery will be encouraged principally through the PURSE project, but local government's support for greater private sector involvement will also be sought. These recommendations are in keeping with the major TKPP guidelines and the philosophy of Pancasila embodied in the three-pronged approach to the national economy – through cooperatives, state-owned companies and the private sector. Since 1969, when the implementation of the successive Repelitas began, private sector involvement in the growth of the national economy has been emphasized. At the same time, GOI has been under great pressure to provide urban services to the rapidly expanding industrial and urban residential sectors.

At 7.4 percent Indonesia's economy sustained a high growth rate in the 1990/91 fiscal year (Bank Indonesia, 1991). This performance is even more notable given global recession (the slowdown of developing countries' economies appear to be of a longer-term nature than that of the industrialized countries), devaluation of the national currency, and stagnant oil prices on the world market. The principal factors of this sustained growth can be attributed to the restructuring of the national economy, which included the deregulation of the banking system, relaxed import restrictions and an overall strong performance of privately-owned companies.

These achievements notwithstanding, Bank Indonesia forecasts that in 1992 the national economy will record lower growth rate than in the previous year. Given that Indonesia's urban growth rate at 5.4 percent annually is among the highest in the world, it is expected that the demand for urban infrastructure and services will continue to grow unabated. As in the past, government budgetary constraints will continue to limit governments' (central, as well as local) role in urban infrastructure and service provision (Taylor, 1992). Increasingly, both the central and the municipal governments look to the private sector for accepting a more pronounced role in responding to the high public infrastructure demand.

The private sector's interest in participating in urban infrastructure and service provision has been growing, especially since all levels of government have joined in a concerted effort to attract private sector participation. Indeed, the pace of the country's future growth will depend on the sustained motivation of the private sector to participate in the infrastructure and service provision. The key needs for infrastructure continue to be water and transportation, followed by sewer and waste disposal. It is these infrastructure

domains that concretely affect environmental quality, and through private sector's active involvement, disaster prevention, mitigation and preparedness measures should become a part of the development process.

Sets of fiscal and environmental policies are discussed in this Report (see section 5.2), some of which are directly intended to enhance the private sector participation in the delivery of infrastructure components enhanced by PMP measures. The remainder of this section will discuss:

- First, the major projects supported by Indonesia's major banks (through foreign or domestic funding) that are relevant for the private sector's direct participation in infrastructure provision. The projects that are described would be receptive for inclusion of disaster PMP strategies.
- Secondly, the role of property and disaster insurance in long-term disaster mitigation as well as leveraging post-disaster recovery funds. It is important to note that the role of property and specifically disaster insurance is discussed in some depth because of the role insurance is likely to have in the Indonesia's rapidly developing economy. While the insurance industry currently is only in the process of evolving, its potential for serving as a viable tool for disaster prevention, mitigation and preparedness cannot be overestimated.
- Thirdly, the role of professional associations (such as the National Association of Structural Engineers) in endorsing and promoting PMP strategies for creating a disaster-resistant environment.

7.1 The Banking Industry

The current context of Indonesia's banking industry is that of deregulation and increasing competitiveness among individual banks. Since 1984, when deregulation began, until July 1992 when a law was passed allowing the previously state-owned banks to form limited companies and setting free up to 20 percent of banks' assets to be potentially owned by foreign capital, the competitive environment had brought about a significant boost to private sector investment. The private sector's participation in infrastructure development, however, has been retarded. Major reasons for this are the unusually large volume of funds needed for infrastructure financing, and the long-, rather than short-term nature, of return on investment in infrastructure development.

Currently, there are eight state banks: Bank Indonesia (Indonesia's Central Bank), BAPINDO (Indonesia Development Bank), BNI (National Bank), BRI (Rural Bank), BDN (National Trading Bank), BBD (Land, Forest and Plantation Bank), BTN (Housing and Mortgage Bank), and Bank ExIm (Export-Import Bank). It is only after the deregulation process had begun that these state banks (which had previously been

narrowly specialized) have been able to compete freely on the market. At this time it appears that GOI (major or the exclusive stockholder in these banks) is reluctant to sell stock to the private sector investors on a large scale. Since the private sector commonly prefers short-term return on investment, to date private companies have not overwhelmingly participated in infrastructure development.

Bank Indonesia, or the Central Bank, is currently in the process of administering loans through several projects which could accommodate disaster PMP strategies. The first project is an environmental project on *Pollution Abatement Equipment*, funded by the Japanese Overseas Economic Cooperation Fund (OECF). The project's purpose is to finance with subsidized interest rates (16.7% per annum, vs. the commercial interest rate of 25-28%) the purchase of equipment which will reduce environmental pollution from all aspects, but foremostly water and air pollution. This is a pilot project administering US \$124 million over a period of twenty years.

Currently, Bank Indonesia also administers the *Small Scale Enterprise Development Project*, which had begun in 1974 under the auspices of The World Bank. In 1987 The World Bank funding had ceased, but GOI has continued the investment in this project through Bank Indonesia. Starting this year the Commission of European Community will invest an additional US \$4.5 million, during a period of three years. The project is targeting small business entrepreneurs, whose requests for loans are assessed on a competitive basis. In addition to credit, the loan components include education and training in the technical, administrative capability, management and marketing skills for the small businesses owners. This project has to date assisted small business in the thirteen urban centers country-wide. Although until now this project has not been assisting small scale private entrepreneurs in infrastructure service delivery, this is not excluded from future funding.

The *Project for the Protection of Watershed Areas* began in 1986 and is entirely financed by GOI. Loan recipients obtain the funds for prudent use of watershed zones. Education and training are part of the TA component of this loan which intends to develop an understanding among the population of the dangers of overexploiting watershed zones and develop lasting commitments for safe use of this land. Loans are limited to Rp 15 million over six years.

BAPINDO (Indonesia Development Bank) is in the process of initiating a major *Infrastructure Project for Jakarta-Bandung Jalan Toll (Toll Road)*. A consortium of three major private sector construction companies have been selected in a competitive process to construct this road. BAPINDO is now in the process of securing the funding for this major capital investment. Since user charges are a component of this project, the private companies have found a profit rationale to bid for this project, although the return of investment is over a longer period of time.

7.2 The Insurance Industry

Insurance markets have been slow to respond to the new trends of rapidly growing economic losses in disasters. The basic premise of property insurance – to pool the risk of loss or damage and spread it among a sufficiently large group of policy-holders in order to allow for acceptable premium levels – does not lend itself well to insuring natural hazards in the traditional way. The cause of damage (or insured peril) must occur frequently to be statistically reliable and enable the predictability of the severity of loss. Fire, among insured perils, is probably the only urban disaster event that occurs with statistical predictability. In some instances floods can also fall into the category of statistically predictable perils, especially in the areas where they occur frequently, and where historical records of their past occurrences also exist. Among the most difficult catastrophe perils to insure are earthquakes and tsunamis. They usually have long return periods, which creates the lack of awareness among the members of the general public, and importantly, the loss of institutional memory of the damaging event. Compounding the problems of earthquake insurance may also be the tax laws of a given country. For example, in the United States insurance companies cannot create catastrophic reserve funds and obtain tax deductions for them. The losses may be deducted only in the year in which they occurred. When they do happen, however, earthquakes have a great potential for destruction.

7.2.1 Components of Successful Disaster Insurance Programs

Despite the constraints the insurance industry is confronting in insuring against natural disasters, sufficient experience in catastrophe insurance exists in many countries of the world to suggest the advantages and disadvantages of individual approaches. For a successful catastrophe insurance programs to exist three conditions are required:

- that regular insurance markets are well developed,
- that disaster risk has been well documented through scientific studies and risk assessment mapping projects, and
- that the risk be spread across a sufficiently wide market, whose members are well motivated to participate in the program, i.e. willing to purchase the policies.

The last condition, for example, is differently fulfilled in New Zealand and Japan, the two earthquake-prone countries with well established earthquake risks and developed insurance markets: in New Zealand, earthquake insurance is mandatory, while in Japan frequent earthquakes and extraordinarily high financial exposure create a very dynamic market for catastrophe insurance. There, losses from volcanic eruptions and tsunamis are covered under earthquake policies. In the United States, however, all three conditions

are fulfilled for some hazards (such as floods), but not for other catastrophic perils, such as earthquakes. As a result, a successful National Flood Insurance Program (NFIP) has been running since 1968, while earthquakes, erroneously perceived as an "only California problem," have never managed to motivate a sufficiently large audience for a national program to be launched. Given that the magnitude of losses in a catastrophic earthquake in the U.S. may exceed \$60-70 billion, and that international reinsurers may fail to cover the losses of such an event, two different proposals are currently in front of Congress to consider for earthquake insurance: the first calls for the establishment of an earthquake re-insurance pool (underwritten by the Federal Government) that would assume the liability of private insurance companies in the case of a catastrophic earthquake, which is expected to generate possible insured losses to the order of \$40-50 billion (Roth, 1990). Earthquake insurance would be included in all homeowners policies and commercial risks, thus spreading the market across the nation, irrespective of the level of the probable maximum loss (PML) for a given region. The second proposal goes beyond the first, since it provides not only the funds for recovery, but also includes earthquake hazard reduction measures. Similarly to the guiding principle of NFIP, it mandates that individual communities pass zoning laws containing implementation of earthquake mitigation measures, before they become eligible for government insurance.

Requiring the incorporation of disaster mitigation or loss reduction measures into the rating structure for property insurance is strongly recommended by Munich Re, the world's leading catastrophe re-insurer. Success of such a policy was shown in Agadir, where following the 1960 earthquake, the insured high-rise buildings remained undamaged. The insurance company had provided tight construction quality control and ensured compliance with seismic provisions as a prerequisite for purchasing property insurance.

In addition to this new role (i.e., disaster mitigation), insurance is also a well recognized instrument for quickly providing reconstruction funds. For example, following the 1979 hurricane "Frederick" more than 100,000 claims were filed in the United States (Berz, 1984). Because of an advanced loss adjustment system, the insurance industry had a full picture of the extent of losses within 36 hours of the impact, and 80% of the claims were settled in only three weeks. This role of the insurance industry is extremely important, because in this way the private sector can leverage the overall recovery funds. Thus the private and the public sector share the cost of and accelerate the process of economic recovery. Government-provided reconstruction funds, which in the wake of disasters usually become available, can be freed for the many aspects of disaster management in the public sector that only governments (central and local) can do:

- cover their own losses that are traditionally self-insured (e.g., government-owned infrastructure components and buildings), and
- assist the under- and un-insured sectors of the economy. Worldwide, small business establishments and the residential sector (including both the homeowners

and the renters) fall into the category of under- and un-insured. For example, in California, which has a history of recurring damaging earthquakes and an exceptionally well developed insurance market, less than five percent of small businesses, and approximately 25 percent of homeowners are insured against earthquakes. Following the 1989 Loma Prieta earthquake in northern California, only \$680 million (or ten percent of the total loss of \$6-7 billion) was paid in personal and commercial losses, which included large commercial losses (Roth, 1990).

7.2.2 The Role for Insurance in Natural Disasters

Given the link between the government and the private sector (through insurance companies), Indonesia's vulnerability to a host of natural hazards, and the current decentralization process in Indonesia, it is appropriate to consider a plan for sharing the cost of protecting from hazard exposure the increasingly sophisticated and costly municipal infrastructure systems across the nation. Importantly, cost-sharing will also reduce local communities' dependency on central government relief following disasters, thus furthering the goals of decentralization, many of which are expressed in the policies of TKPP.

Since the implementation of the Policy Action Plan under the HGL-002 will further increase the value of Indonesia's municipal infrastructure portfolio, the level of infrastructure exposure to natural disasters will simultaneously rise – unless appropriate strategies are used to protect this investment.

Indonesians traditionally are not formal insurance policy buyers. Instead, in cases of personal and family emergencies they tend to rely heavily on the assistance of a network of extended family members, friends and neighbors. Even industrialists purchase insurance only to satisfy commercial bank requirements for obtaining loans. (In terms of catastrophic insurance these policies cover only fire losses.) When natural or man-made disasters affect communities, extensive central government assistance appear to be the norm. For example, this was the case in Majalengka and two other neighboring regencies, Sumerdang and Kuningan, when a total of 10,090 families were affected in the 1990 earthquake. The central government provided not only food and shelter to the victims, but also building materials for *gotong royong* repair of houses and technical assistance in earthquake resistant construction techniques. Additionally, central government also had to deal with the repair of 98 government buildings, 107 schools and 257 mosques. Total property damage in this earthquake surpassed Rp. 15.5 billion (BAKORNAS PB, 1991).

Unlike the developed insurance markets in the well documented natural hazard areas (such as that of Japan), which have already been saturated by insurance demand and have exhausted re-insurers' willingness to sell catastrophe coverage, Indonesia has not

been acknowledged as a potential threat to international reinsurers. Rather, this investigation has revealed considerable capacity of Indonesian market to offer all types of coverage – and obtain re-insurance (Meyer, 1992). Given that the Indonesian market is new and that the basis of a new insurance law are only now being formulated, it would be opportune to use the current situation to the advantage of disaster prevention, mitigation and planning, and introduce appropriate PMP provisions into the language of the new Indonesian insurance law.

7.3 Professional Associations: the Example of HAKI

The role of professional associations in assisting the process of natural hazard reduction cannot be overemphasized. Experience shows that building codes of countries which have strong associations of practicing structural engineers, architects and planners, with a developed sensitivity to natural hazards, reflect these concerns in terms of special provisions of building codes. Indonesia's *Society of Structural Engineers* (HAKI) is a national professional association which, from among the relevant associations in the country, has the strongest concerns about the resistance of the built environment to natural hazards. Nevertheless, HAKI is a relatively weak association despite its enthusiastic membership, and it appears to need assistance in order to develop to its full potential and fulfill the important role it has in improving the safety of buildings and their occupants.

HAKI is a non-profit organization of practicing structural engineers with chapters throughout the country, but its most active and strongest group is the Jakarta Chapter. For example, certification is needed for engineers to practice in the national capital district, as is the membership in HAKI, which helps swell HAKI's ranks. Nevertheless, HAKI is not the lead organization to initiate the change, developing and following through the adoption of building codes. The Department of Public Works has that function. The Department calls upon HAKI's prominent membership to join the process of code development in advisory capacity.

The latest building code that was adopted in Indonesia was the 1991 Concrete Code. Seismic code was adopted in 1981 and has not been modified since. (No special building regulation exists for the construction in flood-prone areas.) Earthquake Code is the result of *Indonesian Earthquake Study*, prepared by Beca, Carter, Hollings and Ferner LTD. and the Indonesian Counterpart Team, under the direction of the New Zealand Steering Committee, and as a part of the New Zealand Bilateral Assistance Programme to Indonesia. This study, which consists of seven independent volumes, divides the country into six zones of expected earthquake severity (zone 1 being the most, and zone 6 being the least vulnerable to earthquakes).

A sentiment was expressed at HAKI that Indonesian earthquake code is very conservative, but in contrast, that the process of code enforcement was very poor.

Therefore, the built environment does not reflect entirely the levels of seismic safety as expressed by the Code. HAKI feels that it would be more appropriate for Indonesia to have realistic, rather than too conservative seismic requirement in its building code, which would be universally enforced. For example, only Jakarta has a municipal construction supervision agency, and similar agencies are needed in all major cities.

It is HAKI's opinion that students of engineering receive insufficient information on seismic design, and that it is necessary to strengthen this aspect of formal education process. By the same token, it is important to initiate a strong system of continuing education for the practicing engineers, architects, planners – all the professionals that in the course of their practice may be in the position to advise, or make, the decisions relating to the safety of built environment in natural hazards. Apart from some HAKI's sporadic efforts little has been done in terms of professional continuing education. HAKI has no funding and little other resources to put on continuing education seminars and workshops, although it does so whenever possible. For example, earlier this year HAKI organized a lecture by an earthquake engineering professor from Japan, who was visiting Jakarta on other business and accepted to address HAKI members (without an honorarium) on the topic of the state-of-the-art of earthquake design. Two hundred and eighty five engineers attended this seminar, which was an excellent showing. While such informal methods should be used in the future too, they do appear to be too erratic as the sole means of continuing education. Apparently, HAKI would be delighted to participate in a process of technical assistance which could address some of these pressing problems of Indonesian engineers. Sample activities are listed below specifying the most important issues that should be considered by a technical assistance program.

Given this situation in respect to continuing education, it would be appropriate to consider establishment of firm cooperative partnerships between HAKI and the Institute of Human Settlements and the Geological Research and Development Center of Bandung. These two institutions are well equipped for a variety of activities important for HAKI membership (discussed in detail below) and could share their resources with HAKI members, especially since HAKI could be of assistance in promoting many of these institutions' programs.

Sample Activities.

- o Assist professional associations of engineers, architects and planners to organize regular continuing education programs for their respective memberships, regarding state-of-the-art criteria for the design of buildings resistant to natural hazards, especially earthquakes.

- o Assist professional associations to produce and distribute appropriate natural hazard reduction educational materials (booklets, manuals, slide/tape modules and video-tapes) to their members.**
- o Provide technical assistance (TA) for the development of municipal construction supervision agencies in all major Indonesian cities.**
- o Provide technical assistance for the revision of the seismic requirement in the current Indonesian building code.**
- o Provide necessary technical assistance to improve regular undergraduate and graduate level curricula for engineers, architects and planners, regarding the safety of the built environment in natural disasters.**
- o Encourage HAKI to establish cooperative partnership with the Institute of Human Settlements and the Geologic Research and Development Center in Bandung, in order to take advantage of their numerous education resources and also to assist them in their disaster mitigation efforts.**

PART IV. ACTION PLAN

8. Background

GOI has made a commitment to transfer both the responsibility and authority for the leading public sector role in urban development to local governments, in view of the present needs for improvements of the local management capacity and resource mobilization for physical and environmental infrastructure development. GOI's Policy Action Plan is a framework for coordinating achievements toward these ends. This Action Plan was initially established in 1987 (TKPP, 1987,a), and updated several times since then, (most recently in May 1990 -- TKPP, 1990) to serve as the basis for the Government's management of its own activities, as well as the support of relevant external donors (Kingsley, 1990).

The themes of GOI's Policy Action Plan have become central to USAID programs, since the first HGL (497-HG-001) was initiated in 1988. The following six themes constitute the core of the Policy Action Plan:

- Strengthening and clarifying local government responsibility for urban infrastructure.
- Implementing a coordinated and decentralized process for programming urban infrastructure investment.
- Enhancing local government resource mobilization, financial management, and involvement of the private sector in infrastructure and service delivery.
- Establishing effective mechanisms to support municipal borrowing and improving the system for allocating intergovernmental grants.
- Strengthening the institutional capacity of local governments
- Improving intergovernmental coordination and consultation in urban development.

During the process of preparing the present Report, *The Indonesia Hazard Mitigation Strategy* (IHMS) it became obvious that these six themes were equally relevant for introducing natural hazard mitigation programs in the country. Accordingly, a number of substantive goals, actions, steps, and indicators in natural hazard management were identified and introduced under the current policy agenda of the Action Plan of HGL on Municipal Finance for Environmental Infrastructure Project.

8.1. Program Sustainability

The USAID has played an influential role in the implementation of the GOI's programmatic Agenda. To implement the PMP goals – as part of the Policy Agenda – will require continued support from USAID and other donors (e.g., UNDP). USAID policy dialogues with Indonesian counterparts and technical assistance are critical for the establishment of a natural hazard mitigation program in Indonesia. Institutionally, the sustainability of the IHMS will be fully operational, as progress in integrating natural hazard mitigation issues into Policy Action Plan of the HGL is achieved.

8.2 Project Feasibility

Indonesia is experiencing great changes as GOI takes concrete steps toward decentralization. The GOI has been receptive to the adoption of policies leading to the delivery of a sound environmental infrastructure. A recent USAID assessment of the GOI's Policy Action Plan determined that "while the progress has not always been as rapid as desired there have been no reversals of backsliding with regard to any of them" (Kingsley and Peterson, 1992). Natural disasters are the key link between the provision of infrastructure on the one hand, and the protection of public and private sector investments on the other. The feasibility of IHMS is based on the understanding that GOI is supportive of the policies which lead to the delivery of sound environmental infrastructure. The goals introduced in this report are an additional step which guarantees projected public and private capital investments in urban infrastructure. In addition, during the preparation of this Report, interviewed government officials, key private sector individuals, and community groups' leaders expressed their interest in promoting and participating in natural hazard management activities.

8.3. Progress Indicators

It is expected that the implementation of the IHMS will lead to:

- including natural disaster management considerations in the institutional framework and the development process of key Indonesian institutions;
- strengthening disaster-related institutions and local governments in terms of long-term disaster mitigation strategies; and
- expanding the role of private sector and community-based organizations in natural disaster management activities.

The indicators selected and included in the action plan aim to provide guidance during the project evaluation. They are designed to indicate the level of achievements of each medium-term goals. They are indicative of the following stages: a) agree committee, indicates consensus of the action proposed; b) agree work-plan, indicates that concrete actions have taken place toward the action(s) proposed; c) integration of working committee, indicates that preliminary actions have already occurred; d) initiation of the activity, indicates that preliminary organized actions have already been initiated; f) development of activity; indicates that the activity has progressed at least in a fifty percent point; and g) completion of activity, indicates that goals, actions proposed and key steps are fully completed.

8.4 Project Implementation

The proposed natural hazard mitigation strategies will be carried out throughout Indonesia. For the implementation of IHMS it is essential to select, recruit, and base in USAID/RHUDO, Jakarta, a PMP Advisor. The main role of the PMP Advisor will be to plan, establish priorities, monitor, and oversee the entire implementation of the IHMS. In addition, the PMP Advisor will finalize the details of the IHMS technical assistant program and will manage relevant contractual arrangements resulting from the implementation of the TA program.

ACTION PLAN TABLES

POLICY AREA OBJECTIVES	MEDIUM-TERM GOALS	ACTION PROPOSED	KEY STEPS	INDICATORS
<p>1. Strengthening and clarifying local government responsibility for urban infrastructure</p>	<p>1.1 Include natural hazard impact assessments into early project cycle of municipal government in order to protect urban infrastructure</p>	<p>Design natural impact assessments (in the form of PILs and ANDALs)</p> <p>Introduce natural impact assessments within Cipta Karya's decentralized agencies</p> <p>Introduce natural impact assessments within BAPPEDAS planning process</p>	<p>Select municipalities with high vulnerability</p> <p>Assign working group and provide TA</p> <p>Coordinate with Walikota, and key official of Cipta Karya and BAPPEDAS implementation of guidelines</p> <p>Implement program</p>	<p>Development of activity</p> <p>Initiation of activity</p> <p>Development of activity</p> <p>Agreed work-plan</p>

POLICY AREA OBJECTIVES	MEDIUM-TERM GOALS	ACTION PROPOSED	KEY STEPS	INDICATORS
<p>2. Implementing a coordinated and decentralized process for programming urban infrastructure</p>	<p>2.1.a Introduce within Cipta Karya the use of codes and standards for urban infrastructure located in high risk area</p> <p>2.1.b Through BAPPEDAS introduce natural hazard considerations within master plans</p> <p>2.1.c Through BAPPEDAS introduce land use considerations that include concepts of vulnerability and risks for urban infrastructure</p>	<p>Establish inter-institutional coordination between municipal government, SATLAK Pbs, Cipta Karya, and BAPPEDAS for programming delivery systems of urban infrastructure that include disaster mitigation measures</p>	<p>Select municipalities with high vulnerability</p> <p>Assign working group and provide TA</p> <p>Establish working procedures</p>	<p>Development of activity</p> <p>Development of activity</p> <p>Initiation of activity</p>
	<p>2.2.a Introduce natural hazards considerations in standard procedures of BAPEDAL.</p> <p>2.2.b Introduce natural hazards considerations in standard procedures of SATLAK Pbs</p>	<p>2.2 Establish inter-institutional coordination between SATLAK Pbs and BAPEDAL in selected municipalities</p>	<p>Develop guidelines</p> <p>Exchange mutual reinforcing information and data</p> <p>Collaborate in pilot activities in Kapuk Muara</p> <p>Collaborate in pilot activities in Jalan Toll</p>	<p>Development of activity</p> <p>Development of activity</p> <p>Integration of working committee</p> <p>Integration of working committee</p>

130

POLICY AREA OBJECTIVES	MEDIUM-TERM GOALS	ACTION PROPOSED	KEY STEPS	INDICATORS
<p>3. Enhancing local government resources mobilization, financial management and involvement of the private sector in infrastructure and service delivery</p>	<p>3.1 Enhance the participation of community-based organizations in natural hazard management activities</p>	<p>Develop a network of NGOs willing to work in natural hazard programs</p> <p>Implement a Pilot project in Kampung Kopuk Muara, Jakarta</p> <p>Introduce natural hazard mitigation measures in selected kampungs as part of KIP activities</p>	<p>Assign working group through BAKORNAS PB and provide TA</p> <p>Coordinate activities through BAKORNAS PB, local government and NGOs</p> <p>Coordinate working group including SATLAK Pbs, Cipta Karya, and local governments.</p>	<p>Completion of activity</p> <p>Development of activity</p> <p>Agree work plan</p>
	<p>3.2 Enhance the participation of private sector in natural hazard management activities</p>	<p>Initiate pilot activities in project Bandung Jalan Toll</p> <p>Initiate natural hazard mitigation activities in coordination with HAKI</p> <p>Coordinate with HAKI and educational centers training and dissemination activities related to natural hazard preparedness and mitigation</p> <p>Create a Commission to study the role of the insurance market in relation to natural hazard assessments and mitigation strategies</p>	<p>Establish a working committee through BAPINDO</p> <p>Develop a working agenda</p> <p>Provide TA</p> <p>Establish a working committee</p> <p>Develop a working agenda</p> <p>Identify educational centers that could collaborate with HAKI</p> <p>Provide TA to working committee</p> <p>Provide TA to selected private insurance companies to investigate strategies related to the insurance market and natural disasters</p> <p>Assign a working group for considering the formulation of a new insurance law</p>	<p>Completion of activity</p> <p>Completion of activity</p> <p>Development of activity</p> <p>Completion of activity</p> <p>Development of activity</p> <p>Completion of activity</p> <p>Development of activity</p> <p>Agree study committee</p> <p>Agree study committee</p>

POLICY AREA OBJECTIVES	MEDIUM-TERM GOALS	ACTION PROPOSED	KEY STEPS	INDICATORS
<p>5. Strengthening the institutional capacity of local government</p>	<p>5.1 Strengthen the capacity of local officials to understand natural hazard phenomena and to include appropriate disaster mitigation measures within provincial level</p>	<p>Provide TA in scientific research and provide technical assistance in order to increase the capacity and ability of local officials to undertake natural hazard management programs.</p> <p>Involve NAKI in the preparation of technical material designed to increase appropriate Prepare</p>	<p>Select municipalities with high vulnerability</p> <p>Prepare course and seminars</p>	<p>completed</p> <p>Development of activity</p>
	<p>5.2 Disseminate information to public officials about necessity to include PHP measures to protect infrastructure projects</p>	<p>Prepare through appropriate research and educational institutions literature in natural hazard management.</p>	<p>Prepare booklets, manual, slide/tape nodes and video tapes for the preparation of hazard reduction awareness programs</p>	<p>Development activity</p>

1020

POLICY AREA OBJECTIVES	MEDIUM-TERM GOALS	ACTION PROPOSED	KEY STEPS	INDICATORS
<p>6. Improving intergovernmental coordination and consultation in urban development</p> <p>a) Strengthen inter-institutional arrangements between BAKORNAS PB and key planning institutions</p>	<p>6.1 Pursue strong inter-sectorial support for spatial planning of urban infrastructure</p> <p>6.2 Enhance the participation of local governments, private sector, and community organizations PHP activities</p> <p>6.3 Integrate natural hazard management as an inter-related sectorial component of environmental concerns</p> <p>6.4 Increase the investment of local government in sound environmental urban infrastructure</p>	<p>Include BAKORNAS PB as an institutional member of the TTRN</p> <p>Include BAKORNAS PB as an institutional member of TKPP</p> <p>Include a representative of BAPEDAL in the membership of BAKORNAS PB</p> <p>Include BAKORNAS PB as an institutional member of IMG</p>	<p>Creation of a working group to analyze concerns related to natural disaster and physical planning.</p> <p>Support BAKORNAS PB and Cipta Karya in their programs for spatial planning</p> <p>Preparation of an strategy</p> <p>Creation of a working group to analyze concerns related to the resource mobilization and development of sound local infrastructure.</p> <p>Support BAKORNAS PB and municipal governments in incorporating other sectors in the delivery of sound infrastructure</p> <p>Preparation of an strategy</p> <p>Creation of a working group and provision of TA in mutual reinforcing training activities</p> <p>Include natural disaster considerations in existing standards procedures which assist the incorporation of mitigation measures into project analysis.</p> <p>Design standard procedures that integrate natural hazard considerations with delivery of urban infrastructure</p> <p>Disseminate these standard procedures throughout municipalities located in high risk areas.</p>	

PART V. TECHNICAL ASSISTANCE PROGRAM

9. Disaster-related Research Capabilities, Studies and Pilot Activities

9.1 Geological Research and Development Center

The Geological Research and Development Center (GRDC) in Bandung is run by the Ministry of Mines and Energy, and its several divisions include Directorate for Volcanoes, Directorate for Seismotectonics, and Directorate for Environmental Geology. This last one is in charge of landslide and subsidence phenomena, as well as mapping projects.

Since all of Indonesia is situated within the Pacific Rim, it is exposed to a variety of geologic hazards, the most important of which are the subject of GRDC's investigations: volcanic eruptions, landslides and subsidence, and earthquakes. GRDC staff is investigating the mechanisms of occurrence of earthquakes, and volcanic eruptions. They are also developing the maps of areas likely to be affected by any single one, or several, of the major geologic hazards. GRDC, however, is not involved in the long-term monitoring process of the activity of volcanoes and earthquakes. Rather, it obtains input on the activity of Indonesia's 128 volcanoes from the Volcanological Survey of Indonesia, and information on earthquake activity from the Meteorological and Geophysics Bureau through its array of strong motion instruments. Both of these institutions are well equipped for their tasks, and closely cooperate with the foreign, internationally renowned expert institutions (e.g., the French volcanological office, the Japanese satellite centers, and the United States Geological Survey).

For the purpose of the current project (i.e., the incorporation of the PMP component into the infrastructure development process), the most important activity of GRDC is mapping. GRDC has considerable and sophisticated mapping capability in its central Bandung office, and in its fourteen regional offices. GRDC is involved in producing geological, seismic and landslide susceptibility maps of Indonesia. While maps produced to date have not completely covered the total area of the country, the staff are in the process of completing this major task, through thorough scientific research and mapping of the geographical areas susceptible to volcanic, earthquake and landslide activity.

GRDC scientists have mapped a large number, and produced usable, well designed and illustrated information booklets on the risks posed by sixty of them. The booklets record information on the historical activity, show the main directions of lava flow, and the extent of ashfall. GRDC's expertise is currently sought by the Departments of Tourism, Forestry and Regional Internal Revenue, who have an interest to develop as a tourist area the region of Krakatau, and would like to rely on GRDC's judgment on the levels of risk. The area proposed for development is currently preserved as a wild life reserve.

- **first, in procedural terms, this pilot Project embodies the type of roles for and the process of interchange among the members of the different central and municipal level departments that should be emphasized in the process of decentralization of the country, and that is particularly necessary for the viability of a meaningful incorporation of the PMP strategies into the overall infrastructure development process;**
- **second, in substantive terms, this pilot Project is the very example of the type of preliminary activities all disaster-prone regions of Indonesia should engage in, in order to embark on the implementation of the concrete natural hazard mitigation measures.**

It is also important to note that GRDC members expressed a keen interest in assisting future natural hazard assessment efforts for other regions. They suggested that the GRDC Director General's office would be the appropriate level to initiate cooperative agreement with BAKORNAS (proposed by this Report to be the leading institution for coordinating the identification and implementation of PMP activities). Specifically, Geological Research and Development Center "is anxiously awaiting to cooperate with BAKORNAS" (GRDC, 1992).

Given the level of multi-year-long GRDC staff's experience of collaborating with their counterparts in the Department of Public Works, as well as with the local (Bandung) BAPPEDA representatives, it is noteworthy that GRDC volunteered all the possible assistance they can extend to other regions in developing similar partnerships for multiple hazard assessment and land-use planning. Specifically, it was suggested that GRDC staff would collaborate directly on the development of multi-hazard and land-use maps with the local BAPPEDA staffs in all the provinces where regional offices of the Department of Mines and Energy do not exist. In the fourteen regions where such offices do exist,¹¹ the GRDC staff would provide expert assistance as needed and requested by the municipal level project participants.

One of the findings this Report would like to emphasize as particularly impressive is that this pilot project has already developed the technical assistance (TA) role for the central government level expertise. The TA role for the central government departments is the role that the decentralization process country-wide is aiming to promote in all fields of endeavor, and that the currently proposed *HGL-002: Municipal Finance for Environmental Infrastructure Project* is also recommending. It is especially encouraging for this PMP strategy project that a noteworthy precedent of such a role already exists in the natural hazard assessment area, and that it can be used as model for developing central-municipal government partnerships in other regions of the country as well.

¹¹Regional offices of the Department of Mines and Energy have been established in the following regions: Aceh, North Sumatra, Riau, Bengkulu, South Sumatra, West Kalimantan, South Kalimantan, Central Kalimantan, East Kalimantan, North Sulawesi, South Sulawesi, Maluku, West Nusa Tenggara and Irian Jaya.

9.2 Institute of Human Settlements

Institute of Human Settlements is the research arm of the Agency for Research and Development, of the Ministry of Public Works. The Institute is located on the outskirts of Bandung. The facility consists of a campus (9.36 ha), and a complex of buildings totalling 11,521 sq m. The campus buildings include: main building (housing administrative offices of the professional and support staff); dormitories that can accommodate 32 people in double occupancy rooms; several large and small classrooms fully equipped with sound, slide, overhead and video presentation capabilities; a kitchen and a dining room. Separate buildings on the campus serve as a Praying Room and a major conference hall. Four separate buildings serve as laboratories for structures and earthquake engineering, building materials, fire testing and sanitary engineering research. Buildings that house a workshop, utility equipment and a guardhouse complete this brand new research campus which was officially opened only last December. This facility, the cost of which amounts to approximately Y2 billion, is a donation of Japanese government. The facility was designed and supervised by the Japanese architects, but it was constructed with local labor.

The Institute of Human Settlements is an important facility that already has a pronounced role in research and development of the Ministry of Public Works, but its potential significantly surpasses the needs of the Ministry. Given its orientation to research and education/training, the Institute can successfully broaden its role within the country at large, and within the region of Southeast Asia as well, specifically in terms of prevention, mitigation and preparedness.

9.2.1 Research Component

The Institute's research capability is supported by four research laboratories, each of which is fully equipped to perform research into a given aspect of human settlements. For example, the structure/earthquake laboratory contains a retaining wall, hydraulic equipment, tilting table for earthquake testing of full scale residential buildings of different construction types, as well as a small shaking table for earthquake testing of scaled-down building models. All equipment is fully computerized permitting sophisticated measurements and comparisons of results with other research laboratories world-wide. Investigations that are carried out in this laboratory are foremostly shelter-related: appropriate construction techniques are investigated to improve the design for and construction of earthquake-resistant small residential and school buildings. Building performance in earthquakes is tested on the equipment described above, and appropriate changes are made in construction details to accommodate low-cost and seismic safety requirements.

Equipment in other laboratories includes: equipment for housing environment analysis (statistical analysis and survey data collection, equipment for analyzing aerial photography and map analysis); equipment for building materials testing includes general chemical testing apparatus, fresh and hardened concrete testing equipment, apparatus for testing cement-based materials, wood and wood-based materials testing equipment, and apparatus for testing plastics and coating materials; sanitary engineering laboratory contains the equipment for testing water quality, liquid and solid waste, microbiological testing apparatus, chemical testing equipment, as well as portable testing kits and data acquisition system for water and sanitary tests; fire testing laboratory contains fire-proof testing apparatus and fire resistance testing equipment; finally, general metal and wood workshop equipment is located in a separate building, supporting testing activities in the various laboratories. The Institute also has a small printing press for publishing its journal, topical booklets and course materials.

9.2.2 Education and Training

The Institute of Human Settlements is engaged both in formal type education activities (through seminars and workshops held either on its own premises or in the local communities), and in practical, "hands-on" training sessions targeting in particular the community-based contractors, masons and carpenters.

In terms of hands-on education and practical training, the Institute's staff build prototypes of buildings jointly with local masons and carpenters in the geographical areas that are particularly vulnerable to earthquakes. The prototypes are based on the Institute's laboratory findings. For example, following the 1990 Majalengka earthquake, several building prototypes were built in the area of impact: five residential buildings, one junior high school and five mosques. The construction types that are particularly important for Indonesia are wood or reinforced concrete column-and-beam systems, with reinforced masonry infills. Local masons and carpenters are recruited to participate in one week-long education sessions in the field, after which the five best students are selected to build prototypical buildings under Institute's staff supervision. This pattern of practical, hand-on education of local contractors, masons and carpenters had been a successful practice even before the Institute moved to its new home last December. As early as 1979, prototypical residential buildings were constructed in Tangyung Jaya village, Tasik Malaya province, using local timber of inferior quality (the only wood that is available for local construction given wood export demands). In 1980 this area was affected by an earthquake in which all the buildings constructed according to Institute's design were undamaged.

In addition to the hands-on approach of disseminating the knowledge on sound building practices in seismically prone areas, Institute also organizes several types of seminars and training courses. Twice a year, three-day long seminars are organized in the field for local government officials, building consultants and contractors on the construction that

is affordable, and at the same time resistant to earthquake and environmental impact (e.g., the aspects of wood preservation and treatment). For these seminars the Institute charges only nominal fees to the participants.

Workshops and training sessions are also organized at the Institute's own facility, both for the domestic audience (building officials, consultants) and the international groups. Ten international seminars on earthquake and fire risks have been organized to date, usually for an audience from the region, including Fidji, Pakistan, Sri Lanka, Bangladesh, Papua New Guinea and Singapore. JICA is very active in sponsoring regional seminars: in February 1992 a seminar on housing design, including environmental and earthquake components was held, and in late August 1992 an earthquake seminar is planned.

9.2.3 Knowledge Dissemination

In addition to the education component, the Institute is also engaged in sharing the results of their research with academic institutions and libraries in the country and abroad. A journal/newsletter is published, as well as topical booklets for particular audiences.

9.2.4 Issues of Concern and Potential for Improvement

Institute's Director, H.R. Sidjabat, and several other interviewees agree that, despite the very sophisticated facility and excellently equipped laboratories, the Institute lacks operating budget for staff's own professional improvement, specifically in terms of their participation in international seminars and workshops. Moreover, some of their laboratories are understaffed in terms of professional researchers, and funding for the outreach programs is insufficient.

Nevertheless, the capability exists within the Institute to earn the revenue for at least some of these activities through consulting for the private sector. Sophisticated laboratories at the Institute are unique in the country, enabling the sanitary engineering and the structure/earthquake laboratories to accept testing jobs for the private sector. It is also important to note that Institute's rules and regulations *do allow* the staff of these two laboratories to perform such consultancies on behalf of the Institute. Other divisions, including information dissemination, cannot perform services for the industry on the consultant basis.

Clearly, the Institute's activities are closely related to disaster mitigation and planning, but this crucial component is still not incorporated into the Institute's program. Currently, some plans are being made to recruit architects and planners to fill the disaster mitigation and planning gap, but actual funding is insufficient for staffing in this area.

9.3 Asian Disaster Preparedness Center (ADPC), Asian Institute of Technology (AIT)

The Asian Disaster Preparedness Center (ADPC) at the Asian Institute of Technology (AIT) in Bangkok is a regional institution which provides support to national programs in Asia in the form of general and specialized disaster management, prevention, mitigation and preparedness training, information services and technical assistance.

ADPC was created in 1986 and its primary role is to assist countries of the Asian and Pacific region in formulating their policies and developing their capabilities in all aspects of disaster management. To achieve this ADPC provides general and specialized regional training programs, information services, assistance in developing national training programs and technical assistance to national programs in accordance with the expressed needs and requirements of its clients.

ADPC is part of the Asian Institute of Technology Outreach Program (AIT) which was established in 1959 and chartered in 1967 by special legislation of the Royal Thai Government, as an autonomous international postgraduate technological institute. AIT has an international faculty and draws students from all over Asia as well as other parts of the world. AIT carries out its mission through a) Regular Academic Programs -- which lead to the award of Doctoral and Master's degrees and Diplomas; b) Regional Outreach or extension activities -- which contribute to the continuing career development of practicing professionals; and c) Research Programs -- which are conducted by faculty and students or in cooperation with other institutions in Asia and abroad.

AIT is located on a 42 kilometer site north of Bangkok. It houses a 600-seat auditorium, hotel rooms for 120 guests, and seminar and meeting facilities.

9.3.1 Special Courses

To date, ADPC has organized 23 courses, workshops or seminars for 667 participants from 46 countries. Several courses prepared by ADPC are of particular interest for the IHMS. For example:

Disaster Management Course is targeted at senior and mid-level practicing disaster managers. The curriculum is designed to improve participants' understanding of the theory and practice of disaster management.

Improving Cyclone Warning Response and Mitigation Course is conducted both at AIT and overseas. During the course each country is represented by a team of three people - a meteorologist, a disaster response manager and an engineer or planner responsible for structural mitigation measures.

The **Seismic Hazards Mitigation** course provides special emphasis on earthquake resistant design and construction, and training on the preparation of natural resource assessments and monitoring systems.

Other courses include **Flood Prevention, Mitigation and Management; Socio-Economic Aspects of Disasters; A Regional Seminar on Disaster Mitigation.**

ADPC training resources include a collection of audio-visual materials and the KIT Library which is a collection of bibliographic information on publications pertaining to disaster prevention in the south Pacific region: ie., cyclones, floods, tsunamis, volcanic eruptions, earthquakes, droughts, and landslides. It is intended that these resources be utilized for the creation of small libraries in the various countries in the South Pacific region. This program is being sponsored by UNDRO.

ADPC has a permanent staff of 8 professionals, 7 professional associates and 8 support personnel. The Center also draws upon a multidisciplinary network of Disaster Management experts in the region who make presentations in their particular area of expertise and participate in the training courses. Course participants make up a network of about 700 individuals throughout Asia who are involved in disaster management activities.

9.3.2 New Activities

Currently ADPC is expanding its research activities. Several programs have been initiated at ADPC which are of particular interest for the implementation of IHMS.

- In collaboration with OFDA and USAID a five year program has been designed to stimulate and demonstrate the value of corporate government-community cooperation in disaster management.
- An Urban Development and Shelter program has been initiated to assist countries in the region in the development of in-country preparedness and mitigation programs in the urban development and shelter sector. This program focuses on the planning and development of pilot projects which have potential for replication; the preparation of post-disaster surveys and damage assessments; and the preparation of shelter guidelines, manuals and teaching materials on the subject.

- A Logistical Decision Support System has been introduced responding to the growing need for systems design in disaster management. This expert system computer software is intended to facilitate the planning and implementation of disaster management logistical systems.
- The ADPC is planning to further develop its own capability and those of national disaster management planners and practitioners in the use of contemporary technologies. It is anticipated that this program will reinforce national commitments to developing local capabilities and further disaster information dissemination throughout the region.

9.3.3 Other Areas of Interests

AIT's resources include a Remote Sensing Laboratory comprised of three mutually-supporting laboratory facilities: visual analysis and cartography; digital analysis and image processing; and photographic processing. This particular program offers great potential for application in hazard mitigation activities. For example the digital analysis facility's image processing systems (IPS) and geographic information systems (GIS) cover a wide range of sophistication. The work stations have a wide array of input-output devices including tape and disk drives, digitizing tables, printer and ink-jet plotter, and stand-alone Optronics scanners, and plotter systems.

The Geographic Information System Tutorial (GIST) is a program developed at AIT that can carry out spatial analysis on a limited data set (50 x 50 grid). The package is oriented for training and most basic GIS operations can be carried out by the package in color or black-and white.

9.3.4 The UN-GRID Program

ADPC and the UN-GRID program (located in the same building) are in the process of establishing a collaborative effort with the goal of being able to offer region wide support for multiple hazard mapping and vulnerability /risk assessments. This program offers training in remote sensing, airborne and satellite remote sensing instrumentations, photo interpretation and mapping, digital analysis of remote sensing data, and geographic information systems and applications. Practical project implementation experience is gained through team participation in a remote sensing workshop.

The UN-GRID program has gathered a large data base for Southeast Asia, including Indonesia. This resources can be accessed by and become extremely valuable when implementing natural disaster programs in Indonesia.

9.3.5 Issues of Concerns and Potential Areas for Improvement

In spite of the multiple resources that AIT/ADPC possesses in terms of natural hazard management activities, there are areas in which possible technical assistance to the Indonesia Hazard Mitigation Strategy is lacking. For example, major considerations endorsed by this strategy related to strengthening the capacity of local governments and community-based organizations. Although AIT/ADPC's courses have included the participation of local government staff and NGO members, the major curricula of these centers are not directed at these specific areas of concern.

However, AIT/ADPC are institutions that have typically responded to the needs of current development. The initiation of training activities to expand the role of private sector programs in natural disaster management activities is a good example of the adaptability of these institutions to changes in major development paradigms. If these institutions are to play a major role in providing technical assistance to the GOI, new curricula activity must be developed within these institutions to meet the goals established within the Indonesia Hazard Mitigation Strategy.

9.3.6 Proposed Arrangements for Identified Research Institutions: Cooperative Partnerships between GRDC, IHS and ADPC/AIT

Given the regional nature of the natural hazards in Southeast Asia on the one hand, and the capabilities of the teaching and research institutions in the region on the other, it would be appropriate to recommend that a cooperative partnership be developed between the Geological Research and Development Center (GRDC), Institute of Human Settlements (IHS), both of Bandung, and the Asian Disaster Preparedness Center (ADPC) of Bangkok. Geological Research and Development Center is an excellent resource of scientific (geological, seismotectonic) and mapping capability. However, it does not have formalized educational and training capabilities which is a strong feature of the Institute of Human Settlements. At the same time, ADPC has already established itself as the regional leader in the planning aspects of disaster preparedness, but has no physical testing capability of the Human Settlements Institute, nor the level of scientific resources of GRDC. A partnership between these three institutions could benefit each of them individually, as well as provide an excellent blend of expertise and experience for the national and regional natural hazard mitigation. It would be appropriate, therefore, to establish memoranda of understanding and cooperative partnerships between these institutions on joint educational and research efforts which would tap the GRDC's, IHS's and ADPC's respective strengths: scientific and mapping capability of GRDC, planning and educational capability of ADPC, and the physical testing, technical research and hands-on training capability of the Institute.

Similar memoranda of understanding and cooperation should also be established between the Institute and the Bandung Institute of Technology, and the prospective Environmental Management Center (EMC) which is currently being built in Serpong, West Java, through the funding from the Japanese government.

Respective Strengths of GRDC, IHS and ADPC/AIT

- GRDC**
- o Research (geological and seismotectonic)
 - o Mapping
 - o Scientific Consulting
 - o Experience in multi hazard/land-use mapping pilot project
- IHS**
- o Physical testing
 - o Building prototype structures (educational purpose)
 - o Hands-on, practical training
 - o Education (continuing education) – mainly logistical capability
- ADPC/
AIT**
- o Education (formal, mainly at AIT)
 - o Training (planning and disaster preparedness focus)
-

10. Proposed Technical Assistance

Five levels of technical assistance (TA) have been identified throughout this report: a) the Central Government Level, designed to promote institutional building of BAKORNAS PB, IDMC, and SATLAK PBs; b) the Provincial Level, designed to strengthen local institutions with special emphasis in local governments; c) the Community-Based Organization Level, designed to increase the knowledge and participation of NGOs, grassroots organizations, and community leaders in natural hazard management activities; d) the Private Sector Level, designed to expand prevention and mitigation measures in key private sector infrastructure projects and increase the knowledge and participation of key professional association in natural hazard mitigation measures; e) the Institutional Level, designed to increase the research capacity of key institutions in preparedness and mitigation strategies.

10.1 Proposed Activities

10.1.1 Central Government Level

- **Redefinition of BAKORNAS PB'S institutional roles - emphasis in expanding long-term mitigation strategies.**
- **Development of a natural hazard strategy for BAKORNAS PB - emphasis on local government, private sector, and community participation.**
- **Redefinition of SATLAK PBs' institutional roles - emphasis on expanding long-term mitigation strategies.**
- **Development of a strategy to strengthen local SATLAK PBs' emphasis on private sector and community participation.**
- **Development of guidelines to incorporate natural disaster management concerns within IMG standard setting.**
- **Development of guidelines to incorporate natural hazard considerations into standard procedures of BAPEDAL.**
- **Development of guidelines to incorporate environmental considerations into standard procedures of BAKORNAS PB.**
- **Assist BAKORNAS PB and SATLAK PBs in the development of a net-work of NGOs that would implement natural hazard management activities.**

10.1.2 Local Government Level

- **Redefinition of municipal roles in terms of natural hazard management activities - emphasis on expanding long-term mitigation strategies.**
- **Development of a municipal strategy with an emphasis on the expansion of the private sector, and community-based organizations in hazard mitigation activities.**
- **Assistance to local governments in the preparation of natural hazard impact assessments in the form of PILs and ANDALs.**
- **Preparation of procedures that allow local governments to include natural hazard impact assessment in early project formulation (coordination with BAPPENAS and Cipta Karya's decentralized agencies).**

- Preparation of guidelines that permit the incorporation of natural hazard consideration within PJMs.
- Assistance to BAPPEDAS for incorporating natural hazard consideration within land use planning activities.
- Assistance to BAPPEDAS for developing a master plan incorporating natural hazard actions.
- Assistance to Cipta Karya for developing hazard-resistant codes and standards for urban infrastructure.
- Assistance to municipalities for developing fiscal tools that address preparedness and mitigation strategies.

10.1.3 Community-Based Organizations Level

- Assistance to BAKORNAS PB and DKI Jakarta local government for designing and implementing a flood program in Kampung Kapuk Muara.
- Assistance to BAKORNAS PB for identifying future pilot project sites.
- Assistance to SATLAK PBs, Cipta Karya and local governments for selecting kampung to introduce natural hazard considerations in KIP activities.

10.1.4 Private Sector Level

- Assistance to the Indonesian Development Bank for designing the Bandung Jalan Toll with natural hazard mitigation measures.
- Assistance for the creation of a Commission to study and examine the role of the insurance market industry in natural hazard mitigation in Indonesia.
- Assistance to selected private insurance companies for demonstrating that hazard assessments can become a part of actuarial formulas for calculating property insurance premiums.
- Assistance for developing incentives for private insurance companies to offer reduced property insurance premiums for properties which adopt natural hazard mitigation measures.
- Assistance for developing a new insurance law for the country which incorporates PMP-related components into the legislative language.

- Assistance for developing an incremental plan for increasing the role of the insurance industry in natural hazard mitigation.
- Assistance to HAKI for producing and distributing appropriate natural hazard reduction educational materials.
- Assistance to HAKI for organizing regular continuing education programs.
- Assistance to selected educational centers for improving curricula regarding the safety of the built environment in natural disasters.

10.1.5 Institutional Level

- Preparation of hazard identification studies and mapping.
- Preparation of vulnerability assessments.
- Preparation of risk assessments.
- Training on retrofitting techniques.
- Preparation of a program on public awareness.
- Preparation of guidelines for damage assessments.

10.2 Staffing (long-short term expatriate advisor(s), long-short term consulting services, Indonesian professionals.

The different components of TA will be addressed by contracted international/regional institutions or firms with expertise in the following areas:

o Central Government Level

A regional or international institution or firm will be contracted to plan and provide technical assistance and training for strengthening the capacity of BAKORNAS PB, redefinition of its institutional roles, redefinition of SATLAK PBs institutional roles, development of guidelines and procedures for long-term disaster mitigation planning, development of natural hazard-environment concerns.

e Local Government Level

A regional or international institution or firm will be contracted to plan and provide technical assistance and training directly to local governments for strengthening capacity of local governments in terms of natural hazard management activities; strengthening the capacity of local planning institutions so that natural hazard concerns can become an integral part of land use planning, master plans preparation, building permit approvals, and investment procedures. TA will include the preparation of natural hazard assessment impacts in the forms of PILs and ANDALs and a set of fiscal tools that would allow local institutions to effectively address effectively preparedness and mitigation activities.

o Community-Based Organizations Level

A regional or international institution or firm will be contracted to plan and provide technical assistance and training directly to community-based organizations. Working with local NGOs, the firm will develop training materials (specially floods training programs) for disaster mitigation, and environmental awareness. TA will also involve BAKORNAS PB, selected local governments, and SATLAK PBs.

o Private Sector Level

A regional or international institution or firm will be contracted to plan and provide technical assistance and training directly to the Indonesia Development Bank for introducing mitigation consideration within the design of the Bandung Jalan Toll. TA should be provided to professional associations to promote the inclusion of PMP strategies into everyday practice. TA should be provided to selected educational centers for improving curricula regarding the safety of the built environment in natural disasters. TA should be provided for the development and support of insurance markets that consider natural hazard mitigation strategies.

o Institutional Level

A regional or international institution or firm will be contracted to plan and provide technical assistance and training to develop and/or improve a set of intervention strategies that would prevent the destructive results of a future disaster, such as the preparation of hazard identification studies and mapping; vulnerability assessments; risk assessments; retrofitting techniques; damage assessments; and public awareness programs.

10.3 The Roles of Identified Research Institutions

When applicable the GRDC, IHS, and ADPC/AIT would carry most of the activities within the areas of their expertise such as research, training, education, mapping, etc. (see section 9.3.6)

10.4 Local Counterparts and PMP Advisor

Competent local counterparts will be identified to participate in TA activities. Regional/international institutions or firms and local counterparts will closely work with the PMP Advisor, Jakarta.

11. PROJECT BUDGET

The project will cost \$3,045,000 million over its three year implementation. The budget has been prepared according to the five major areas requiring TA. The following charts content detailed information and estimates on the implementation activities.

A. CENTRAL GOVERNMENT LEVEL (thousands of dollars)

ACTIVITIES	Year One	Year Two	Year Three	Total
Technical assistance for redefining BAKORNAS institutional roles	20	20	5	45
Development of a natural hazard strategy	20	20	10	50
Development of a strategy for strengthening local SATLAK PBs	10	20	5	35
Redefinition of SATLAK PBs institutional roles	10	0	5	15
Development of guidelines to for natural disaster-environmental issues	30	20	20	70
Technical assistance to BAKORNAS PB in developing a net-work of NGOs	10	20	20	50
Other	10	10	10	30
Total	110	110	75	295

B. LOCAL GOVERNMENT LEVEL
(thousands of dollars)

ACTIVITIES	Year One	Year Two	Year Three	Total
Redefinition of Municipal Roles in terms of natural hazard management	20	20	10	50
Development of a municipal strategy with emphasis on private sector and community-based organization in hazard mitigation considerations	50	30	10	90
Assistance to prepare procedures for a natural hazard impact assessments	30	20	5	55
Assistance to prepare PJMs including natural hazard considerations	30	20	5	55
Assistance to BAPPEDAS for land use planning with natural hazard considerations	40	30	10	80
Assistance to BAPPEDAS for developing master plans with natural hazard consideration	40	30	10	80
Assistance to Cipta Karya for developing hazard-resistance codes and standards	40	30	10	80
Assistance to selected municipalities for developing fiscal tools that address preparedness and mitigation strategies.	40	30	20	80
Other	20	20	10	50
Total	300	230	90	620

C. COMMUNITY-BASED ORGANIZATIONS LEVEL
(thousands of dollars)

ACTIVITIES	Year One	Year Two	Year Three	Total
Implementation of pilot activities in Kampung Kapuk Muara	50	70	40	160
Assistance to BAKORNAS PB for identifying future pilot project sites	10	0	0	10
Assistance to SATLAK PBs, Cipta Karya and local governments for selecting kampung to introduce natural hazard considerations in KIP activities	20	10	0	30
Other	10	10	10	30
Total	90	90	50	230

D. PRIVATE SECTOR
(thousands of dollars)

ACTIVITIES	Year One	Year Two	Year Three	Total
Assistance to the Indonesian Development Bank for designing the Bandung Jalan Toll with natural hazard mitigation measures	40	70	20	130
Assistance HAKI for producing natural hazard educational material and organizing continuing education programs	20	20	10	50
Assistance to selected education centers for improving curricula regarding safety of the built environment in natural disasters	10	10	5	25
Assistance for the creation of a Commission to study and examine the role of the insurance market industry in natural hazard mitigation	10	10	0	20
Assistance to private insurance companies for requiring that hazard assessments become a part of actuarial formulas	10	10	0	20
Assistance for developing a new insurance law	10	10	0	20
Assistance for developing an incremental plan for increasing the role of the insurance industry in natural hazard mitigation	10	10	0	20
Other	10	5	5	20
Total	120	150	40	310

E. INSTITUTIONAL LEVEL
(thousands of dollars)

ACTIVITIES	Year One	Year Two	Year Three	Total
Preparation of hazard identification studies and mapping	50	50	20	120
Preparation of vulnerability assessments	50	50	20	120
Preparation of risk assessments	50	50	20	120
Training on retrofitting techniques	75	50	30	155
Preparation of a program on public awareness	75	50	20	145
Preparation of guidelines for damage assessments	50	50	30	130
Other	20	20	10	50
Total	370	320	150	840

**F. ESTIMATED TOTAL PROJECT BUDGET
ALL ACTIVITIES
(thousands of dollars)**

ACTIVITIES	Year One	Year Two	Year Three	Total
Central Level	110	110	75	295
Local Government Level	300	230	90	620
Community-Based Organizations	90	90	50	230
Private Sector	120	150	40	310
Disaster Intervention strategies	370	320	150	840
Regional Advisor	200	200	200	600
Mid-term and Final Evaluation	30	30	30	90
Impact Information System	20	20	20	60
Total	1240	1150	655	3045

BIBLIOGRAPHY

References

- Bank Indonesia. 1991. *Report for the Financial Year 1990/91*. Jakarta: Bank Indonesia.
- Berz, G. 1991. "Natural Disasters and Insurance and Reinsurance." *Earthquakes and Volcanoes*. Vol 22 (3), pp. 99-102.
- Berz, G. 1984. "Research and Statistics on Natural Disasters in Insurance and Reinsurance Companies." *The Geneva Papers on Risk and Insurance*.
- Brabb, E.E. 1991. "The World Landslide Problem." *Episodes*. Vol. 14 (1). March. pp. 52-61.
- Donner, W. 1987. *Land Use and Environment in Indonesia*. London: C. Hurst & Company.
- Dowall, D. 1980. "An Examination of Population Growth Managing Communities." *Policy Studies*. Vol 3 (9), pp.414-427.
- Frank, J.E. & P.B. Downing. 1987. "Patterns of Impact Fee Usage." Presented to the 1987 Conference of the American Planning Association, Florida State University, Department of Urban and Regional Planning.
- Jefferey, S. 1981. "Our Usual Landslide: Ubiquitous Hazard and Socioeconomic Causes of Natural Disaster in Indonesia." Boulder, CO: Institute of Behavioral Science, University of Colorado. (Working Paper 40).
- Kingsley, T. and G. Peterson. 1992. *Project Design for Indonesia HG-002: Municipal Finance for Environmental Infrastructure*. (Draft). US AID.
- Kockelman, W.J. 1990. "Reducing Earthquake Hazards in Utah - The Crucial Connection Between Researchers and Practitioners." *U.S. Geological Survey Open-File Report*. 90-217.
- JICA. n.d. *SABO in Indonesia*. Ministry of Public Works. Volcanic SABO Technical Center.
- Munich Re. 1984. *Volcanic Eruption - Causes and Risks*. Munich: Munich Re.
- Pelzer, K.J. 1963. "Physical and Human Resource Pattern." In *Indonesia*, edited by R.T. McVey. pp. 1-23. New Haven: HRAF Press
- Rubin, C., M.D. Saperstein and D.G. Barbie. 1985. *Community Recovery from a Major Natural Disaster*. Boulder, CO: Institute of Behavioral science, University of Colorado.
- Santoso, D. 1989. "Landslides Controlled by Weathering and Geological Structure in South Cianjur, West Java, Indonesia." *Landslide News*. 1989 (4), pp. 16 & 17.
- Siswovidjojo, S. 1988. "Seismicity and Other Phenomena Associated with the Eruption of Galunggung Volcano in West Java, Indonesia, in 1982/83 and their Volcanological Implications." Paper presented at *Bulletin of the International Institute of Seismology and Earthquake Engineering*. Vol 23 (1989), pp. 433-466.
- Tilling, R.I. 1990. "Coping with Volcanic Hazards." *Earthquakes and Volcanoes*. Vol. 22 (4).