

# **Community-Based Analysis of Coping with Urban Flooding : a Case Study in Semarang, Indonesia**

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March, 2007



# **Community-Based Analysis of Coping with Urban Flooding : a Case Study in Semarang, Indonesia**

by

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This thesis submitted to the International Institute for Geo-information Science and Earth Observation in partial fulfilment of the requirements for the degree of Master of Science in Geo-information Science and Earth Observation, Specialisation: Urban Planning and Land Administration

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**INTERNATIONAL INSTITUTE FOR GEO-INFORMATION SCIENCE AND EARTH OBSERVATION  
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## Abstract

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Flood disaster, by number and economic losses, account for about a third of all natural catastrophe throughout the world. Semarang, as a waterfront city, has since historic time been suffering with flooding. Flooding within the city is still a major problem for the local government of Semarang City. Many parts of Semarang, especially along the rivers and along the shore, are suffering from flooding. This research aims to capture people's perception and response to different level of flood. Describing the types of people's coping strategies against different stage of floods is the main objective of this research. The second main objective of this research is to review the local government policies and regulation on flood disaster management, and to study to what extent the identified coping strategies of the community can be considered into the local government regulation and policies on disaster management. This research primarily looks into the attitude and behaviour of the people. How do people live with flood risks and how do they feel about that? What can be learnt from that for communication on flood risks and flood risk management? About a hundred respondents from 5 villages located within flood-prone area along the East Banjir Kanal were selected using purposive multi stage area sampling. This methodology of sample selection intended to get to the desired unit of analysis. The respondents were interviewed using questionnaires about the way they perceived flood in their area. Result of this research shows that the people's behaviour towards flood is influenced by some factors, such as : the magnitude degree of the flood(flood extent, flood level and flood duration) and their capacity, in term of economic capacity, to cope with its impacts. Local people in the surveyed kelurahan experienced the largest flood with the flood depth inside the house ranging from 0.10 meter up to 2.5, while the average duration of flood in this area is 3 – 7 days. This result of this research also revealed that a number of important factors about the interaction between people and floods. Experience with floods influences the perceived threat and concerns related to them. The research highlights that the solidarity values among the community are still high, and this kind of social can be useful especially during the flood events.

Many efforts have been made by the Local Government of Semarang City to deal with, and to minimize the negative impact of frequent flood in this area, consisting of structural and non-structural measures. The Local Government believe that joint use of non-structural measures and structural is the best alternative of coping with flood. Unfortunately, those efforts have not been sufficient to overcome problems caused by frequent floods in this city. The community have been still suffering from frequent flood. This research revealed that there is a lack of acceptance by the Local Government of local people's knowledge and their response to flood mitigation measures and management. Cooperation between the local authorities and the affected population assumes a key role with regard to the flood hazard. Recent problems related to the effective management of floods are seen to require an approach which should incorporate an integrated view of strategies, policies, plans and others measures of social and institutional character.

Keywords : Flood, Community, Coping Strategies, Local Government Disaster Management

## Acknowledgements

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Alhamdulillah rabbi 'alamin, Praise be to Allah The Cherisher and Sustainer of the Worlds. Nothing I can do without His Will, Guidance, and Permission.

Many colleagues and friends have helped me to research and write this thesis. There are too numerous to thank individually, but I hope their help will get the return from no one except God.

Firstly, I would like to express my sincere thanks to Netherland Education Centre (NEC) in Jakarta for providing me with the STUNED scholarship and all persons behind 'the scene' of it. My sincere thanks especially goes to Dr. M.K. McCall and Drs Nannete Kingma for their support, patience and invaluable guidance during the writing process of my thesis. My gratitude also goes to Dr Hartono DESS, the Dean of Faculty of Geography, Gadjah Mada University, and Dr Sudibyakto for their support and guidance before and during the fieldwork, as well as thanks to all staff in Faculty of Geography, Gadjah Mada University, Dr Junun, Dr Pramono Hadi, , Danang, Barandi, Joko Marwasto, and Aris Marfai and Heri Sutanta for sharing the important data.

There are many people who helped me in finding and collecting the necessary data. In Semarang, I appreciate the help of all staff in Bappeda and Balikpapan Semarang, as well as all staff in Balai PSDA, Semarang. I especially thanks to my "tough fieldwork team" for helping me during the interviews, and still kept in "semangat" during the fasting time and kept working hard under the hot Semarang. My acknowledgement also goes to all participants for the interviews.

Thanks to all Indonesia students who has become my family in Enschede, Mbak Tyas, Mbak Wiwin, Mas Trias and family, and last year student of ITC, Budi, Zul, Kang Lena, Mbak Ning, Hendro, Saut, Tommy, Nunung and Yuda for welcoming me and making such a "home" environment, and "forget" about being far away from home.

To my dear friend Edna, thank you for being such a very good friend to me, for sharing the happiness and the sadness of being "a stranger" in Enschede, and for the final "touch" of my thesis.

To all people who share this ITC experience, to all my classmates of UPLA course, specially to Ginella, for sharing "the toy", gracias my friend; Anura, Quang, Bekim, Liton, JP, Demelash, Mary, Margareth, Javier, Denis, Imanuel, Seif and Vivien for being such a good friend for me, especially during the tough time of thesis writing, I appreciated all your existence for me in whatever way, thank you my friend.

To my boss, Ms Betty Mardanus, and all my colleagues in Geosys, to Mr Robert De Groot, for all his help and for encouraging me to have gut to pursue one of my dream, your help and kindness will never be forgotten for the rest of my life.

To my family, sisters and brothers, thank you for always being there for me, especially during my difficult time. To my late parent, wish you could "see" me from the surga, this is all for you.

Enschede, March 2007,

A. Dewi

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## Abbreviations

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Bappenas	National Development Planning Agency
Bappeda	Regional Development Planning Agency
BAKORNAS PB	National Coordinating Board for the Management of Disaster
Bakosurtanal	Indonesian National Agency of Survey and Mapping Coordination
Satkorlak PB	Provincial Disaster Management Coordination Unit
Satlak PB	District Disaster Management Implementing Unit
BPS	Central Bureau of Statistics
BPPT	Agency for The Assessment and Application of Technology
PSDA	Water Management Agency
BMG	Meteorology and Geophysics Agency

# 1. Introduction

*This chapter describes the introduction of the research, consisting of the background of the research, the research problems, the research objectives, the research question, the research conceptual framework, the significance of the study, the scope and limitation, and the thesis structure.*

## 1.1. Background

The research is conducted in Semarang city, Indonesia, which suffers from frequent flooding. Floods are defined as extremely high flows or levels of rivers, whereby water inundates flood plains or terrains outside the water-confined major river channels (Yevjevich, 1992)

*Flooding is one of the common hazards that causes loss of life and properties of the people and even causes severe economic setback, specially, in developing countries (UNDP, 1999).*

Hazards are measured by the probability of occurrence of their damaging values, conceived generally as flood risk, or by their impact on society, conceived usually as the loss of lives and material damage to society. (Yevjevich, 1992)

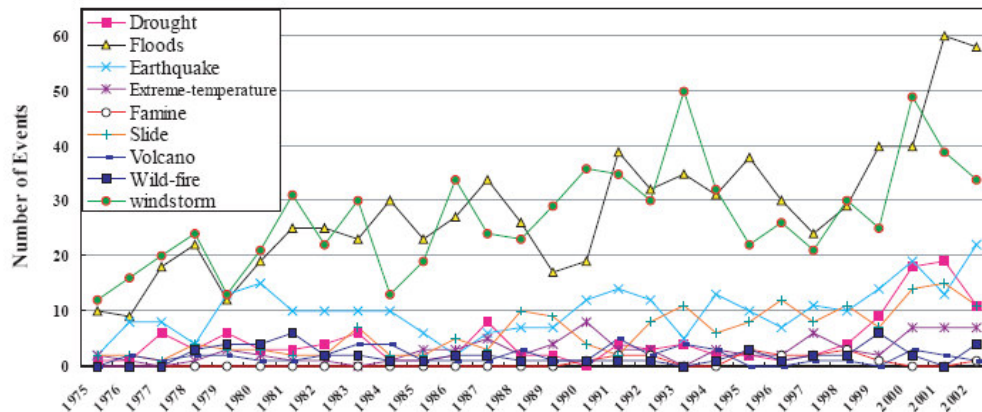


Figure 1-1: Flood disaster trend in Asia in the last 28 years compared to other natural disasters

Indonesia is one of most vulnerable countries in Asia (see figure 1-2), and flood is one of among the frequent and most disastrous natural hazards in this country. It is estimated that more than 50 million of people live in cities, and due to high concentration of people, buildings, infrastructure and socio-economic activities in the cities, there will be tremendous losses and damage when such a severe flood strikes. The most recent example of flood hazards in Indonesia is large floods in the capital of Jakarta on February, 2007, which almost all the area of the capital are affected, and causing the death of more than 29 people and more than 200,000 people displaced (Source : Bakornas PB, 2007).

Current situation as a result of monetary and economic crisis since the middle of 1997 has affected the whole country. The impacts have greatly increased the extent and magnitude of social problems. The grave situation has been aggravated by the occurrence of El Nino causing large scale forest and land fires, drought, and even famine. Economic and environmental losses have undoubtedly drained the country's natural resources making more difficult to sustain its development. Currently Indonesia is also preparing for the incoming La Nina that may cause floods and landslides in disaster prone areas of the country. To deal with the impacts and related problems, strategic approach is to apply principles of the social safety net to disaster management.

Promotion of community awareness particularly those who live in disaster's prone areas has to be prioritized, so they can live, adapt and cope day-to-day with disaster threat. Empowering communities is conducted by optimizing their own resources and potentialities, and by providing initial limited incentives to enable them to help themselves. Mapping of disaster prone areas in line with Disaster Information System are also important. However, although there are several number of effort have been made by the government of Indonesia in dealing with the flood disaster management, still losses are increasing.

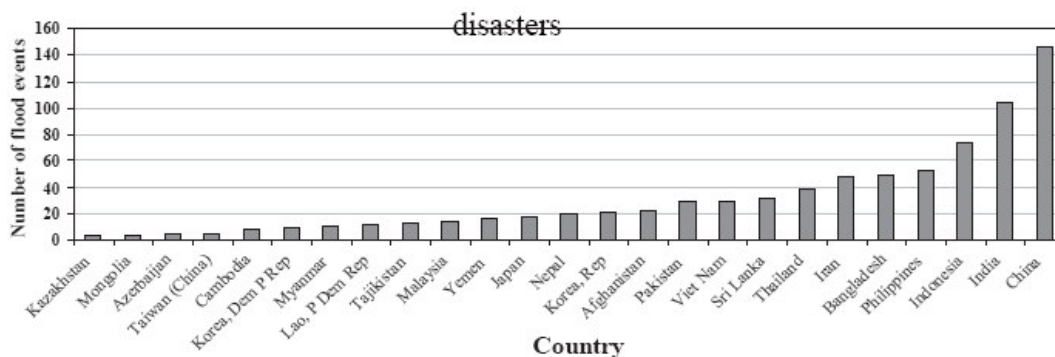


Figure 1-2: Flood events in different Asian countries in last 28 years

Interaction between floods and society are complex, requiring sociological studies of behaviour of individuals, groups and institutions.

The entire interaction between floods and society can be divided into three groups :

1. Learning about floods, as the major information input into design of any policy or strategy for coping with floods, including the alternative of doing nothing except the information dissemination;
2. Estimation of flood impacts of previous floods, or synthesizing the potential future flood damages under the most recent or future life and property conditions in flooding areas; and
3. Coping with flood in order to minimize flood impacts either by value judgment, selected flood policy or economic optimizing.

Knowledge of how vulnerable people in flooding areas respond to a threat is essential. Outside interventions can then be built based on these strategies. Natural hazards, such as floods, are not new and people have been living in hazard-prone areas for centuries, in some cases for thousands of years. They have, inevitably, devised their own skills and resources, as well as their experiences. Their knowledge system, skills and technologies are usually referred to under the heading of “indigenous knowledge”.

The application of indigenous knowledge in the face of hazards and other threats is referred to as a “coping mechanism” or “coping strategies” (Twigg, 2004). The choice of skills and resources to be applied varies according to the nature of the hazards threat, the capacities available to deal with, and to a variety of community and individual priorities than can change during the course of a disaster.

According to Twigg, (2004), there are four broad categories of coping strategies :

- economic/material
- technological
- social/organizational; and
- cultural

Most coping strategies involve elements of all of these, and are often used in sequence to respond to different stages of adversity or crisis.

Coping mechanisms that the community has developed can be applied at all phases of the hazard management cycle: mitigation, preparedness, response and recovery. The coping mechanisms are developed in the community based on past experiences and to suit its needs. From the community, we learned how people use and search for existing local resources and capacities to prepare for, respond to and recover from the impact of flood event. People hit by disaster have different levels of coping.

This indigenous knowledge is important and useful information for planners and policy makers to provide information in the planning and policy setting for more viable disaster mitigation and response measures. Knowing these local coping strategies can also help external actors, such as the local government and NGO’s in determining more appropriate types of intervention and avoid undermining people’s capacities (de Dios , 2002).

This study is focused on identifying the community’s coping mechanisms and the effectiveness based on different level of flooding in Semarang City. The knowledge generated from this study can be useful information for the local government of the city of Semarang to undertake an effective Disaster Management Program in order to minimize the impact of flooding.

## **1.2. Research Problem**

It is well known that flood is the most common natural disasters in the world. Floods, so-called one of natural hazards result from the potential for extreme geophysical events, to create an unexpected threat to human life and property (Smith,1996) . When severe floods occur in areas occupied by humans, they can create natural disasters which involve the loss of human life and property plus serious disruption to the ongoing activities of large urban and rural communities ( Smith and Ward, 1998).

However, besides the negative flood impact such as : damage to houses and other buildings, loss of life, loss of jobs or income, disruption of the network of social contact, and interruption to normal access education, health and food services, there can be a wide variety of positive flood impacts, for instance, increased fertility of agricultural land (Parker et al., 1987). Though, this research focuses

only on strategies/mechanisms employed by the community of the city of Semarang to cope with the negative impact of flood.

In the case of Semarang city, due to high concentration of people, buildings, infrastructure and socio-economic activities in the city, there will be tremendous damage when such a severe flood strikes. A severe flood happened in early 1990, due to the overflow of the Garang river and other rivers flowing through the city of Semarang. It resulted in 47 deaths and losses counting to Rp 8.5 billions (at that time), which until now no comprehensive solution for the flood problem has been made. However, based on the literature review and to the best of my knowledge, there is no detailed study or research conducted in Semarang city about how local people cope with flood or what types of coping mechanisms or strategies used by the local people in order to cope with the flood.

Coping is the manner in which people and organization act, using existing resources within a range of expectations of situation to achieve various ends (Blaikie, et al., 1994 ). They further state that people often set up ways of coping with an event when they know it may occur in the future because it has happened in the past. Such coping strategies depend on the assumption that the event itself will follow a familiar pattern, and that people's earlier actions will be a reasonable guide for similar events. The assumptions on which people make their decisions therefore rest in the knowledge that, sooner or later, a particular risk will occur of which people have some experience of how to cope (Blaikie, et al, 1994). He also emphasized that all coping strategies for adverse events which are perceived to have precedent consist of actions before, during and after the event. People have the respective mitigation and response measures that would protect their lives and cope with the effects of floods (Carter, 1992).

Although there are several number of government and non-government organizations are involved in the flood disaster management, in Indonesia, still losses are increasing. It is important to note that in order to reduce the risk of disasters, the most essential thing is to mitigate it at the planning stage. Hence, highlighting the disaster mitigation in the development plan of the local authority is important. Some measures for disaster management such as awareness-creation among the people and training a wide range of officials has been implemented quite long, though the present situation of disaster preparedness is still doubt full. Soon after a big disaster, people, tend to forget all about the damages and deaths. They never think of preparing for the next disasters. Therefore, all organization dealing with disaster mitigation should organize continuous program for preparedness for the next disaster.

The most effective way to reduce disaster risk is to work with local people to identify and analyze their vulnerability and capacities, and to develop and implement an action plan (Venton & Hansford, 2006). Understanding how people view the risk is particularly important. The accumulation and application of knowledge are directed by vulnerable people's perception of the risks they face. It is also well understood that the public participation in mitigation of a disaster is very useful. The community's knowledge in flood mitigation and response is very important information for the disaster management to be considered.in order to find the best solution to meet their needs. However, the problem lies on how community's knowledge on flood mitigation and response be considered in disaster management by the authorities.

This research emphasizes on identifying the community's response to different flood level and its mechanism to the effects of the floods. The concept of coping mechanism emphasizes on the positive aspects and actions of people to cope with the adverse effects of floods in the study area. The sketch map based on IKONOS imagery was used to map the extent of flooding within the study area based on people perception. Households interviews using questionnaires was used in the primary data collection.



### 1.3. Research Objectives

There are two main objectives of this research, which are :

1. To identify the coping strategies among the community in relation to flood hazard mitigation
2. To identify the flood management strategies of the local government and examine how local knowledge about coping can be incorporated.

Based on the two main objectives as mentioned above, five sub objectives can be derived as following :

- 1.1. To map the people's perception about flooding risk.
- 1.2. To identify people's coping strategies.
- 1.3. To identify and describe the factors influencing the selection of coping strategies.
- 2.1. To identify the local government strategies/policies on flood disaster management
- 2.2. To study on how/to what extent coping strategies of the local community can be considered into local government regulation and policies on flood disaster management.

### 1.4. Research Questions

The following research questions are needed to be addressed in order to achieve the research objectives as mentioned above:

Table 1-1: Research Objectives and Research Questions

No	Research Objectives	Research Question
1.1	To map people perception about flooding risk	a. What is people perception of flooding? b. What social differences are there in flood perception?
1.2	To identify people's coping strategies	a. What are the community's coping strategies? b. What are the household coping strategies?
1.3	To identify and describe the factors influencing the selection of coping strategies	a. What are the factors influencing the coping strategies? - socioeconomic factors in the community - physical characteristic of flood
2.1	To identify the local government flood strategies/policies	a. What are the local government regulations and policies and practice in relation to flood disaster management?
2.2	To asses how/to what extent the coping strategies of the community can be considered in the local government regulations and policies on disaster management	a. What opportunities are for incorporation community coping strategies into Local Government ? b. What are the constraints/problems to include community coping strategies in Local Government ?

To achieve the research objectives and to answer the research questions as mention in table 1-1, secondary and primary data are required. The secondary and primary data are collected using some acquisition methods (see table 1-2).

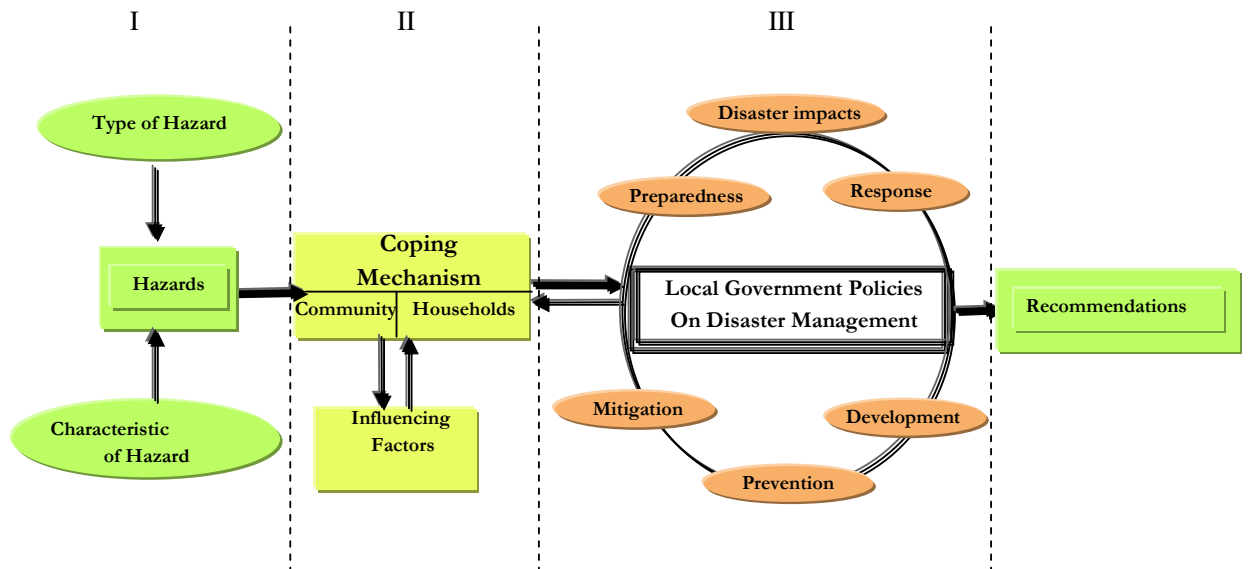
Table 1-2: Research questions & Proposed Methods

Sub Objectives	Research Question	Sources	Acquisition methods
1.1	a. What is the people's perception of flooding? b. What social differences are there in flood perception?	Households interview	Interviews with questionnaires to respondents, primary data obtained during fieldwork (field observation), sketch maps based on IKONOS imagery
1.2	a. What are the community's coping strategies? b. What are the household coping strategies?	Households interview	Interviews with questionnaires to respondents, primary data obtained during fieldwork (field observation)
1.3	a. What are the factors influencing the coping strategies? - socioeconomic factors in the community - physical characteristic of flood	Households, local government official (PSDA, Bappeda, PU)	Interviews with questionnaires to respondents, primary data obtained during fieldwork
2.1	What are the local government's regulation and policies in relation to flood disaster management ?	local government officials (PSDA, Bappeda, PU) , Local Government documents and spatial information	Interviews with Local Government officials, collection of local government documents, Bappeda maps
2.2	a. What opportunities are for incorporation community coping strategies into Local Government ? b. What are the constraints/problems to include community coping strategies in Local Government ?	Community and local government officials	Data integration and analysis

All the required data that need to address the research question as primary data was collected during the fieldwork. A survey was conducted to collect information about the community's coping mechanism and response towards floods.

The community's response at the different level of flooding is collected and analyzed as well as the factors relating to the choice of the coping mechanism. Field data was gathered from households interviews using a purposive multi stage area sampling . Some additional and secondary data were also collected during the field work from other sources, such as : Local Planing Agencies, Public Work Agency, and Water Management Board. This research is focused on how the community react towards floods and to cope with different level of flooding.

### 1.5. Research Conceptual Framework



**Figure 1-3:** Conceptual Framework

The conceptual framework describes the general concept of the research. As illustrated in figure 1-3, there are 3 main components discussed in this research, which are Hazards(I), Coping Mechanism (II) and Government Policies (III). Each of the three main components has a different role and causality one another. Hazard, by definition, is the potential or existing condition that may cause harm to people or damage to property or the environment (Twigg,2004). The hazard is the threat that the community has to cope with. Understanding of type and characteristic of the hazard is important in order to address and or reduce the impact of the hazard. Hazards in this research concept is referring to floods. Hence, the coping of community and the households is specifically referring to coping mechanism for dealing with floods. The coping mechanism is the community's strategies and household's strategies to deal with the effects of floods. The knowledge of the community and household's strategies can be considered in the local government regulations and policies on disaster management.

The research leads towards a recommendation to Local Government Disaster Management. These are discussed more detail in chapter 2.

## **1.6. Significance of the Study**

This study is focused on identifying the community's coping mechanisms and the effectiveness based on different level of flooding in Semarang City. The knowledge generated from this study can be useful information for the local government to undertake a Flood Disaster Management Program in order to mitigate the negative impact of flooding.

## **1.7. Scope and Limitation**

The selection of the study area for this research was decided in short time as a replacement from the previous research study area in Sri Lanka. However, the selection of Semarang, Indonesia had been considered sufficient and scientific reasons to conduct the research with regard to the similar topic of coping mechanisms against flood. Semarang City in Indonesia has the same problems as Ratnapura , Sri Lanka, which is suffering from frequent flooding as well.

The scope of this research covers the identification of people's perception of flood in their area and the selection of coping mechanisms against flood. This research tries to capture the real life situation of people in the study area dealing with flood, and brings it to the scientific design of report (thesis). Due to the time constraints in preparation before the fieldwork, some data which are supposed to be prepared before going for fieldwork, such as the base map and the flood-prone area map provided by the Bappeda, and IKONOS imagery were only be able to collected during the fieldwork before doing the interviews with households. Fieldwork was conducted in September – October 2006, it was Ramadhan time in Indonesia, when the Moslem people are doing fasting. This condition more or less affected the interview done during that time.

## **1.8. Thesis Structure**

### **Chapter 1**

This chapter discusses the background of the research, description of research problem, research questions, research objectives, general methodology, the availability of the data and the limitation to the research

### **Chapter 2**

This chapter discusses about theoretical background related to the study by reviewing of relevant literature.

### **Chapter 3**

Characteristic of the study area discusses in this chapter focusing on the demographic and physical aspects. Related facts, such as, hydrological, topographic and meteorological factors causing flood

will also be discussed in the chapter. This chapter will also discuss on proposed approach for the fieldwork, data required, data collection as well as data processing and handling.

**Chapter 4.**

This chapter will discuss socio-economic characteristic of respondents, and people's perception on physical characteristic of flood in the study area. The physical characteristic of flood is referring to the flood magnitude, in this research is only focused on flood depth, duration and extent.

**Chapter 5.**

Community and household's coping strategies as the main topic of this research discusses in this chapter. This chapter focuses on the discussion about type of coping strategies employed by the local people in the city of Semarang dealing with the impact of different level of floods.

**Chapter 6.**

This chapter discusses on the local government flood management in the city of Semarang.

**Chapter 7.**

This chapter presents the conclusions and recommendations of the research.



## 2. Review of Related Literatures

*This chapter discusses the related literatures used to support this research. It describes the definition the hazard and disaster, flood and its impact, concept and trends in flood hazards management, concept of coping mechanism, concept of public participation in urban flooding. This chapter also discusses about the possible factors influencing the type of coping mechanism employed by the community.*

### 2.1. Defining The Hazard and Disaster

There are different definitions of hazards. According to Twigg, (2004), hazard can be defined as potentially damaging physical event, phenomenon and/or human activity, which may cause loss of life or injury, property damage, social and economic disruption or environmental degradation, while *disaster* defines as what occurs when the impact of a hazard on a section of society (causing death, injury, loss of property or economic losses) overwhelms that society's ability to cope. Cutter, (1993) argued that "hazard is a broader concept that incorporates the probability of an event happening, but also includes the impact of the magnitude of the event on the society and environment". Blaikie, (1994) states that hazard refer to " extreme natural events which may effect different places singly or in combination at different times over a varying return period". Tobin, et. al., (1997) states that hazard is an "interaction between the human system and the events." They further state that hazard overlap with disaster where hazard is the potential event and disaster is the result of the hazard. Blaikie, et. al., (1994) state that " there is a disaster when significant number of people had been affected by the hazard, be it to their livelihood, lives and properties, that made then incapable of regaining or coping with losses". According to Smith, et. al., (1998), the detailed way to define disaster is " an event, concentrated in time and space, in which the community experience severe danger and disruption of its essential functions, accompanied by widespread human, material or environmental losses, which often exceeds the ability of the community to cope without external assistance. These definition of disaster have in common that the difference between the flood event (hazard) and disaster depends on the coping capacity of the community affected. Apparently floods in well-prepared communities with a strong social structure are less disastrous than the unprepared communities.

An extreme natural events only becomes a disaster when it has an impact on human settlement and activities (Andjelkovic, 2001).

### 2.2. Flood and its impacts

Floods are natural disasters that have been affecting human lives since time immemorial. Defining a flood is rather difficult, partly because floods are complex phenomena and partly because they are viewed differently by different people. Yevjevich, (1992) defined floods as extremely high flows or levels of rivers, whereby water inundates flood plains or terrain outside the water-confined major river channels. The more general definition of flood was introduced by Ward, (1978) by incorporating the rarer coastal and the more common valley-bottom inundations. He defined a flood as a body of water which rises to overflow land which is not normally submerged.

In local context , floods are defined based on its causes. In Semarang City, there are three types of floods : *banjir local* (locally flood inundation), *banjir kiriman* (river flood) and *banjir rob* (tidal flood) , Marfai, (2003).

Ward, (1978) emphasized that for more practical purpose and certainly in popular usage a meaningful flood definition is incorporate the notions of damage and inundation.

Flood is claimed as one of the common hazards that affects more people than any other (Ward 1978; UNDRO 1978:1). Floods account for approximately forty percent of natural disasters and may become more frequent and severe due to global warming (Reacher , et al, 2004).

There are many of research surveys conducted regarding with flood and its impacts, covering social, economic and health impacts. A survey of impacts of flooding in association with illness of the flood victims was conducted in the town of Lewes in Southern England following severe river flooding on 12 October 2000 ( Reacher, et al, 2004). A historical study was conducted by telephone interview for new episodes of illness in all age groups, and for psychological distress in adults. Two hundred and twenty –seven residents of 103 flooded households and 240 residents of 104 non-flooded households in the same postal district were interviewed by random selection of addresses from a post flooding survey and a commercial database respectively. The result of the study showed that there is association between flooding and new episodes of physical illness in adults diminished after adjustment for psychological distress. According to the result of the study, association with physical illnesses affirm the need for advice and assistance with individual, household and environmental hygiene and access to medical services.

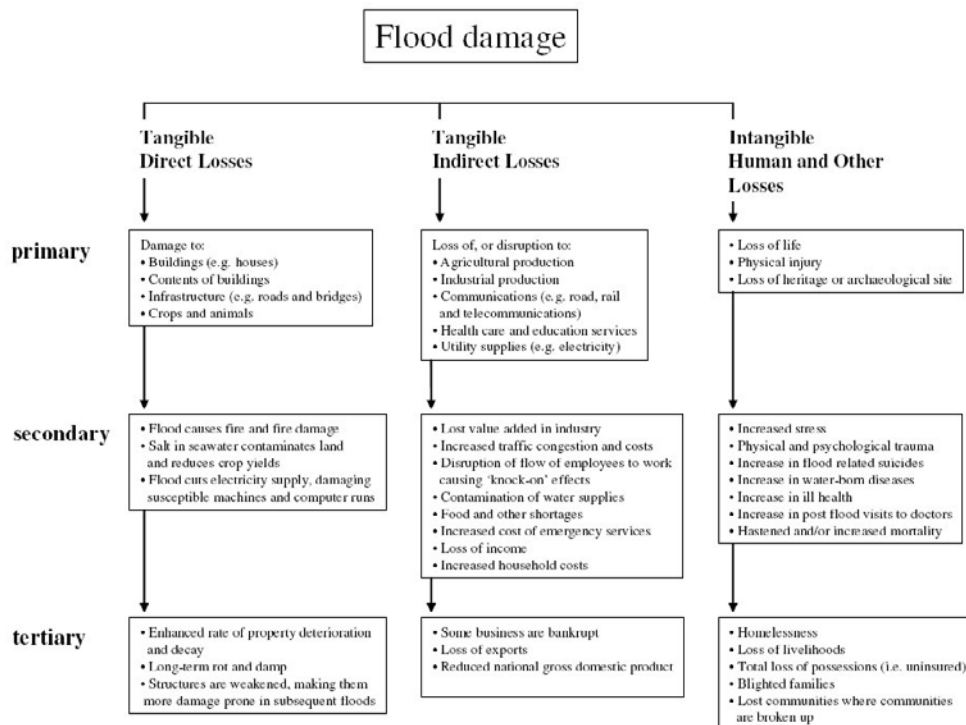


Figure 2-1: Categorization of flood damage (Parker, 2000)



The figure 2-1 describes the flood damage categorized by Parker (2000). As shown in table 2-1, flood damage can be divided into three classes : tangible direct losses, tangible indirect losses and intangible human and other losses. The losses causing by flooding are not only economic but also can be physical, ecological and social.

### **2.3. Concepts and Trends in Flood Hazards Management**

Floods can not be prevented but planning the emergency measures through flood management can often reduce their disastrous consequences (Andjelkovic, 2001). Inception of flood management normally begins after a major disaster happens. Throughout history, progress in water-related disciplines often came as a reaction to severe emergency situations, water supply system were extended after major droughts, sewerage systems upgraded after outbreaks of major epidemics, pollution control schemes introduced after major spills of pollutants that destroyed life in water courses, and storm water drainage systems built after major floods. Flood management is a broad spectrum of water resources activities aimed at reducing potential harmful impacts of floods on people, environment and economy of the region. The main limitation of the current flood management methodologies comes from favouring mostly economic impacts and paying minor attention to the environmental and social impacts of floods.

According to Carter, (1991), the concept of disaster management should be regarded as an important tool in successfully coping with all impacts caused by disaster. He emphasized that only a comprehensive approach which covers all aspects of disaster management cycle, including an appropriate balance of prevention, mitigation, preparedness, response, recovery and disaster-related development, can be effective. He further stated that in order to define a disaster management policy, it is necessary to consider certain main factors or pillars, such as : an accurate definition of the disaster threat, identification of the effects, assessment of the resources available to deal with the threat, the organisational arrangements which are required to prepare for, respond to and recover from disaster events, and any other specific factors which may be applicable, especially those aspect which are concerned with the development and protection of the environment.

Management for flood disaster has been understood as a complex and need to be handle carefully, by involving as many as parties as well as the community who has direct impact of the flood. The main purpose of development of flood disaster management is to build and increase awareness of all stakeholders, including local community in order to reduce/minimize flood impact.

The flood hazard disaster management mainly covers mitigation, preparedness and prevention (Twigg, 2004). He states that, mitigation which is defined as any action taken to minimise the extent of a disaster or potential disaster, can take place before, during of after a disaster, but the term is most often used to refer to actions against potentials disaster. Mitigation measures are both physical or structural (such as flood defence or strengthening buildings) and non-structural (such as training in disaster management, regulating land use and public education). While preparedness is defined as specific measures taken before disasters strike, usually to forecast or warn against them, take precautions when they threaten and arrange for appropriate response (such as organising evacuation and stockpiling flood supplies. The term of prevention is not widely used nowadays, since this is unrealistic in most cases. Prevention is defined as activities to ensure that the adverse impact of hazards and related disasters is avoided.

Proofing by zoning and coding activities in inundation-prone areas against flood impact, as the major activities under the administrative or contractual forms of regulation on how the flood plains may be used, as part of flood disaster management, will likely be more strictly planned, designed and enforced (Yevjevich, 1994).

## **2.4. Concepts of Coping Mechanism**

In relation to flood hazard, coping is defined as the manner in which people and organization act, using existing resources within a range of expectations of situation to achieve various ends (Blaike, et al. 1994). According to Douglas, 1985 ( cited from Blaike, et al, 1994) when people know an event may occur in the future because it has happened in the past, they often set up ways of coping with it. Such coping strategies depend on the assumption that the event itself will follow a familiar pattern, and that people's earlier actions will be a reasonable guide for similar events. The assumptions on which people make their decisions therefore rest in the knowledge that, sooner or later, a particular risk will occur of which people have some experience of how to cope (Blaikie, et al, 1994). He also emphasized that all coping strategies for adverse events which are perceived to have precedent consist of actions before, during and after the event. In term of natural hazards, for instance, flood, the application of indigenous knowledge in the face of hazards and other threats is referred to as a "coping mechanism" or "coping strategy" (Twigg, 2004).

In a range of disaster contexts, Twigg categories the coping mechanism into four broad categories :

- Economic/material; (economic diversification, such as having more than one source of income, even having large family can be seen as part of economic coping strategy because it gives household additional labour; saving and credit schemes are often an important component of economic coping strategies)
- Technological ;( the way that housing is adapted to repeated floods. Common adaptations include building houses on stilts so that floodwater can pass underneath, building them on plinths or platforms of mud or concrete so that they remain above flood levels, and building escape areas under or on top of roofs).
- Social/organizational; (the family is a fundamental social mechanism for reducing risk. Extended kin relations are networks for exchange, mutual assistance and social contact).
- Cultural (include risk perception and religious views, which are frequently connected)

Figure 2-2 describes examples of flood proofing by constructing buildings with specific types of constructions to avoid the negative effects of flood. Public buildings that are used as shelter can be built above the expected flood level. This can be done by constructing the building on natural or artificial high grounds, by placing the building on columns and stilts or by providing access from outside via staircase to the upper floors (figure 2-2). In areas where floodwaters are shallow and slow moving, temporary barriers composed of sand bags may be used to protect individual buildings.

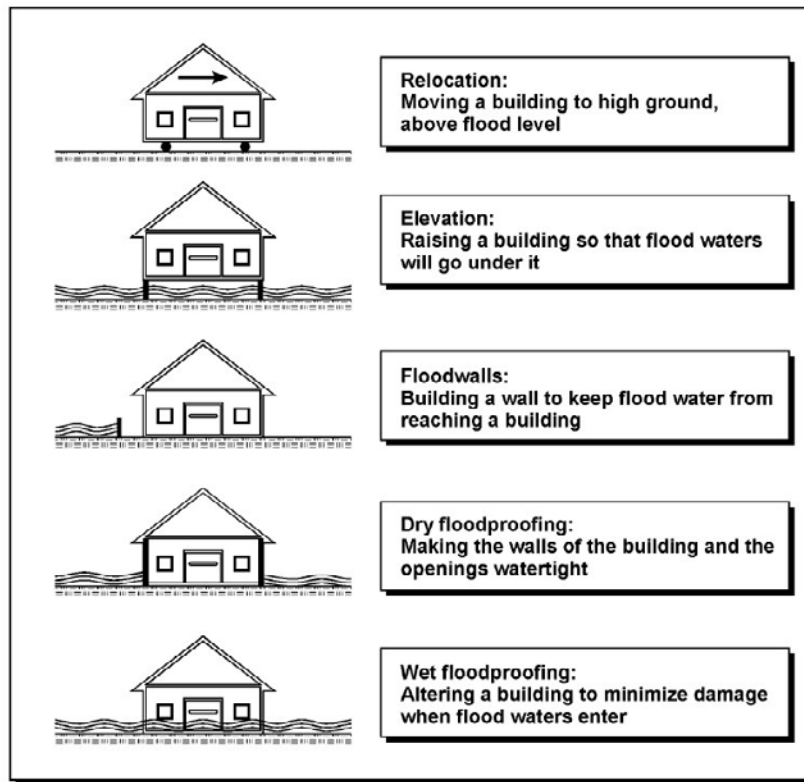


Figure 2-2: Example of flood proofing (UNESCO, 1995)

Similar to the concept as mentioned above, the concept of coping mechanism according to Yevjevich, 1994, are :

- Do-nothing on floods except learning how to live with them wisely; (flood impact are minimized by avoiding them. The future of this type of coping mechanism will highly depend on the concept of how and to what degree the environment is to be protected ).
- Use of non-structural measures, including flood insurance(regulation for proofing of flood plains(zoning and coding); defence from flood; and flood insurance))
- Use of intensive and extensive structural technologies; (intensive : a flood levee along the river bank, terracing of land, changing biological cover and soil conservation in a catchment. Extensive : reshaping of the land surface, protection of soil from erosion, delay of runoff of rain and increase of infiltration by doing : soil conservation, especially by restoring the vegetation cover, the proper ways of cultivating land, and similar catchment-wide activities (mainly for agriculture, but it can be done as joint activities benefiting not only for agriculture but also forestry, urbanization and the other parallel useful purposes).
- Joint use of non-structural measures and structural technologies (in the real world, the mixture of non structural and structural technology is believed as the best alternative of coping with flood).

## 2.5. Concepts of Public Participation in Urban Flooding

According to Twigg, 2004, the concept of community participation can be defined as the “active involvement of people in making decisions about the implementation of process, programs and projects which affect them. Community participation is being encouraged in many areas of development, including disaster management, for instance when dealing with urban flooding.

There is submerged contradiction in the concept of *participation*, in that participation is always promoted and guided, if not even directed by *someone*, whether within the local community, or more often from outside (McCall, 2004). He states that the intensities of actors who are promoting the concept of “participation” can be related to fundamental differences in three underlying purposes or intentions of the agencies (external or internal) that are “pushing” participation as a strategy and promoting participatory spatial planning.

In the conduction of a program related to community, involvement of community’s participation is an important matter, particularly in preparation stage. Giving space for community’s aspiration, opinion and proportion, is a contribution for program’s value. It also has to be noted that during the conduction of program, related community should be actively and maximally involved according to their involvement’s proportion in the program. The wider community level involved in the program and the more intense their involvement, the better the value of the activity is, though it is needed to be stated that to cover a more community level, a more complicated time and energy needed from program.

In relation to flood disaster mitigation, public and community participation are two important elements of an effective social mobilization and public awareness program. This program should be community-specific, based on assessment of information needed, integrated with existing disaster warning and response systems, focused towards information on prevention, mitigation and long-term recovery, established as on-going process, and addressed towards the most vulnerable people (Andjelkovic, 2001).

Co-ordination between the community agencies, representing its citizens and the municipal authorities is essential. Specific tasks are vested with the community, while others belong to the domain of municipal authority. The capacity of the community determines how much should be executed by the outsiders. Once co-ordination is established, all concerned need to develop knowledge and skills that can reduce the possibility of damage and death during floods. The practice of learning while doing is accepted in community participation, but formal training programs are preferable.

## 2.6. Influencing Factors of Coping Mechanism

According to Twigg, 2004, the choice of skills and resources to be applied varies according to the nature of the hazards threat, the capacities available to deal with it, and to a variety of community and individual priorities that can change during the course of disaster.

According to Blaikie, et. Al (1994), the community’s coping mechanisms is influenced by the resources the people have, which can be tangible and intangible and the magnitude of flooding that community have to cope with. Tangible resources includes those asset that have values when it sold and people can mobilize these resources to cope or rebuild the losses while intangible are those assets

with no physical existence, this focus on social structure and people's well-being (Blaikie, et. Al, 1994; Haque, 1997).

A study on coping on erosion in Bangladesh by Hague (1997) found that socio-economic structural components of the community significant influence the type of coping measures of the community. Some socioeconomic indicators, such as household income, household size and its occupational types like the labourer engage in pottering and services worker engage in rendering services to restaurant, were used to access socio-economic structures of the community.

It is well-understood that income and social structures are the main assets in coping with disaster. Income and social relationship are important assets of coping strategies in a study of poverty, vulnerability and flood coping strategies. Households with greater income have diversified livelihood and has different meals style and social status. Likewise, people who are economically stable in term of financial assets sustained lesser impact of hazard, can employ suitable mitigating measures and has faster recovery compared to those that are poor in term of financial resources (Mosser, 1997; Blaikie, et. al, 1994). Economic improvement and strengthening social networks may lead to a reduction on the vulnerability of the community or the people. In a study of vulnerability and adaptive capacity of community, conducted by Smith, (2002), it was found that there are changes in coping range when the economic, social and institution conditions of the community or the households changes. The coping range is the extent of the community or households coping capacity or the capacity to cope with the effects of floods. The effectiveness of the social network or the institution, economic resources, and infrastructure are the factors that can influence for coping with the hazards. It has a reinforcing capacity that a supportive community and diverse promotes the development in collective way these includes, neighbourhood relations and participation in communities activities or organizations (Hyde, 1999). Developing relationships among communities resulted in building trust and mutual responsibilities for the good of the community (Lesser, 2001). They further emphasizes that communities of practise is a generator of social capital. Participatory in voluntary associations, embodying norm and trust, reciprocity, tolerance, and inclusion and activating networks in public communication are believed as important aspects of social capital. In an example of such social network, Moser, et. al (1997) showed the important role that woman play, like cooking, taking care of children and sharing food and water. Dealing with the effects of flood depends on the resources, the threat they face with, and their geographical locations. It is therefore important to know the driving forces that influence the community's strategies to counter the effects of floods.



### 3. Study Area and Methodologies

This chapter discusses about the general overview of the study area and the methodology and process used for this research. Discussion section about the study area starts with the general information of the study area, geographic and administrative, climate and topography, population and age structure. The process of this research divides into three sections that are data preparation, data collection and data processing and analysis.

#### 3.1. Study Area

##### 3.1.1. General Information of the Semarang City

The city of Semarang, the capital of Central Java province is located on the north coast of Java Sea (figure 3-1). The Northern part of the city is lying across on the plain coast and the Southern part is on the hilly side from Candi Baru area upward to the town of Ungaran. Along with the national development of Indonesia, the islands of paradise on the equator, the regions of JOGLOSEMAR acronym of Jogjakarta, Solo and Semarang, "The golden triangle" of Jogjakarta and Central Java shall be developed economically whilst preserving its precious culture and nature, avoiding environmental damages. The City of Semarang has an area of 373.67 km<sup>2</sup> and approximately 1.5 million people making it the Indonesia's fifth largest city. Semarang is located at 6°58'S 110°25'E.

Figure 3-2 describes the city of Semarang which is divided into 16 districts (*kecamatan*) and 177 sub-districts (*kelurahan*). The 16 districts are: Semarang Barat, Semarang Timur, Semarang Tengah, Semarang Utara, Semarang Selatan, Candisari, Gajahmungkur, Gayamsari, Pedurungan, Genuk, Tembalang, Banyumanik, Gunungpati, Mijen, Ngaliyan, and Tugu (figure 3-2).

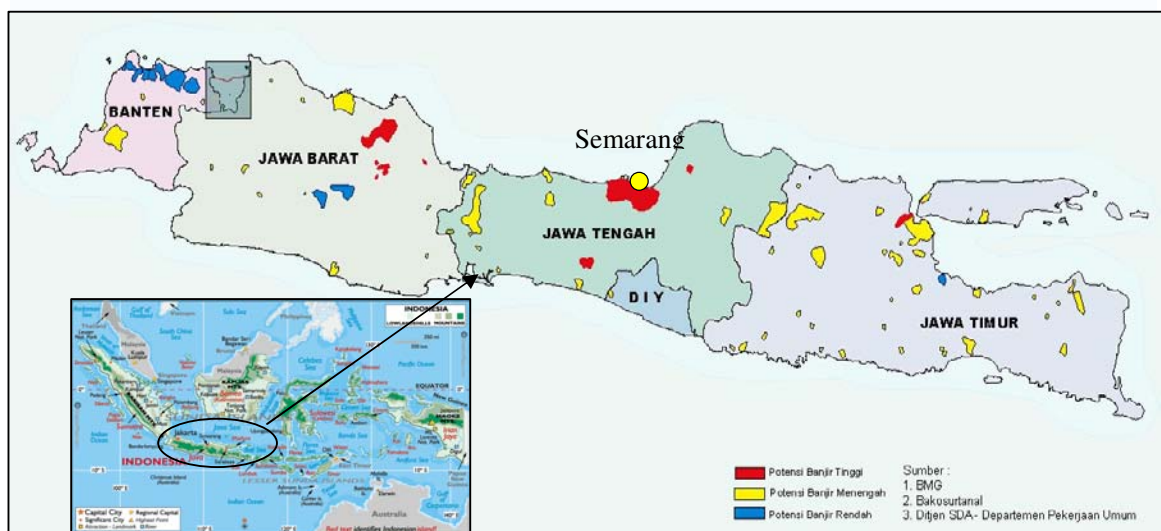


Figure 3-1: The location of Semarang city in Java island (Source:<http://www.semarang.go.id>.)

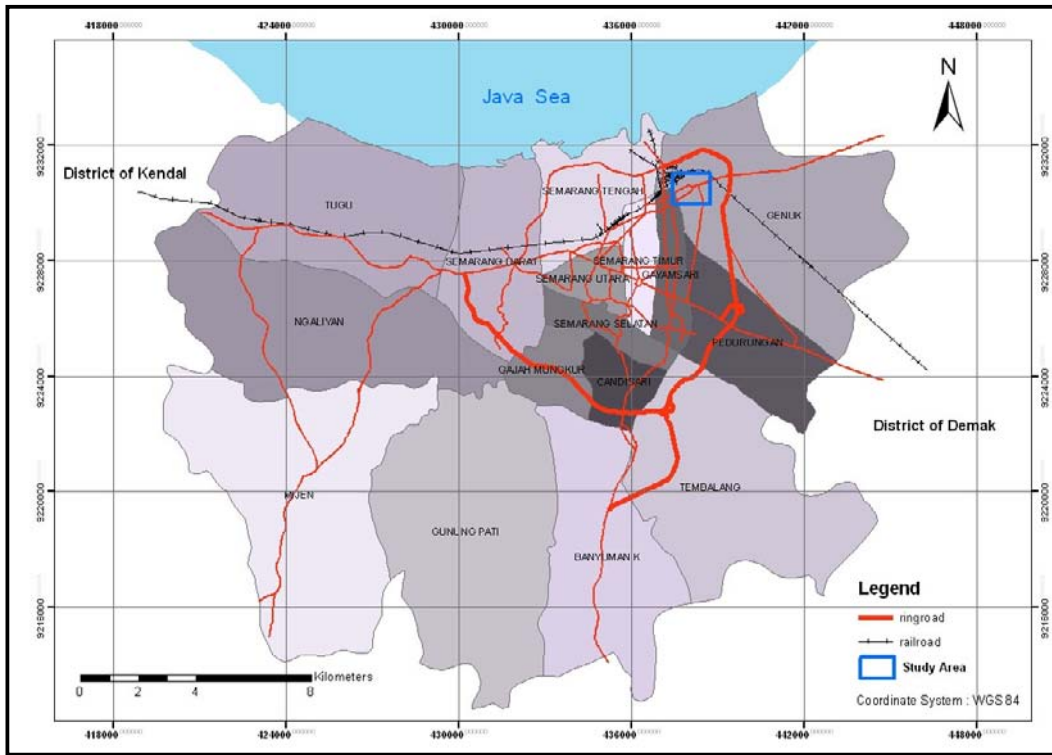


Figure 3-2: Administrative Map of Semarang City (Source: Bappeda, Semarang)

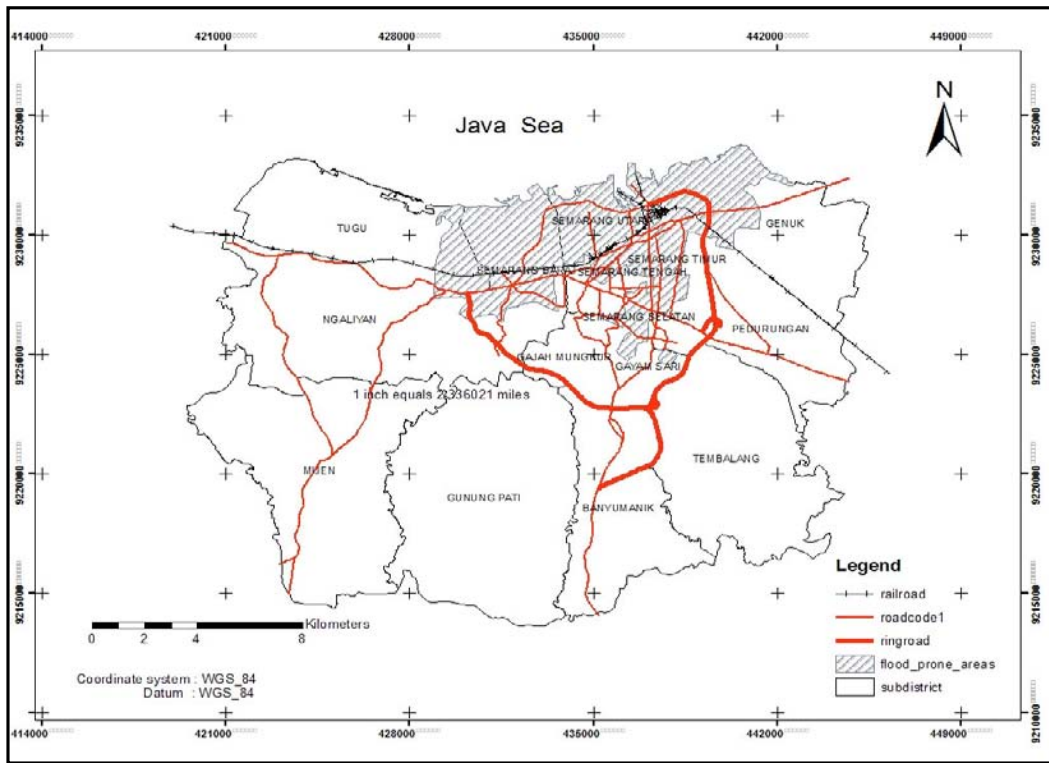


Figure 3-3: Flood-prone area map of Semarang City (Source : Bappeda)



### 3.1.2. Climate and Topography

Semarang city has, a tropical climate with a wet and a dry season, changing every 6 months. The wet season is from November to April, influenced by monsoon, and the dry season is from May to October, influenced by east monsoon. The average of the low temperature is 25.80° C and the highest one is 34.3° C. The topography of Semarang city consist of coastal lowland area, and a hilly area. In the Northern, that is coastal and lowland area, has a dip between 0-2 % and various altitudes between 0 – 3.5 meters. In the Southern is highland plain area with a dip between 2 – 40%, and altitude elevation between 90 – 270 meters above sea level. Figure 3-6 illustrates the variation of the topography of Semarang city, created using the IKONOS imagery(2002), and Digital Elevation Model. In order to get the desired view of topography, the height of Digital Elevation Model was exaggerated up to 2 m interval.

### 3.1.3. Land Use

Land use for certain area is influenced by a several number of factors, such as geographic position, topography and elevation, and available infrastructure. Human activities has significant influence land use, particularly in urban area. The urban activities will affect the use of land within the area, for instance, the need of land for residential, infrastructure, etc. It is well-known that human tend to live in the area which has more sufficient infrastructure. This can usually be found in the urban area. This condition leads to the growing fast of population in the urban area, who needs more infrastructure and land to live. As depicted in figure 3- 3, residential area are concentrated in the northern part of the city. The residential are growing in the east along the main roads to Demak district, and to the west along the main road to Jakarta, with the urban area concentrates very close to the port. As a growing city, the land use in the Semarang city is changing rapidly.

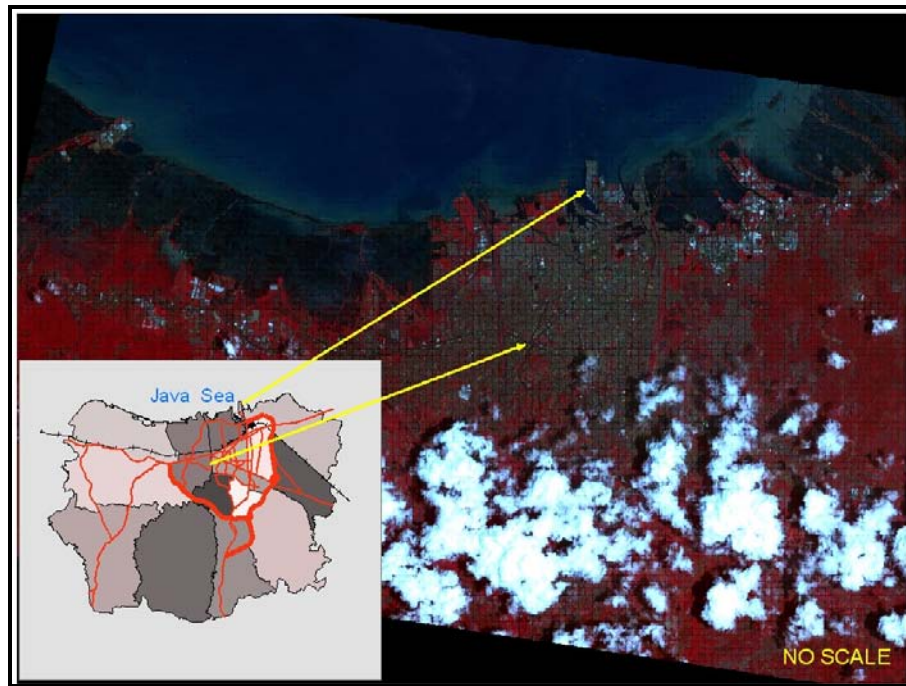


Figure 3-4: ASTER Satellite Imagery (2001) of Semarang City (Source : <http://www.asterweb.jpl.nasa.gov>)

### 3.1.4. Characteristic of The Surveyed Kelurahan

This research conducted consists of 5 villages located within the East Banjir Kanal (BKT<sup>1</sup>), which are : Kaligawe, Tambakrejo, Mlatibaru, Maltibaru and Kemijen. The BKT river is one of the flood controller system for Semarang city. There are 20 kelurahan<sup>2</sup> (villages) within 7 sub district located along the BKT river. The population distribution and the population density for each village within the BKT is showed in table annex 1.

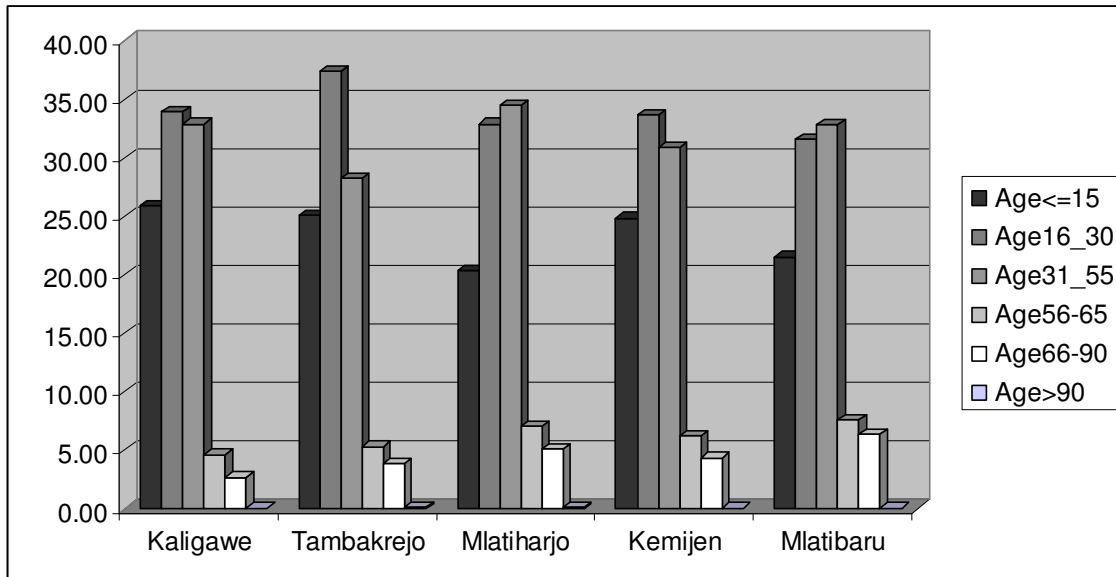


Figure 3-5: Age Structure of 5 Surveyed Villages in the City of Semarang  
(Source : BPS, 2000)

Figure 3-5 describes the age structure of the 5 surveyed villages in the study area. It can be seen that the population profile of those 5 villages is categorized as a young. This young profile of population can be a positive aspect and this is a potential of a very large, strong and energetic group of people under the age of 30. With the necessary political will, can we envisage the mobilization of predominantly young communities to protect their settlement against disaster risk (?) This implies the development of training, leadership, and suitable institution for such a task.

Studies of disaster casualties have indicated that the young and the old are often most at risk. They are, for example, less mobile (capable of evacuation), more dependent, have less resistant to disease, and often command fewer resources. Increasing casualties in disaster can be anticipated in this age group (Blaikie, et al. 1994 : p. 36)

<sup>1</sup> BKT – East Banjir Kanal

<sup>2</sup> Kelurahan - village

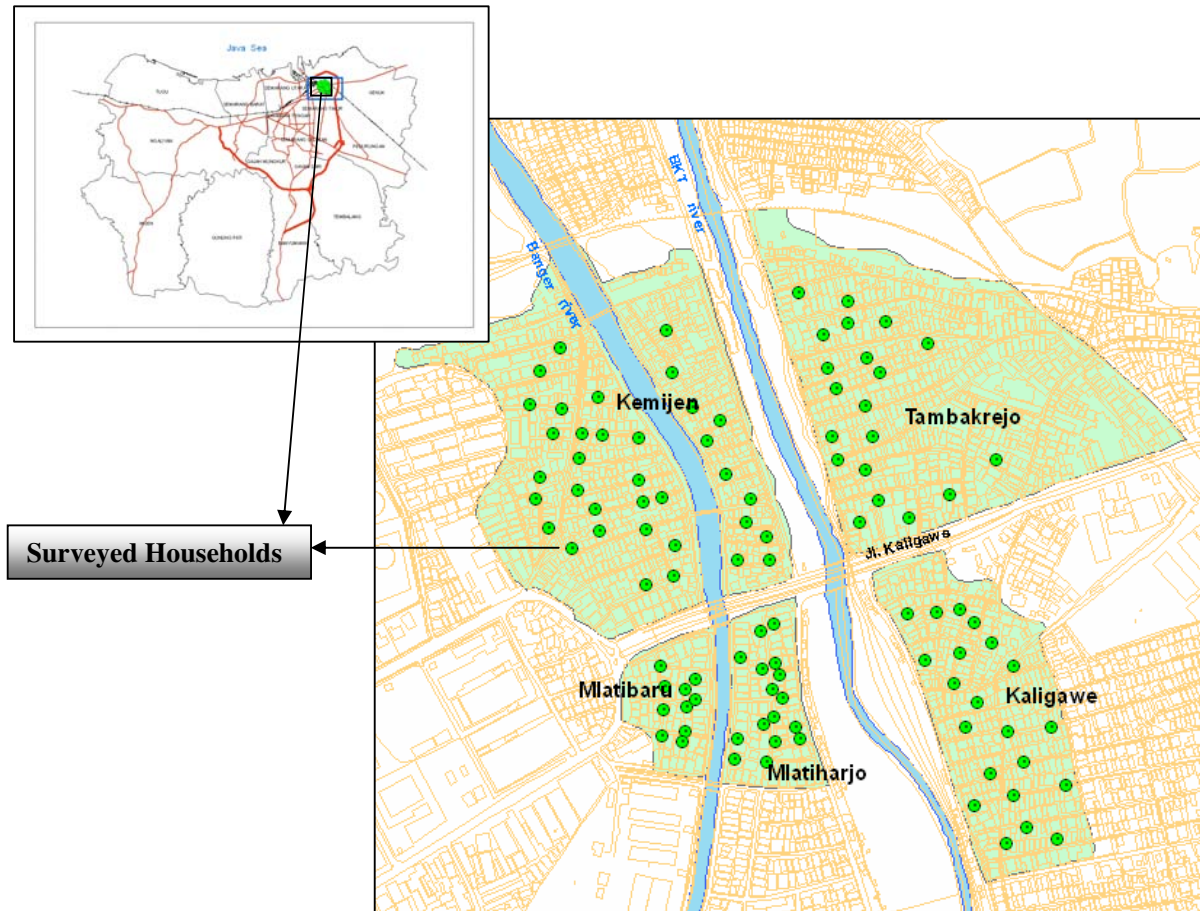


Figure 3-6: The 5 Surveyed Kelurahan in The City of Semarang

### 3.1.5. Flooding in The Semarang City

The City of Semarang is growing at the present to emerge as a metropolitan city. Nevertheless the city of Semarang and its surrounding suffer from flood every year and inundation in the rainy season. Flooding within the city is still a major problem for the local city government. Many parts of Semarang, especially along the rivers and along the shore, are suffering from flooding. It is estimated that around 15,000 Ha of the city is categorized as flood-prone area (see Figure 3-3). This problem is related to the inadequate number and quality of canals in line with land subsidence in several parts of the city, and is linked to over exploitation of ground water resources. Economically, the effect of flooding is substantial; many areas drain slowly, causing prolonged traffic jams, economic losses, and damage to infrastructure. According to Directorate of Environmental and Geology of Indonesia (2001), cited from Damen, Voskuil & Sutanta (2002), there is evidence of land subsidence in Semarang, presumably due to the overexploitation of groundwater. The rate of subsidence in some parts of Semarang city is high. Geodetic levelling measurements have been conducted in parts of the

city. The result shows that the north eastern of part of the city has been subsidizing by 20.5 cm in three years time (Sutanta, 2002, after Basuki, 2000).

The most obvious of land subsidence and sea level rise is flooding. There are two type of flooding in Semarang city : one is caused by river flooding (from the hinterland), the other is caused by the high tide (from the sea). Local people refer to the latter as rob.

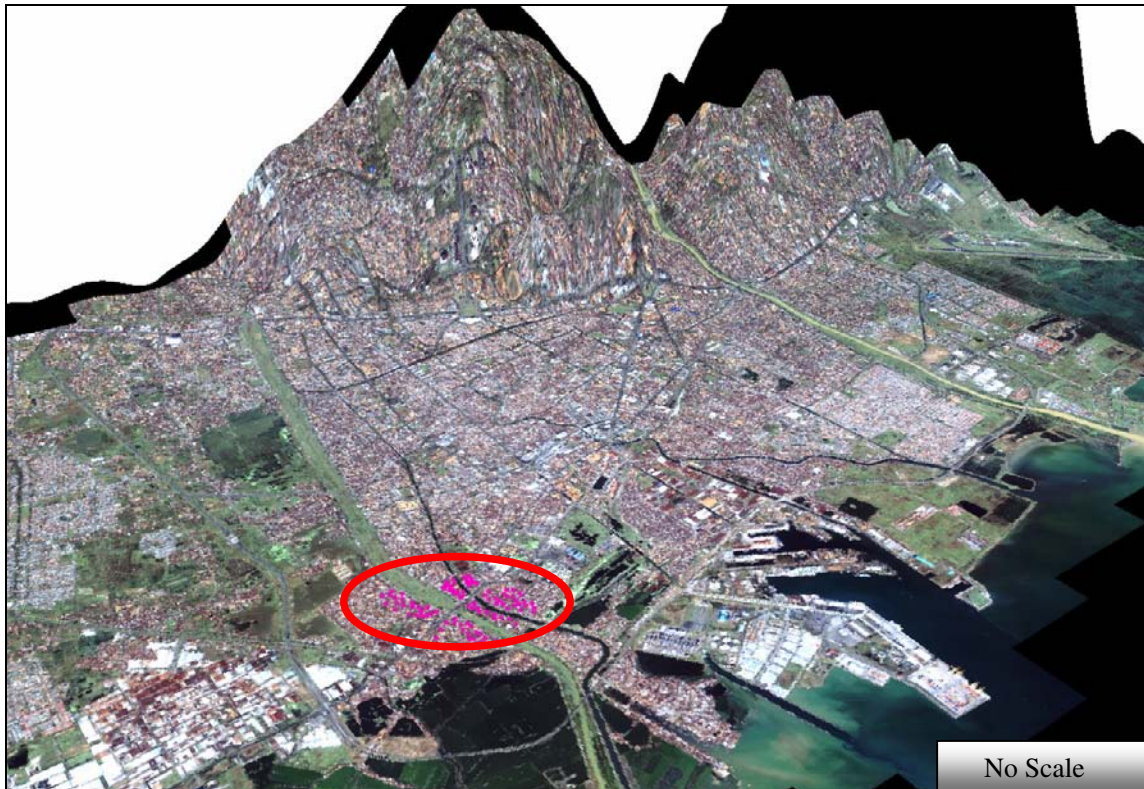


Figure 3-7: Overview of the study areas (Source: IKONOS , 2002; DEM & Fieldwork, 2006)

## 3.2. Methodologies and Research Activities

The research of community-based analysis is focused on identifying the type of coping mechanism which are applied by community to cope with floods threat. In order to achieve the goals of this research, the methodology used in this research is divided into three main phases : (1) Pre-Field, (2) Fieldwork, (3) Post-Field.

### 3.2.1. Pre-Field

As described in figure 3-4, there are two main activities in the pre-field phase, which are related literature review (I) and spatial data conversion (II). The first activity is to review the related literatures. The literature reviews was conducted to strengthen the concept of this research .The literature review activity consisted of problem definition, research objectives and research question formulation, study area delineation, the identification of the required and data availability. The data

availability for this research is described in table 3-1. In this phase, all the collected spatial data were brought to the same coordinate system. The standard coordinate system used for Indonesia is WGS-84.

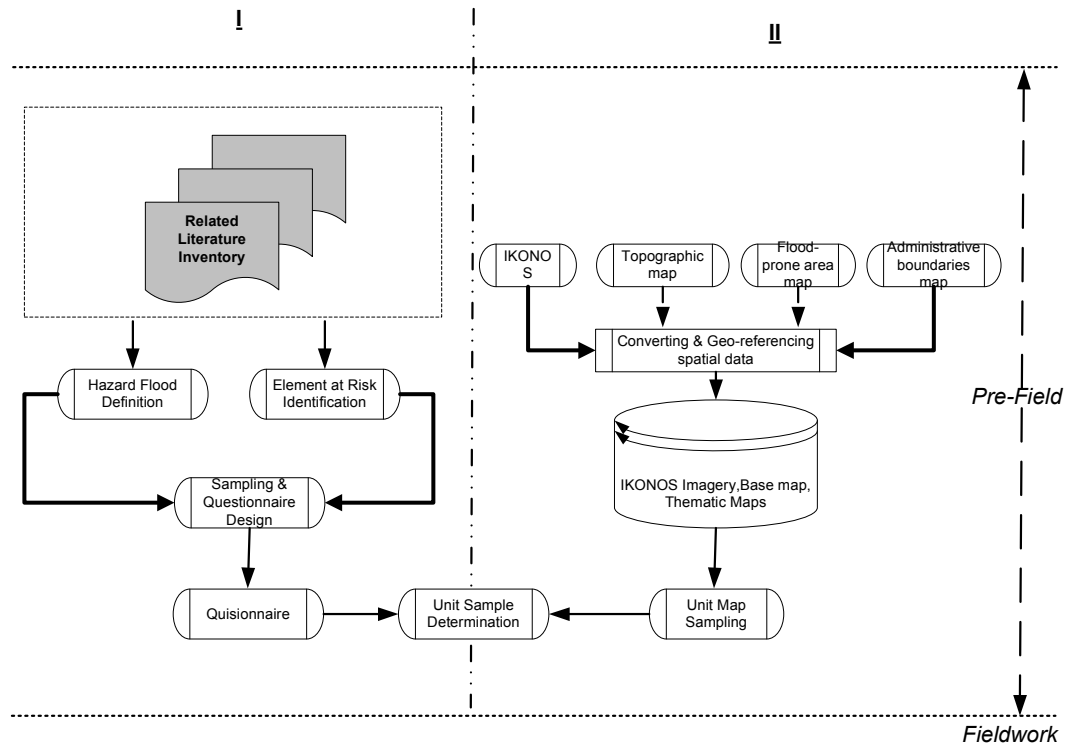


Figure 3-8: Pre-field Phase

Table 3-2 describes identified data and source of the data use for this research. The main primary data used were IKONOS imagery 2002, provided by Space Imaging, Administrative map, digital road map and river map provided by BAPPEDA.

### 3.2.2. Fieldwork

The two main activities of the fieldwork phase are the additional secondary data collection and the primary data collection (figure 3-9). The fieldwork was conducted in September-October to collect primary data by doing interviews with community and to verify the secondary data used for the pre-field phase, such as: IKONOS imagery and base map of the Semarang City.

### 3.2.2.1. Secondary Data Collection

Secondary data, such as base map, flood-prone area map and IKONOS imagery were collected from a number of sources and related organizations. The important secondary data about the flood prone area were collected from the planning agency (Bappeda). These data were used, later on, to select the sampling area.

Table 3-1: Data Availability

Spatial Data	Source
Digital Elevation Model (DEM)	Created from photogrammetry spot height with 100 m interval on the hilly area, 200 m interval on the lowland area (Sutanta, 2002)
Topographic Map, scale 1 : 50,000	BAKOSURTANAL <sup>3</sup>
Detailed Topographic Map, scale 1 : 5,000	PU <sup>4</sup> “Semarang Urban Drainage Master Plan Project 2002. “
Land use , scale 1 : 5,000	Public Works Department (PU) “Semarang Urban Drainage Master Plan Project ,2002. “
IKONOS imagery 2002, Landsat +ETM 2001, ASTER 2001	BAKOSURTANAL, Space Imaging, and previous research (Sutanta, 2002)
Administration map, scale 1 : 50,000	BAPPEDA <sup>5</sup>
Digital Road map, scale 1 : 50,000	BAPPEDA
Digital River map, scale 1 : 50,000	BAPPEDA
River Flood map, 100 year return	JICA <sup>6</sup> project “ Master Plan on Water Resources Development and Feasibility Study for Urgent Flood Control and Urban Drainage in Semarang City and Sub-Urban”, 1993.
Tidal Flood Map	PU, “ Semarang Urban Drainage Master Plan Project, 2002.”
Flood-Prone Area	BAPPEDA

<sup>3</sup> BAKOSURTANAL - Indonesian National Agency of Survey and Mapping Coordination

<sup>4</sup> PU – Public Works Department

<sup>5</sup> BAPPEDA - Regional Planning and Development Agency of Semarang

<sup>6</sup> JICA - Japan International Cooperation Agency

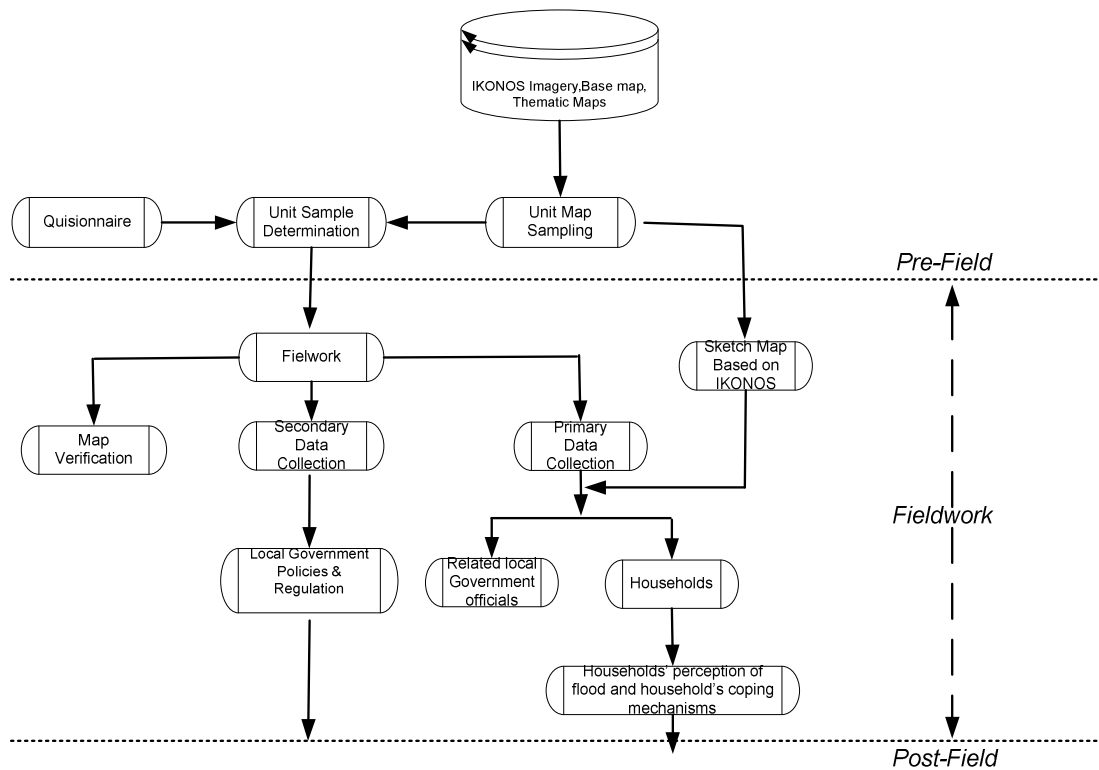


Figure 3-9: Fieldwork Phase

### 3.2.2.2. Primary Data Collection

The primary data was collected by doing interviews using questionnaires with 102 households and officials from the Bappeda, PSDA<sup>7</sup>, as well as from other related organization/agencies within the study area. The methodology of selection for the study area adopts purposive *multi stage area sampling* (figure3-10). Using a multi stage area sampling design, the spatial extent of the sampling frame is divided into geographic areas or features, as in cluster sampling (Montelo, and Sutton, 2006). A hundred and two households from five administrative areas (*kelurahan*) within two sub districts of the flood - prone area were selected, by considering the geographic location of these areas. In order to get down to the desired unit of analysis, each of these *kelurahan* is divided into smaller areas or features called *Rukun Warga (RW)*. These selected *Rukun Warga*, were then divided into the smallest administrative, which is called *Rukun Tetangga(RT)*. The 102 of respondent were randomly selected from each of this selected *Rukun Tetangga*.

<sup>7</sup> PSDA – Water Management Agency

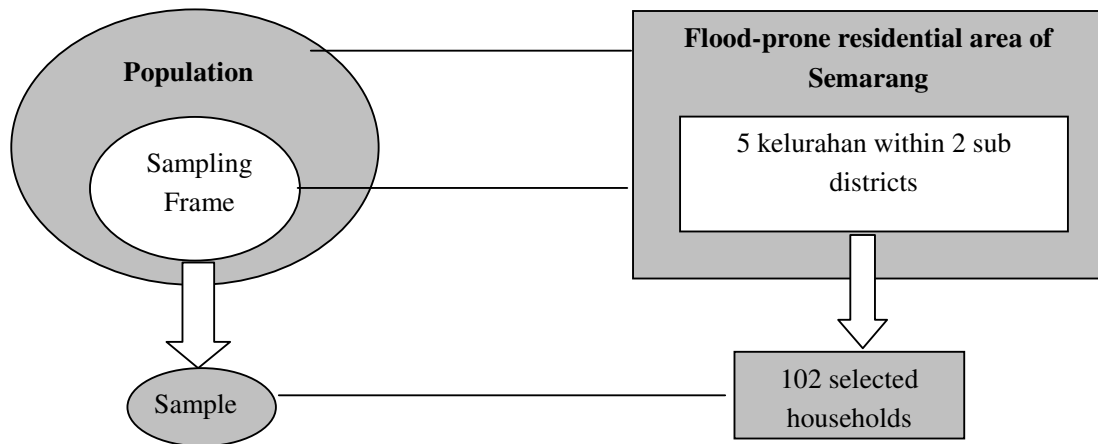


Figure 3-10 : The Conceptual relationship among population, sampling frame and sample.  
(Source: Montelo, and Sutton, 2006)

#### ***A household – basic Interview***

#### ***A Survey Sample and Interview***

A survey on flood impact and community coping mechanisms was conducted during the fieldwork period. A hundred and two households within flood - prone residential areas were identified and details of housing damage ever happened were sought and entered into a database.

A hundred and two households of the respondents located in 2 sub districts which are : Gayamsari and Semarang Timur, and five villages called Kelurahan, , were selected using purposive multi stage area sampling. This methodology of sample selection intended to get to the desired unit of analysis. This methodology enables each of household in the study area has the same chance to be selected. The household-basis interview was intended to collect information about the personal people perception about flood in their area. This information is considered as important information in order to understand what factors influencing the choice of coping mechanism among the community.

#### ***Housing and Household Questionnaire***

A housing and household questionnaire was completed confirming the presence or absence of flooding at the address. If flooded, the level of flood depth was measured based on how many meter water entering the house. The level of flood depth were measured inside the house with reference to the plinth or ground floor. An interview of the individuals who were normally full-time residents at the study area and present there at any time during the flood were taken. Based on personal observation during the interviews, the local community in the surveyed villages had gave good response toward the research. Generally, there was no difficulties to interact with the local people in the study area.

#### ***Interviews with Officials***

During the fieldwork time, consultation and discussion with some officials from related local authorities were held. Interviews with officials of the related local authorities was conducted. Interviews with some officials from Local Planning Agency and Water Management Institution to collect information related with flood within the city, especially in the study area of sub district Gayamsari and Semarang Timur. Interviews was also held with the local community leaders, the



leaders of RT, RW and representatives from *local government officer in Kelurahan*, as well as with the Head of Gayamsari and Semarang Timur sub districts.

**Participatory-Mapping**

During the data collection conducted on the field, sketch map based on IKONOS imagery was also used to get the perception of flood, especially for extent of flood in the study area. The respondents were asked to draw the extent of flooding within their area. The perception of flood by the local community considered as an important aspect as the local perception of flood can be used as an input for the local government/local authorities to make policies related to flood in order to meet the main goal. Of the 102 respondents, 32 gave response for the P-Mapping .

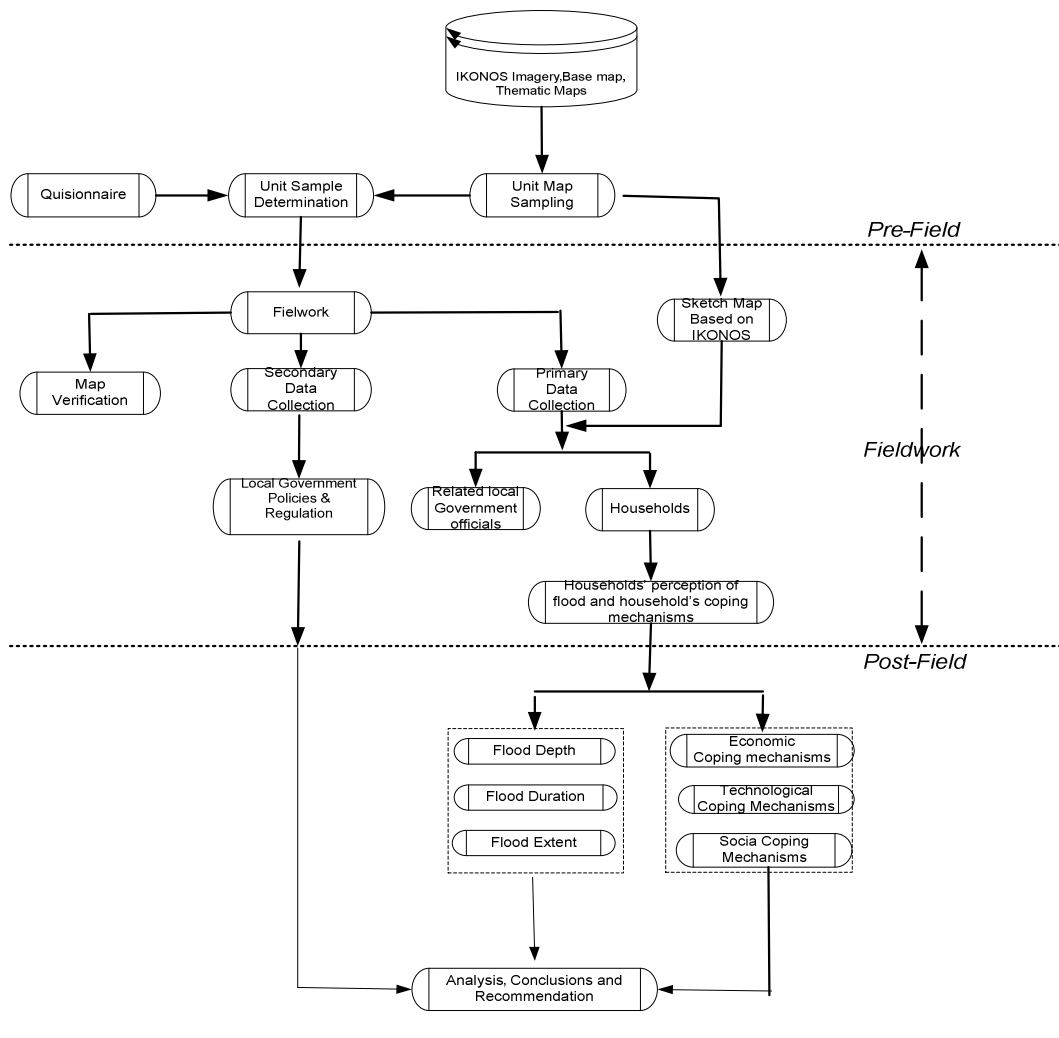


Figure 3-11 : Post-Field Phase

### **3.2.3. Post-Field**

Figure 3-11 shows the post phase of this research. The post-field phase is the final phase in this research. The post-field phase is come up with the conclusions and recommendations which will be discussed more detail in chapter 7.

Data collected during preparation and fieldwork phase were analysed according to the purpose of this research. Questionnaires were double checked for differences and corrected, and individual and housing records linked using SPSS software. The main variables collected from the households interviews such as : height of water level during flood, and the duration, flood history, coping mechanism, and the socio –economic were analysed. For spatial analysis purpose, the tabular data entered into a database were linked to spatial data into ArcGIS Geodatabase.

## **4. Socio-Economic Characteristic and Perception of Flooding of the Local Community of Semarang City**

*This chapter discusses mainly the socio-characteristic of the local people represented by the respondents. A hundred and two respondents from 5 villages, called kelurahan, were selected. The discussion about the socio-economic characteristic of the local people focuses on the possible variables which are assumed to have correlation with the way they perceive flood (flood history, depth, duration and extent) in their areas. The result of the analysis and discussion from this chapter will be then used for the discussion in chapter 5.*

### **4.1. Introduction**

One of the main goals of this research is to find out the type of coping mechanism employed by the local people dealing with flood hazards in different magnitude of flood. In order to understand better the type of coping mechanisms employed by the local people, it is important to study the factors behinds the employments of the coping mechanisms. The choice of skill and resources to be applied in dealing with flood hazards varies according to the nature of the threat, the capacities available to deal with it, and to variety of community and individual priorities that can change during the course of disaster (Twigg, 2004).

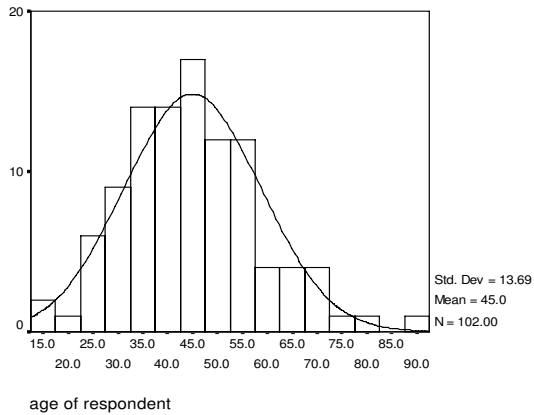
In this research, some indicators to access socio-economic structure of the local people in the study area, such as household expenditure, assets, household size, households' structure and occupational types are used.

### **4.2. Socio-Economic Profile of the Respondents and the Households**

The socio-economic characteristic of the respondents were assessed based on : age, gender, education, as well as economic condition of the households were collected during the fieldwork time. This information could help to understand why and how local people reacts toward floods. The economic condition can be determined by household's expense and the total asset of the households.

### 4.2.1. Information of The Respondents

#### Age of respondent

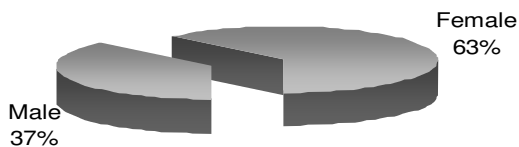


Further analysis need to beconducted to find out if there is correlation between variable of age of respondents with the way people perceive about flood which is assumed to have indirect correlation with the type of coping mechanism employed by the local people.

Figure 4-1: Distribution of Respondents by Age

Figure 4-1 describes the distribution of age of respondent for this survey. Variable of age of respondent is used for this research with the pre-assumption that the age of the respondents has correlation with the way they perceive flood, such as flood duration, flood depth, as well as flood extent. The analysis of this relationship is based on the pre-assumption that there is indirectly relationship between the way people perceive flood in their area and the type of mechanism/strategies employed by the community in order to cope with flood. It can be seen from the histogram that mean of age of the respondent is 45 years old. The age of the respondents is ranging from 15 to 90 years old.

#### Gender of Respondents



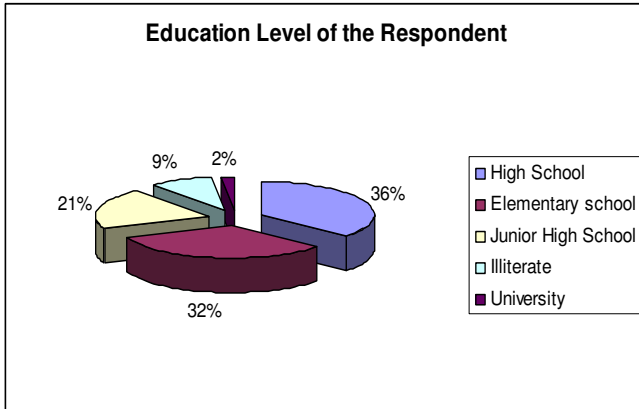
Further analysis need to be conducted to find out if there is correlation between variable of gender of respondents with the way people perceive about flood which is assumed to have indirect relationship with coping mechanism employed by local people.

Figure 4-2: Distribution of Respondents by Gender

Figure 4-2 showing the pie diagram for the number of respondents divided into male and female. It shows that the percentage for female respondent is higher than male. Of the total 102 respondent, 63 % is female, while 37 % is male. It can be explained, because the interviews during the fieldwork were held at day time when the male as head of family are mostly working. It is also presumed that

sex is a variable affecting the way people perceive flood. The possibility about the relationship between the age of respondents and the way they perceive flood in their area will be discussed later on this chapter.

### Education Level of Respondents



Possible questions need to be answered if there is correlation between variable education level of the respondents with the way they perceive flood in their areas, which is assumed to have indirect correlation with coping mechanism employed by the local people.

Figure 4-3: Education level of respondents

Figure 4-3 illustrates the education level of the respondents. It is presumed that the education level of the respondents has relationship with the way they perceive flood. Further discussion about the possible correlation between the education level of respondents and the way local people perceive flood in their areas will be presented in this chapter. It can be seen from the figure that the highest percentage of the respondent's education level is high school (36%), followed by elementary school (32%). The figure indicates that only 2% of the total of 102 respondents has a university level, and another 9% of the respondents are illiterate.

### Occupation of The Respondents

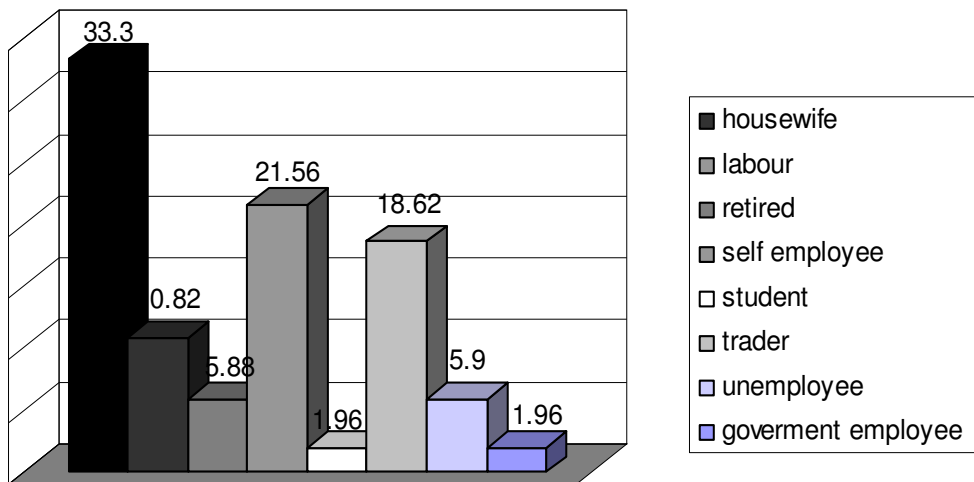


Figure 4-4: Occupation of the respondents

Figure 4-4 shows the occupation of the respondents. Variable occupation of respondent is being considered in this research based on the assumption that occupation as part of economic activity has close relation with the type of the coping mechanism applied by the community to cope with flood. Of the total 102 respondent, housewife has the highest percentage of the occupation, which is 33.3%, followed by self employee 21.56% and trader 18.62 %. The highest percentage of respondent with housewife occupation can be understood because the interview was done mostly during day time when men as head of households are working.

#### 4.2.2. Information of The Households

##### Households Structure

The households structure in this research is determined by considering not only the households size (the number of family member), but also how many of family members has a job as source of income, and the distribution of households members by age. Blaikie, et al.(1994) mentions that a positive aspect to the young population profile as a potential of a strong and energetic group of people under the age of 25 ,and with the necessary political will, can be envisaged the mobilization of predominantly young communities to protect their settlements against disaster risk. He further explained that this condition implies the development of training, leadership, and suitable institutions for such a task.

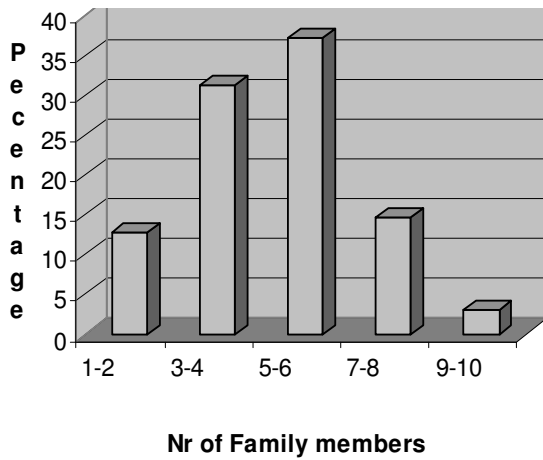
Based on the theory as mentioned above, the household structure of the community can be also considered as a dominant asset of household coping mechanism against flood. The more family members, the more labour in the case of flood.

Table 4-1: Number of family member who has job as source of income

Sources of income	Percent
0	1
1	35.3
2	36.3
3	19.6
4	3.9
5	2.9
6	1
Total	100.00

Table 4-1 illustrates the number of the family's members who has a source of income. It can be seen from the table, that more than 50 % of the interviewed households has more than 1 source of income.

**Households Size**



As shown in figure 4-5, the households size of the interviewed respondents varies, ranging from 1 to 10 member of family. The information about the households' size is considered to be important to understand the economic condition of households. The size of the surveyed households was dominated by the household with the 5 to 6 of family number, followed by 3 to 4.

Figure 4-5: Distribution of House Size

**Household's Daily Expenses**

As describes in Figure 4-6, the average household's expense for food in the study area is Rp 20,475 (Rp 11,500.00 = E 1.00) and the average of the household's daily expense for transportation is Rp 11,800. Information about household's expenses was collected from the interview of 102 respondents during the fieldwork. Household's expenses were calculated based on the 2 basic daily expenses, which are daily expense for food and expense for transportation, plus additional expenses for others, if any.

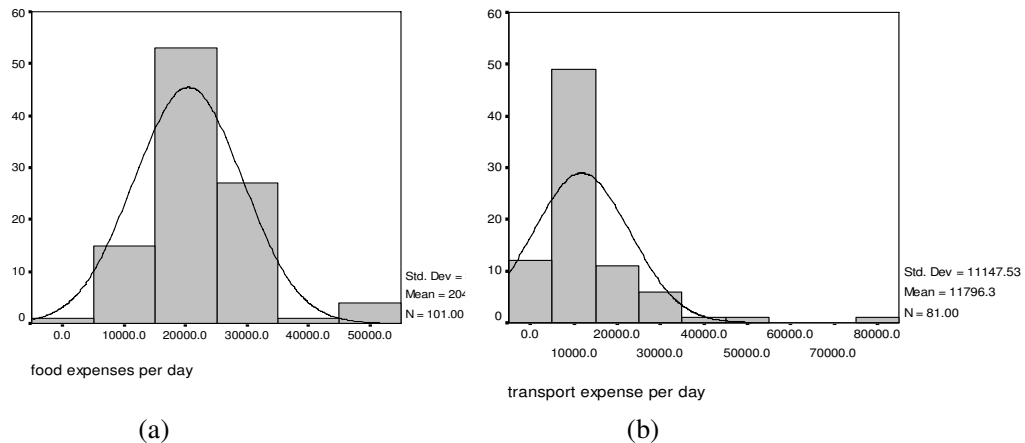


Figure 4-6: Distribution of respondents by daily expense : (a) daily food expense, (b) daily transport expense

**Total Assets of The Households**

Total assets of the households are calculated from the total value of building contents and out site properties. This information was collected during interview using questionnaires. Based on the observation during the field work and analyses result, the information of total asset is then classified

into five classes, which are : less than Rp1000K<sup>8</sup>, Rp1000K – Rp5000K, Rp5001K – 10000K, 1001K – Rp15000K, > Rp15000K.

Figure 4-7 illustrates the distribution of the household’s total assets. It can be seen from the figure that the highest percentage of the household’s total assets is between Rp 1000K – Rp 5000K, followed by Rp 15000K

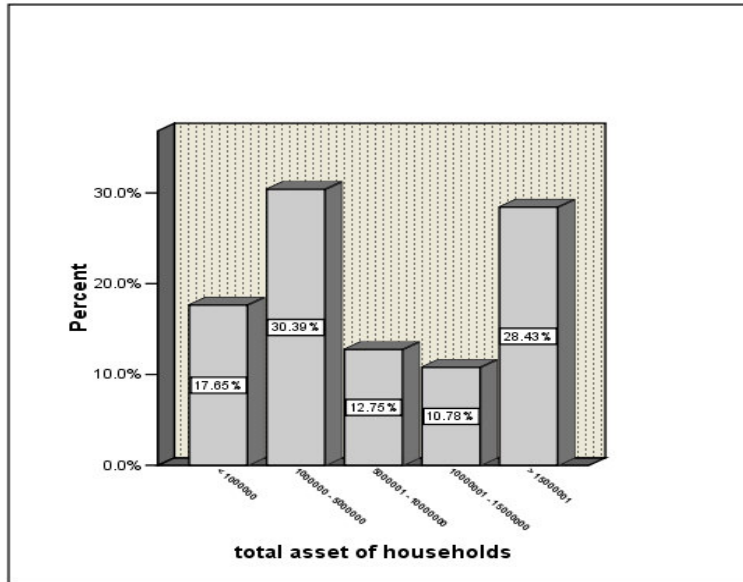


Figure 4-7: Distribution of households by total asset

### 4.2.3. Information on Reasons to stay

Figure 4-8 shows the reasons for the respondents to stay. Based on analysis and findings that the main reason for people stay in the study area is ancestral properties, and access to education is the last reason to be considered by the people. Most of respondents in the study area have more than 1 reason to stay.

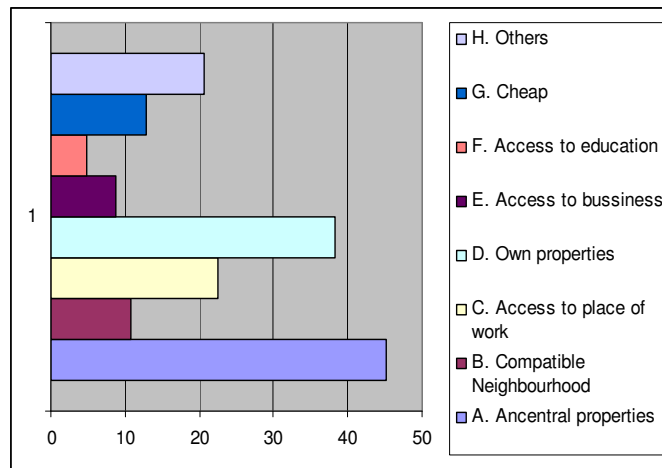


Figure 4-8: Distribution of respondent by reasons of stay

<sup>8</sup> 1K = 1000



### 4.3. Physical Structure of Respondents' Houses

The socio-economic of people is well-known as one of factors influencing the employment of the type of coping mechanisms. The social-economic of people can be seen by the way the construct their house. Information about physical structure of the houses (materials used to construct the houses) is important to be collected in relation with the type of coping mechanism employed by local people in the study areas. Economic improvement and strengthening social networks may lead to a reduction on the vulnerability of the community or the people.

#### Material Structure of The Houses

Table 4-2 describes the largest portion (42 %) of the respondent construct their house with reinforced materials such as combination brick as wall material and tile/ceramic for their flood material. It is important to analyze the construction of houses by the type of material. The type of material used for constructing houses implies the socio-economic condition of the local people. The result of this research shows that there are 9 types of combinations of material structure of the houses.

Table 4-2: Cross tabulation between floor and wall material of houses

Floor material	wall material					Total
	wood	bamboo	brick	press cement	mix	
cement	5	0	36	0	5	46
tile/ceramic	0	0	42	2	0	44
soil	2	1	4	0	0	7
other	0	0	5	0	0	5
<u>Total</u>	<u>7</u>	<u>1</u>	<u>87</u>	<u>2</u>	<u>5</u>	<u>102</u>

### 4.4. Respondents' Perception and Flooding in Semarang

Based on the conceptual framework discussed in chapter 1, that there are 3 main components in this research, which are : hazards, coping mechanism and governments policies and recommendation on Disaster Management. Hazards, in this research is flood, by definition is the potential or existing condition that may cause harm to people or damage to property or environment. People living in the flood-prone area have to adapt to this situation and use their capability to cope with the effect of the flood. In order to mitigate and reduce the impact of flood hazard in the study area, understanding the type and characteristic of the flood hazard is very important. Among those characteristic of flood such as water depth, velocity, duration, sediment concentration, sediment size, pollution load of flood water, this research will only consider the magnitude of flood which are assumed to have influences to the type of coping mechanism, namely flood depth and flood duration. The velocity of flood is also an important aspect of flood magnitude that has a major influence to the type of coping mechanism, since the velocity of flood have also a major influence to damage. However, the velocity of flood is not taken into account in this research.

This section discusses the magnitude of the flood in the study area based on the local people's perception. Information about the magnitude of flood in the study area such as flood depth and flood duration, as well as flood history were collected during the fieldwork. The discussion of flood in the study area is presented in the sections below.

### People's Perception on Flood History

The causes of flood in the study area can be from tidal flood or river flood, as well as from the combination of the both, tidal and river flood.

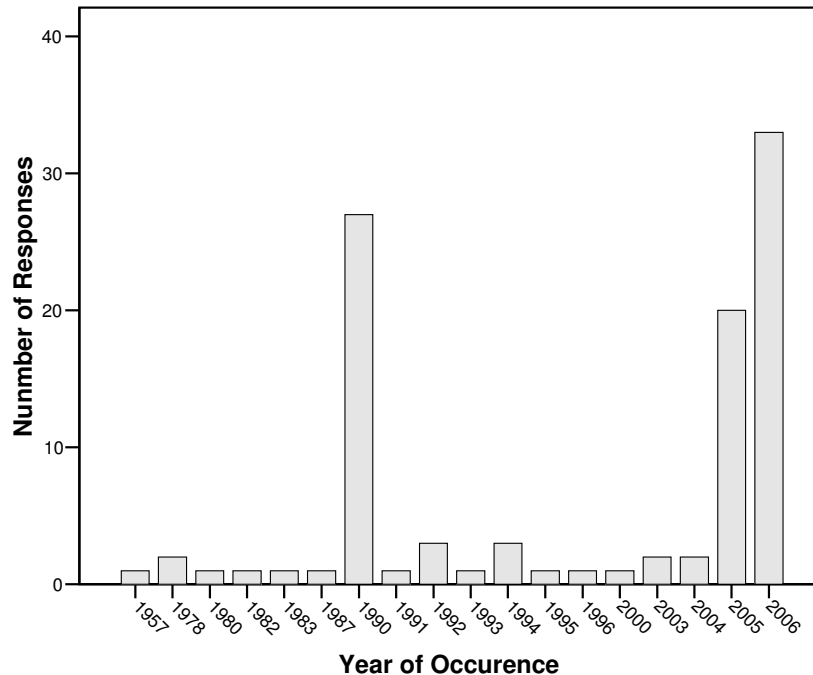
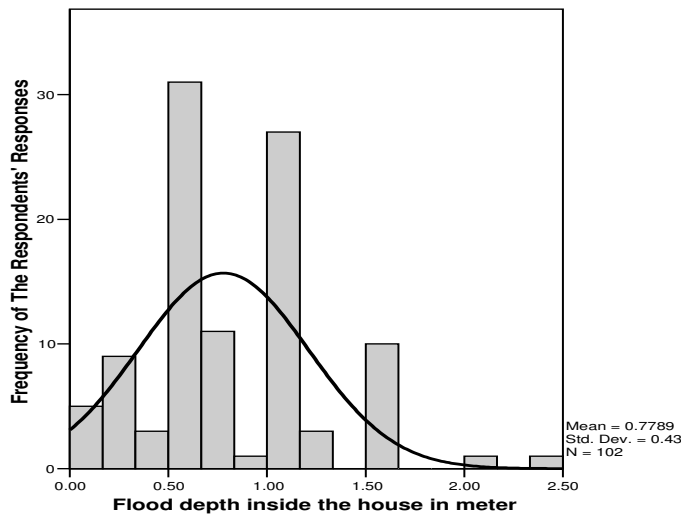


Figure 4-9: History of Large Flood Based on People's Responses

Based on the personal observation during the fieldwork, local people experience more frequent tidal flood than the river flood. The level of magnitude of flood in this area is raising when it is caused by the combination of tidal and river flood. Based on the personal interview with the local people, most of the respondent of this research could recall the largest flood in their area in recent year of 2006 and 2005, and a large flood happened in 1990. However, most of respondents have been experiencing the flood every year in the area with the magnitude getting higher and higher.

### People's Perception on Flood Depth

One of the characteristic and nature of flood hazard which has to be assumed to have an influence to the type of coping mechanism is flood depth. The information on flood depth in the study area is collected during the fieldwork. The flood depth information was measured based on local people perception and their experience. The flood depth was measured based on how many meter water entering the house. The level of flood depth were measured inside the house with reference to the plinth or ground floor. Based on the observation during the field work and analysis result of the interview of the total of 102 respondents, it can be observed that the water level during the highest flood is ranging from 0.10 m to 2.50 m (figure 4-10).



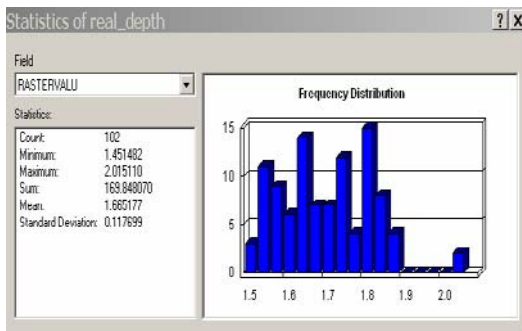
Based on the flood depth perceived by the people, the average of the flood depth is 80 cm. For further analysis, the flood depth is classified into three classes, which are: (1) slightly flooded, when the water level is < 0.50 m, (2) moderately flooded, when the water level is 0.50 – 1.0 m, and (3) severely flooded, when the water level is > 1.0 m.

Figure 4-10: People perception of flood depth inside the house

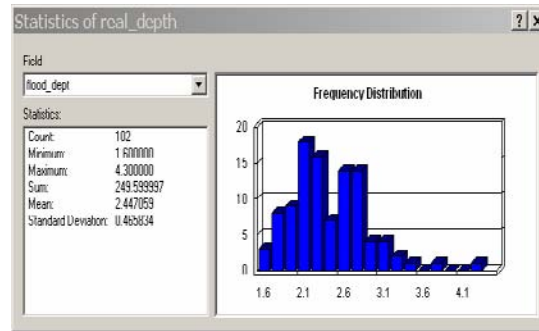
In order to get the real flood depth in the study area, the flood depth inside the house for each household was added with height of the study area by extracting the height information from digital elevation model. The result of the extraction from the digital elevation model to the flood depth collected from the households interview shows that flood depth inside the houses above mean sea level varies. Based on the extraction result from the digital elevation model, it is ranging from 1.6 meter as the lowest and 4.3 meter as the highest. Figure 4-11 describes the real flood depth above mean sea level in the study area.

Table 4-3: Distribution of respondent by flood depth

Flood depth	Nr of respondents	Percent
Slightly flooded	17	16.7
Moderately flooded	70	68.6
Severely flooded	15	14.7
<b>Total</b>	<b>102</b>	<b>100.00</b>



(a)



(b)

Figure 4-11: Distribution of flood depth and elevation in the study area : (a) frequency distribution of the elevation extract from DEM, (b) frequency distribution of the real flood depth inside the houses based on DEM elevation.

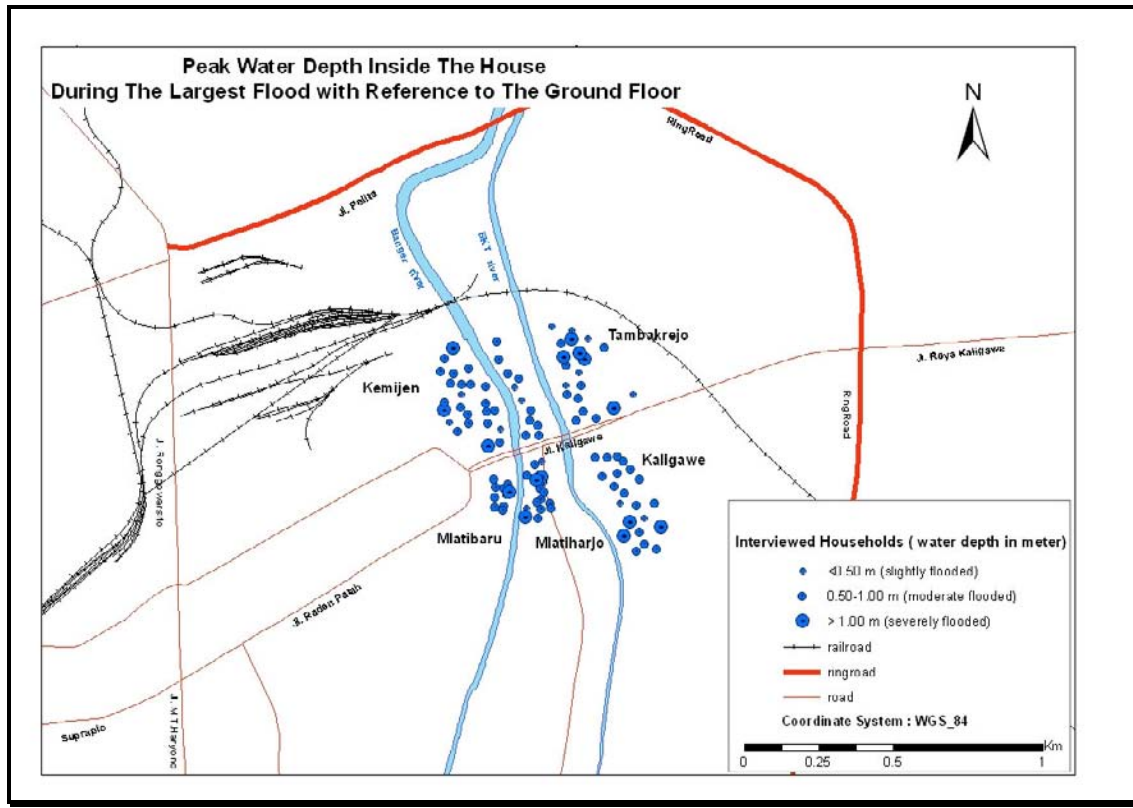


Figure 4-12: Spatial distribution of flood depth inside the house perceived by local people

### Water Duration

The distribution of people’s perception about flood duration can be seen in table 4-4 as follows. Water duration during the highest flood was measured in days. Based on the interviews, it can be observed that the water covered in the study area during the highest flood is ranging between < 1 day as the shortest and >7 days as the longest. The highest percentage of water duration in the study area is between 3 – 7 days.

Table 4-4: Distribution of people perception on flood duration

Flood duration(day)	Nr of respondents	Percent
< 1	4	3.9
1-2	18	17.6
3-7	75	73.5
> 7	5	4.9
Total	102	100.00

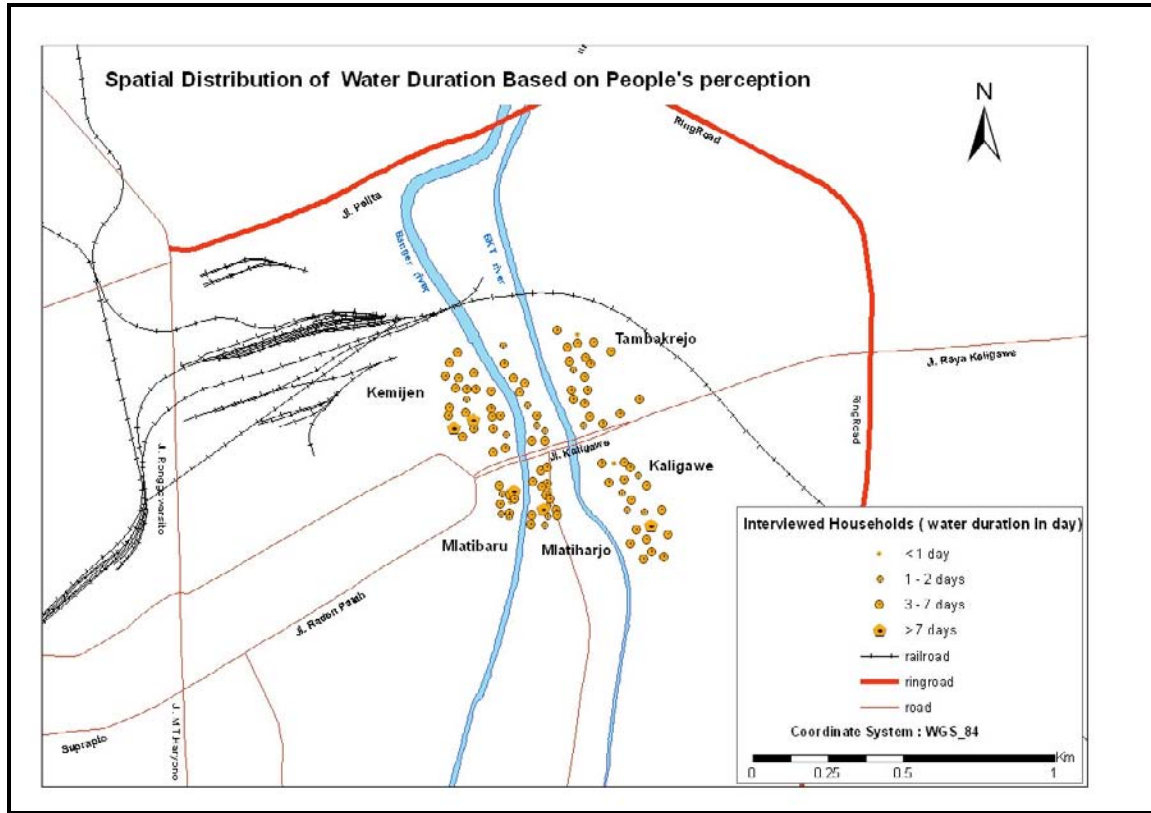


Figure 4-13: Spatial distribution of flood duration perceived by local people

Table 4-5: Cross Tabulation of people perception on flood depth and flood duration

Flood Depth	Flood Duration				Total
	< 1 day	1 – 2 days	3-7 days	> 7 days	
Slightly flooded	3	4	8	2	<u>17</u>
Moderately flooded	1	14	<b>52</b>	3	<u>70</u>
Severely flooded	0	0	15	0	<u>15</u>
<b>Total</b>	<u>4</u>	<u>18</u>	<u>75</u>	<u>5</u>	<u>102</u>

Table 4-5 shows the cross tabulation between people perception about flood depth and flood duration. It can be concluded from the table that the combination of moderately flooded (0.50 – 1.00 m) with 3-7 days flood duration is the highest percentage of flood magnitude in the study area (52%). The second combination which has significant percentage is combination between severely flooded and 3-7 days of flood duration (15%).

### People's Perception of Flood Effect on Daily Working Activities

The result of this research also shows the people perception on flood effect on their daily working activities. Table 4-6 shows the distribution of people's responses on flood effect on their daily working activities. Of the total, 50 % of the respondents could not continue their daily working activities when the flood strikes. Reasons for not working are disruption of road/access to work place, flood depth and extent which is not possible to getting through, taking care of family and properties, feeling insecure to leave the house because of expecting the larger flood will strike. Another 40 % of respondents were still go for the daily working activities, with main reason as a obligatory to earn money for feeding their family.

Based on personal observation during the interview with the local people, there were opinions that the flood is getting worse every year since some industries/companies were built in this area. However, there is no detail information or discussion about this topic in this research. On the other hand, the presence of the companies/industries can help local people by providing the job opportunities.

Table 4-6: Distribution of responses based on people perception of flood effect on their daily working activities

Continue working	Nr of respondents	Percent
yes	41	40.2
no	51	50.0
partly	10	9.8
Total	102	100.00

### People's Perception of Flood Effect Severity

The concept of nuisance can safely be said to be almost in capable of concrete definiton. In this research, nuisance includes any negative impacts of floods which annoys, injures, endangers the confort, health, and threaten the properties damaged. Cathastrophe is reffering to a disaster, when the negative impacts of flood is not only threaten their properties but also directly threaten their lives.

Table 4-7 shows the distribution of people's perception of flood effect severity. Observation of the data shows that more than 50 % of respondents perceived flood in their areas as nuisances. The negative impact of flood in the surveyed kelurahan seen to have damaged properties of the people , rather than directly threaten their lives.

Table 4-7: Distribution of respondents based on respondent's perception on flood severity

Perception	Nr of respondents	Percent
Nuisance	80	78.4
Catastrophe	20	19.6
Others	2	2
Total	102	100.00

#### 4.5. Respondents' Perception on Flooding Using Sketch Mapping

In this research, special questionnaire using printed IKONOS imagery covering the study area were used. The respondents were asked to mark and draw the areas threatened by floods on printed IKONOS and maps. The methods of using High Resolution Imagery like IKONOS as a tool was intended to understand the possibility of laypeople (local people) knowledge on mapping of flood threat. This method was intended to collect the information about the extent of flood. Of the total 102 respondent, only 32 respondents gave the answer when they were asked to draw which area are covered by water during flooding, and the rest of 70 refused to response. There is question about this result, why is only small percentage of the respondent could give positive response when they were asked to draw and why some others refused? There are numerous possible explanations for why some do and others do not participate. Based on the personal interview with the respondents, most of the respondent who refused to draw or to give response because they do not know or do not get use to this imagery product. For those who participated were able to indicate the threatened and the extent of flood, and their answers differed depending on the place of residence. At least partially, the printed IKONOS and maps reflect the perceived risk of flood. This also reflects that people are aware of floods and affected area. Figure 4-14 shows examples of sketch map based on IKONOS imagery used for the interviews.

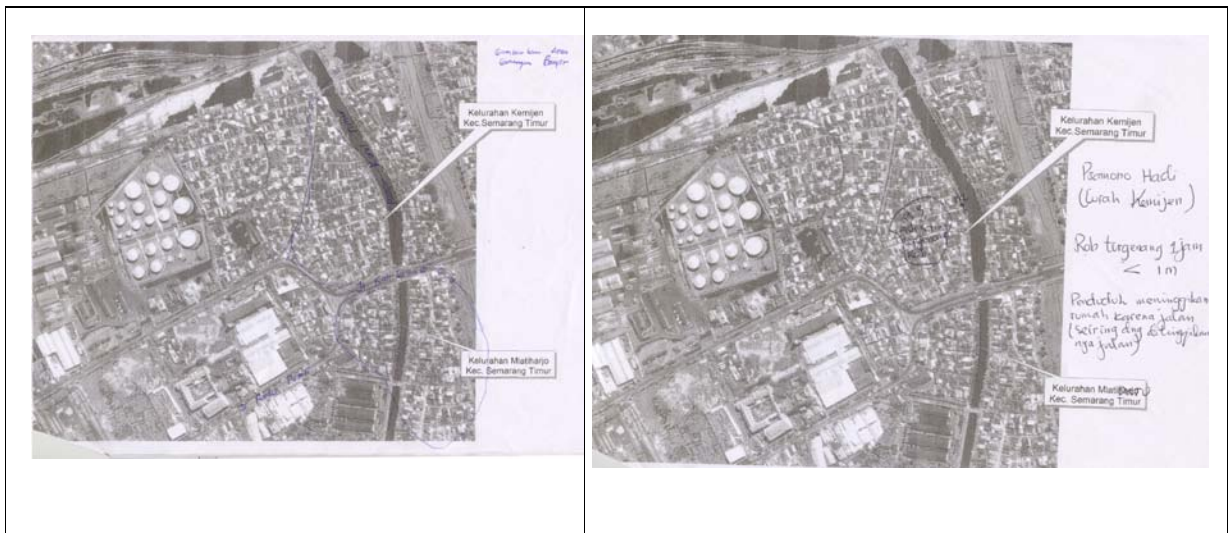


Figure 4-14: Examples of printed IKONOS imagery used for the interview

#### 4.6. Concluding Remarks

This chapter discussed the socio-economic conditions of the respondents, and the way people perceived the flood risk in the study area. This chapter appraises the general perception of floods and related events, such as: flood history, flood level and the duration, as well as flood extent.

As the choice of skill and resources to be applied in dealing with flood hazards varies depends on the flood magnitude, the capacities that people have to deal with flood threat, and on variety of community and individual priorities that can change during the course of disaster, hence the clear understanding about the three aspects as mentioned is very important.

Some indicators are used to access socio-economic structure of the local people in the study area, such as household expenditure, asset, household size, households' structure and occupational types are used.

The nature of flood threat in the study area is determined by the flood depth and flood duration, as well as the flood history in the study area. Result of this research on magnitude of flood in the study area revealed that the highest of flood depth ever is 4.3 m while the lowest of flood depth ever is 1.6 m. Water duration during the highest flood was measured in days. It can be observed that the water covered in the study area during the highest flood is ranging between < 1 day as the shortest and >7 days as the longest. The highest percentage of water duration in the study area is between 3 – 7 days. Flooding in the study area has been affecting the local people for long time. People living in the study area have been experiencing with flood threat almost every year. Among the flood ever, people could recall well about the severe flood happened in 1990 when rivers flowing through the city of Semarang and resulting losses and damage in the city.

The capacity that people have to deal with flood threat can be measured using indicators of socio-economic e.g. household's structure (how many source of income of the household), household size and total assets. Result of this research on socio-economic condition of the local people revealed that more than 50 % of the respondent have more than 1 source of income.



## 5. Community's Coping Mechanism

*This chapter discusses coping mechanisms for floods employed by local people in the study area. The discussion about the types of coping mechanism are classified into three types, which are: economic coping mechanisms, technological/structural coping mechanisms and social/organizational coping mechanisms. The discussion will be followed by the possible factors influencing the selection of coping mechanisms.*

### 5.1. Type of Coping Mechanism

The identification of types of coping mechanisms employed by the local people in the study area are based on the observation during the household interviewed. What are the most important activities for the respondents of this survey, what would they do to cope with flood? The selection and implementation of effective and optimised strategies for floods is important .

Table 5-1: Type of coping mechanism activities employed by the local people at different stages

Before flooding	<ul style="list-style-type: none"> <li>Construction of house with the reinforced material</li> <li>Ronda (patrol area neighbourhood)</li> <li>Preparing temporary place at friend's or relative's place</li> <li>Preparing place for storage at the higher place</li> <li>Storing basic food items such as : rice and sugar</li> <li>Cleaning the canal surroundings the house as part of social coping mechanism</li> <li>Building dikes in front of house using sand bags</li> </ul>
During Flooding	<ul style="list-style-type: none"> <li>Evacuating the family, especially children and elderly to the safer place, such as: factory building, kelurahan office (local building office), mosque , friend's or relative's place</li> <li>Evacuating the important things to the safe place</li> <li>Closing the door and windows properly to avoid water</li> <li>Purchasing cheap food</li> <li>Continue working</li> <li>Do nothing</li> <li>Securing house entrance to avoid debris</li> <li>Saving money</li> <li>Cleaning the house by draining</li> <li>Searching relief materials</li> <li>Guarding the house to ensure safety belongings</li> </ul>
After Flooding	<ul style="list-style-type: none"> <li>Repairing minor damage of the appliance</li> <li>Repairing important damage to the house</li> <li>Cleaning the house and surroundings</li> <li>Fixing things</li> <li>Looking for alternative place to move</li> <li>Continue patrolling the neighbourhood (ronda)</li> <li>Helping other's community member in doing work ( gotong royong)</li> </ul>

As described in table 5-1, the coping mechanisms employed by the people living in the surveyed kelurahan are classified according to Blaikie, et. al, (1994) into three different stages , as follows : before, during and after flooding.

In table 5-2, the coping mechanisms are classified according to Twigg (2004), namely economic coping mechanism, technological/structural coping mechanism and social coping mechanism. The definition of economic coping mechanism in the study area refers to the economic activities and diversification, including those strategies of the community linked to materials goods and resources, for instance, having more than one source of income, can be seen as an important component of economic coping strategies. The type of technological/structural coping mechanism in this research refers to the structural activities employed by households living the flood-prone area to cope with flood losses or damages. The structural activities identified in the study area, such as the way people construct their house and type of materials used for their construction to minimize the flood losses and damage. Local people constructed their house using the reinforced material to deal with flood magnitude. The construction of the house using reinforced material such as : brick , cement and tile or ceramic , as well the combination of the three types of those material to construct their house, are the most common types of coping mechanism in the study area. As illustrated in previous table 4-2, the combination of using brick for constructing wall and cement or ceramic or tile/ceramic for floor is seen to be the predominant materials used by the local community to constructs their house.

Spatial distribution of the predominant material used for the wall and floor in the surveyed kelurahan is shown in figure 5-1 and figure 5-2.

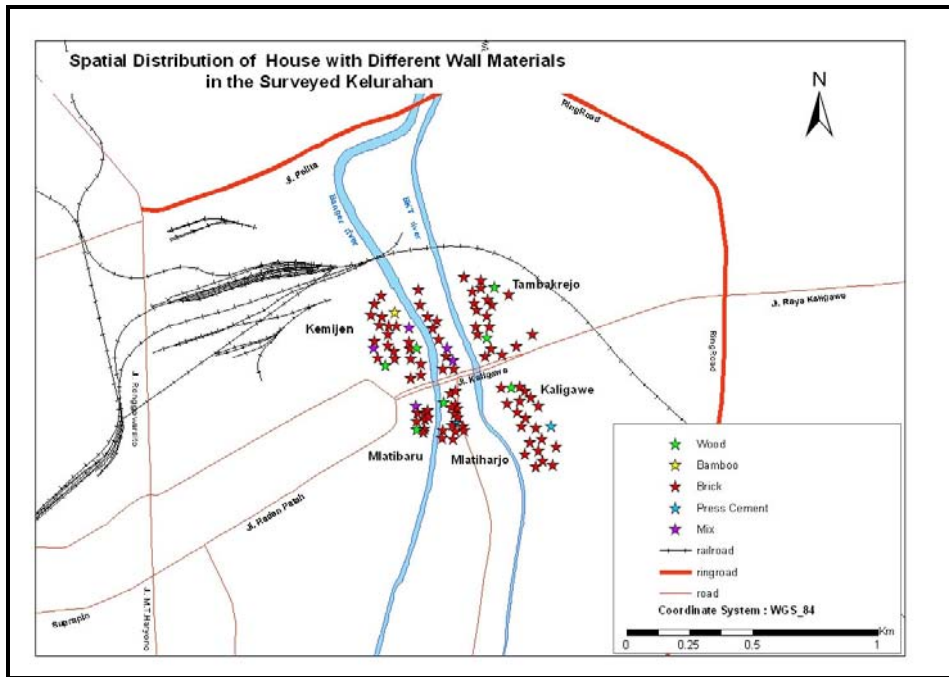


Figure 5-1: Spatial distribution of respondents by wall material of house's construction

The social/organizational coping mechanisms are those activities and or social relationship and network among the community and local government that can help people to minimize the flood losses and damage. Among the types of coping mechanisms, continue patrolling the neighbourhood (ronda) and helping other's community member in doing work (gotong royong) are included in the social coping mechanism which can be very important asset to cope with the negative impacts of flood.

**Table 5-2** : Categorise of coping mechanism activities employed by the local people

Economic (1)	<ul style="list-style-type: none"> <li>Construction of house with the reinforced material</li> <li>Preparing place for storage at the higher place (1,3)</li> <li>Storing basic food items such as : rice and sugar</li> <li>Building dikes in front of house using sand bags (1,2)</li> <li>Repairing minor damage of the appliance (1,2)</li> <li>Repairing important damage to the house(1,2)</li> <li>Fixing things(1,2)</li> <li>Continue working</li> <li>Purchasing cheap food</li> <li>Repairing minor damage of the appliance (1&amp;2)</li> <li>Repairing important damage to the house (1&amp;2)</li> <li>Saving money</li> </ul>
Technological/Structural(2)	<ul style="list-style-type: none"> <li>Construction of house with the reinforced material</li> <li>Closing the door and windows properly to avoid water</li> <li>Do nothing (1,2&amp;3)</li> <li>Securing house entrance to avoid debris</li> <li>Cleaning the house by draining (1&amp;2)</li> <li>Repairing minor damage of the appliance</li> <li>Repairing important damage to the house</li> <li>Fixing things</li> <li>Cleaning the canal surroundings the house (2&amp;3)</li> </ul>
Social/Organisational (3)	<ul style="list-style-type: none"> <li>Cleaning the house and surroundings</li> <li>Looking for alternative place to move</li> <li>Continue patrolling the neighbourhood (ronda)</li> <li>Helping other's community member in doing work (gotong royong)</li> <li>Guarding the house to ensure safety belongings</li> <li>Searching relief materials</li> <li>Evacuating the family, especially children and elderly to the safer place, such as: factory building, kelurahan office (local building office), mosque , friend's or relative's place</li> <li>Evacuating the important things to the safe place (1,3)</li> <li>Preparing temporary place at friend's or relative's place</li> <li>Preparing place for storage at the higher place (1,3)</li> <li>Cleaning the canal surroundings the house (2&amp;3)</li> </ul>

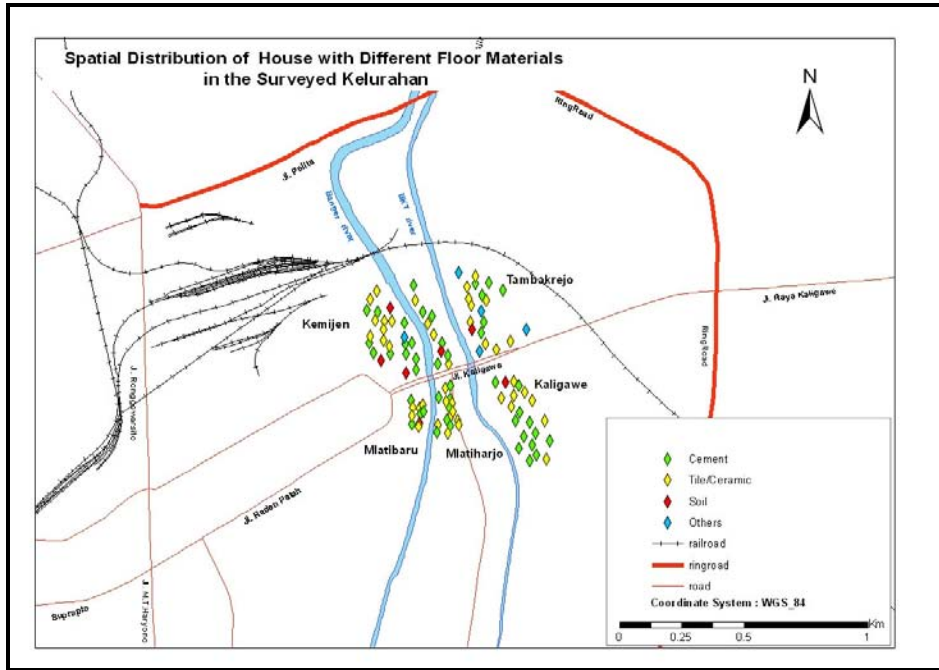


Figure 5-2: Spatial distribution of respondents by floor material of house's construction

It is well-known that some people living in the flood-prone area construct their house with 2<sup>nd</sup> floor in order to cope against flood. However, this kind of house's construction can be rarely seen in the surveyed kelurahan (8.8%) due to lack of financial capacities. It is also observed that the urban growth in city of Semarang is in horizontal direction. The use of high building is still not common. It is observed from the field observation and analysis result of the questionnaire that people with higher level of economic have more capability to construct their house better than those people who have lower capacity in term of economic.

### 5.1.1 Coping Mechanism in relation with flood magnitude

The selection of coping mechanisms by the people living in the flood-prone areas is influenced by the resources the people have, which can be tangible and intangible and the magnitude of flooding that community have to cope with. The magnitude of flooding that people have to cope with consists of the flood depth, flood duration and flood velocity. The flood velocity is not considered in this research, simply because there is lack of data about flood velocity.

People living in the surveyed kelurahan have been experiencing frequent flood. They have learnt how to deal with flood and to minimize its impacts. They set up ways of coping to deal with the flood. Many type of coping mechanisms found in the surveyed kelurahan were classified based on stage as shown in table 5-1 and categorize into three classes: economic, technological/structural and social/organizational as described in table 5-2.

Figure 5-3 depicts examples the type of house constructed and material used for house constructions in the surveyed kelurahan.



**Figure 5-3: Examples of construction of the house in the study area (Source : field work, 2006)**

Table 5-3: Cross Tabulation of people perception about flood depth and type of coping mechanisms employed by local people *before* flooding

Flood Depth	Economic		Structural		Social	
	<u>Yes(%)</u>	<u>No(%)</u>	<u>Yes(%)</u>	<u>No(%)</u>	<u>Yes(%)</u>	<u>No(%)</u>
Slightly flooded	0	16.6	6.9	9.8	9.8	6.8
Moderately flooded	8.8	59.8	34.2	34.2	42.2	26.6
Severely flooded	1.9	12.7	6.9	7.8	6.8	7.8
<u>Total</u>	<u>10.9</u>	<u>89.1</u>	<u>48</u>	<u>52</u>	<u>58.8</u>	<u>41.2</u>

It can be observed that the most common type of coping mechanisms before flooding employed by the community in the study area is social coping mechanism. As shown in table 5-3, the percentage of social coping mechanism is relatively higher (58.8%) comparing to structural coping mechanism (48%) and economic coping mechanism (10.9%). Of the total of 10.9 % of economic coping mechanism employed by the community, people living in the moderately flooded area has the highest proportion (8.8%) and only about 1.9 % of people who live in severely flooded area tend to employ the economic coping mechanism such as saving money, for preparation activities in case of flooding. Of the total of 48% of structural coping mechanism, 34.2 % is people living in the moderately flooded, 6.9% of severely flooded and 6.9 % of people living in slightly flooded. Of the total of 58.8 % of social coping mechanism, similar to structural and economic coping mechanism, the highest percentage of people who employed the social coping mechanism is people who live in the moderately flooded area, which is 42.2 %, followed by slightly flooded area (9.8%) and severely flooded (6.8%).

Table 5-4: Cross Tabulation of people perception about flood depth and type of coping mechanisms *during* flooding

Flood Depth	Economic		Structural		Social	
	<u>Yes(%)</u>	<u>No(%)</u>	<u>Yes(%)</u>	<u>No(%)</u>	<u>Yes(%)</u>	<u>No(%)</u>
Slightly flooded	0.9	15.7	2.9	13.7	2	14.6
Moderately flooded	13.7	55	15.7	53	5	63.7
Severely flooded	2.9	11.8	2.9	11.8	3	11.7
<u>Total</u>	<u>17.5</u>	<u>82.5</u>	<u>21.5</u>	<u>78.5</u>	<u>10</u>	<u>90</u>

Type of coping mechanism during flooding employed by the community in the study area, is relatively low comparing to the type of coping mechanism employed by the community before flooding (see table 5-4). During flooding, people in the study area tend to employ structural coping mechanism (21.5%), rather than social coping mechanism (10%). Relatively, economic coping mechanism is higher (17.5) during flooding rather than before flooding.

Table 5-5: Cross Tabulation of people perception about flood depth and type of coping mechanisms *after* flooding

Flood Depth	Economic		Structural		Social	
	<u>Yes(%)</u>	<u>No(%)</u>	<u>Yes(%)</u>	<u>No(%)</u>	<u>Yes(%)</u>	<u>No(%)</u>
Slightly flooded	0	16.6	4	12.7	0	16.6
Moderately flooded	5	63.7	27.4	41.2	13.7	55
Severely flooded	0	14.7	3	11.7	5	9.7
<u>Total</u>	<u>5</u>	<u>95</u>	<u>34.4</u>	<u>65.6</u>	<u>18.7</u>	<u>83.3</u>

As shown in table 5-5, after flooding, local people tend to employ structural coping mechanisms such as : repairing important damage to the house and minor damage of the appliance . Type of social coping mechanisms after flooding employed by the community are looking for alternative place to move, cleaning house and surroundings, continue patrolling the neighbourhood (ronda) and helping other's community member in fixing thing or doing work (gotong royong). Based on observation during the interview, there were about 35.3 % of respondents have desired to find another safe location to move. However, most of the respondents (64.7%) prefer to stay because they have a job as source of income, which is likely difficult for them to get if they are moving to other place.

### 5.1.1. Coping Mechanism in relation with socio economic of the community

Economic level of the local people is determined based on the households interview of 102 respondents. The economic level of the households is determined based on the households size which is defined by the number of total family number; and the total asset, as well as household's structure, which is determined based on the number of family member who has job as source of income.

#### Coping Mechanism in Relation with Households Size

The information about the households size is considered to be important to understand the economic condition of households.

Table 5-6: Cross Tabulation of households size and type of coping mechanisms *before* flooding

Nr of family members	Economic		Structural		Social	
	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)
1 - 2	2	10.7	5	6.7	6.8	5.8
3 - 4	5	26.4	16.7	14.8	18.7	12.7
5 - 6	4	33.3	15.6	21.6	18.7	18.6
7 - 8	0	15.6	8.8	6.9	11.7	4
9 -10	0	3	2	1	3	0
<b>Total</b>	<b>11</b>	<b>89</b>	<b>48.1</b>	<b>51.9</b>	<b>58.9</b>	<b>41.1</b>

As described in pervious table 4-2, the households size of the respondents in the study areas varies. Table 5-6 there is considerable evidence of a slightly correlation between the households size and the type of coping mechanism employed by the local people. It can be seen from table 5-7 that household which more than 3 people tend to employ technological and social coping mechanisms or combination of the two.

Table 5-7: Cross Tabulation of households size and type of coping mechanisms *during* flooding

Nr of family members	Economic		Structural		Social	
	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)
1 - 2	2	10.8	2.9	9.8	1	11.8
3 - 4	5.9	25.5	6.9	24.5	2	29.4
5 - 6	7.8	29.4	6.9	30.4	3.9	33.3
7 - 8	2	13.7	3.9	11.8	1	14.7
9 -10	0	2.9	1	2	2	1
<b>Total</b>	<b>17.6</b>	<b>82.4</b>	<b>21.6</b>	<b>78.4</b>	<b>9.8</b>	<b>90.2</b>

In relation with households size, there is no evidence that the higher the households size, the higher the coping mechanism before flooding employed by the community, either economic, structural or social coping mechanism. Of the 17.6 % of economic coping mechanism, the highest percentage is household which has 5-6 members of family (7.8%), followed by household with 3-4 family members (5.9%). As described in table 5-7, the social coping mechanism during flooding is almost the same for all household size classes, with the highest percentage of 3.9% for household with the 5-6 total family members.

Table 5-8: Cross Tabulation of households size and type of coping mechanisms *after* flooding

Nr of family members	Economic		Structural		Social	
	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)
1 - 2	0	12.7	2.9	9.8	2	10.8
3 - 4	1	30.4	7.8	23.5	4.9	26.5
5 - 6	2.9	34.3	18.6	18.6	10.8	26.5
7 - 8	1	14.7	4.9	10.8	1	14.7
9 -10	0	2.9	0	2.9	0	2.9
<b>Total</b>	<b>4.9</b>	<b>95.1</b>	<b>34.3</b>	<b>65.7</b>	<b>18.6</b>	<b>81.4</b>

As illustrated in table 5-8, the most common type of coping mechanism after flooding employed by the community in relation with household size is structural coping mechanism (34.3%), followed by social coping mechanism (18.6%) and economic coping mechanism(4.9%). Repairing minor damage of the appliance, repairing important damage to the house, cleaning the house and surroundings, fixing things, looking for alternative place to move, continue patrolling the neighbourhood (ronda), and helping other's community member in doing work (gotong royong), are among the activities which are employed by the community as part of coping mechanism after flooding. There is no strong evidence that there is positive relationship between having larger family members can be a part of coping mechanisms in the study area.

### Coping Mechanism in Relation with Household's Structure

The importance of exploring the relationship between the households structure with the coping mechanism employed by the households and to measure the level vulnerability. For this research, the household's structure is defined as the total number of family member who has a job as source of income. It is assumed that the higher number of the households structure have higher ability to cope against disaster.

Table 5-9:Cross Tabulation of household's structure and type of coping mechanisms *before* flooding

Nr of family members	Economic		Structural		Social	
	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)
0	0	1	0	1	0	1
1 - 2	8.8	62.7	32.4	39.2	38.2	33.3
3 - 4	2.0	21.6	14.7	8.8	18.6	4.9
5 - 6	0.0	3.9	1	2.9	2	2
<b>Total</b>	<b>10.8</b>	<b>89.2</b>	<b>48</b>	<b>52</b>	<b>58.8</b>	<b>41.2</b>



It can be observed from the table 5-9 above that there is no direct evidence to prove that by having higher source of income for the household/family, the capacity of the household in dealing with flood threat is also become higher. This can be explained based on the personal observation during the fieldwork, that the most source of income of the community in the study area is come from the labour. This type of source of income is not enable people to have high capacities, in term of financial, in case flood strikes.

Table 5-10: Cross Tabulation of household's structure and type of coping mechanisms *during* flooding

Nr of family members	Economic		Structural		Social	
	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)
0	0	1	0	1	0	1
1 - 2	12.7	58.8	17.6	53.9	6.9	64.7
3 - 4	4.9	18.6	3.9	19.6	2.9	20.6
5 - 6	0	3.9	0	3.9	0	3.9
<u>Total</u>	<u>17.6</u>	<u>82.4</u>	<u>21.6</u>	<u>78.4</u>	<u>9.8</u>	<u>90.2</u>

Similar to the coping mechanisms before flooding, the cross tabulation between households structure and type of coping mechanism shows that the relationship between household's structure and type of coping mechanism has no clear pattern. Table 5-10 shows households with 1 to 2 source of income has the highest percentage of employing economic coping mechanism (12.7%), structural coping mechanism (17.6%), and social coping mechanism (6.9%).

Table 5-11: Cross Tabulation of household's structure and type of coping mechanisms *after* flooding

Nr of family members	Economic		Structural		Social	
	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)
0	0	1	1	0	0	1
1 - 2	2.9	68.6	21.6	50	15.7	55.9
3 - 4	2	21.6	8.8	14.7	2.9	20.6
5 - 6	0	3.9	2.9	1.0	0	3.9
<u>Total</u>	<u>4.9</u>	<u>95.1</u>	<u>34.3</u>	<u>65.7</u>	<u>18.6</u>	<u>81.4</u>

### Coping Mechanism in Relation with Total Asset

In this research, a total asset of the household represents the socio-economic of the household. It is well assumed that the higher level of the socio-economic of household has higher capacity to cope against flood disaster, comparing to those who has lower capacity which is represented by lower in socio-economic level. The total assets of the respondent are classified into five classes, which are ; <1000000, 1000001-5000000, 5000001-10000000, 10000001-15000000, and > 15000000 .

Table 5-12 up to table 5-14 shows a slight trend in structural coping mechanism in relation with total assets. Based on personal observation during the fieldwork, in order to minimize the impact of flood, the household with higher total assets tend to have more capacity to construct their house with better reinforced material.

Table 5-12: Cross Tabulation of household's total assets and type of coping mechanisms *before* flooding

Total asset(Rupiah)	Economic		Structural		Social	
	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)
< 1000000	2	15.7	8.8	8.8	9.8	7.8
1000000-5000000	3.9	26.5	13.7	16.7	21.6	8.8
5000001-10000000	1	11.8	4.9	7.8	3.9	8.8
10000001-15000000	0	10.8	5.9	4.9	8.8	2
>15000000	3.9	24.5	14.7	13.7	14.7	13.7
<b>Total</b>	<b>10.8</b>	<b>89.2</b>	<b>48</b>	<b>52</b>	<b>58.8</b>	<b>41.2</b>

Note : 1EURO = 11.100 Rupiah

Table 5-13: Cross Tabulation of household's total assets and type of coping mechanisms *during* flooding

Total asset(Rupiah)	Economic		Structural		Social	
	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)
< 1000000	4.9	12.7	3.9	13.7	0	17.6
1000000-5000000	3.9	26.5	6.9	23.5	2.9	27.5
5000001-10000000	2	10.8	2.9	9.8	2	10.8
10000001-15000000	1	9.8	2.9	7.8	2	8.8
>15000000	5.9	22.5	4.9	23.5	2.9	25.5
<b>Total</b>	<b>17.6</b>	<b>82.4</b>	<b>21.6</b>	<b>78.4</b>	<b>9.8</b>	<b>90.2</b>

Note : 1EURO = 11.100 Rupiah

Table 5-14: Cross Tabulation of household's total assets and type of coping mechanisms *after* flooding

Total asset(Rupiah)	Economic		Structural		Social	
	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)
< 1000000	0	17.6	4.9	12.7	3.9	13.7
1000000-5000000	2	28.8	9.8	20.6	6.9	23.5
5000001-10000000	0	12.7	5.9	6.9	2	10.8
10000001-15000000	0	10.8	2	8.8	1	9.8
>15000000	2.9	25.5	11.8	16.7	4.9	23.5
<b>Total</b>	<b>4.9</b>	<b>95.1</b>	<b>34.3</b>	<b>65.7</b>	<b>18.6</b>	<b>81.4</b>

Note : 1EURO = 11.100 Rupiah

### 5.1.2. Coping Mechanism in relation with geographic location

Geographically, the 5 surveyed kelurahan are located in the same elevation, which is around only 2 meters above mean sea level. The geographic location result in almost the same risk of tidal flood. Result of this research revealed that the people from these five surveyed kelurahan react toward the flood threat with the similar behaviour. Combination of structural coping mechanism and social coping mechanism is the most common type of coping activities employed by the people in the study area. The coping activities before flooding consist of construction of house with the reinforced material, building dikes in front of house using sand bags, ronda (patrol area neighbourhood), preparing temporary place at friend's or relative's place in case of flooding, preparing place for storage at the higher place, storing basic food items such as :rice and sugar, and cleaning the canal surroundings the house as part of social coping mechanism.

Before Flooding

Table 5-15: Cross Tabulation of geographic location and type of coping mechanisms before flooding

Village	Economic		Structural		Social	
	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)
Mlatiharjo	1	13.7	5.8	8.9	9.8	5
Mlatibaru	2	17.6	10.8	8.9	11.7	7.8
Kemijen	4	22.5	13.7	12.8	16.6	9.9
Tambakrejo	3	16.6	11.7	7.8	10.7	8.8
Kaligawe	1	18.6	5.8	13.7	9.8	9.9
<u>Total</u>	<u>11</u>	<u>89</u>	<u>47.8</u>	<u>52.2</u>	<u>58.6</u>	<u>41.4</u>

Table 5-15 describes the cross tabulation between the surveyed kelurahan and type of coping mechanisms before flooding. This result highlights that the five surveyed kelurahan, namely , Mlatiharjo, Mlatibaru, Kemijen, Tambakrejo and Kaligawe, have the similar pattern of coping mechanism. Ronda and gotong royong as social network of the community are still existed. This type of coping mechanisms can be important assets that can be used to during the disaster event.

During Flooding

Table 5-16: Cross Tabulation of geographic location and type of coping mechanisms during flooding

Village	Economic		Structural		Social	
	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)
Mlatiharjo	3	11.7	4	10.8	3	11.6
Mlatibaru	4	15.6	3	16.6	0	19.6
Kemijen	4	22.5	6.8	19.5	2	24.5
Tambakrejo	4	15.6	5	14.7	1	18.6
Kaligawe	3	16.6	3	16.6	4	15.7
<u>Total</u>	<u>18</u>	<u>82</u>	<u>21.8</u>	<u>78.2</u>	<u>10</u>	<u>90</u>

The cross tabulation between the surveyed kelurahan and type of coping mechanism shows that the predominant coping mechanism during flooding existed among the surveyed kelurahan was structural coping mechanism (see table 5-16). Among the five surveyed kelurahan, Kemijen employed the highest of structural coping mechanism, relatively, comparing to the four other kelurahan.

Table 5-17: Cross Tabulation of geographic location and type of coping mechanisms after flooding

Village	Economic		Structural		Social	
	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)
Mlatiharjo	1	13.9	7.8	6.8	3	11.7
Mlatibaru	1	18.8	5.8	13.8	5	14.7
Kemijen	1	24.7	7.8	18.7	6.8	19.6
Tambakrejo	2	17.8	3	16.7	3	16.6
Kaligawe	0	19.8	9.8	9.8	1	18.6
<u>Total</u>	<u>5</u>	<u>95</u>	<u>34.2</u>	<u>65.8</u>	<u>18.8</u>	<u>81.2</u>

After flooding, the local people living in the five surveyed kelurahan As described in table 5-17, during flooding people tend to employ a combination of structural coping mechanism and economic coping mechanisms , such as : protected their house using sandbags and still continue working. Among the five surveyed kelurahan, Tambakrejo has the lowest percentage of employing the structural coping mechanism. It is also highlighted from this result that social network in Kemijen is relatively higher comparing to the four other kelurahan.

## **5.2. Defining Predominant Type of Coping Mechanism**

The result of data observation shows that the households in the surveyed kelurahan employed more than 5 coping mechanisms in order to cope with the negative impact of flood. The varieties of coping mechanisms were employed by the community to protect their lives and properties.

Result of the analysis showed that the community from the surveyed kelurahan were employed the combination of economic, technological/structural and social coping mechanism in order to minimize the negative impacts of flood. In combination of the three types of coping mechanisms, they constructed their house using reinforced material, such as brick for its wall and tile/ceramic for its floor. For this local community, the social coping mechanism has an important role, for instance, they help each other during the house construction. The social coping mechanism employed by the local community includes cleaning the house and surroundings, looking for alternative place to move, continue patrolling the neighbourhood (ronda), helping other's community member in doing work ( gotong royong), guarding the house to ensure safety belongings, searching relief materials, eevacuating the family, especially children and elderly to the safer place, such as: factory building, kelurahan office (local building office), mosque , friend's or relative's place, evacuating the important things to the safe place, ppreparing temporary place at friend's or relative's place, preparing place for storage at the higher place, cleaning the canal surroundings the house.

During flooding the predominant coping mechanism employed by the households are continue working, do nothing, move the appliances and valuable things to the safe place, to the higher place within the house, if any, and/or at neighbours and relatives place, or the local government offices or factory buildings, and doing the ronda.

Coping mechanisms employed by the households after flooding are dominated by structural and social coping mechanism. Repairing minor damage of the appliance, repairing important damage to the house, cleaning the house and surroundings, fixing things, looking for alternative place to move, continue patrolling the neighbourhood (ronda), helping other's community member in doing work ( gotong royong) are among the predominant coping mechanism employed by the community.

### 5.3. Concluding Remarks

It is observed that there are three type of coping mechanisms employed by the surveyed households, classified into economic, technological/structural and social coping mechanisms.. Some type of economic coping mechanism identified from the field, are: saving money, storing basic food items like rice and sugar, and continue working. While type of structural coping mechanism, it can be observed during the fieldwork that local people try to construct their house using reinforced material. The family and social network is a fundamental social mechanism for reducing risk of flood. Based on field observation and data analysis on questionnaire, the local people employ social coping mechanism such as gotong royong (working together with some other community members) to clean the neighbourhood before and after the flood strikes and ronda (patrol neighbourhood). These specific traditional type of social coping mechanism are employed by the community to minimize the possible negative effects of flood. For the social point of view, by doing gotong royong and ronda, the social relationship and networking among the community member can be strengthen. The strong network and relationship among the community is an important asset to cope against flood threat.

Based on observation during the fieldwork, it can be observed that more than 50 % of interviewed households has more than one source income. According to Blaikie, et al (1994), that economic diversification, such as having more than one source of income, even having large family can be seen as part of economic coping strategy because it gives household additional labour; saving and credit schemes as well having insurance are often an important component of economic coping strategies. The result of this research shows that there is considerable evidence of a slightly correlation between the households size and the type of coping mechanism employed by the local people. It can be seen from the analysis of the result presented in table 5-5 that household which more than 3 people tend to employ technological and social coping mechanisms or combination of the two. However, there is no strong evidence supporting the assumption that the larger the household family members the higher the household's capacity to cope against flood .

There is a little evidence that the local people in the study area tend to allocate some amount of money to prepare for the flood impacts, except they allocated some amount of money to buy the reinforced material for their houses. The other economic coping mechanism included saving money to buy basic food before and during flood. However, this kind of economic activities, such as saving money, as economic coping mechanisms can rarely be found in the surveyed households, even though households have more than one source of income. Based on fieldwork observation that the economic condition of the households is not enable them to save money to prepare in case of flooding. Of 102 respondent, less than 5 % employed saving money as coping mechanism in case there is flood. The very little percentage of saving money explained that the economic condition of the households is not enable them to save money from their basic income.



## 6. Local Government Flood Management

*This chapter discusses local government policies dealing with Flood Disaster Management. The pressure and response toward floods impacts by the local government of central java will be also discussed in this section.*

### 6.1. Introduction

Flooding within the city is still a major problem for the local government of Semarang City. Many parts of Semarang, especially along the rivers and along the shore, are suffering from flooding. This problem is related to the inadequate number and quality of canals in line with land subsidence in several parts of the city, and is linked to over exploitation of ground water resources. Economically, the effect of flooding is substantial; many areas drain slowly, causing prolonged traffic jams, economic losses, and damage to infrastructure. Since flooding reduces the value of land, the urban poor tend to live where flooding is most frequent; conversely, the damaging effects of flooding are increased in areas where the urban poor live, because their population density means more waste to clog drains, and fewer incentives for community participation in efforts to maintain drainage facilities. In order to avoid the flooding, the local government have been building several canals surrounding the city and improve the function and quality of river.

Figure 6-1 illustrates the flood and landslides cycle in Indonesia.

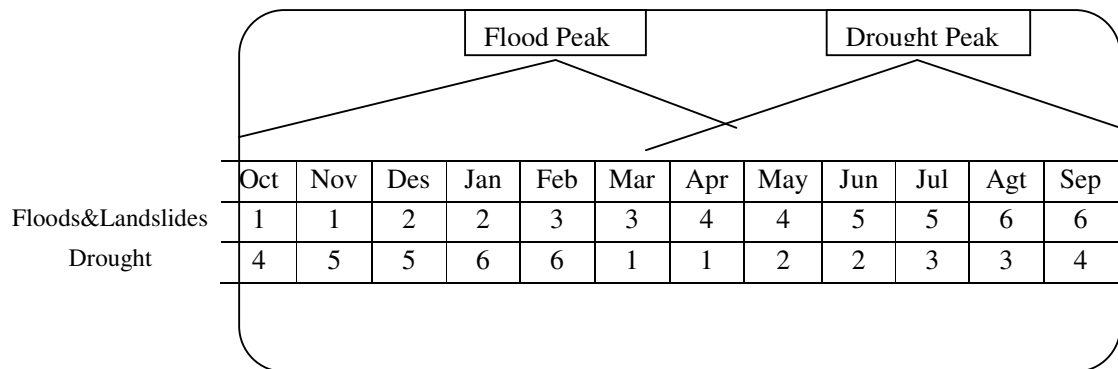


Figure 6-1 : Flood, Drought and Landslides Diagram Cycle in Indonesia (Source : PSDA )

Disaster Management Activities : (1) Preparing before the disaster, (2) Response during the disaster, (3) Recovery after the disaster, (4) Study, Monitor and Development, (5) Action Plan), and (6) Preventive and Mitigation

## 6.2. Local Authorities Disaster Management in Semarang City

The city of Semarang as the capital of Central Java Province is growing at the present to emerge as a metropolitan city. The City of Semarang is situated at a very strategic location regionally as well as sub-regionally. This city constitutes a regional transit point which makes the city of Semarang further develop continuously as service and distribution centre as well as an access gate to other regions. According to the National as well as the Central Java Spatial Master Plan, Semarang has been projected as the KEDUNGSEPUR (Kendal-Demak-Ungaran-Semarang-Purwodadi) leading city which growth and emergence is indicated by the extension of runway strip of the Ahmad Yani Airport, the opening of international direct flight from Semarang, the construction of Semarang-Jakarta “double track” railway, the development of Tanjung Emas Harbour by the inauguration of a new container terminal a few time ago, and the planned construction of JOGLOSEMAR (Yogya-Solo-Semarang) Toll Road.

The above mentioned development can be assured to constitute stimulation for economic development in the whole area of Central Java province, and other developments which finally open very large job opportunities in the future for the people of Central Java in general and the city of Semarang in particular.

Nevertheless, the City of Semarang and its surrounding suffer from flood every year and inundation in the rainy season, which obviously can hamper the above mentioned development. A severe flood happened in early 1990, due to the overflow of the Garang river and other rivers flowing through the city of Semarang, causing 47 deaths and losses amounting to Rp 8.5 billions (at that time), which until now no comprehensive solution has been made. On the other hand, Semarang has also been facing a problem to meet the demand for fresh water, especially in the dry season. Water supply to serve the need of the society managed by the PDAM (Local Government-Own Water Supply Enterprise) of the Semarang city covers only 40 % of the total demand for water supply. The use of ground water by the society and industry has been very critical, has been indicating to cause “land subsidence” in several areas of Semarang causing very serious impact (Bappenas/National Development Planning Board).

### 6.2.1. Land Use Change and Flooding

Semarang as a capital of Central Java Province is one of the biggest cities in Indonesia and has been long time suffering with flood. Human modification of catchments and floodplains has increased the flood hazard risk since settlement of the region. Expansion and intensification of urban areas increases the consequences of flooding. As much as 5,255 ha of the subdivision in Semarang are subject to potential flood hazards. There is also pressure in the coastal area to develop land that is prone to flooding.

Table 6-1: Distribution of population affected by land subsidence based on elevation (Source: Sutanta, 2002)

Elevation class	Area in years (ha)			
	2001	2010	2019	2070
< 0.0 m	-	1,270	2,302	5,597
< 0.5 m	1,260	2,270	3,985	6,697
< 1.0 m	3,559	4,881	5,676	7,746
< 2.0 m	6,674	7,201	7,525	8,949
< 5.0 m	9,352	9,610	9,790	10,400
<u>Total</u>	<u>20,845</u>	<u>25,232</u>	<u>29,278</u>	<u>39,389</u>



Land use change may also alter hydrological regimes which affect flood frequency. While there have been few studies into the impact of land use change on flooding in Semarang, it is likely that urban development cause quicker runoff during rainfall, resulting in larger and more rapid peak storm flows (Watt, 2005a, after Sutanta, 2002). It is also important to note that according to the Directorate of Environmental and Geology of Indonesia (2001), land subsidence in Semarang is extremely high, up to 12 cm/yr. The land subsidence contributes to the increase in flooding within the city of Semarang. Besides land subsidence, the issue of sea level rise is believed to have major contribution in flooding. However, this issue of land subsidence and sea level rise related with flood have not been incorporated in the city planning (Sutanta, 2002).

**6.2.2. Response**

In response to flood hazard in the city, the related local authorities of Semarang City has been employing some measures to mitigate the risk of flood, consisting of structural measures and non-structural measures as shown in table 6-2.

Table 6-2 : An overview of structural and non- structural flood related measures by Local Authority in Semarang City (Source : PSDA)

Structural	Extensive : Reshaping of land surface Protection from erosion Delay of runoff processes Increase of infiltration Urban work Intensive : levees, dikes, floodwalls Dams and reservoirs Flood ways and diversion work Polder and fill Drainage works
Non-structural	Regulation : Zoning Coding Flood defence : Forecasting Warning Flood proofing Evacuation Relocation Formation of task forces

**6.2.2.1. Structural Measures**

**Construction of Dikes and Embankment**

Dikes and embankments were constructed to control riverbank erosion and reduce siltation to the river. The East Banjir Kanal was constructed to help the River overflowed and to fix the river channel and prevent from siltation.

### Improvement of River Flow

The local authority of Semarang city has introduced several projects through the related and responsible institutions/agencies such as PSDA and PU to maintain the rivers within the city which suffer potential flooding. These projects range from canal and river channels cleaning up and improve waste disposal system. The problem posed by the squatters or informal settlers along the river bank does not only contribute to pollution but impedes the cleaning up of the river. The refusal of the squatters to be relocated or moved out of the area hampers the cleaning/construction works on the river channel, thus hampering the implementation of the mitigating measures ( figure 6-2).

#### 6.2.2.2. Non - Structural Measures

##### Zoning and Coding

Land use management as part of non-structural measures employs two principal options : zoning control and development/building control. Zoning control includes designing, by the responsible authority, the type of activity that can be undertaken within the flood-prone area. Most of the physical , social and economic associated with flooding , soil erosion and water pollution are attributable to inappropriate urbanization of the floodplain, unwise land use within the city, insufficient attention to drainage in urban planning and ineffective updating of existing flood water control facilities .



Figure 6-2: Clearance of informal settlement along the river bank of East Banjir Kanal by the local authority  
(Source: <http://www.semarang.go.id>, November 01, 2006)

The local authority of Semarang City has issued policies regarding the land use zoning and coding. The Local Authorities of Semarang City has been trying to control the activities within the flood-prone area by mapping the land use plan , and in corporation with other related local government institution to enforce law regarding the land use activities. This policies and map describe of what kind of activities are allowed within the flood-prone area, such as settlement , industry, and commercial area. However, the implementation of this policies is likely not as easy as it is planned.

##### Forecasting

The local city of Semarang has for a long time established and developed a system for forecast and dissemination of the prediction. The dissemination of weather forecast and prediction are accessible to the local community though tools, such as TV program and radio. The dissemination of forecast information on regular basis is very important. This information can help the local community to be well-prepared in case flooding is coming.

### Early Warning System

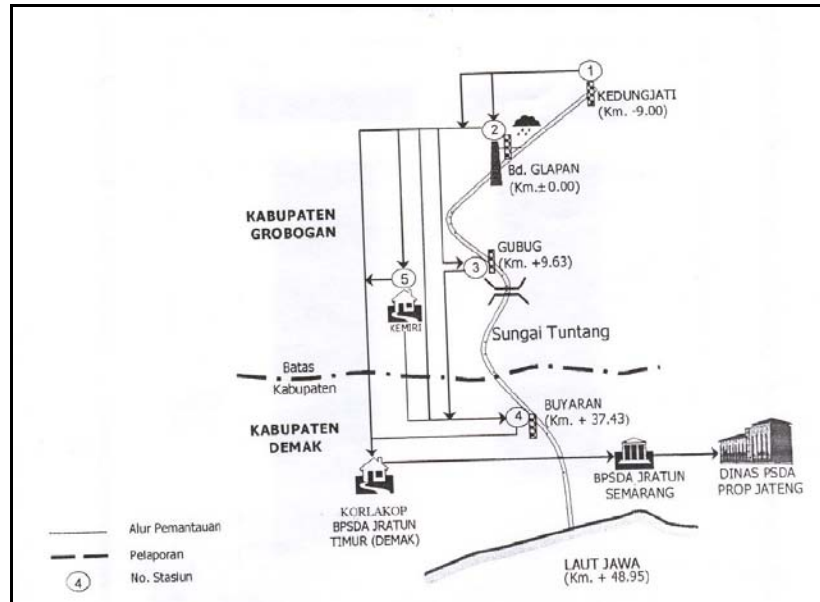


Figure 6-4: Example of Local Flood Warning System Employed by Local Government

Local authorities, presented by Water Management Board, as the local government agency which is responsible for water management, provides flood warning to the region’s urban communities living in the flood prone areas (figure 6-4). Data is collected from a network of some automatic rainfall stations, and automatic river level monitoring stations. Most sites located at strategic positions across the region, are telemetered and transmit real-time information via radio or cell phone and /or then via traditional tool, called “kentongan” to the local community.

Table 6-3: Level of alertness and public information system

Level of danger	Level of alertness	Level of river surface	Monitoring interval	Warning time interval	Warning sign
Danger I	Alert-I ready (green)	1.5-2.25 m	2 hours	6 hours	Alarm, kentongan, a whistle device, continuously every...seconds
Danger II	Alert-II preparedness (yellow)	1.25-0.75 m	1 hours	3 hours	Alarm, kentongan, a whistle device, continuously every...minutes
Danger III	Alert-III emergency (red)	0.75 – 0.50 m or when the controller building critical	continuously	0.25 hour till 1 hour	Alarm, kentongan, a whistle device, continuously every...minutes

After receiving a heavy rain warning from weather forecast, the staff monitoring the information transmitted from monitoring stations. Information collected every few minutes is compared to pre-set alarm levels. If rainfall and river levels reach the alarm point the system automatically warns the staff. Where possible, local authorities and local community are given advance warning of the situation. Incoming data is updated at least every 2 hours and flood predictions are adjusted accordingly. Table 6-3 depicts the level of alertness and public information system.

### Formation of Task Force

Table 6-4: Formation of task force and related institution (Source : BPPT)

Cause of flood	Action Plan Priority	Related Institutions/Agency
Land use change	Land use change evaluation especially in the upstream To compensate the water catchments area before it is changed Reforestation & land conservation Law enforcement	Ministry of Forestry, PSDA, Ministry of Agriculture, Related Government officers
Garbage disposal	Public awareness Giving sanction	Community, PSDA, Related Government Officers
Erosion & Sedimentation	Erosion & sedimentation studies To compensate the water catchments area Controlling water catchments area by stakeholders River normalization Law enforcement	Ministry of Forestry, Ministry of Agriculture, Ministry of Mining, PSDA, Community, Related Government officers
Informal settlement along the river	Improve the settlement area Public awareness Law enforcement Normalization	PSDA, Community, Related Government officers
Inappropriate & inefficient flood controlling system	Review and evaluation Improve water catchments area Improve river/drainage system	PSDA, BalitBang, Ministry of Forestry, Ministry of Agriculture
Rainfall	Socialization weather forecast Flood warning system Flood-prone area and landslide mapping	BMG, PSDA
Physiographic	Review and evaluation Improve water catchments area Improve system	PSDA, Balitbang, Ministry of Forestry, Ministry of Agriculture
Inadequate river and drainage capacity	Review and evaluation Improve water catchments area Improve river and drainage system	PSDA, Ministry of Forestry, Ministry of Agriculture
High tidal	River/drainage normalization Improve coastal area	PSDA, other related government institution
Land subsidence and <i>Rob</i>	Study and monitor the use of ground water Study and monitor the buildings within the affected land Study and monitor soil and geology characteristic	Ministry of Mining, PSDA, Related Government officers
Land drainage	Review & evaluation Improve water catchments area Improve river/drainage system	Ministry of Forestry, PSDA, Balitbang, Ministry of Agriculture
Dams and water building	Review & evaluation Improve building system	PSDA, Ministry of Agriculture
Flood building damage controller	Review & evaluation Improve building system	PSDA, Ministry of Agriculture

The local authority of Semarang has organized task forces to deal with flood risk within the city. The tasks of the related institutions/agencies include the cause of flood and types of activities which should be taken as a priority ( table 6-4).

However, the implementations of those tasks as mention in table 6-4 are likely not as easy as it is planned. The action plan and implementation to deal with land use change, for instance, which are consist of land use change evaluation in the upstream and law enforcement, are likely to face problems , especially because this action deals with socio-economic aspect of people. As the growing population demands the new land for housing, while the land existence is fix, the land use change within the city is inevitably. The Ministry of Forestry and Agriculture and other related institutions in the Semarang City have long time been trying to improve the water catchments area by doing reforestation and land conservation within the upstream area of Ungaran. However, these effort are likely not sufficient enough to impedes the land use change, which at the long run, will contribute to the increasing of flood impacts . There will be more efforts that include all stakeholders can be considered into the actions.

Garbage disposal and informal settlement have a long time been recognized as one of factors that causes flooding within the Semarang City. This condition can not easily be solved, because this involves socio-economic of the community, and need the actively involvements of the related community. Based on personal observation during the field work, the local community have negative habit to dispose their household garbage unwisely. However, there is no sufficient evidence to blame this condition on the local community. The local authorities may also have contribution to this condition. Hence, the public awareness action should be also incorporated the building of sufficient garbage disposal within the city and give proper sanctions for those who violate the law.

The existence of informal settlement within the city, especially along the river bank, does not only contribute to pollution but impedes the cleaning the up the river. The refusal of the squatters to move out of the area, on the name of economic reasons, hampers the implementation of mitigating the flood impacts. However, the law enforcement action by clearance of informal settlement along the river bank is not sufficient to solve this problem (see figure 6-3). This action requires the active cooperation not only from the related local authorities but also the affected community.

The problems in Semarang City related to floods is very complex and needs the active cooperation from all stakeholders, that consists of not only related local government organizations, but also the affected community.

### **6.3. Concluding Remarks**

A primary goal of the urban flood management is to have a unified and comprehensive conceptual program from drainage and flood control, in order to mitigate future flood damages while systematically reducing annual flood damages. Above all, the heart of master planning lies the identification of problems, opportunities and constraints, the setting of goals and objectives, the establishment of policies and priorities that govern overall effort, and finally, the development of criteria and standards for evaluating system's performance under future development scenarios (Andjelkovic, 2001). As a waterfront city, problems relating to floods in city of Semarang has existed

a long time. Flooding has been associated with city of Semarang as old as the city of Semarang itself. Urban settlement is growing so fast. This condition leads to much bigger population under the vulnerable condition to coastal disaster, including flood.

Settlement of the surface level and rise of sea level as well as land subsidence are believed as the major drivers for the flooding problem in the city of Semarang.

The local government of city of Semarang has issued and established policies and measures, structural and non-structural to address the problems related to flooding and reduce the negative impact of flooding. In fact, the Local Government of Semarang City is aware that the best answer to flood management lies in an integrated approach and joint actions that needs involvement all related stakeholders: the community and related local government institutions. To address the issue, the local authorities of Semarang has organized task forces to deal with flood risk within the city, consisting of related institutions and some other stakeholders. The integration actions and task forces start with an understanding about the processes and cause of the problem and the possible related institutions and stakeholders that can join and vulnerability related to the people who might be affected in the process.

The design and implementation of disaster management strategies at local level is understood to be a complex task, since they have to cope with the high diversity of stakeholders. These stakeholders show different perception and different relationships to flood hazards, and reflect different socio-economic background. Therefore, the implementation of public participation into flood disaster mitigation decision-making processes may help local authorities to develop mitigation strategies that will both fit into the local context and answer the social expectation of differing population subgroups as regards disaster mitigation.

Many efforts have been made by the Local Government of Semarang City in order to deal and to minimize the negative impact of frequent flood in this area, consisting of structural and non-structural measures. And it is believed that joint use of non-structural measures and structural is the best alternative of coping with flood. Unfortunately, those efforts have not sufficient enough to overcome problems caused by frequent floods in this city. The community have been still suffering from frequent flood.

## 7. Conclusion and Recommendations

*This chapter describes the conclusion about the finding of this research and the methodology used for this research. This chapter concludes the discussion from chapter 1 to chapter 6, and states the main contribution of this research by relating the findings with research questions and the objectives of this research. Some recommendations on further research provides in this chapter based on the discussion and finding of this research.*

### 7.1. Conclusion and Main Findings

#### **People Perception of Flooding Risk**

This first main objectives of this research is to identify the community's coping mechanisms based on different level of flooding in the city of Semarang . In order to understand better community's coping mechanism, it is important to collect information on the way local people perceive about flood threat in their area, because the way community perceive flood has influences to the type of coping mechanism employed to deal with its negative impacts.

The level of flood depth was measured based on how many meter water entering the house. The level of flood depth were measured inside the house with reference to the plinth or ground floor. Based on the observation during the field work and analysis result of the interview of the total of 102 respondents, it can be observed that the water level during the highest flood is ranging from the lowest of 0.10 m and the highest of 2.50 m. In order to get the real flood depth in the study area, the flood depth inside the house for each household was added with height of the study area by extracting the height information from digital elevation model. The result of the extraction from the digital elevation model to the flood depth collected from the households interview shows that flood depth inside the houses varies. Based on the extraction result from the digital elevation model, the real flood depth in the study area is ranging from 1.6 meter as the lowest and 4.3 meter as the highest . While the flood duration in the study area is measured in days, water duration during the highest flood is ranging between < 1 day as the shortest and >7 days as the longest. The highest percentage of water duration in the study area is between 3 – 7 days. People in the study area of Semarang city have been living with flood for years. Based on discussion in chapter 4.4, more than 50 % of respondents perceived flood in their areas as nuisances. The negative impact of flood in the surveyed kelurahan seen to have damaged properties of the people , rather than directly threaten their lives.

#### **Community's Coping Strategies and Household's Coping Strategies**

As located in the flood- prone area, people do aware and have tried to protect and cope with flood effects. Based on personal observation during the fieldwork and analysis of the data, there are three main types of coping mechanism employed by the local people to deal with the negative impact of flood, as follows : economic, technological/structural and social coping mechanisms. The definition of economic coping mechanism in the study area refers to the economic activities and diversification, including those strategies of the community linked to materials goods and resources, for instance, having more than one source of income, can be seen as an important component of economic coping strategies. The type of technological/structural coping mechanism in this research refers to the

structural activities employed by households living the flood-prone area to cope with flood losses or damages. The structural activities identified in the study area, such as the way people construct their house and type of materials used for their construction to minimize the flood losses and damage. The social/organizational coping mechanisms are those activities and or social relationship and network among the community and local government that can help people to minimize the flood losses and damage.

Based on the observation, people constructed their house with reinforced material and some houses with second floor to protect their lives and properties against flood. This research also highlighted, that among the other coping strategies, the solidarity among the community is still high. This value of solidarity shown in ronda and gotong royong behaviour, obviously can help during the flood event.

For instance, people do gotong royong cleaning the canal and the surrounding as anticipating before flooding to minimize the effect of flood. This type of social coping mechanism is easily to be found in the study area. It is also can be observed from the personal interview during the fieldwork that people have learned when unfavourable weather condition, they will prepare and try to move their valuable belongings to the safer place such as to the higher place of their house if any, or to their neighbours or relative's place. As places to evacuate, in a case of flood, besides relatives and neighbourhood's place, the community used also local government building such as mosques, kelurahan and also factory buildings.

### **Influencing Factors The Selection of Coping Strategies**

Based on personal observation during the fieldwork and analysis of the data, the perception implies how the people view the impact of the flooding based on their own experiences and these perception influence the behaviour and decision they make to deal with negative flood impacts. The result of this research revealed that the type of coping mechanism employed by the households are influenced most by the magnitude of the flood and the capacity household have to deal with it. The characteristic of the flood threat in the City of Semarang is measured based on the magnitude, such as the flood depth and flood duration. The people's perception of flood magnitude lead to the attitude and behaviour of the affected people to cope with its impacts. People living in the surveyed kelurahan have been experiencing frequent flood and have learnt how to deal with it. They set up ways of coping to minimize the negative impacts of flood. Another factor influencing the type of coping mechanism of the community in the city of Semarang is the community's capacities to deal with the negative effects of flooding. The capacity of the community in this research is referring to the socioeconomic of the community. It is concluded that the higher the community's capacity the less they vulnerable against flood threat.

### **The Local Government flood strategies/policies**

One of the roles of government in formulating a flood policy is to draw attention to the hazards of life, health and property in those area where flooding has occur and will occur again. In order to deal and to minimize the negative impact of frequent flood in the City of Semarang, many efforts have been made by the Local Government of the city of Semarang, consisting of structural and non-structural measures. In related to structural and non-structural measures to minimize the negative impact of flood in the city, the Local Authority of Semarang has organized task forces involving related institution/agencies, and other stakeholders, as well as the community. Within the task forces, it is clear who in charge and what issues should be responded to, however the implementation need the



more active cooperation from each related stakeholders. And it is believed that joint use of non-structural measures and structural is the best alternative of coping with flood.

### **To what extent the coping strategies of the community can be considered in the local government regulations and policies and practice in relation to flood disaster management**

Local Government for Semarang City has come up with many efforts to deal and minimize the impacts of frequent flooding within this city. A combination use of structural and non-structural measures is found to be the best alternatives for coping with flood. Nevertheless, this efforts have not been able to sufficiently overcome the problems, and the community are continually suffering from the floods. This research revealed that cooperation between the local authorities and the affected people assumes a key role with regard to the flood hazard. However, there is a little evidence that the local government of Semarang city has been included the local knowledge of the people into their implementation. Recent days problem related to the sustainable and effective management of floods are seen to require approach which should incorporated an integrated view of strategies, policies plans, specific projects and others measures of social and institutional character. An integrated approach to the flood mitigation decision making process should provide the best response of society in flood hazard situation, therefore there is important to include the knowledge of the affected people. The integration actions should be based not only on the expert side/perception but also should include the active participation of the local community who might be affected in the process. Increase of public participation in flood management, proper development of spatial planning and river regulation by considering all pressure including the findings about the land subsidence, need for educating and training people about floods and proper reactions during flood events as well as stimulating proper preparation.

## **7.2. Conclusions Finding on the Methodology and Tools Used**

This research aims at capturing people's perception and response to different flood level. This research primary looks into the attitude and behaviours of the people, and to study what can be learnt from that for possible incorporation with the policies and regulations established by the local government of Semarang City on flood disaster management. To achieve the goals of this research, secondary and primary data were required, and methodology and tools were used.

A survey was conducted to gather information on the community and household's responses in dealing with floods. The attitude and behaviour of the community in dealing with flood were collected by doing interviews using questionnaires. The selection of the respondents from the 5 surveyed kelurahan adopted purposive multistage are sampling. This methodology of sample selection was intended to get to the desired unit of analysis.

As part of household's interviews, the sketch map based on IKONOS imagery was used to collect the people's perception on the extent of flood. The method was intended to capture the people's knowledge on mapping flood threat in their area. There were less than 50 % of the respondent give a positive response when they were asked to draw the extent of flood. There are several possible explanation for why some did participate on the mapping of flood extent and some other did not participate and . However, based on the personal observation during the interview, most of the respondents who did not participate have special reasons, such as, they do not know and do not familiar with the sketch map drawn on the IKONOS imagery. For those who participated were able to

indicate the threatened and the extent of flood, and their answers differed depending on the place of residence. At least partially, the printed IKONOS and maps reflect the perceived risk of flood. There are several method to improve the use of sketch map.

There were two tools used to visualize the data collected and data analysed. ArcGIS/Arc Map was used to visualize data spatial, and SPSS software was used to visualize the data tabular and or data graphic. Socio-economic information of the interviewed households were collected, analysed and visualized on table and/or graphic.

The spatial display and analysis tools of GIS was used simply for displaying the kinds of geographic pattern of the study area within the flood-prone area.

### **7.3. Suggestions for Future Studies**

- For further study, the factor of flood velocity should be included as a factor that is considered to have influence to the selection of type of coping mechanisms. Event though the information about the flood velocity is not easy to get, but this factor would become an important factor to describe the real magnitude for people to response with.
- Disaster preparedness and coping with disaster can only works if the two groups affected, the authorities and the affected population co-operate together. They are called on join forces and enter into a risk partnership, in order to make the most of opportunities that present themselves. Only effective co-operation will lead to development from which all those concerned, and in particular the flood-prone population, can benefit. Therefore, it is important of having workshops with many stakeholders, including the affected community in the same workshop to get the necessary understanding between and among the stakeholder

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# Appendices

**Appendix 1.** Population Density in the location of Banjir Kanal Timur (East Banjir Kanal)

Villages	Population	Area (Km <sup>2</sup> )	Population Density(Pop/Km2)
Pedurangan Kidul	9,078	1.8	5,043
Gemah	12,716	1.01	12,590
Kedungmundu	7,658	4.95	1,547
Sendangguwo	15,797	3.28	4,816
Lemper Tengah	11,729	0.7	16,756
Lemper Lor	6,166	0.33	18,685
Peterongan	7,806	0.51	15,306
Gayamsari	12,539	0.9	13,932
Pandean Lamper	16,223	0.98	16,554
Sambirejo	5,723	1.05	5,450
Sawah Besar	7,675	0.55	13,955
<b>Kaligawe</b>	<b>9,001</b>	<b>0.7</b>	<b>12,858</b>
<b>Tambakrejo</b>	<b>9,254</b>	<b>0.69</b>	<b>13,412</b>
Terboyo Kulon	475	1.81	262
Karangtempel	4,728	0.92	5,139
Rejosari	17,511	0.99	17,688
Bugangan	9,476	0.68	14,332
<b>Mlatiharjo</b>	<b>6,039</b>	<b>0.65</b>	<b>9,290</b>
<b>Mlatibaru</b>	<b>9,447</b>	<b>0.95</b>	<b>9,944</b>
<b>Kemijen</b>	<b>13,326</b>	<b>1.41</b>	<b>9,451</b>
Tanjung Mas	28,694	3.24	8,856

Source : related village offices (2006)

**Appendix 2.** Questionnaire for : Community-Based Strategies for Coping with Urban Flooding

*This information will only be used for scientific research purpose.*

Questionnaire no :            Interviewer :            Date:            Time :

Researcher : Anggraini Dewi  
 Contact : [dewi09823@itc.nl](mailto:dewi09823@itc.nl)  
 International Institute for Geo-Information Science and Earth Observation (ITC),  
 Enschede, the Netherlands

House number :  
GPS No:    Lat :            Long :  
 Name of respondent :

**Personal Profile of Respondent :**

Age : \_\_\_\_\_  
 Sex : \_\_\_\_\_  
 Education : \_\_\_\_\_  
 Year of Stay : \_\_\_\_\_  
 Job (Source of Income) : \_\_\_\_\_

**Household members :**

Name	Sex (F/M)	Age	Last Education and Current Job
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Expense per day :

- Food                            \_\_\_\_\_
- Transport                    \_\_\_\_\_
- Others                         \_\_\_\_\_

**1. General Information**

Sub-District		
Building-id		
Building size		
Plot size		
Block_id		
Building age		
Ownership	own	rent

**2. Element at Risk**

**2.1. Building (please select)**

Type	(1) Storage	(2) Shop	(3) B Hall	(4) Residential	
	(5) School	(6) Workshop	(7) Chapel	(8) Other (?)	
Floor material	(1) cement	(2) tile/ceramic	(3) soil	(4) wood	(5) other
Wall material	(1) ply wood	(2) wood	(3) bamboo	(4) brick	
	(5) RCC	(6) press cement	(7) mix	(8) zinc	
Number of floor	pillar	(1) 1	(2) 2	(3) 3	
Height of 1 <sup>st</sup> floor					(m)
Height from surface					(m)
Height from street					(m)
Roof material	(1) clay	(2) cement	(3) zinc	(4) nipah	(5) other

**2.2. Building Content**

**2.2.1. Appliances**

**2.2.2. Furniture**

Item :	Q	Value		Item :	Q	Value
TV				Carpet		
Stove				Sofa		
Refrigerator				Dinning set		
Computer				Book case		
AC				Drawers		
Radio				Chairs		
Tape stereo				Curtain		
Washing machine				Bed		
				Double bed		
				Table		

**2.3. Outside properties**

Item	Q(number)	Value
Animal		
Car		
Motorcycle		
Bicycle		
Other (please mention)		

**3. Floods**

**3.1. Flood occurrence**

What was the highest of water level (ever) ?	
How long was the area covered with water ?	
When did the maximum flood happen ?	
What was the cause of the maximum flood ?	



**3.2. Floods History**

Cause of floods	Year	Level	Duration

**4. Damages and Losses**

**4.1. Damage to building structure**

*What is the maximum damage to building structure in last 10 years ?*

Item	Depth	Damage		Item	Depth	Damage
Floor						
Wall						
Door						
Window						

**Note :** C = Collapse HC = Half Collapse NH = Nothing Happen

*How much is the cost to repair the damage ?*

Item	Depth	Damage		Item	Depth	Damage
Floor						
Wall						
Door						
Window						

**Note :** in money (Rupiahs)

**4.2. Damage to building content**

*What kind of building content have been damaged caused by flood in the last 10 years ?*

Item	Depth	Damage		Item	Depth	Damage
Appliances						
Furniture						

*How much is the cost to repair the damage ( in total )?*

Item	Depth	Damage		Item	Depth	Damage
Appliances						
Furniture						

**Note :** in money (Rupiahs)

**4.3. Damage to outside properties**

- *What kind of damage has been happened to outside properties in the last 10 years ?*

\_\_\_\_\_

- *How much is the cost to repair the damage ?*

\_\_\_\_\_

**5. Floods Coping mechanism (protection)**

5.1. What are your reasons living in this place(area) ?

Ancestral properties	<input type="checkbox"/>	Own properties	<input type="checkbox"/>	Access to education	<input type="checkbox"/>
Compatible neighborhood	<input type="checkbox"/>	Access to business centers	<input type="checkbox"/>	Cheap	<input type="checkbox"/>
Access to place of work	<input type="checkbox"/>	Others	<input type="checkbox"/>		<input type="checkbox"/>

**5.2. Have you applied any floods coping mechanism (protection) ?**

(1) Yes; (2) No. If yes, please mention.

*Economic aspects*

Before floods	During floods	After floods

*Physical aspects*

Before floods	During floods	After floods

*Social aspects*

Before floods	During floods	After floods

**5.3. Flood Impacts**

- *Have you experienced flooding problem before you move to this place ?*  
Yes / No

*If Yes, where was the former place ?* \_\_\_\_\_

- *Are you considering to move to other area to gateway from flooding ?*  
Yes / No

*If Yes, where is the place to move ?* \_\_\_\_\_

*What is the reason to move to the place ?* \_\_\_\_\_

- *How do you perceive the floods in your area ?*  
(1) Nuisance, (2) Catastrophe, (3) Others

- *What kind of protection would you like to do for your building safety against the floods ?*  
\_\_\_\_\_

- \_\_\_\_\_
- *In case of flooding, what kind of action do you do in order to reduce the damage of building contents ?* \_\_\_\_\_  
\_\_\_\_\_
  - *How long do you need to get your things away in case there is flooding (in hour )* \_\_\_\_\_
  - *Where do you place your things during the floods ?* \_\_\_\_\_  
\_\_\_\_\_
  - *Where does your family evacuate to when flooding strikes ?*  
\_\_\_\_\_
  - *Can you continue working when flooding strikes ?      Yes / No/Partly*  
*Why ?* \_\_\_\_\_  
\_\_\_\_\_

***END OF QUESTIONNAIRES***

We thank you very much for your help and kind cooperation