



"River of Life Project - Kuala Lumpur" By AECOM (2012)

# RESILIENCE: THEORY TO PRACTICE

An Assessment Framework for Flood Resilience of City  
Case Study: Kuala Lumpur, Malaysia

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## ABSTRACT

The combination of rapid urbanization and climate change are likely to result in substantially larger flood impacts compared with former flood events. These could cause a problem for traditional flood management in order to assess the potential flood impacts which have been exaggerated by interlinked political, socioeconomic and environmental changes. Furthermore, cities that depend on flood-control measures which can resist flood only up to a certain magnitude will have a problem to cope with growing flood events that are expected to increase due to extreme and unpredictable climate. In this context, the concept of resilience has gained much attention from researchers and academicians despite facing many challenges, especially in implementation and management practice. This study attempts to tackle these challenges by developing a practical framework which is based on a multidimensional strategy; context, content, and process. With the purpose of applying the theoretical framework to practical situation, then it will be implemented to assess the flood resilience city of Kuala Lumpur, Malaysia.

# Table of Contents

1	INTRODUCTION.....	1
1.1	Background.....	1
1.2	Problem Statement and Research Questions.....	2
1.3	Research Strategy.....	4
1.4	Scientific and Social Relevance.....	6
1.5	Thesis Outline.....	6
2	THEORETICAL FRAMEWORK.....	8
2.1	Urban Environments and Vulnerability.....	8
2.2	Understanding the Resilience Concept.....	9
2.2.1	Perspectives in Resilience.....	9
2.2.2	Resilient in term of Urban Environment / City.....	11
2.2.3	The Key-Dimensions of Resilience.....	11
2.3	Adaptive Governance.....	13
2.4	Institutional Capacity Building.....	14
2.5	Flood Risk Management and Resilience.....	15
2.6	Translating Resilience into Management Practice.....	17
2.6.1	The First Framework - Strategy-Based Framework for Assessing Flood Resilience of Cities	17
2.6.2	The Second Framework - Understanding Regional Resilience.....	19
2.6.3	Summary of both framework.....	21
2.7	Conceptual Framework For Assessing Flood Resilience of Cities - Kuala Lumpur.....	21
3	METHODOLOGY.....	25
3.1	Research Methodology.....	25
3.2	Research Method.....	25
3.2.1	Context.....	26
3.2.2	Content.....	26
3.2.3	Process.....	27
4	MALAYSIA’S PLANNING AND DEVELOPMENT CONTEXT.....	29
4.1	Overview of Malaysian Planning System.....	30
4.1.1	National Planning.....	30
4.1.2	State and Regional Planning.....	31
4.1.3	Local Planning.....	32
4.1.4	Publicity and Public Participation.....	33
4.2	Introduction to Study Area: Kuala Lumpur.....	34

4.2.1	The Exploding Growth and Urbanization of Kuala Lumpur .....	34
4.2.2	Flooding and Environment Sensitive Issues.....	35
4.3	UNISDR.....	37
5	MANAGING FLOOD IN MALAYSIA – KUALA LUMPUR.....	40
5.1	Context Analysis.....	41
5.1.1	Organizational Structure.....	41
5.1.2	The Establishment of Disaster Management and Relief Committee.....	43
5.1.3	Legislation .....	44
5.2	Content Analysis .....	46
5.2.1	The Structural Measures.....	46
5.2.2	The Non-Structural Measures.....	49
5.2.3	The New Urban Stormwater Management Manual (MSMA).....	51
5.2.4	Integrated River Basin Management (IRBM).....	52
5.3	Process Analysis .....	53
5.3.1	Intellectual Capital .....	53
5.3.2	Social Capital .....	53
5.3.3	Political Capital.....	55
6	REFLECTION AND RECOMMENDATIONS.....	57
6.1	Theoretical Reflection.....	57
6.2	Empirical Reflection .....	59
6.3	Recommendations .....	60
6.3.1	Institutional Policy.....	61
6.3.2	Raise Public-Private Partnership .....	61
6.3.3	Research, Education and Exchanged Knowledge.....	62
6.3.4	Public/Community Awareness, Preparedness and Participation .....	62
6.4	Suggestion for Further Research.....	63
7	REFERENCES.....	65

## List of Table

Table 1: Summarise of Flood Risk Management Strategy (Meijerink and Dicke, 2008) .....	15
Table 2: A strategy-based framework for assessing the flood resilience of cities (Restemeyer et al., 2015) .....	18
Table 3: The Conceptual Framework for Assessing Flood Resilience of City (Author, 2015).....	22
Table 4: Interview outline (Author, 2015) .....	28
Table 5: Various Types of Plan in the Malaysian Planning System .....	30
Table 6: Ten Essential Area in “Making Resilient Cities” Campaign (UNISDR, 2010) .....	38
Table 7: List of Planning Legislations Relate to Flood Management.....	44

## List of Figure

Figure 1: Research Framework (Designed by author, 2015) .....	5
Figure 2: The Ring Model of Resilience (Galderisi et al., 2010) .....	12
Figure 3: Framework for Assessing Resilience (Foster, 2007) .....	20
Figure 4: The Integrated Resources Planning and Management system in Malaysia (National Physical Plan 2, 2005).....	31
Figure 5: Location Plan and Land Use Tabulation of Kuala Lumpur (DBKL, 2000 edited by Author) .....	35
Figure 6: Major River and Flood Plain in Klang Valley (Kuala Lumpur). (DID, 2003) .....	36
Figure 7: Organizational Structures involved in Planning and Flood Management .....	42
Figure 8: Flood Mitigation Project in Klang Valley (Abdullah, 2004).....	47
Figure 9: Aerial View of Klang Gates Dam and Batu Dam (DID, 2009).....	48
Figure 10: Illustrations of The Storm water Management and Road Tunnel (SMART) (DID, 2009).....	48

## ABBREVIATION

DBKL	Kuala Lumpur City Council
DID	Department of Irrigation and Drainage of Malaysia
DMRC	Disaster Management and Relief Committee
EPU	Economic Planning Unit
IFM	Integrated Flood Management (IFM)
IRBM	Integrated River Basin Management
IWRM	Integrated Water Resources Management
JPBD	Federal Department of Town and Country Planning Peninsular Malaysia
KLFMP	Kuala Lumpur Flood Mitigation Project
KLSP	Kuala Lumpur Structure Plan
MP	5-years Malaysia Plan
MSMA	The New Urban Storm water Management Manual
NDP	National Development Policy
NDPC	National Development Planning Council
NEC	National Economic Council
NPP	National Physical Plan
NRE	Ministry of Natural Resources and Environment
NSC	National Security Council
NUP	National Urbanisation Policy
SMART	Storm water Management and Road Tunnel
SPC	State Planning Committee
UNISDR	United Nations International Strategy for Disaster Reduction
UPEN	State Economic Planning Units



# 1 INTRODUCTION

## 1.1 Background

History shows that there are numbers of natural disasters that occurred all over the world, and one of them are floods. The number of hazardous flood event has increased since the past century (White, 2008) and the observed trend is expected to rise further in the future (Restemeyer *et al.*, 2015). In 2011, Thailand was hit by one of the worst flood events in their history. More than two-thirds of the country, approximately 90 billion square kilometres of land were drowned by floodwaters (HALL, 2011). A few major towns in Central and Northern Provinces were submerged and completely paralyzed. The World Bank (2011), estimated that the flood has caused Thailand about US\$45.7 billion in economic damages and losses. Hectares of agriculture land such as rice fields were damaged, and most of the country's biggest manufacturing and industrial estates were affected and forced to close due to the flood.

Floods have caused many damages and losses especially in the high-risk areas, despite many of them being protected by extensive flood-control infrastructures, such as levees, dams, and channelization. Moreover, rapid urbanisation process has led to an increasing susceptibility towards flooding as the result of the concentration of economic and social growth in flood-prone areas. Instead of generating economic and social wealth in some place, urbanisation also led to a continuing poverty in others that will increase the vulnerability to flooding. Furthermore, climate change poses a serious threat to sustainable development and has placed many cities at risk of being flooding.

Like other Asian countries, Malaysia also experienced numbers of disastrous natural events such as floods, storms and landslides. Recently, some part of the country also experienced a small-scale earthquake. As a rapidly growing and developing country, these disasters may have caused a significant impact in Malaysia in terms of economic growth and urbanization. Based on the Malaysia experience, flooding has affected many areas and caused huge damage and losses (Chan, Zakaria, Ghani, and Lian, 1997). The flood problem has escalated over the years as the country become more developed. In the last decades, numbers of major floods were recorded in the years 1967, 1971, 1973, 1983, 1995, 2005, 2006, 2010, 2012 and 2014 (DID, 2013; and Loi, 1996). However, the severity of flood in Malaysia is considered mild compared to other countries in the region such as Thailand, Bangladesh and China. Nonetheless, the ongoing floods have resulted in the loss of billions of dollars and destruction of infrastructure and facilities. Besides that, the government has to allocate substantial funds to improve the existing drainage system and build a new infrastructure measure as one of the initiatives to prevent flood disaster (Chia, 2004).

Most of the countries especially in the developing region are heavily relied on flood control measures, even though it is criticized for harming riverine ecosystem and increasing the long-term flood risk (Burby *et al.* 2000; Liao, 2012). The traditional flood management aims to control and reduce the probability of flood event through the implementation of structural and non-structural measures. The conventional approach is doubtful and not a reliable mitigation approach in the face of climate change uncertainties. According to UNHSP (2008), due to the

high concentration of populations, infrastructure and economy, the impact of climate change may be perceived more in urban areas rather than other places.

A new mitigation strategy is needed to improve the inadequate traditional method to cope with the growing flood risk especially in the urban areas. Various strategies have been introduced, in search for more holistic and comprehensive approaches. Among these new approaches, the concept of resilience has gained increasing attention and has been considered as a promising framework that integrating both fields, environmental management and urban planning. Previously, the resilience concept was once a straightforward concept that used only in physics and engineering field, but now resilience has been recognised across multidisciplinary which interlinked ecological systems and human.

However, putting resilience into flood risk management and urban planning context need further clarification due to their complexity and interdependent system. Therefore, this study attempts to summarize and translated the resilience concept into an operational framework that can be used to assess the flood resilience of cities. Besides relying on literature and theoretical review, the study attempt to apply the conceptual framework into an empirical study (Kuala Lumpur) in order to gain some useful thought. In addition, this study also seeks to answer the critical question regarding what cities and their components should do to move towards a more resilient future state.

## 1.2 Problem Statement and Research Questions

For the past few decades, several flood events have occurred in various locations in the whole country. Floods often occurred in the urban areas and highly risk areas, such as in the river basin and coastal area. However, flood event in the rural area and upstream areas seem to increase in the past years. Every year total numbers of victims and affected area, are increasing. For instance, in December 2014, several states in East Coast of Malaysia were suffered from the worst flood in the history of the country (JPM, 2014). These flood events are expecting to increase if the responsible actors still could not find the tailor-made solution for the problems.

Malaysian urban river corridors are facing a serious threat and major physical transformations for the last decades. The uncontrolled developments and rapid urbanization aggravated by the competition between two key industry sectors, commercial base and tourism development, have increased the demand and competition for the uses of these spaces. As pointed out by Chan (1995a), flood in several cities in Malaysia, such as Kuala Lumpur and Georgetown are caused by the failure of the drainage and river system generated by the intensive development.

In addition, increasing population in the urban area from 24.4 percent in 1957 to 61.8 percent in 2000 had a significant impact on land use change and the urban landscape in Malaysia (Soo, 2006). Due to population growth, the demand for housing has increased significantly and given that there is a limited availability of lowland area, and this has become an issue for the country (Chan, 1997). To fulfil the need for development and urbanization, floodplain and upstream areas have to be exploited which will increase the vulnerability and exposure of this area and the residents who are living there to the future flood disaster.

Furthermore, climate change is another global trend perceived to have a significant impact on flood risk. Climate change is making the weather less predictable; rains and heavy storm rainfalls are unexpectedly high. Several cities in Malaysia, such as Kuala Lumpur, Pulau Pinang, Kota Bharu and Melaka, which are located in river basin area and the coastal area may be affected strongly by the increasing precipitation and sea level rising. Moreover, the natural variability of the climate system and other non-climatic risks has a higher impact on flood risk over longer-term climate trends.

Based on these emergent problems, managing floods nowadays has become multifaceted and more complex due to the endless factors that are related to each other. There is a need to find a new approach to the conventional flood management. Currently, resilience strategy has gain attention among academicians and practitioners as a promising concept for managing the flood. According to (De Bruijn and Klijn, 2001), resilience strategy focus on controlled flooding to minimise the damage, and on spatial planning that is in tune with (more or less) natural flood frequencies. Centred to the idea of resilience and flood risk management, the main objective of this study is to translate this concept into practise by establishing a practical framework which can be used for assessing the flood resilience of cities. It begins with a theoretical review on resilience concept and flood risk management, and how both could related and positioned into the spatial planning. It then offers a practical framework for assessing the flood resilience of city through case study analysis, namely Kuala Lumpur in Malaysia. To reach the objectives formulated above, a series of questions are used to guide the research:

*How resilience concept and flood risk management can be translated into an assessment framework for flood resilience of city in Kuala Lumpur?*

The main research question will be answered and supported by the following sub-questions. These answers will form the basis for the conclusion and recommendations.

- i. What is meant by resilience in the field of flood risk management and to what extent resilience is significant in urban planning environment?*
- ii. How to transform the concept of resilience into an operational framework that can be used to evaluate the flood resilience of cities?*
- iii. What constitutes the flood risk in Kuala Lumpur and how they respond in current flood management system?*
- iv. To what extent Malaysia (Kuala Lumpur) incorporated flood resilience and spatial planning in their current flood management system?*

### 1.3 Research Strategy

The study consists of two main parts, which is theoretical study and empirical study. In the theoretical part, the study aims to understand the significant of resilience concept in spatial planning context with regards to flood risk management. Besides that, throughout the literature review, a practical approach or framework to assess flood resilience city will be identified. Data for literature review are mostly attain from the literature (articles, journals, books) which is available in many sciences studying website (e.g. SAGE, SpringerLink, ScienceDirect, Taylor& Francis Online, etc).

The conceptual model (assessment framework) developed at the end of Chapter 2 is use to assess and analyse the selected case by using the empirical study. The empirical study in this study is in Kuala Lumpur, Malaysia. Kuala Lumpur is the national capital and the most inhabit city in Malaysia (JPM, 2010). Despite being the centre of national economic growth, Kuala Lumpur has experienced numbers of flood events since past few decades. Through this study, various documents including the laws, regulations, manuals and planning documents are obtained from different institutions at each of the government levels. With the document analysis, legislations and institutional structure are analysed to understand limitations of present policies/planning in coping with floods as well as the role of the key institution in practice.

The study also considers experts' perspective via numbers of an interview session with the main stakeholders. This key actor including the government officer in the related departments such as water department and physical planning department from the federal and local government. Their opinions will reveal their attitude about cooperation. Interview's data will help to confirm the judgment on paper and to learn more opinions of relevant stakeholders. Finally, the interaction between theoretical and empirical studies will contribute to giving strategic recommendations for the case as well as to reflect back to the theory.

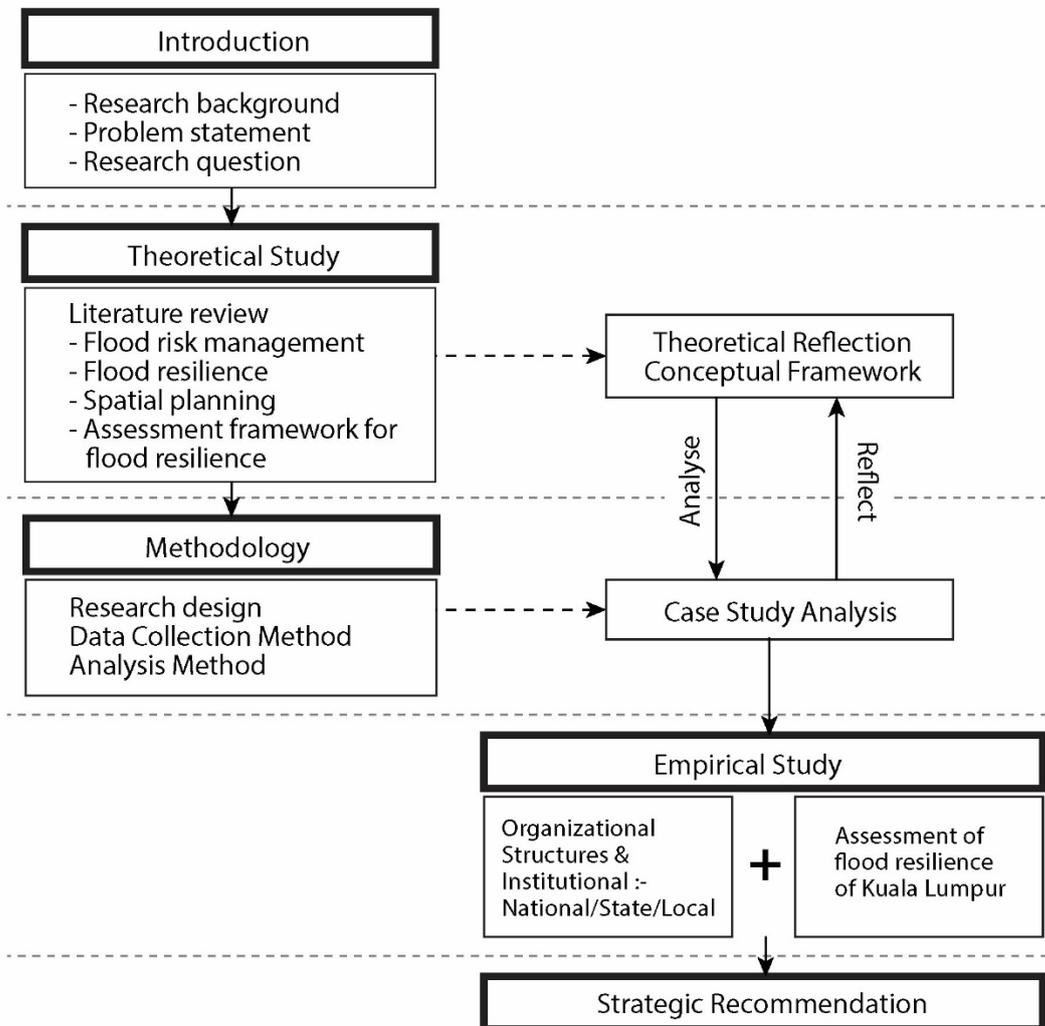


Figure 1: Research Framework (Designed by author, 2015)

#### 1.4 Scientific and Social Relevance

For the past decades, the resilience concept has often been used to define the ability of a system to withstand to any disruption, particularly in engineering and ecology field. Recently, there are a several effort to put and add resilience concept into the flood management and urban planning context. However, recent study and discussion only concentrate on the theoretical and exploring the conceptual part of flood resilience instead of try to implement them in the planning practice. It is a challenging task to translate and implement resilience concept into planning and management practice (Schelfaut *et al.*, 2011). Therefore, this study aims to provide an operational framework to evaluate the flood resilience of a city that can be used either by scientists or planner and decision-makers. Furthermore, next to enriching the current literature on flood risk management, this study could be used as a basis for following further research in related topic especially in urban flood resilience.

In addition, this study also bring a lot of benefit to Malaysia, especially for Kuala Lumpur to examine to what extent their ability and capability to deal with disasters, especially floods in more effective and sustainable way. Through the study, the performance and effectiveness of current management systems can be assessed to identify the weaknesses and point for improvement. This study also could contribute and plays a significant role in improving the current system (conventional-technical measures) towards more integrated and sustainable approach. Besides that, the study also could facilitate the development of a new perspective on water and disaster management in the future. With this study, more flood resilient cities could be developed in Malaysia. On the other note, this study also helps in promoting and raising awareness among civilians about the urban flood resilience and flood risk management.

#### 1.5 Thesis Outline

This thesis describes how cities are understood to be resilient, and able to withstand to disaster, especially flooding. By means of resilience concept, the thesis will study to what extent cities are able to manage their resources effectively in the face of disasters. The overall content of this study can be divided into six chapter. Chapter 1 introduces some general information about the research such as the background of the study, problems statement, research objective, research questions, and methodology. Issues and problems are crucial in facilitating and designing the research framework.

Chapter 2 consists of theoretical and literature review on the several theme to enrich the knowledge and understanding about the research topic. This chapter explores the resilience notion from various perspective and how it could relate to the flood risk management and urban planning. In addition, this chapter also tries to explore how these theories could be transform into a practical framework that can be use by practitioners and further researchers. In chapter 3, the strategy used in conducting the research are explained through research methodology. This chapter describes the data collection methods and analysis method that applied in the research. Furthermore, introduction and overview of the case study were also covered.

Subsequently, Chapter 4 examines the planning and development context of Malaysia and Kuala Lumpur in particular. The overview of the general planning system could help in understanding the local governance and political culture in Malaysia and Kuala Lumpur. Based on the conceptual framework, Chapter 5 will analysis the empirical problems of the case study based on three dimensions; *context*, *content* and *process*. This chapter explains about the current flood risk management in Kuala Lumpur. This chapter also compares theoretical and empirical study in Kuala Lumpur, by assessing the extent of Kuala Lumpur is resilience to flooding. The last chapter, Chapter 6 will reflect the theory and summarize the empirical study as well as highlight several strategic recommendation for the case study.

## 2 THEORETICAL FRAMEWORK

This chapter attempts to explore and understand the resilience concept and how cities can withstand and resilient to flooding. Begin with the explanation of urban environments system and focuses the discussion on urban vulnerability, this chapter explores how urbanisation process could lead to a disaster (flooding) unless there are manage and plan properly. Moreover, this chapter also looks at the resilience concept and study its relation with flood risk management and urban environment through various literature. These features and components will be addressed to gain more understanding of the notion. Besides that, this chapter also explores how the flood resilience concept could be operationalise into a practical framework that can be use in the practice field. At the end of this chapter, a practical framework will be developed to assess the flood resilience of cities.

### 2.1 Urban Environments and Vulnerability

Urban environment refers to the complexity and dynamics interaction between the human system and the environmental system (Stern et al., 1992; Naughton and Hunter, 1994; Hardoy, Mitlin and Satterthwaite, 2001). In this context, the environmental system refers to the resources from the natural environment such as forest, water body, etc. While, human system comprises of built environment and socio-economic environment, which consist of the process of turning the resources into various usable products and services. For examples, buildings, road infrastructures, water supply, economics and business activities and urban lifestyles in general.

Both, the elements and processes in the urban environment are interrelated and interdependent, and if there is a change in the certain component will lead to changes in the others. As Thomson et al. (1986) demonstrated, the interaction within the urban environment can be understand in the form of feedback loops which, every element is influencing to each other. Furthermore, the changes resulted from the interaction may be in a positive or negative form. From the positive side, it would increase the socio-economic growth and open up more opportunity to live and work in the cities and urban areas. However, as White (2008) describes the attitude and desire to pursue economics and capital in urban development has put many cities at higher exposure and vulnerable to flood risk. For instance, the increasing number of flood hazards in the city are the result of rapid urbanisation and uncontrolled developments (Pelling, 2003).

The concept of vulnerability in flood risk management is seen as a system's capacity to anticipate, cope with, resist, and recover from the impact of floods (Blaikie *et al.*, 1994; Messner and Meyer, 2005). While, Pelling (2003) divides vulnerability into three elements: exposure, resistance and resilience. First, exposure to vulnerability is dependent on physical location and the character of the built environment and natural environment (Pelling, 2003). Resistance is one of the most important components; it reflects the capacity of humans to defend themselves against the impact of a hazard as it relates to economic, psychological and physical health and their systems of maintenance (Pelling, 2003). Last but not least, resilience

is a measure of the rate of recovery from hazard stress or resistance to change, for example, planned preparation or premeditated adjustments to the hazard (Smith, 1992; Handmer, 1999; Pelling, 2003).

The concept of vulnerability is not necessarily related to physical features only such as buildings or infrastructure, but also include social, economic and institutional features. The vulnerability of affected people and infrastructure is crucial, which will determine the degree of harm and damage when flood event occur. According to Pelling (2003), some urban societies vulnerability to flooding is determined by the location of their house in a flood prone area and a few household characteristics such as low wages, a big family and various pressures in life. Furthermore, institutions and culture also have a role in constructing perceptions of vulnerability.

Helm (1998) illustrated the relation between flood risk and vulnerability by either reducing the level of exposure of the region (through improving capacities) or reducing the vulnerability (through resistance and resilience increasing measures). Hazard can be explained as a chance or probability of a certain flood event to happen at any time and place, commonly expressed as occurrences. Over the past decades increasing numbers of developments that related to human activities have certainly caused changes in the flood hazards for example occurrence frequency, duration and magnitude of high flows. While, vulnerability is defines as the degree to which a system or asset that make it susceptible to the damaging effects of a hazardous event (ISDR, 2009).

$$\text{Risk} = f(\text{hazard} \times \text{exposure} \times \text{vulnerability})$$

This variance in risk assessment approaches goes hand in hand with a shift in flood risk reduction and management strategies. The conventional measures in flood risk management can be distinguished from two perspective; narrow sense which is focused in managing an existing flood risk situation while in a wider sense, more attention given to the planning systems to reduce the flood risk (Plate, 2002). However, there is a growing awareness amongst policy makers that a solution for the flood disasters needs a change from structural solutions towards a more adaptive and holistic approach.

## 2.2 Understanding the Resilience Concept

### 2.2.1 Perspectives in Resilience

Although resilience is recently introduced into planner's dictionary, resilience already has a long history in engineering and ecology field (Holling 1973; Holling, 1996). There are different ways to understand the resilience concept, and it depends on which context are we refer. Folke (2006) acknowledged the resilience concept from three different perspectives, which is engineering resilience, ecological/ecosystem resilience and social-ecological resilience.

Resilience root and originates in most of literature from the field of physics and engineering. In this context, resilience or *resi-lire* in Latin, is describes as characteristics of a spring to withstand an external shock (Davoudi, 2012). Furthermore, engineering resilience also describes as the ability of a system to return to a steady and stable state following a disturbance (Holling, 1973 and 1986 in Davoudi, 2012; Gunderson, 2003). According to Folke (2006) and Davoudi (2012), engineering resilience behaviours focus on a single equilibrium, which emphasize on the rate at which system return to the stable state after such a disruption. Speed and the estimated amount of time taken for the system to recovery and bounces back is a crucial measure of resilience. Furthermore, engineering resilience also emphasizes in maintaining the efficiency and stability of the system when low probabilities of failures or, in the case of failure, quick recovery to the normal state.

Holling (1996), described ecological resilience as “the magnitude of the disturbance that can be absorbed before the system changes its structure”. Despite the recovery time, ecological resilience can be express by the ability of a system to absorb as much as disturbance it could take and remain in the critical condition. As Carpenter *et al.* (2001) described the ecological resilience has the additional ability to adapt and re-organization after such disturbance. The ecological resilience depends on the flexibility and adaptability capacity of the system as a whole, rather than simply strengthening the structures as in the engineering resilience. Davoudi (2012) distinguished ecological resilience and engineering resilience by the existence of multi-equilibria, and the possibility of systems to flip into new or alternative domains rather than going back to the same domains before the disturbance.

Social ecological system is considers to be complex adaptive systems as they involve multiple scales which operate through feedbacks (non-equilibrium dynamics) and deals with the uncertainty faced through learning and adaptation (Folke, 2006; Pendall et al., 2010; and Holling, 1994). Carpenter et al. (2001); and Folke (2006) interprets social-ecological resilience as; “(i) the amount of disturbance a system can absorb and still remain within the same state or domain of attraction, (ii) the degree to which the system is capable of self-organization (versus lack of organization, or organization forced by external factors), and (iii) the degree to which the system can build and increase the capacity for learning and adaptation.”

The Panarchy model (Gunderson and Holling, 2002) illustrated the multi-scale interactions that occur in social-ecological resilience which referring to the interaction in dynamics ecosystem/world where uncertainty and complexity are seen as a rule rather than the exception (Folke, 2006). From this concept, it can be understood that the disturbance within a system is also an opportunity for changes to the system, emergence of new possibilities and allows for continuous development which balances between maintaining and evolving (Folke, 2006). Thus, planners and decision makers should turn the crisis into an opportunity through imagining and alternate futures through innovative transformations.

### 2.2.2 Resilient in term of Urban Environment / City

As discussed in the previous section, urban environment or city refers to the dynamic and interdependent system between human system and the environmental system. The complexity and uncertainty that embedded within this system have led to susceptible to disasters. According to Godschalk (2003); and White (2008), due to its complexity, city is at significant risk and vulnerable to many aspects such as infrastructure, energy and buildings. Godschalk (2003) defines the resilient city as “a sustainable network of physical systems and human communities.” In the urban environment, the physical systems are the constructed and natural elements of the city, such as roads and buildings as well as the natural systems such as waterways and geography. These systems should be able to function under severe stress. Human communities are the city’s social and institutional components, including the formal and informal institution such as schools, organizations and agencies. As physical systems, human communities also need to be resilient to ensure a city’s decision-making ability. Both systems need to function wisely in the face of the disastrous event. Otherwise, a city will be very vulnerable to disasters.

With regards to the context of city, resilience in the socio-ecological system seem to link together. As discussed before, social-ecological resilience link human system and nature systems, as a separation of social and ecological systems is artificial, and these systems mutually depend on each other. Besides being persistence to any disturbance, resilience also takes the opportunities to transform the disruption into a new system by recombination of evolved structures and process. In other word, resilience provides adaptive capacity for the city system to learn, innovate and transform into new more desirable configurations despite being persist in the face of change and disturbance. According to Godschalk (2003), a resilient cities should prepare for and anticipate the impact of hazards and become stronger and resilient by learning from past catastrophic events. Moreover, urban resilient should also develop resilient communities that can manage disasters.

In conclusion, due to their complex nature, cities need to deal with many vulnerabilities. Resilience is a way for cities to address the vulnerabilities and to be able to withstand shocks as well as gradual changes without falling into chaos. Resilience has not only a physical aspect but also considers communities and institutions. After a shock, a resilient city needs to adapt and learn from its changing environment.

### 2.2.3 The Key-Dimensions of Resilience

As discussed in the previous section, the resilience concept is an evolution of a once clear physical meaning to an interdisciplinary and multi-interpretable concept. This evolution and different interpretation of resilience concept are mostly attached to the idea of complexity and interdependent system. Resilience falls within the broader context of vulnerability and adaptive capacity of systems. However, it is hard to give a precise definition and dimensions included in the resilience concept (Schelfaut et al., 2011). According to Cumming et al. (2005) in (Galderisi et al., 2010), the multidimensional character of resilience has made it difficult to

decide which variable or features may induce resilience. Furthermore, it is also difficult to clearly understand if actions aimed at reducing some aspects of vulnerability may contribute to enhancing resilience and vice versa. There are various scientific literature attempt to understand and figure which dimensions and characteristics are linked with the concept of resilience. Apart from engineering and ecology field, resilience has been widely used and interpreted in another field of studies such as sustainable development, urban environments and economics (Galderisi et al., 2010).

Galderisi et al. (2010) has developed a model that call ‘The Ring Model of Resilience’ which sorted all the key dimensions of resilience from different typologies systems (Refer to the Figure 2). The ring model provides a conceptual model that could overcome the interpretations and overlapping issues between resilience and vulnerability in the different phases of the disaster cycle (Galderisi et al., 2010). Moreover, it could lead to identify the right features and dimensions which and could help in defining the characteristics and dimensions that represent the core of the resilience itself.

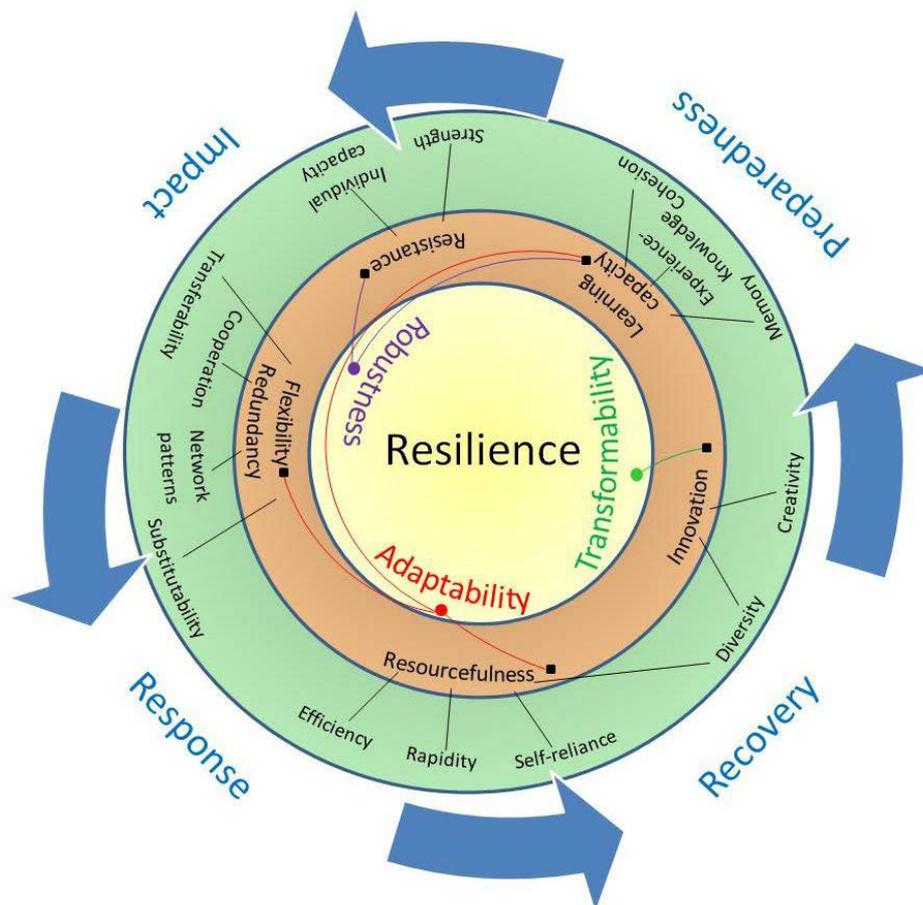


Figure 2: The Ring Model of Resilience (Galderisi et al., 2010)

The 'Ring-Modal of Resilience' consists of three major rings that build act as a foundation which are; inner-ring, intermediate-ring and outer-ring. These rings were organised based on a hierarchical structure, largely applied in planning, linking goals, objectives and actions. The most internal ring includes robustness, adaptability and transformability which are then recognized as the key features and can be interpreted as the main goals for a resilient system. They represent three distinct sides of resilience and related to different stages of the disaster cycle, such as preparedness (ex-ante), impact, response and recovery (ex-post).

The second path or the intermediate ring includes the key dimension and capacities which is need to be strengthen that will affect and enhance the performance of the three main components of resilience. For example, the learning capacity which plays an important role in the phase of preparedness and largely influences both robustness and adaptability. Finally, the outer ring includes those dimensions which are related to the intermediate dimensions that acting through specific policies in order to positively contribute to enhance resilience. For instance, the resistance of a city is linked to individual capacity and strength which respectively referred to the built environment and to the social area.

With regards to this study, resilience's city properties refer to the three main components of the ring model; robustness, adaptability and transformability.

- Robustness - the ability of city and its element (human and physical system) to withstand a given level of stress without suffering degradation or loss of function;
- Adaptability - with the capacity to adapt in face of the consequences (in terms of losses or failures) of a hazardous event; and
- Transformability - the possibility to turn the disaster into an opportunity by creating different conditions, sometimes more desirable, with respect to the pre-impact configuration

### 2.3 Adaptive Governance

As discussed in the previous section, socio-ecological with high adaptability is considered to be complex systems as they involve multiple scales and numbers of actors which have the capacity to reorganise and respond in the face of disturbances. Therefore, key components to reaching resilience in a social-ecological system are by the ability to adapt and learn. This could be achieved through the use of adaptive governance. This is because through adaptive governance, socio-ecological system would be able to self-organize and respond to the changing conditions and disturbances of its system (Folke et al., 2005). According to Folke et al. (2005), governance from resilience perspective is collective action which "can be thought of as purposeful collective action (among state, private, and civil society stakeholders) to either sustain and improve a certain regime, or to trigger a transition of the system to a more preferable regime; these are referred to as adaptive capacity and transformative capacity, respectively."

According to Folke et al. (2005), "adaptive governance is operationalized through adaptive co-management systems and that the roles of social capital, focusing on networks, leadership,

and trust". In this context, the social capital, networks and trust are the concepts which commonly used in planning context to evaluate the institutional capacity of governance. Adaptive co-management depends on the collaboration of various stakeholders which incorporates both vertical and horizontal networks.

Adaptive governance is linked to institutional capacity building or also known as institutional capital. Capacity building is often understood as the efforts to increase the knowledge and skills of organizations and individuals, their capacity for mobilization and relational resources in order to create effective institutions (Khakee, 2002). Giddens in Healey (1997), describes institutions into two components; structure and agency. Institutions identified as one of the element of the structure that shape the society to function and guide the routines of the agency. However, the relationship between structure and agency is dynamic, which both are able and constantly influence each other.

## 2.4 Institutional Capacity Building

Institutional capacity or institutional capital defines as the overall quality of the collection of resources which embodied in social relations and interactions in a certain place (Healey et al 1999 in Khakee, 2002). The complexity and interrelated links between places, for example in a city means that local action in one place may effects on the places. With regards to the flood management issues, policy in spatial planning without consideration of other place or sectors (e.g. environmental) may result in natural hazards disasters such as flooding. Healey et al., (1999); Healey (1998); and Khakee (2002) have identified three criteria in building the institutional capacity, namely; social, intellectual, and political capital.

### Intellectual Capital

According to Khakee (2002), "Intellectual capital refers to various knowledge resources built on previous experiences, scientific investigations and understanding of people, places and issues". In this context, the broad range of knowledge resources is seen as an accumulation of the knowledge that is developed through social interactions among stakeholders, which is based on experiences, local knowledge and scientific inquiries. Therefore, in order build up the intellectual capital, a diverse range of actors should be involved from diverse social and discipline backgrounds, for example, academicians, planners, water managers, local community, etc.

### Social Capital

Khakee (2002) defines social capital as "social network resources that enable collaboration between a broad range of partners in order to achieve support and enhance the capacity to coordinate decisions and actions". In other word, social capital refers to the good relationship and trust between all involved stakeholders. The networks or relationship are organized in various ways, either in between formal organizational such as government agencies (planning and water department) or informal web alliances such as community group or civic associations.

However, Davoudi and Evans, (2005) highlighted the importance of stakeholders engagement throughout the process to avoid the feeling of mutual interdependency and the sense of purpose of the members will be affected. In addition, social capital also depends upon existing power relations. An imbalance in the power relations would cause a failure in the collective action (Khakee, 2002).

### Political Capital

Khakee (2002) describes political capital as “commitment and willingness among not only politicians and government officials but also among citizen movements and stakeholder groups to shape agendas and take actions”. Healey (1997) linked the political capital to the capacity and effort of social mobilization which encompassing support by involved actors, especially within the policy and decision-makers. Political capital is crucial for building consensus in decision-making process and mobilizing resources especially in term of financial resources.

## 2.5 Flood Risk Management and Resilience

Flood risk management involves all activities that enable an area to maintain or improve the way it copes with flood waves, storm surges, peak discharges or excessive rainfall (de Bruijn and Klein, 2001). There are various numbers of measures to consider for flood risk management to cope with flood events. Meijerink and Dicke (2008) have illustrated three main strategies of flood risk management that focus on; - i) hazards reduction; ii) exposure reduction and; iii) vulnerability reduction.

Table 1: Summarise of Flood Risk Management Strategy (Meijerink and Dicke, 2008)

Flood Risk Management			
Strategies	Reduce probability of flooding. Hazard reduction ('Keep floods away from urban areas')	Reduce impact of flooding. Vulnerability reduction ('Prepare urban areas for floods')	Exposure reduction ('Keep urban areas away from floods')
Measures	Technical: dams, dykes, storm surge barriers Spatial: space for water	Early warning and evacuation Adjustments to real estate, and infrastructure	Inhibiting floodplain occupancy Relocating house/de-urbanization

The first strategy emphasises on to keep the flood away from people or urban area. The strategy is the backbone of the flood risk management in all case which mainly focus on the structural measures assigned to reduce the probability of floods (Meijerink and Dicke, 2008; Oosterberg et al., 2005). From the perspective of flood-resilient city, this strategy relates to the one of the resilience property; robustness. City's robustness refers to the extent which city can survive in the face of flood impact through the construction of structural and engineering measures such as construction of dams, barrier or river dykes (Kendrick, 1988; McMinn, Yang

and Scholz, 2010; and Tingsanchali, 2011). In other words, this strategy can be seen as a resistance strategy where emphasis is on flood defence and control. This traditional engineering solution is highly effective in some circumstances and conditions such as for a long-term solution and requires strong financial support. While on the other hand, they tend to transfer flood risk from one location only to increase it in another (World Bank, 2012).

The second strategy for flood risk management is aimed at reducing the impact of the flood. The strategy focuses to reduce vulnerability within the city by preparing the urban area or people for floods. This strategy is comparable to the resilience approach as it focuses on adaptation. Adaptability refers to the capacity of the city and its components (physical environment, institutional and social system) to adapt and make adjustments to the situation and consequences of the flood. For instance, this strategy allows for urban flood risk to take place if the people or citizens take precautions and make adjustments to their houses (Meijerink and Dicke, 2008).

Many cities and urban areas are already located and concentrated in deltas and flood-prone areas. Thus, they are at the higher risk and most vulnerable to flooding at any time. Early warning systems and evacuation systems are the examples of approaches that will ensure urban areas are better prepared for flooding. Flood risk maps and flood insurance also are logical instruments in this strategy. Flood risk maps have many functions. One of them is it could help and influence local planners in their decisions for new and future developments. Moreover, the flood risk map plays a significant role in providing information to the public on evacuation routes in case of flood and also serve as a basis for the provision of flood insurance.

Last but not least, current policy makers and water managers increasingly aimed at reducing the exposure to flooding by preventing any new development in flood-prone areas such as in river banks. In other words, this strategy imposes to keep people or urban areas away from floods (Meijerink and Dicke, 2008). This strategy is seen to be the most efficient in reducing flood risk. However, it is the hardest strategy to implement. It is almost impossible to prevent or relocate any development in floodplains and river basin areas because many cities, and urban areas are already located in this area for so many years. This type of strategy calls for strong policy formulation and spatial planning systems at every government level, but in many cases it proved to be very difficult to implement such policy (Oosterberg *et al.*, 2005).

In conclusion, there are various types of measures and strategies for flood risk management that have been used in many parts of the world. It is worthwhile to explore the benefits and costs of adopting these strategies. Flood risk management needs a more holistic and adaptive water management strategy instead of depending on the large-scale flood defence such as structural measures. An integrated risk management approach includes a various set of measures that will enhance the economic and social drivers of risk and improve the risk governance. In this study, the focus will be given to the shift in flood risk management from resistance strategy towards the resilience strategy, to reduce the vulnerability and exposure to the flood events.

## 2.6 Translating Resilience into Management Practice

Although resilience has gained much attention as a promising framework in the disaster reduction arena, it is not a direct task to translate resilience into practice. As stated by Schelfaut *et al.*, (2011); and Klein *et al.* (2003), establishing urban flood resilience is a challenging and complex task as it incorporates multi-dimensional of components, processes, and interactions that take place within and beyond a city. There are several other elements that need to be considered rather than a list of possible measures. Furthermore, resilience is difficult to measure and may vary from system to system and from one kind of disturbance to another (Schelfaut *et al.*, 2011). Currently, there are a few tools and framework that support the measurement of progress in resilience building efforts (ARUP, 2014). Through this section, two resilience framework by (Restemeyer *et al.*, 2015; and Foster, 2007) will be addressed with focus on several aspects including the interpretation of resilience concept, components and focus on the framework. At the end of this section, a conceptual framework for assessing flood resilience with regards to this study will be suggested. The framework will be applied to the case study in Kuala Lumpur, which experienced numbers of flood events in the last few decades.

### 2.6.1 The First Framework - Strategy-Based Framework for Assessing Flood Resilience of Cities

The strategy-based framework is based on the literature by Restemeyer *et al.* (2015). Resilience in this context is interpreted in three main idea, including robustness, adaptability and transformability (Restemeyer *et al.*, 2015). Robustness refers to the extent which city can withstand the impact of the flood through the construction of structural and engineering measures. Second, adaptability refers to the ability to adapt and making adjustments to the situation of being flood (Restemeyer *et al.*, 2015). Last but not least, transformability is about capacities to change and innovate to a new system after certain disturbance. Restemeyer *et al.* (2015) insisted that “transformability requires the capacity for knowledge, creativity and envisioning in order to create innovative solutions, while power, resources and public support are required for actual implementation”.

According to Restemeyer *et al.* (2015), flood resilience city requires an actively stakeholder participation and broadening collaboration between different disciplines in the different cycle of disaster (before, during and after flooding). Hence, a broad perspective of strategy-making is used to operationalise the resilience thinking. The framework addressed the flood resilience based on an integrated strategy that encompasses three dimensions: *context*, *content*, and *process*. With regards to this context, the framework has incorporates resilience strategy into each of the dimensions, which *content* refer to (“Deciding what to do”), *process* refer to (“Deciding how to do it”), and *context* refer to (“Aligning strategic decisions with internal and external conditions”).

Table 2: A strategy-based framework for assessing the flood resilience of cities (Restemeyer *et al.*, 2015)

	Robustness <i>'Reduce flood probability.'</i>	Adaptability <i>'Reduce consequences of flooding.'</i>	Transformability <i>'Foster societal change.'</i>
<b>Content</b> Measures and policy instruments	<ul style="list-style-type: none"> <li>- Technical measures (e.g. dikes, dams, barriers)</li> <li>- Spatial measures (e.g. river widening)</li> </ul>	<ul style="list-style-type: none"> <li>- Discourage vulnerable land use in flood-prone areas</li> <li>- Floodproofing existing buildings &amp; infrastructure in flood-prone areas</li> <li>- Waning &amp; evacuation schemes</li> <li>- Flood insurances/recovery funds</li> </ul>	<ul style="list-style-type: none"> <li>- Risk communication &amp; awareness raising among; - private &amp; public stakeholders</li> </ul>
<b>Context</b> Strategic issue, Institutional structure and legislation	<ul style="list-style-type: none"> <li>- Water and climate: water as a threat</li> <li>- Strong public responsibility for water management</li> <li>- Collaboration between water management &amp; spatial planning on specific project</li> </ul>	<ul style="list-style-type: none"> <li>- Land use &amp; socio-economics changes need to create synergies</li> <li>- Shared legal responsibility: public-private</li> <li>- Strong collaboration between water management, spatial planning &amp; disaster management on all project</li> </ul>	<ul style="list-style-type: none"> <li>- Societal changes need to establish water as asset</li> <li>- Informal networks fostering a new 'water culture.'</li> <li>- New interdisciplinary networks and social organizations</li> </ul>
<b>Process</b> Intellectual capital Social capital	<ul style="list-style-type: none"> <li>- Expert knowledge in engineering &amp; planning</li> <li>- Good relations among water managers &amp; spatial planners</li> </ul>	<ul style="list-style-type: none"> <li>- Expert knowledge &amp; local knowledge (vulnerability reduction &amp; adaptation options)</li> <li>- Good relations among water managers, spatial planners &amp; disaster managers; civil awareness &amp; willingness to invest in flood risk management measures</li> </ul>	<ul style="list-style-type: none"> <li>- Creativity, openness towards new knowledge, learning</li> <li>- Mutual trust between public &amp; private stakeholders &amp; social acceptance of new interdisciplinary networks</li> </ul>
Political capital	<ul style="list-style-type: none"> <li>- Strong political &amp; financial supports for bigger structures ( public funds)</li> </ul>	<ul style="list-style-type: none"> <li>- Strong political &amp; financial support for adaptation &amp; a risk-based approach</li> </ul>	<ul style="list-style-type: none"> <li>- Change agents, leadership, financial support for informal &amp; interdisciplinary networks</li> </ul>

*Context* dimensions refer to various contextual factors that influence the vulnerability of a city and play an important part to determine the resilience strategy (Restemeyer *et al.*, 2015). As Hutter (2006) described two group of contextual dimensions; external context which is consists of political, legal, economic and social conditions. While, internal context influence the development and strategy-making from within. Both dimensions have a huge influence in decision-making strategy at each of government level. For examples, the organizational and institutional structure could determine the constraints and opportunities in the planning process that may reflect the strategy-making process in flood risk management.

Second, the *content* refers to the actual measures and policy instruments that used in flood risk management. Flood management focused on flood hazard control consists of structural measures such as dykes, dams and flood channel. While, policy instruments aimed at the risk-based approaches such as risk communications and spatial planning to reduce vulnerability

and exposure to flood hazards (Restemeyer *et al.*, 2015). The *process* dimensions refer to the flood resilient city's capacities to cope with, adapt to, recover and renew after certain disturbances (Restemeyer *et al.*, 2015). The city's capacities in this context refer to organization and community that related to the area. In the *process* dimension describes how strategies are formulated and how they can be implemented. In this strategy-based framework, three main criteria are used in building city's capacity that is intellectual capital and social capital and political capital.

Based on the strategy-based framework that encompasses three dimensions (context, content and process), the framework developed by Restemeyer *et al.* (2015) perceived to be practical framework that can be used to assess to what extent a city can be considered as flood resilient. Strategy-based framework provides a holistic approach to assess the resilience of a city because it compromise different phases of flood disaster (pre-flood, during flood and post-flood) which is one of the crucial element related to resilience concept. In addition, the strategy element that consist of robustness, adaptability and transformability can help to improve our understanding of resilience notion which is previously often overshadowed by the definition from ecological aspect.

#### 2.6.2 The Second Framework - Understanding Regional Resilience

The framework is based on the literature by Foster (2007), which explored the possibility to apply resilience concept into the complex setting of metropolitan regions. The framework addressed several key aspect related to resilience, including, how might regions respond and adapt to certain stress? And how could resilience be measured? (Foster, 2007). Although the framework is more concentrated on regional resilience and might be different with the study context (city's level), there are several aspect that might be suit and beneficial to study context.

Foster (2007) described resilience into two different though connected types, which is preparation resilience and performance resilience. The first part, preparation resilience is associated with the assessment and readiness of redundancy and resourcefulness. These properties describe the capacity and ability of a system to build and achieve resilience (Foster, 2007). According to Bruneau *et al.* (2003), redundancy describes as the inclusion of extra components or substitutes which are not strictly necessary to functioning in the event of a disruption, in case of failure in other components. Resourcefulness associated with the capacity of a systems to identify problems, establish priorities and to optimize the available resources in the face of disruption (Bruneau *et al.*, 2003). In addition, learning capacity also describes as an important part in resilience preparedness.

Response and recovery phase are linked with the performance resilience which is incorporate two type of resilience properties; robustness and rapidity (Bruneau *et al.*, 2003; Foster, 2007). These properties refer to the end-state of resilience, which is the actual performances of a system in responding to such disturbance (Foster, 2007). Robustness refers to what extent a system could handle distraction without suffering degradation or loss of function. Despite being resist, robustness also related to the flexibility of a system, which is refers to the capacity to bounce back to a previous state or new form after the hazardous event.

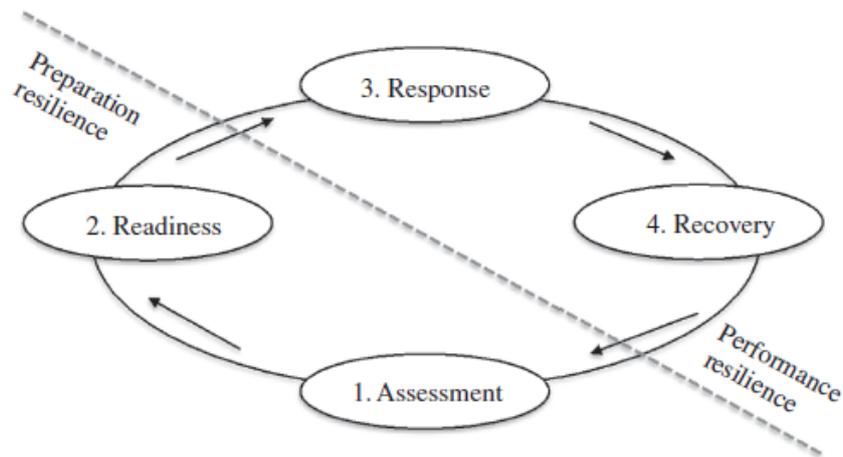


Figure 3: Framework for Assessing Resilience (Foster, 2007)

Foster (2007) insisted that a resilient regional (refer to the Foster’s context) should have the ability to anticipate, prepare for, respond to and recover from disturbance. These properties are placed in the two stages of resilience which are preparation resilience and performance resilience (Refer Figure 5). Although the framework suggests the assessment stage as a starting point, both stages can work continually and potentially coincide with each other. As stated by Foster (2007), resilience not only applies to a system as a whole, but to a system element and certain dimensions, such as infrastructure, physical environment, governance, institutional and economics.

The framework has insisted that a region or city (refer to the context of this study) could perform poorly or well in both stages, preparation and performance resilience. As Foster (2010) illustrated, even a city or region which has a systematic and high marks in preparation resilience, still has no guarantee that they will function perfectly during performance stage. For example, the performance resilience of a city may be relatively poor due to several factors beyond its control. The factors including the unexpected and unmanageable external factors such as extremely high levels of rainfall in the face of climate change. In contrast, a city might have worst preparations to face the disaster, but yet still able to have high-performance resilience due to past experience and good fortune. Nevertheless, a resilient region or city is necessary to include both perspectives, preparation (assessment and readiness) and performance (response and recovery). Only with conscious preparation and outstanding performance are regions and cities judged to achieve an ideal, intentional resilience (Foster, 2007).

### 2.6.3 Summary of both framework

In assessing the resilient of a city and the capacity to respond to a disturbance, both frameworks have identified a different set of resilience's properties used in their framework. Foster (2007) identified resilience in four properties, including, robustness, redundancy, resourcefulness and rapidity. The first and last properties, measure the end-state resilience which is refer to the actual performance of the system in responding to a disturbance. While, the other two properties, redundancy and resourcefulness, measure the capacity and potential of a system to build and achieve resilience.

On the other hand, Restemeyer et al. (2015) defines resilience in three main properties, including robustness, adaptability and transformability. Robustness refers to the ability of a system to withstand from any given disaster event. Second, the adaptability recognizes self-organization as a key aspect in response to the complex systems in the face of hazardous events. While transformability is related to the capacity of cities system to induce a change in the face of hazards. Although both frameworks determine resilience in different dimensions, study by Galderisi et al. (2010) showed that all dimensions mentioned by each framework are inter-related to one another. (Refer Galderisi et al., 2010). For example, resourcefulness (Foster, 2007) has been identified as a key property for both improving adaptability, in the response phase, and enhancing transformability, during the recovery one. Furthermore, it is clearly understood that both framework aimed at reducing some aspects of vulnerability, and contribute to enhancing the resilience.

In addition, both framework also consider a broadening of time scale and a different phase of disaster in establishing the flood-resilient city. Foster (2007) insists that only with conscious preparation (assessment and readiness) and performance (response and recovery) are cities judged to achieve an ideal, intentional resilience (Foster, 2007). Restemeyer et al. (2015) relates the three dimensions of resilience with the different phases of the disaster cycle, which can be interpreted as the main goals to achieve in order to enhance the resilience of city. Based on these two key points, this study will combine insight from both frameworks and use it as a basis for developing an assessment framework for resilience cities in Malaysia.

## 2.7 Conceptual Framework For Assessing Flood Resilience of Cities - Kuala Lumpur

The theoretical review revealed that water and flood management have become issues of major concern over the past decades. With the increasing numbers of natural disasters, especially floods, there is general concern among civilians, whether they are well protected from the impact of the disaster? And the extent to which current mitigation measures are working in the face of disruption? The current approach which is based on conventional flood management that aimed at prevention and control is recognized as inadequate and less efficient. There is a major concerned to look for a new perspective and approach to managing this issue.

Based on the combination of the findings from the literature review, the components of resilience used in this assessment framework is based on three main dimensions which is

robustness, adaptability and transformability (Restemeyer et al., 2015; Galderisi et al., 2010). Robustness refers to the physical strength to withstand a disturbance without any functional degradation. While, adaptability is considered as the capacity of a city and its components to reduce the consequences in the face of a hazardous event especially flood (Restemeyer et al., 2010). In addition, transformability relates to the recovery phase after certain disturbance. Transformability laid in the capacity and ability of the city to translate the disaster into an opportunity.

However, establishing a flood resilient city based on robustness, adaptability and transformability has becomes complex and challenging task. As mentioned early, multi-sectoral intervention with the consideration of both short and long-term planning is requires in the flood resilience. For example, besides a resilience strategy, the resilient city also requires a combination of resistance strategy which is implies in the technical measures. Using technical measures such as dikes, dams and river channelization could help a city to become robust and to withstand a flood event. Furthermore, flood resilience strategy also requires more participation and capacity building among diverse stakeholders either in public or private sectors. For instance, a strong collaboration between different field especially in spatial planning and water management is crucial in managing development in flood prone area.

Due to the complex condition, a resilient city requires more than a list of possible measures which comprise of structural or non-structural measures. As Restemeyer et al. (2015) indicates the need for a broad perspective of strategy-making in order to operationalise the resilience thinking into a practical field especially in the formulation of flood-resilient city. Following the theoretical discussion and work by Restemeyer et al. (2015); and Hutter (2006), this study offers a conceptual model based on the three-dimension strategy (context, content, process) which is tailor-made for particular context of Kuala Lumpur.

Table 3: The Conceptual Framework for Assessing Flood Resilience of City (Author, 2015)

	Robustness	Adaptability	Transformability
<b>Content</b> Measures and policy instruments	- Technical/Structural measures - Spatial measures (Non-structural)	- Land use and zoning plan (control land use in flood-prone areas) - Flood proofing - Flood forecast, early warning system & evacuation schemes - Integration spatial planning and flood risk management	- Risk communication - Raise awareness / education - Private & public partnership
<b>Context</b> Institutional structure and legislation (National and State/Local)	- Government (public) responsibility for water management - Integrate water management & spatial planning - Strong collaboration (Federal-State-Local)	- Shared legal responsibility: public-private - Strong collaboration between water management, spatial planning & disaster management on all project - Policy and legislative enforcement - Coordination between (Federal-State-Local)	- Shift from 'top-down' approach to more horizontal and 'bottom-up' approach - Societal changes need to establish water as asset - New interdisciplinary networks and social organizations

<b>Process</b>	-	Expert knowledge in engineering & planning	-	Expert knowledge & local knowledge	-	Creativity, openness towards new knowledge
Intellectual capital			-	Mix of traditional approach and modern approach	-	Learning capacity
Social capital	-	Good relations among water managers & spatial planners	-	Good relations among water managers, spatial planners & disaster managers	-	Mutual trust between public & private stakeholders & social acceptance of new interdisciplinary networks
			-	Public/community awareness & willingness to invest in flood risk management measures		
			-	Good coordination - Disaster Relief Machinery (Federal-State-Local)		
Political capital	-	Strong political & financial supports for bigger structures (public funds)	-	Strong political & financial support for adaptation & a risk-based approach	-	Leadership, financial support for informal & interdisciplinary networks

*The Content* dimension refers to the aims, targets and combination of measures and policy instruments applied to reduce flood risk. Moreover, this dimension also acknowledge the effectiveness and efficiency of strategic measures in flood management strategies. As stated by Meijerink & Dicke (2008) and Oosterberg et al. (2005), there are three different types of flood risk management measures which aiming at hazard reduction, vulnerability reduction and exposure reduction. In this context, the measures and policy instruments can be linked to the three key component in resilience which is robustness, adaptability and transformability. Robustness refers to the reduction of hazard probability by either technical for examples dikes and dams or spatial measures by create more space for water. The idea of vulnerability reduction can be seen as a means to increase the adaptability of a city. Adaptability of city can be attained by warning and evacuation schemes as well as adjustment of existing building through flood proofing. While, exposure reduction can be achieved by prohibiting any vulnerable land uses in flood prone areas. However, it requires more than just physical transformation. Transformability asks to foster the societal changes in term networks, learning capacity, collective action, and support from each of the governance structure in the face of flood event.

The *Context* dimension defines as the internal and external factors that influence the flood risk management in the study area, Kuala Lumpur. According to Hutter (2006), contextual factors may explain why certain contents or process patterns in strategy-making are chosen. With regards to this study, the contextual factor refers to the policy and decision-making perspective. Therefore, it is important to analyse the organizational structure and legislation system in three different government level in Malaysia; federal, State and Local. For instance, a well-developed institutional structure which integrates flood risk management and urban planning would be a huge factors in establishing a resilient city, because it could facilitates adapting land uses for flooding. This could also be expressed in terms of legislative system. For

example, a specific legislation or law for flood risk management has to be considered in planning process. This rules and legislation are important in the implementation process and could also emphasises on a responsibility between public and private stakeholders.

The *Process* dimension describes how strategies are formulated and how they can be implemented. According to Hutter (2006) process is about learning how to deal with diverse political interests, resource scarcity, current responsibility of actors and cultural context. Moreover, in complexity and dynamic urban environment, a strategy processes for flood risk management do not always follow a simple or systematic logic. A flood resilient city requires capacities from broad range of stakeholders including the formal or informal organizations as well as individual actors to cope with, adapt to, recover and renew itself after a hazard. With regards to this study, three criteria for assessing the institutional capacity have been identified, namely social capital, intellectual capital, and political capital (Healey et al., 1999; Healey, 1998; and Khakee (2002).

Intellectual capital refers to the range knowledge resources (Khakee, 2002). In term of flood resilient city, a pool of expertise and knowledge in engineering and urban planning is crucial in flood risk management. Besides that, openness and willingness to exchange knowledge between different discipline also important in integrating water management and planning, as well as to generate new and innovative solutions. According to Khakee (2002), social capital refers as a network and relational resources within broad range of actors. In flood resilient city, good relationship between water managers and spatial planners (in three tie of government: national, state and local) is important in order to maximise their knowledge and skills to develop a comprehensive flood management strategy. In addition, social capacity-building also asks for more participatory approach especially within the public and local community. Political capital refers to the commitment and willingness of politicians and decision-makers to implement the resilience strategy. Furthermore, political capital also refers to the capacity of and the financial resources to conduct the resilience strategy such as building dikes, install a flood forecasting system and invest in the flood awareness campaign. Last but not least, political capital also ask for strong leadership to manage the interdisciplinary networks.

### 3 METHODOLOGY

Based on the previous theoretical chapter, the following chapters are developed. In general, this chapter gives an overview of how the study was conducted. Throughout the chapter, methodology and methods used will be elaborated in detail.

#### 3.1 Research Methodology

Empirical study or case study is an important part of a research study especially to guide and provide a clear direction for researchers to produce a good research. A case study not only provides reliable information, but it may also be used “in the preliminary stages of an investigation” to generate hypotheses (Flyvbjerg, 2006). In order to gain more concrete knowledge on real-life situations about flood resilience of cities, Malaysia has been selected as a case study for this research. Therefore, current literature and concept in the previous chapter will be enriched by using this case study.

In general, with a total population of 29.33mil (DSM, 2012), Malaysia located in the South East Asia which is share a boundary with Thailand at the North part and Singapore at the Southern part of the country. In the context of the study, the assessment framework will be applied to one of the cities in Malaysia, which is Kuala Lumpur. Kuala Lumpur is a capital city for Malaysia and centre for major economic growth in this country.

Malaysia, in particular, Kuala Lumpur has been chosen as a case study because of three reasons. Firstly, Malaysia is experienced yearly major flood event as a result of extreme monsoons rains (Chan, 1995; DID, 2000; and Billa et al., 2006). Second, Kuala Lumpur has been named as a Role Model Cities as part of the United Nations-led “Making Resilient Cities” campaign launched in May 2010. In this sense, the selection of Kuala Lumpur is acceptable to fulfil the objectives of this study. Last but not least, there is still short of literature and study about resilient city especially in the context of Malaysia and this study hopefully will enrich the current literature and incorporated with other research which can be used to build more resilience cities in Malaysia.

#### 3.2 Research Method

Based on the formulated objective of the research, this section will explain and describe how this research will be carried out especially in term of data collection and analyse method. In this study, the research methodology will be conducted based on the framework proposed in the previous chapter. Based on the strategic framework conceptualised in the previous chapter, the methodology will focus on describing how to collect and analyse data according to three dimensions: *Context*, *Content* and *Process*.

With regards to the three dimensions, the general process used in this study involves the qualitative methods and techniques. The qualitative research is preferable than quantitative research is due to its capacity to capture the complex and specific situation of case study. The

study is carried out based on theoretical and literature review, policy documents, and interviews as well as analysis. The theoretical and literature was chosen using keywords that are specific to this research, such as resilience, resilient cities, flood risk management, and adaptive governance. Furthermore, through the literature review it could help to develop an overview of current and past scientific thinking about the research topic, as well as to build a strong theoretical basis for the analysis. Triangulation Methodology is used to assure the validity of research through the utilization of a variety of methods to collect data. Furthermore, this methodological triangulation could minimise the dependent and fierce impact of one source on the results.

### 3.2.1 Context

As discussed before, context dimension is related closely on how to understand the strategic issue and factors (external and internal) that effect the process of implementation in flood management and urban planning. Therefore, this study will concentrates on the current planning and institutional structures that practised in Malaysia, particular in Kuala Lumpur. In general, governance system in Malaysia was based on three-tier government that consists of federal, state and local. Therefore, it is important to understand and realize the function and scope of work for each of the government.

With regards to this context, various document and planning regulations will be scanned and analysed in order to understand the institutional arrangement and role of the manager/planner especially in water management and spatial planning. For instance, analysis of related law and regulation such as Federal Constitution 1957 and Town & Country Planning Act 1972 (Act 172) will provide a clear insight of institutional structure and physical planning in Malaysia. The legislation and institutional analysis will answer the question “to what extent flood management is consider in urban and spatial planning?”

Moreover, the document analysis as well as newspaper analysis help to identify the strategic issue which have been the factors in determining the implementation of flood risk management and urban planning in certain area or governance level. In addition to the document analysis, in depth interview with government officer from each of the governance level will help to provide insight and critical evidence about the institutional structure in the study area.

### 3.2.2 Content

This dimension encompassed the set of strategies which include measures and policy instruments taken in flood risk management. It will help to understand how the Kuala Lumpur address and respond to the flood management and urban planning issues. With regard to this context, main documents especially in the flood management will be analysed in order to understand and identify wheatear the preparations and action taken are good enough to withstand and adapt to the flood problem. However, until now, there still no specific policy

documents that focus on water resources management and flood management either at the federal government level or at the local government. In addition, this study also consider other statutory planning documents, for example, the spatial and land use plan which could help to determine the extent of environmental and flood management are considered in the development of policy and strategy at both local and national levels. The main planning documents are including the National Physical Plan, Kuala Lumpur Structure Plan 2020 and Kuala Lumpur City Plan 2020.

### 3.2.3 Process

While, the process dimension will implies an extensive understanding of who is involved and what are the responsibilities of the stakeholders to conduct the resilience strategy. Using the institutional capacity building, three main capital will be focused; intellectual, social and political. With regards to the intellectual capital, the analysis will look on to what extent knowledge and information are exchange within flood managers and spatial managers. It also focus on the openness and capacity of government to learn and adapt new knowledge regarding the resilience strategy. While, social capital refers to the collaboration and relationship between public and private actors in flood management as well as in spatial planning. The political capital discusses about the mobilisation of resilience strategy through the strong financial support and willingness among decision makers.

In order to gain insight about the institutional capacity building, in-depth interview will be conducted with several key stakeholders from different level of governments. The interview session will be carried out in the semi-structured method. Semi-structure interview asks the interviewer to follow the formal guide, but still able to follow topical trajectories in the conversation that may stray from the guide when it is appropriate (Cohen and Crabtree, 2006).

In total, there are four in-depth interviews will be conducted among the employees and officer from government agencies related to planning and flood management. The respondents will be selected based on several criteria such as agencies that they are working with and field of expertise. Two out of four respondents are working with public water authority, Department of Irrigation and Drainage of Malaysia (DID) and another two respondents are working with planning authorities in both national (Federal Department of Town and Country Planning, JPBD) and local level (Kuala Lumpur City Council) especially related to the case study. By interviewing these experts with different backgrounds, various set of opinions on the subject of flood management and urban planning are obtained. Besides that, various stakeholders could provide a different view of the coordination among institutions especially in two crucial area, which is spatial planning and flood management. Furthermore, this could provide an integral view of flooding issue in Kuala Lumpur because each of them may have different taught and specialisation about the urbanization and flood management.

Table 4: Interview outline (Author, 2015)

No	Interviewee/Respondent	Descriptions	Type of interview
A	<b>Department of Irrigation and Drainage of Malaysia (DID)</b> Officer (Flood Management Division)	<ul style="list-style-type: none"> <li>• Current flood situation and flood profile in Malaysia</li> <li>• Flood management in Malaysia</li> </ul>	Through email application on June 29 <sup>th</sup> 2015
B	<b>Kuala Lumpur City Council (DBKL)</b> Officer (Civil Engineering & Drainage Department)	<ul style="list-style-type: none"> <li>• Flood management in local context (Case study: Kuala Lumpur)</li> </ul>	Through phone on June 5 <sup>th</sup> 2015
C	<b>Kuala Lumpur City Council (DBKL)</b> Officer (Urban Planning Department)	<ul style="list-style-type: none"> <li>• Planning system in DBKL context</li> <li>• Policy/strategy in spatial planning related to flood management</li> </ul>	Through phone and email application on July 2 <sup>nd</sup> 2015
D	<b>Department of Town and Country Planning Peninsular Malaysia (JPBD)</b> Officer (Spatial Plan/National Physical Plan Divisions)	<ul style="list-style-type: none"> <li>• Planning system and spatial/physical planning in Malaysia</li> <li>• Policy/strategy in spatial planning related to flood management</li> </ul>	Through email application on June 11 <sup>th</sup> 2015

## 4 MALAYSIA'S PLANNING AND DEVELOPMENT CONTEXT

The aim of this chapter is to examine the planning process in Malaysia with the central focus in Kuala Lumpur as a study area. This chapter attempts to analyse the component within the physical planning (land use) and environmental management process that influence the fate of water and disaster management, especially flood management. It is necessary to examine how Kuala Lumpur has grown and the issues involved in its planning development system before the study can further discuss to what extent Kuala Lumpur is resilient to flood. The chapter consists of three main parts. The first part mainly discuss in the planning system and institutional structure, which are useful to understand how the planning system was practiced and implemented.

In general, planning system in Malaysia is based on three-tiered system, consists of consist of the Federal Government (National), State Governments (a region is an area situated in two or more states), and Local Governments such as city council, municipal, and district councils (EPU, 2004; Taib and Ho, 2008). Each of this government level has their jurisdiction, and it is important to understand the differences between them. Spatial and physical planning in Malaysia is regulated based on the Town and Country Planning Act of 1976 (Act 172). Enacted in 1976 under the Federal Constitution, this Act provides the legal basis for the formulation of statutory development plans and also address the role of planning authorities in Malaysia. The statutory development plan in this context, including the national physical plan, state structure plans, district local plans and action area plans. Moreover, the chapter attempts to analyse the component within the spatial planning system and environmental management process that influence the flood risk management in Malaysia.

The second part of the chapter will introduce the study area, Kuala Lumpur in more detail. This part also explores some strategic issues regarding planning development and flood risk management in Kuala Lumpur. The strategic issues include rather general contextual factors such as spatial planning, an economic and social condition that may influence the vulnerability of a city. Kuala Lumpur is the main urban and economic growth areas in the country. Therefore, it is important to understand how these external and internal factors could influence the development and flood risk management.

The final part of this chapter consist of the explanation about the "Making Cities Resilient Campaign" by The United Nations International Strategy for Disaster Reduction (UNISDR). The campaign seeks to raise awareness and urging local governments and citizens to take immediate action on reducing the urban risks. This section will elaborates how this campaign was conducted and to what extent the campaign would facilitate Kuala Lumpur to become flood-resilient city.

## 4.1 Overview of Malaysian Planning System

### 4.1.1 National Planning

As described previously, the statutory developments are produced as a basis and to guide in the development of the nation, region, state or the local area (Refer Table 6). At the national level, the Five Year Malaysia Plan and the National Physical Plan provide the necessary guidance and direction for policies and strategies for other plans at the lower levels in the planning system hierarchy, for example in state and local levels. Since 1970 onwards, there are ten Malaysia Plan (MP) and two National Physical Plan (NPP) have been prepared by the central agency of the Federal Government.

Table 5: Various Types of Plan in the Malaysian Planning System

Level of Government	Plan	Nature of Plan
Federal	5 years - Malaysia Development Plan National Physical Plan	Socio – economic
State / Regional	State Economic Development Plan State Indicative Plan Sub-regional Physical Plan State Structure Plan	Socio- economic /sectoral Socio - economic & spatial plan
Local	Local Plan Specific - area Plan	Development project identification Strategic land use plan Local land use plan Detail development plan

The Five Year Malaysia Plan (5-MP) refers to the medium-term plan to implement the Government's development programme, sets a target of macroeconomic expansion as well as size and allocation provided for public sector development programmes for a five-year period of a plan (EPU, 2004). The growing concern over environmental degradation and scarcity of natural resources has put pressure on the government to integrate the environmental policy and strategy into the national development frameworks. For instance, the Seventh Malaysia Plan (1996-2000) has taken an approach that emphasises on the integration of environmental considerations into the economic and social development process to ensure a sustainable development.

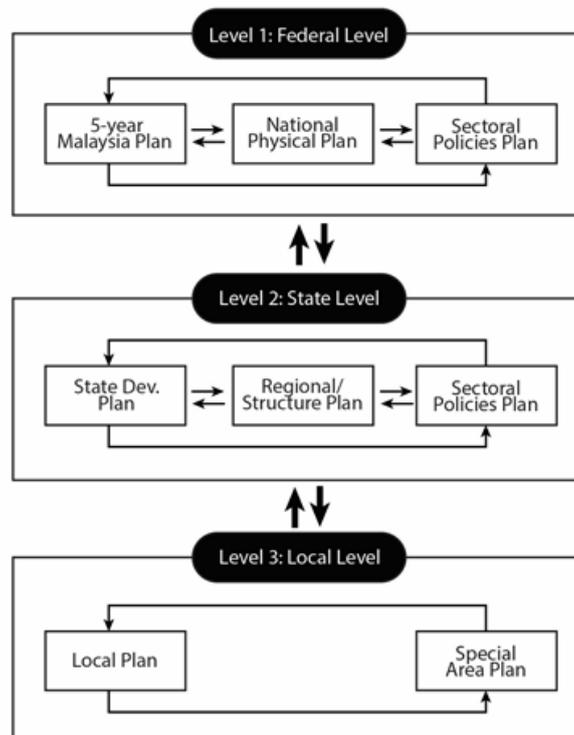


Figure 4: The Integrated Resources Planning and Management system in Malaysia (National Physical Plan 2, 2005)

The Federal agency responsible for coordinating the socio-economic planning is the Economic Planning Unit (EPU) under the Prime Minister's Department. The EPU acts as the secretariat for the National Development Planning Council (NDPC), an inter-agency committee comprising the civil service heads of all the main Ministries and chaired by the Chief Secretary to the Government. The NDPC in turns reports to the National Economic Council (NEC), a committee of the Federal cabinet under the Chairmanship of the Prime Minister.

#### 4.1.2 State and Regional Planning

In regional development, there has been a shift in the planning context from the traditional procedure of planning based on states boundaries to that based on regions (two states that share same boundaries). As outlined in the National Development Policy (NDP) and Vision 2020, the regional development strategies in Peninsular Malaysia are aimed to balance the income distribution, health facilities, utilities, recreational, housing and other socio-economic opportunities.

At the State level, the State Economic Planning Units (UPEN), under the State Secretariat Offices, handle all matters related to local development and are responsible for promoting the integration of agency proposals for development in local areas. Besides that, at this level mainly planning and development focus on the socio-economic aspects of development programmes.

The State Structure Plan is considered as important planning document which contains the broad, long-range policies related to spatial planning and socio-economic aspect. According to Section (3) and (4) of the Town and Country Planning Act, 1976, the formulation and function of Structure Plan can be summarized as:- (i) to interpret national and regional policies; (ii) to establish aims, policies and general proposals; (iii) to provide the framework for local plans; (iv) to indicate action areas; (v) to provide guidance for development control; (vi) to serve as a basis for coordinating the decisions of a wide range of government agencies; and (vii) to bring the main planning issues and decisions before the public and the State Planning Committee.

#### 4.1.3 Local Planning

Local government in Malaysia occupies the third and lowest level after federal and state governments. As stated in the Royal Commission of Inquiry Report, local government in Malaysia context refers as:

- i. Representing the third tier in federal structure;
- ii. Administered by state nominated councillors;
- iii. Geographically encompassing a portion of the country;
- iv. It is infra- sovereign e) Subordinate and subject to the control of the state (limited of financial and administration issues;
- v. It is a separate legal unit / entity from higher government or other local authorities;
- vi. Has power to sue and be sued; and
- vii. Provide obligatory and discretionary to provide goods and services

Local government in Malaysia generally responsible for multiple functions that can categorize into environment aspect, social aspect, public aspect and security aspect. In term of environment aspect, the local authority is responsible in providing and maintaining the Recreation Park, proper drainage and culvert system as well as flash flood control. However, local governments always facing problem to carry out the following functions because of limited resources in term of financial, knowledge and expertise. As a non-profit agencies, local government in Malaysia depend on the financial assistance or grants from the state and federal governments in order to provide the proper service to the local community.

Under the provision in the Federal Town and Country Planning Act, 1976, local authorities are require to prepare and produce two statutory development plan, namely: (i) a general Structure Plan, in the form of policy statement and general proposals for the areas under its jurisdiction, and (ii) a more detailed Local Plan, consists of detailed Zoning Plan or Action Area Plan for any part of its area. Both development plans are important for facilitating local authority to regulate and administer development at the local level.

As in the case of Kuala Lumpur, two Structure Plan have been prepared and implemented since 1984. Prepared under the legal basis of the Federal Territory (Planning) Act 1982 (Act 267), the Kuala Lumpur Structure Plan (KLSP 84) is the first formal documented strategic plan drafted by

City Hall of Kuala Lumpur (DBKL). A few years later, Kuala Lumpur experienced rapid urbanization and economic growth and established its status as one of the main economic hub in the Asian region (Chan, 1997). In order to ensure Kuala Lumpur continued to develop and maintain the competitiveness, the Kuala Lumpur Structure Plan 2020 (KLSP2020) was prepared and adopted in 2003. The vision for Kuala Lumpur that is consistent with the national vision is: “KUALA LUMPUR - A WORLD-CLASS CITY”, will strive to establish the highest quality living, working and business environment benchmarked against the best in the world (DBKL, 2003). With regards to the vision, KLSP2020 has underlined ten development strategies, including the environmental aspects that will guide development policies to the year 2020, as below:

- i. Enhance the working, living and business environment of the City Centre;
- ii. Designate and develop international zones;
- iii. Designate and implement Comprehensive Development Areas;
- iv. Encourage and facilitate the development of Malay Reservation Areas, traditional kampung and new villages;
- v. Initiate and implement the redevelopment of blight areas;
- vi. Ensure complete and integrated city linkages;
- vii. Provide priority and incentives to development in areas around transit terminals;
- viii. Ensure the functional distribution of centres and facilities;
- ix. Consolidate the development and enhance the environment of stable areas; and
- x. Consolidate the development and enhance the environment of major entry points.

With regards to environmental aspect, KLSP2020 has addressed existing situation and several issues faced by Kuala Lumpur such as physical environment, pollution and environmental sensitive area. As highlighted in this Structure Plan, flooding has been a regular occurrence in Kuala Lumpur whenever there is a heavy downpour, especially in the City Centre and downstream areas. The contributory factors leading to the floods were identified as the heavy floodwaters from upstream catchments of Kuala Lumpur and the inadequacy of the primary rivers to contain floodwaters due to the permanent structures within the river reserves. These frequent flash floods disrupt the City’s functioning, damage property and threaten human lives.

#### 4.1.4 Publicity and Public Participation

The publicity and public participation is a unique feature and a component of the preparation of statutory development plans in Malaysia. This process provides an opportunity and power to the local community or civilian to take part in the development planning process. Moreover, it also helps the authorities identify problems and opportunities of the present and future in the area as well as examine and understand the contents of the development plans. However, the public participation process only applies during the formation of Structure Plan, Local Plan and Special Area Plan.

Under the provision of the Town and Country Planning Act 1976 (Act 172), any new development take place within the local authority's jurisdiction area requires the publicity and public participation process. The nature and processes of public participation in Malaysia, involved:

- i. *Publicity* under Section 9(1) of the Town and Country Planning Act, 1976 which states: "When preparing a draft Structure Plan for its area and finally determining its content for submission to the Committee the local planning authority shall take such steps as will in its opinion secure: (i) that publicity is given in its area to the report of survey under Section 7 and to the matters that it proposes to include in the plan; and, (ii) that persons who may be expected to desire an opportunity of making representations to the local planning authority in respect to those matters are made aware that they are entitled to, and are given in opportunity of doing so."
- ii. *Public Involvement* (Participation) as provided under Section 9(1)(b) that any persons are entitle to make representations to the local planning authority in respect of those matters proposed to be included in the plan. It is further provided that the local planning shall consider every representation made within the prescribed period to it. This forms one of the major components prior to the approval of the draft Structure Plan.
- iii. In any case there is an objection, the act provides (as prescribed under Section 9(2), 9(3) and 10(3), that public be notified of the draft Structure Plan and given the opportunity to make objections to the plan.

## 4.2 Introduction to Study Area: Kuala Lumpur

### 4.2.1 The Exploding Growth and Urbanization of Kuala Lumpur

Kuala Lumpur has been established as a hub for economic growth and also the capital city of Malaysia. With an area about 243km<sup>2</sup> (JPM, 2010), Kuala Lumpur located at the heart of Peninsular Malaysia, within the Selangor State. However, since 1974, Kuala Lumpur was separated from Selangor and formed as a Federal Territory of Kuala Lumpur which is governed directly by the Malaysian Federal Government. With regards to geographical context, Kuala Lumpur located in a swampy and river basin area, which is surrounded by several hilly area. Due to its location in a fertile river delta, most of the early settlements located along the Klang River and majority of the early population worked in the tin mines as a major economic resource.

At present, Kuala Lumpur has grown to become a metropolitan city with a population of approximately 1.7 million people in 2014 (JPM, 2010). Formed in 1972, Kuala Lumpur City Council (DBKL) is the local planning authority for the whole area of Kuala Lumpur. DBKL is the responsible agency for public health and sanitation, waste removal and management, town planning, environmental protection and building control, social and economic development, and general maintenance functions of urban infrastructure.

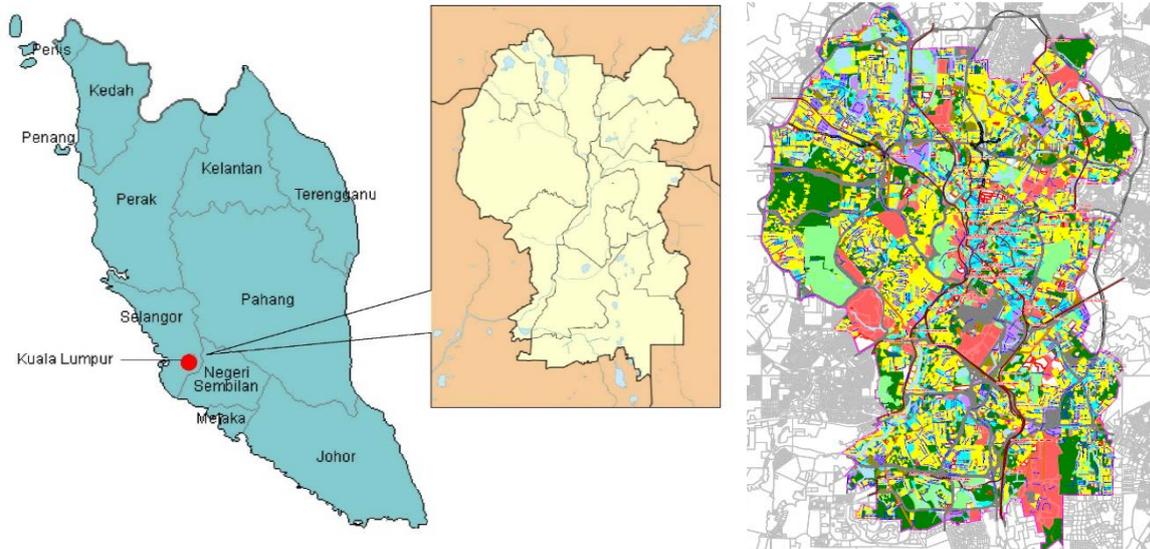


Figure 5: Location Plan and Land Use Tabulation of Kuala Lumpur (DBKL, 2000 edited by Author)

Since 1970, there are several development plan have been formed and implemented in order to ensure a comprehensive and holistic development in Kuala Lumpur city centre. Currently, the development and economic growth of Kuala Lumpur is driven by the implementation of Kuala Lumpur City Plan 2020. Based on Kuala Lumpur City Plan 2020, the main land uses in Kuala Lumpur include residential area (22.6%), commercial (5%) and Industry (2.3%). Nevertheless, an undeveloped land was estimated approximately (23%) of the total area of Kuala Lumpur. Based on the distribution of land use, the development of Kuala Lumpur is seen to rise within the next few years with focus on residential area and commercial development.

#### 4.2.2 Flooding and Environment Sensitive Issues

Geographically Kuala Lumpur is located in a valley where the initial settlement was established at the confluence of two rivers, the Kelang River and Gombak River. Over the last two decades, Kuala Lumpur experienced numbers of flood event and more likely to be a flash flood rather than ordinary flooding. According to the Department of Irrigation and Drainage (DID), flash flood events in Kuala Lumpur occurred 15 times in the year 2000, 5 times in 2001, 8 times in 2002, and 5 times in 2003, but the flash flood event that occurred on June 2003 was the worst flooding disaster since 1971 (DID, 2001,2002,2003 and 2004).

Flash floods occur in the Kuala Lumpur when there is unusually intense rainfall over a short period of time. However, combination with other factors, such as drainage characteristics and land use are contribute to the occurrence, location and intensity of the flash floods. In addition, the increase in flood events also cause by rapid urbanisation and uncontrolled land

development activities (Rahmat, 2000; Chan, 1997). Furthermore, inadequate drainage systems and river capacity due to silting from indiscriminate land clearing operations and deforestation in the upstream area significantly exacerbate the flood problems.

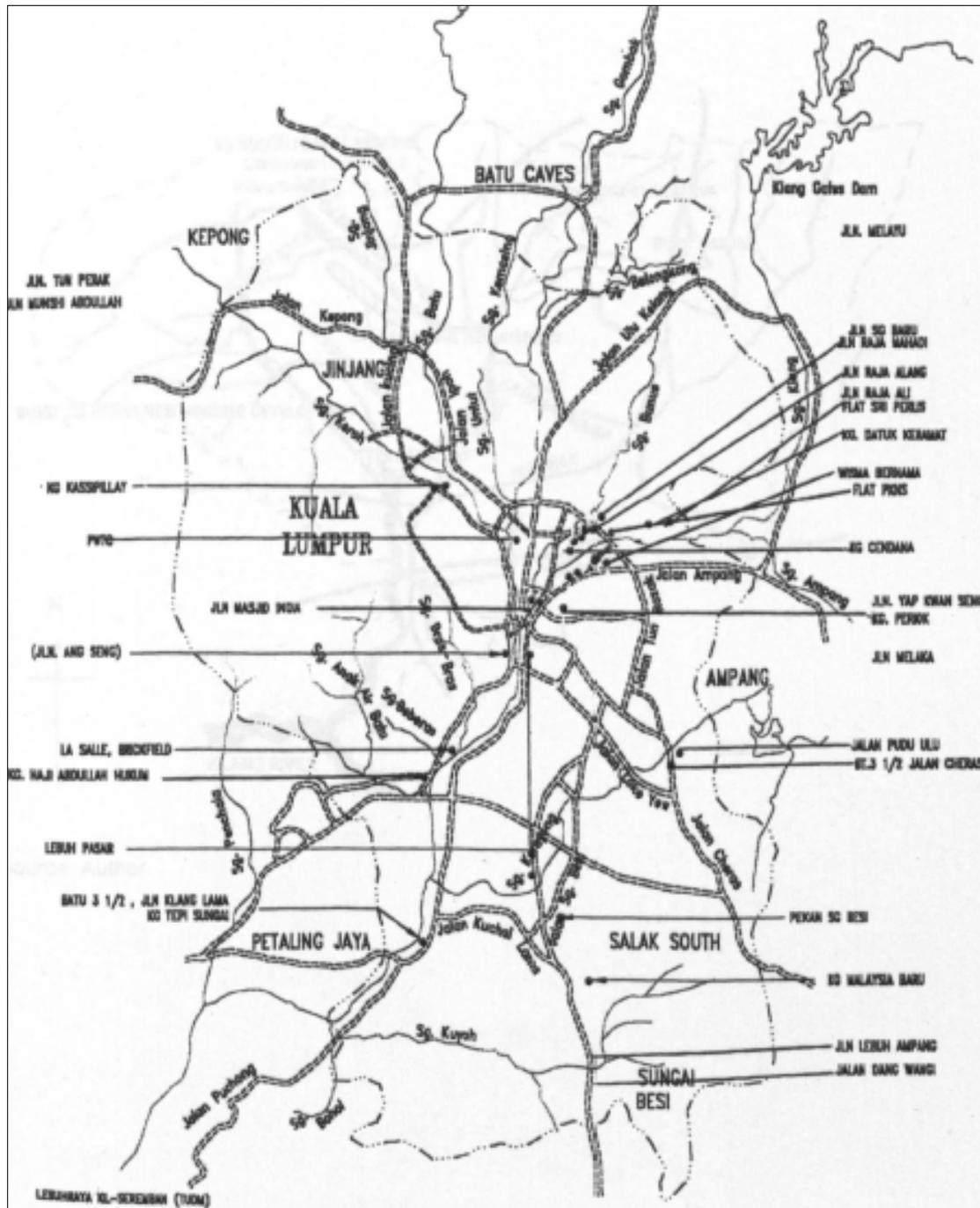


Figure 6: Major River and Flood Plain in Klang Valley (Kuala Lumpur). (DID, 2003)

### 4.3 UNISDR

Officially launched in May 2010, “Making Cities Resilient Campaign” focus to raise awareness and commitment for sustainable development practices as a means to reduce disaster risk and to increase the wellbeing and safety of citizens. The campaign was founded by The United Nations International Strategy for Disaster Reduction (UNISDR) in junction with several key partners, including the United Nations Human Settlements Programme (UN-Habitat), along with other UN organizations, city associations such as United Cities and Local Government (UCLG) and Local Governments for Sustainability and NGO networks are among others.

*“The overall goal of the campaign is to achieve resilient, sustainable urban communities, with a growing number of local governments that are taking actions to reduce the risks to disasters. A longer term objective following the campaign is to empower local governments with stronger national policies to invest in risk reduction at local level, as part of urban and regional development plans” (UNISDR, 2010)*

Following the campaign, each of the cities and local governments is urged to include disaster risk reduction as an integral component in their local development plans and planning agenda. Each of the mayor and local governments that participated in this campaign is encouraged to work towards the urban risk reduction in some different ways. Ten Essentials checklist and the building block for disaster risk reduction were developed in line with the five priorities of the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters.

Throughout the campaign, actual progress made by committing cities and local governments in each of the Ten Essential areas will be evaluate alongside the number of partnerships and alliances developed by different stakeholders at the local level as a measure for the successful of the campaign. By committing to this campaign, UNISDR and its partners encourage each of the local governments and cities to play an active role, both as advocates and drivers of disaster risk reduction implementation at different level of governance; the local and international levels. Every mayor and cities that interested to participate in the campaign will be given an opportunity either to become a “champion”, a “role model” or a participating city or local government.

The framework formed as a guideline to local governments in formulating the development strategies and policies that are more practical and effective to achieve disaster risk reduction and sustainable urbanization in their administrative area (city) respectively. The Ten Essential areas that form as core in the framework perceived to be more towards the risk reduction and management in general context without mentioning any specific hazard that intimidate the urban area. Nevertheless, focusing local government as a point of interest to promote and implement the framework is interesting aspects to be address in this campaign.

Table 6: Ten Essential Area in “Making Resilient Cities” Campaign (UNISDR, 2010)

Five priorities of the Hyogo Framework for Action 2005-2015	Ten Essential Checklist
<ul style="list-style-type: none"> <li>• Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation</li> </ul>	<ol style="list-style-type: none"> <li>1) Put in place organization and coordination to understand and reduce disaster risk, based on participation of citizen groups and civil society. Build local alliances. Ensure that all departments understand their role to disaster risk reduction and preparedness.</li> <li>2) Assign a budget for disaster risk reduction and provide incentives for homeowners, low-income families, communities, businesses and public sector to invest in reducing the risks they face.</li> </ol>
<ul style="list-style-type: none"> <li>• Identify, assess and monitor disaster risks and enhance early warning</li> </ul>	<ol style="list-style-type: none"> <li>3) Maintain up-to-date data on hazards and vulnerabilities, prepare risk assessments and use these as the basis for urban development plans and decisions. Ensure that this information and the plans for your city's resilience are readily available to the public and fully discussed with them</li> <li>4) Install early warning systems and emergency management capacities in your city and hold regular public preparedness drills.</li> </ol>
<ul style="list-style-type: none"> <li>• Use knowledge, innovation and education to build a culture of safety and resilience at all levels</li> </ul>	<ol style="list-style-type: none"> <li>5) Ensure education programmes and training on disaster risk reduction are in place in schools and local communities.</li> </ol>
<ul style="list-style-type: none"> <li>• Reduce the underlying risk factors</li> </ul>	<ol style="list-style-type: none"> <li>6) Invest in and maintain critical infrastructure that reduces risk, such as flood drainage, adjusted where needed to cope with climate change.</li> <li>7) Protect ecosystems and natural buffers to mitigate floods, storm surges and other hazards to which your city may be vulnerable. Adapt to climate change by building on good risk reduction practices</li> <li>8) Apply and enforce realistic, risk compliant building regulations and land use planning principles. Identify safe land for low-income citizens and develop upgrading of informal settlements, wherever feasible.</li> </ol>
<ul style="list-style-type: none"> <li>• Strengthen disaster preparedness for effective response at all levels</li> </ul>	<ol style="list-style-type: none"> <li>9) Assess the safety of all schools and health facilities and upgrade these as necessary.</li> <li>10) After any disaster, ensure that the needs of the survivors are placed at the centre of reconstruction with support for them and their community organizations to design and help implement responses, including rebuilding homes and livelihoods</li> </ol>

Based on the framework developed by UNISDR, this study try to address and reflect some of the key point regarding to the framework suggested in this study. As discussed in the previous chapter, this study suggested resilience notion to three main elements which is robustness, adaptability and transformability. However, UNISDR’s framework do not stated or refered resilience concept to any components or elements. Hence, it is difficult to clearly understand which variables or elements may contribute to enhancing resilience and reduce, in the meanwhile, vulnerability. In addition, this framework only focused on building resilience within the context of local government and city without taking any consideration of other factors, such as the external factors. In order to build a resilient city, we also need to consider other factors that could determine the strategy and process in implementing the resilience approach. In this context, external factors refers to the planning system and institutional structure in

Malaysia. As a country that has strong hierarchical system, it is important to understand how each of the government (federal, state and local) is function and works. We should also consider the interpretation and intervention of federal and state's government in the local level especially in term of spatial planning and flood management.

Furthermore, the framework show less effort to address how a city could develop its institutional capacity to conduct the resilience strategies. Eventhough there are several point in the 'Ten Essential Checklist" that highlighted about the coordination and build alliances among stakeholders, it is still insufficient and unclear on who supposed to involved and etc. Compared to the framework suggested in this study, three main criteria have been identified to assess the institutional capacity which is intellectual capital, social capital and political capital. In flood resilient city, it is not only focused on physical transformation and changes, it also involves the societal change in the face of event. Therefore, it is important to make sure all the involved actors know their responsibility and have the capacity to implement the resilience strategy.

Reflecting on the possible measures and policy instruments highlighted in the UNISDR's framework, it showed that the framework has pointed out the importance of combinations of measures for a resilient city. From the list of 'Ten Essential Checklist", there are various measures and policy instrument that have been highlighted such as engineering and structural measures which can be linked to the robustness attributes in resistance strategy. Besides that, there also other resilience strategy such as land use planning, risk assessment as well as the strategy and policy that foster the societal change for example education program and public empowerment.

## 5 MANAGING FLOOD IN MALAYSIA – KUALA LUMPUR

This chapter will address flood risk management of Malaysia in general and of Kuala Lumpur in particular in order to look to what extent this city is resilient to the flood disaster. The chapter consists of three main parts, which refer to the main dimension in the assessment framework – *context* dimension, *content* dimension and *process* dimension. In addition, this chapter also highlights the preparation resilience and performance resilience address in current planning and flood management system in Kuala Lumpur with regards to the three dimensions. The context dimension in this study refers to the organizational structures and legislation. The organizational structures and legislation are two most important component in the decision-making process, as well as in the developing of policy and strategy. Therefore, the organizational structure and legislation are important to analyse because both can reveal constraints and opportunities for strategy-making.

The *content* dimension in this study refers to the actual measures and policy instruments to lower the flood risk. As discussed in the theoretical chapter, flood risk management measures can be differentiated into three types, aiming at hazard reduction, vulnerability reduction or exposure reduction (Oosterberg et al., 2005; and Meijerink and Dicke, 2008).

In flood risk management, hazard reduction defines as to “keep floods away from urban areas” and achieved by the implementation of various approaches, either technical measures or spatial measures. Moreover, the vulnerability reduction aims to “prepare urban areas for floods” that depend on the city and its component to adapt to certain change and impact of a flood disaster. Last, exposure reduction translates as to “keep urban areas way from floods”. Although it is the most efficient approach to reducing flood risk, it is the hardest strategy to be implement. For instance, relocating the existing properties or prohibiting any vulnerable land use in the flood prone area are considered as a challenging task because most of the cities are already located in flood prone areas.

Moreover, this part examines the measures and policy instruments taken by Kuala Lumpur in the face of flood disasters. Flood management in Malaysia has started to obtain serious attention from the government after several big cities are frequently hit by major floods (Chan, 1997). Previously, flood management in Malaysia mainly relied on the existing system and model that has been practiced since the period of British-Colonial. Since the last few decades, the Government of Malaysia has implemented various strategies and programmes to address the problem of flooding on a nation-wide basis.

The third part of the chapter will mainly focus on the *process* dimension. The *process* dimension in this study refers to the question, how strategies are formulated and how they can be implemented (Hutter, 2006). In other word, it refers to the capacity of a city (Kuala Lumpur) and its components (institutions, organizations and citizens) to operationalise and implement the flood risk management under diverse political interests, resources scarcity, broad range of stakeholders and etc. In doing so, three major components of building capacity, namely intellectual, social and political capital will be addressed through this part.

## 5.1 Context Analysis

This section mainly elaborate on the planning legislation and the institutional and organizational structure, which are useful to understand clearly how urban planning is related to flood risk management. This section consists of two parts which is organizational structures and legislation. In addition, this section also will analysis to what extent flood risk management and urban planning are integrated into the preparation resilience and performance resilience.

### 5.1.1 Organizational Structure

Analysing the institutional and organizational structure of Malaysia in general, and Kuala Lumpur in particular, the institutional arrangement for flood risk management and urban/physical planning still seem rather separate. The responsible authority for physical planning is the Federal Department of Town and Country Planning Peninsular Malaysia (JPBD). While, the Department of Irrigation and Drainage (DID) is responsible for flood management. Moreover, both department also placed under different ministry which is, on the one hand, the DID is under the Ministry of Natural Resources and Environment (NRE). On the contrary, the JPBD was located under the supervision of Ministry of Urban Wellbeing, Housing and Local Governments.

In the early days, the DID was set up as the responsible agency for the irrigation and drainage system, especially for agricultural land. After numbers of transformations and restructuring in the past decades, the DID has acknowledged as the main authority that responsible in several field regarding to water management, including river engineering, coastal engineering, hydrology and supporting civil engineering services. Although the DID recently adopted a corporate plan strategy with well-defined functions and objectives, flood management was only a minor focus. In addition, Chan (1997) stated that the Department of Irrigation and Drainage (DID) does not have full capacity to implement and enforce management actions. DID is considers as an advisory committee and/or consulting body in the State Planning Committee. Furthermore, DID does not have an authority or legislative power to make a decision about the land development.

Besides that, the principal function of the Federal Department of Town and Country Planning is "to encourage a comprehensive, effective and efficient planning system through planning laws, planning methodology, research, procedures and standards" (JPBD, 2005). At the state level, JPBD acts as advisors to the state government on development issues such as land use development. JPBD delegates powers to local authorities to coordinate and control land use development and building construction within local authority boundaries (JPBD, 2005).

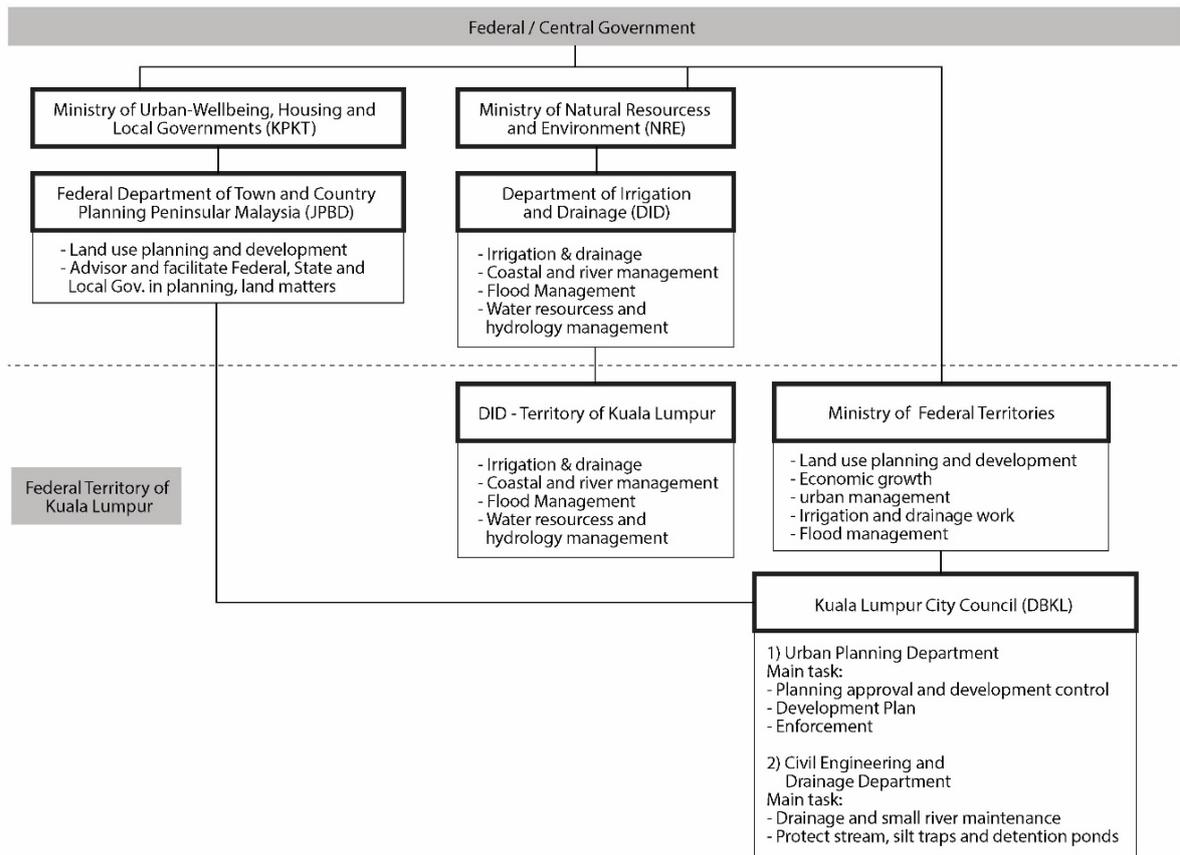


Figure 7: Organizational Structures involved in Planning and Flood Management

In addition to these two main agencies, there are two other authorities who are also responsible for urban planning and flood management in Kuala Lumpur. The Ministry of Federal Territories is also responsible for all planning and development processes, as well as flood risk management in Kuala Lumpur. Ministry of Federal Territories was established in 2003 to replace the Klang Valley Planning Secretariat, which at the time was responsible to coordinated planning and development in Klang Valley area (Kamalruddin, 2003). Besides Kuala Lumpur, Ministry of Federal Territories also responsible for all planning and development processes in the Federal Territory of Labuan as well as in the Federal Territory of Putrajaya.

Besides centrally managed as Federal Territory (the same status as Province), Kuala Lumpur has its own local government which is Kuala Lumpur City Hall (DBKL). The primary role of the Kuala Lumpur City Hall is to manage and sustain the clean appearance of the city and towns, including managing rubbish collection, building and managing public housing, operating traffic flow within the city, controlling pollution, providing infrastructure for urban society and giving planning approval for land use development. Moreover, DBKL also has an internal department specifically to oversee and manage the drainage and irrigation infrastructure.

From the analysis of the organizational structures, DID is understood as the main authority for river and water management. However, Chan (2005) identified that there is still no single agency entrusted with the function and jurisdiction to fully in charge and manage all related functions of the river in an integrated and holistic manner. Even though DID has a capacity especially in terms of expertise and knowledge, but it still does not have enough legislative power to conduct the flood management in full force. In addition, there are currently too many ministries, departments and agencies having same functions related to the river or impacting on the river. Besides DID, the Ministry of Federal Territories and Kuala Lumpur City Hall also involved in the development and management relating to the river and flood mitigation in Kuala Lumpur. As highlighted by Abdullah (2002) this situation may lead to several problems such as power of abuse, communications and double-works effort among agencies and authority.

In addition, the analysis reveals that the current organizational structures may contributes to the further problem which is caused by lack of consultation and communication between the various flood management and planning organisations. Some of the statutory bodies do not have legal obligation to consult or seek approval, except when a particular project is in the jurisdiction of another organisation (Chan, 1997). For example, since land matters are under State's jurisdiction, any state agencies can develop land without get approval or consult by DID even if the developments significantly affect river pollution and flooding downstream. This lack of consultation and communication is an additional reason for mismanagement of the flood hazard.

#### 5.1.2 The Establishment of Disaster Management and Relief Committee

To ensure an appropriate and comprehensive disaster and relief operations, government has established the Disaster Management and Relief Committee (DMRC). This committee was established with the objective to co-ordinating relief operations at the Federal, State and District levels so that citizen especially the flood victims can be support and assist in an orderly and effective manner. The flood disaster relief machinery was formed base on the National Security Council (NSC) Directive No. 20. The directive provides as a guidelines on the management of disasters, including the responsibilities and functions of the various agencies. The main functions of the Disaster Management and Relief Committee are as follows:

- i. To ensure relevant government departments are well prepared for the seasonal monsoon floods;
- ii. To prepare the public for orderly response action during a flood emergency;
- iii. To coordinate and mobilise whatever resources and logistics available from Government agencies and if necessary from the private sector.
- iv. To ensure that assistance and aid are distributed to flood victims in an orderly and effective manner; and
- v. To coordinate relief operations and evacuation plan at all levels

The members of this Committee include Government departments/agencies, search and rescue team as well as social organisations which responsible to provide shelter, rescue and food supplies in case of any disaster. At least once a year, the Committee will meet to ensure the preparation and coordination of the disaster machinery will run smoothly. At the Federal level, DMRC is responsible for the formulation of national policies and strategies regarding the preparation of various agencies that involved in handling the disaster. While, the State and District levels are responsible to implement and carry out the policies and strategies. However, Chan (1997) argued the effectiveness of this machinery since it only provides preparedness training for government officers. Although it is important to keep the officer with knowledge and skill regarding to disaster management, the public at large also needs to be informed about preparedness programmes and flood risk management especially who live in the flood-prone area. Raising awareness and keep public informed about the flood risk are the key to make the flood risk management be more effective.

Furthermore, the flood disaster machinery is closely controlled by DMRC which only work and function during the flood season or if in case of flooding. Without the regularly coordination, other agencies and departments have no coherent role, especially in the flood management aspect. As one of the interviewee revealed that there is insufficient teamwork and mutual support between organisations in relation to flood management. Most of the time, they work independently of one another.

### 5.1.3 Legislation

Although floods is a frequent event in Malaysia, there is no law or specific legislation to address it and the related issues (DID, 2009). Currently, there is only one specific law that related to the environmental aspect applied in the country. However, there are many other laws, rules and regulations that are in forced, and these can be implemented directly and indirectly to address the flood issues. Though, these law and regulations are not designated and practiced by one government department only, but it is designated to many different departments, and each of these departments has specific functions and responsibilities. Refer Table 6.

Table 7: List of Planning Legislations Relate to Flood Management

Law and Legislation	Description related to flood management
Environmental Quality Act, 1974	Flood mitigation is addressed in the Act by the requirement that EIA reports shall be submitted prior to project approval. The Local Authority will ensure flood mitigation is adequately provided in the development proposal with appropriate advice from the DID. For environmentally sensitive areas, the DOE is in the process of preparing related guidelines. When ready, the guidelines can be used by the DID for checking on flood control requirements in development project proposals.
National Land Code, 1965	Water bodies (rivers, drains, or ponds) must be provided with reserves, which should be demarcated in the proposal – for flood mitigation measures The DID as a technical adviser for Local Authority in providing the license for river mining.

The Land Conservation Act, 1960	The Act requires that all hilly areas of specific height and terrain conditions be gazetted. Farming activity need to apply for permit. DID as advisor for Land Office and DID also may impose measures in case for silt control.
The Water Act, 1920 (Revised 1989)	The Water Act has provisions for river conservancy and flood mitigation such as imposing licensing requirements for water abstraction, effluent discharge, felling of trees and building of structures.
The Drainage Works Act, 1954	Relates to designated agricultural drainage schemes. DID has long applied this Act to curb flood problems by constructing, operating and maintaining their drainage and irrigation systems including water related structures.
The Local Government Act, 1976	Provides for the rights of the State Government to administer the Local Government within their area of jurisdiction. Flood mitigation is provided by imposing and collecting the drainage contribution, which is used for maintenance of the drainage facilities (for example, widening/deepening/cleaning of drains).
The Street, Drainage and Building Act, 1974	The drainage layout of a proposed project must be designed and submitted by the Professional Engineer for approval by the Local Authority. The DID is normally consulted to review the proposed project drainage plan prior to approval. Provides for earthworks control which is normally incorporated into Earthworks Bylaws and Uniform Building By-laws (Subsets of the Act) by the Local Authority.
Town, Country and Planning Act, 1976	Mitigation of floods is provided in the Act by preventive control. For example, any proposed development by developer or in the Local Structural Plan or the National Physical Plan should include/demarcate areas for water storage, detention ponds, water bodies or wetlands.

These are the list of planning regulations that often used and also applied to address the flood management aspect. However, all of them only mention the land matters, building code, physical planning and environmental consideration. Although there is a provision that mentioned about drainage and irrigation works or preservation of water bodies such as river and drains, nonetheless there is still a lack of precise on flood risk management. It proved that there is no serious consideration of flooding in planning management or even in the planning system; if yes, these measurements are quite technical and too general.

The lack of legislative power and provision in flood management will influence and affect the implementation of flood management policy and strategy. As stated by the Deputy Secretary of National Security Council (NSC), the specific Act or law for disaster management, especially flood risk management will help the authorities (water manager) to monitor and manage any vulnerable area in more effective (Berita Harian, 2014). Moreover, the law that governing the regulation of river and flood management are not sufficiently enforced and implemented by the related agencies. As mentioned by one of interviewee from DID, the existing law is limited because they were formulated and aimed at regulating and managing single sector water use. Consequently, it has been difficult for authorities to manage and have fully control on all aspect of water use that could affect and cause flooding.

## 5.2 Content Analysis

Flooding has been a regular occurrence in both study area whenever there is a heavy downpour, especially in the city centre and downstream areas. Over the last two decades, the type of flood event experienced in Kuala Lumpur has become more likely to be a flash flood rather than ordinary flooding (Chan, 1995; Leigh and Sim, 1983). Kuala Lumpur experienced the last major flooding was on June 2007 (UNISDR, 2010). However, based on recent record, there is concern among citizen about the possibility of major flood may occur if any mitigation and preventive measures are not in placed. With regards to the case study, the government has start taking serious effort to address the flooding issue in Kuala Lumpur by implementing the Klang Valley / Kuala Lumpur Flood Mitigation Project (KLFMP). The central objective of the KLFMP is to improve the quality of life of the people in the Federal Territory of Kuala Lumpur and Klang Valley by reducing the impact of flood by the implementation of flood mitigation works to support the projected socio-development in the city (Loi, 1996). The documents analysis and interview session identified the flood mitigation programme of Kuala Lumpur consists of long term and short term strategy which include two broad type of measures, structural and non-structural.

### 5.2.1 The Structural Measures

In term of preparation resilience, 'heavy infrastructure' always been a priority for government in managing flood. National government has invests annually on scientific research and engineering projects. The Klang Valley/Kuala Lumpur Flood Mitigation Project (KLFMP) which is the major structural flood mitigation in Kuala Lumpur is estimated at a cost of more than USD 190 million since 1975 (Loi, 1996; DID, 2005). The major engineering works include the following:

- i. Construction of Batu Dam - Function for water supply and flood control with estimated total cost of USD 5.1 million;
- ii. Raising of the Klang Gates Dam - Flood control estimated total cost of USD 0.8 million;
- iii. River improvement and canalisation works for 11 rivers (Sg. Klang, Sg. Gombak and Sg. Batu) with total length more than 100 km, with estimated total cost of USD 120 million;
- iv. Construction and installation of a pumping station in Kg. Baru Pump at estimated cost of USD 0.6 million;
- v. The construction of the Batu Flood Retention Pond with Sg. Gombak diversion channel, estimated cost of USD 11.5 million;
- vi. The improvement of 8 tributaries with total length of about 44 km (Sg. Jinjang, Sg. Belongkong, Sg. Keroh, Sg. Kemuning, Sg. Panchala, Sg. Kerayong, Sg. Kuyoh and Sg. Bohol), with the estimated cost USD 30.7 million;
- vii. Removal of Puchong Drop; and
- viii. Utilisation of ex-mining ponds as flood retention storage

Over the past few decades, the engineering and structural measures are more preferable and represent the most popular solution chosen by the government in the flood mitigation programme in Kuala Lumpur as well as in most of the flood mitigation project in Malaysia in general. According to Douglas (2004), engineering and structural measures are widely practised in the early phase of Kuala Lumpur flood mitigation project through the riverbanks improvement work - concretisation. However, the concretization of the riverbanks has not prevented or minimised the occurrence of flash floods in Kuala Lumpur, but the flash flood was even higher than has been recorded before.

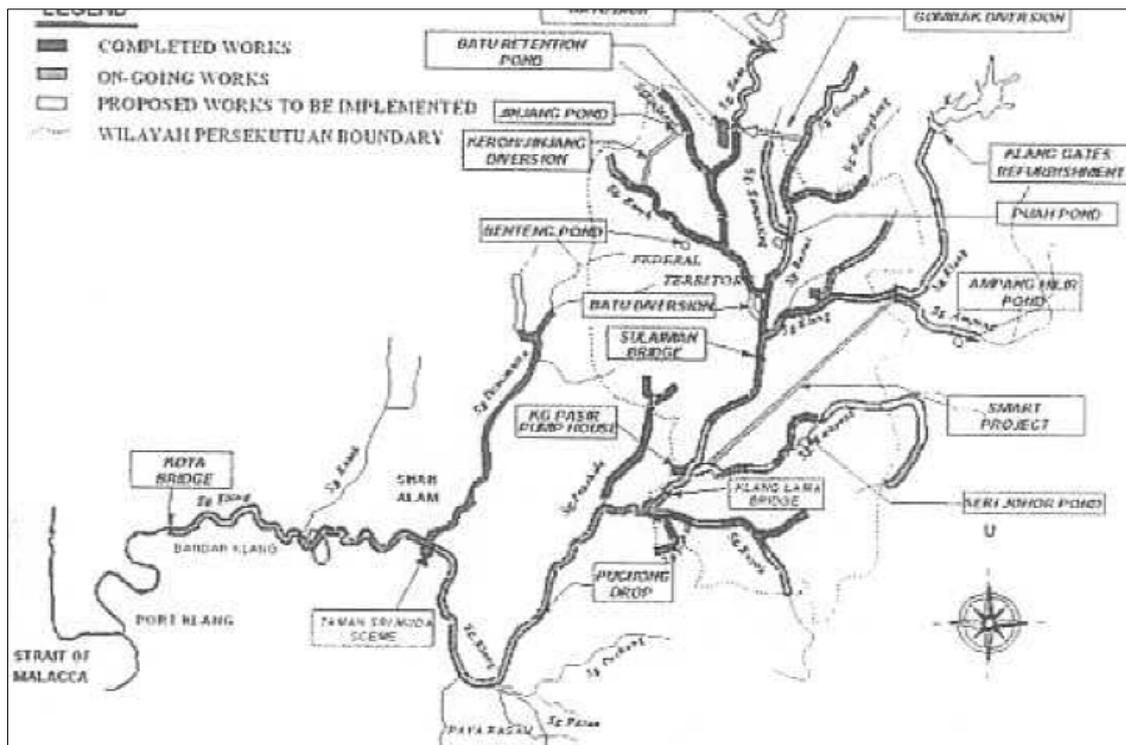


Figure 8: Flood Mitigation Project in Klang Valley (Abdullah, 2004)

The government is still committed and confident in the ability and the effectiveness of engineering solution as a major component in flood mitigation project despite increasing numbers of flood event in the last few decades. In 2004, the federal government spent approximately USD 543 Million to develop a modern river diversion and flood bypass system at the heart of Kuala Lumpur city centre. Stormwater Management and Road Tunnel (SMART Tunnel) is a unique man-made flood bypass system in the world which is a combination of storm water management and traffic. The project aims to provide a partial solution to flood problems that often plague the city of Kuala Lumpur by reducing the floodwaters from entering the city (DID, 2009). Abdullah (2004) stated on the implementation of SMART Tunnel project is to divert and prevent a large volume of floodwater from entering the city centre. In addition, other objectives of this approach is to increase the efficiency of stormwater and river management in Klang Valley river basin.

However, several part of Kuala Lumpur still experienced flood even after the SMART Tunnel starts operating since ten years ago. The Star (2011) highlighted that the citizens and local communities are start to questioning the effectiveness of the millions dollar’s tunnel to mitigate and protect them from being flooded. However, Director of Drainage and Irrigation Department Malaysia (DID), Datuk Ahmad Husaini Sulaiman has denied it and called on Malaysians to be more responsible as rubbish was choking most of the rivers and drains, which could increase the risk of flooding during heavy rain (The Star, 2014).



Figure 9: Aerial View of Klang Gates Dam and Batu Dam (DID, 2009)

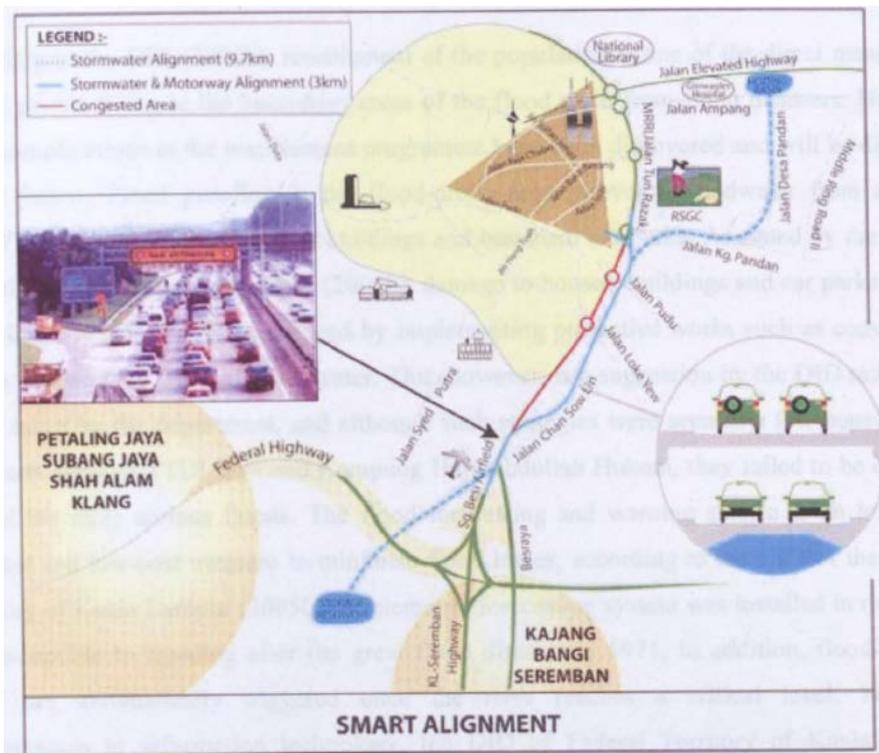


Figure 10: Illustrations of The Storm water Management and Road Tunnel (SMART) (DID, 2009)

According to Department of Irrigation and Drainage of Malaysia (DID) (2003), the implementation of flood mitigation program has shown satisfactory results in controlling and reducing the flood problem. For instance, the implementation of the Klang Valley/Kuala Lumpur Flood Mitigation program (KLFMP) has been successful in mitigating some flood-prone areas and succeeded in reducing the number of areas at risk of flooding from 54 areas to 20 areas only. Based on studies conducted by DID in 2003, through the implementation of flood mitigation program, estimated damage and lost due to flood is reduce from RM1.3 Billion per year to just RM900 million a year. The reduction is in the form of the destruction of infrastructure and public facilities such as roads, private property such as cars and homes as well as business and commercial sectors. These findings clearly increase the government's confidence in engineering techniques as an effective solution to flooding problems. As a result, the government decides to implement more structural and engineering measures rather than other non-structural measures.

Analysis on several documents especially at the level of national planning, such as National Physical Plan 2 (NPP) (2010) and National Urbanisation Policy (NUP) (2006) have revealed the need to address and mitigate the flood hazard issue through a combination of several measures. However, the combination of measures in these documents only mentioned in a general context, such through the implementation of the traditional approach and contemporary approach. While, in the National Water Resources Policy (2000-2050) has outlined several flood prevention measures including structural and non-structural measures. Most of the measures mentioned in the document focuses on technical approach and flood control such as river improvement work and river diversion. Nevertheless, the document also did mention about the new and improvised flood approach known as Integrated Flood Management (IFM) and Integrated Water Resources Management (IWRM). However, the descriptions and detail information provided by both approach are rather limited and difficult to use as a reference in the future.

### 5.2.2 The Non-Structural Measures

Apart from the technical and engineering solutions, the Government of Malaysia has started to add the non-structural measures to the mix. According to DID (2009) non-structural measures are necessary to complement the limitations of implementing and operating structural measures for flood mitigation. In general, non-structural measures for flood mitigation involves planning, programming, setting policies, coordination, facilitating, rising awareness, assisting and strengthening the society to face the threats and impacts of floods. It also covers educating, training, regulating, reporting, forecasting, warning and informing those at risks. In addition, non-structural measures include insuring, assessing, financing, relieving and rehabilitating.

The non-structural measures implemented in the case study area, including population resettlement, flood-proofing, flood forecasting and warning system, preparation of guideline and design standard, as well as public awareness campaign, integrated river basin management (IRBM) and drainage master plan. According to Chan (1995), the resettlement

program for flood management is often carried out in the past, but there are concern about the significance of this method towards current situation because of their cost and unpopularity. In addition, resettlement scheme is difficult and complicated to implement due to land acquisition problems. Relocation only used as a last resort because in reality to relocate people is expensive and further complicated by political and ethnic sensitivities.

The provision of flood forecasting and warning system is an important, practical and low-cost measure to minimise the impact and losses of flood (DID, 2009). Since last decades, the telemetric rainfall and river level stations has been installed extensively at several major rivers around the country and in particular in Klang River basin. In addition, flood warning sirens are automatically triggered once the rivers reaches a critical level. However, the current official flood forecasting and warning system are largely inadequate and should be upgraded (Chan et al., 2004). In this context, the current flood forecasting and warning system should be more proactive with the implementations of computer modelling system which consists of real time data via radar and satellite.

In addition, DID has developed an online hydrological information system called (*infobanjir*) that can be accessed by everyone. In conjunction with the Malaysian Meteorological Department (MetMalaysia), the system works in providing the latest information on current rainfall and water level for major rivers especially in the area that have been identified as flood prone area. With the implementation of online information portal, the existing flood forecasting systems and early warning systems will be improved in order to provide more reliable and latest information about the flood situation to the public. Furthermore, the online information system also important in providing information and recent data to several agencies involved in flood risk management such as a search and rescue agency, local authorities and media.

The implementation of flood proofing is a proactive works to prevent the entry of flood water into individual houses and specific places, for example, by construction of bund or protection wall so that the building, especially ground floor is not submerged during a flood, thus reducing the flood damage. In addition, DID has provides a guideline and design standard on flood prevention for basement car parks. The purpose of the guideline is to provide the requirements and procedure for design and provision of flood proofing measures for basement car parks of new buildings as well as existing buildings (DID, 2006). As regards to the preparation of guidelines and manual, the DID has developed numbers of guidelines that can be applied directly and indirectly to mitigate flood such as river management (Guideline for Development Related to River and Reserve), Coastal Management Guideline, manual for flood damage assessment, New Urban Storm Water Management (MSMA) and Guideline for Erosion and Sediment Control in Malaysia.

### 5.2.3 The New Urban Stormwater Management Manual (MSMA)

In the last decades, the local authority relied upon engineering solutions to move stormwater as quickly as possible into concrete channels toward discharge locations. As a result, the overload of stormwater entering waterways created significant flood damages. With regards to this, a new Urban Stormwater Management Manual (MSMA) has been published by DID in 2000 which has superseded the Urban Drainage Planning and Design Procedure No.1 (1975). In January 2001, was approved by the Cabinet to be implemented and complied by all local authorities, public and private development projects as well. The current emphasis of peak discharge control at source,

One of the initiative by DID to improve the quality of flood risk management through spatial and land use planning is by introducing the New Urban Drainage Manual known as Storm Water Management Manual for Malaysia (MSMA). The introduction of MSMA as a proactive measure which is emphasis on the peak discharge control at source and also contains recommendations on flood fighting. As a developing country, urban development in Malaysia is increasing significantly with increasing numbers of the urban population. The urbanisation has considerably changed the characteristics of natural catchments area which is cover by soil and grass into a pavement and concrete. As a result, hydrologic and hydraulic characteristics of the catchment area will be changed and affect their ability to absorb more water during inundation and increase the water flow (storm water) on the surface area (Zakaria *et al.*, 2004).

Thus, the main objective of MSMA is to improve the efficiency of stormwater management through the implementation of Best Management Practice (BMPs) approach and the latest technology. Among other objectives of MSMA are as follows:

- i. Ensure the safety of the public
- ii. Control nuisance flooding and provide for the safe passage of less frequent and larger flood events
- iii. Stabilize the landform and control erosion
- iv. Optimize the land available for urban development
- v. Minimize the environmental impact of urban runoff on water quality
- vi. Enhance the urban landscape

Since the 1<sup>st</sup> January 2001 and onward, all new development in Malaysia must comply with the new guidelines and design standards in MSMA regarding the drainage system. Throughout local authority like DBKL, the implementation of MSMA will be enforced as one of the prerequisite need in any new planning application. Every new development must meet the requirements and design standard in MSMA and approved by the DID before any local authorities (DBKL) granted the planning permission. This effort seems as a proactive measure to integrate flood risk management into physical/spatial planning as an attempt to reduce flood risk, especially in urban areas. As highlighted by the Interviewee B, the officer from Civil Engineering and Drainage Department, DBKL, the MSMA guideline is an important component in helping to minimise the flood problems. However, there is no by-law or legislative provision that could force private and public sectors to follow the guidelines and standards.

#### 5.2.4 Integrated River Basin Management (IRBM)

The government of Malaysia has taken serious effort in managing flood disaster by the establishing the Integrated Flood Management (IFM). IFM is an improvised approach that opposed to the traditional flood management measures that focus on flood control. IFM is the process of promoting an integrated approach to flood management incorporated into the Integrated Water Resources Management (IWRM) aimed at maximizing benefits from the use of floodplains without compromising on sustainability of the vital ecosystems (DID, 2009). One of the measures proposed is Integrated River Basin Management (IRBM).

Initiated as part of infrastructure initiative in the Eighth Malaysia Plan (2001-2005), the Integrated River Basin Management (IRBM) is one of the latest measures that promotes adaptive flood risk management in Malaysia in general and particular in Kuala Lumpur. According to DID (2005b), IRBM aimed to strengthen the environmental management of issues (floods, water shortages and water pollution) by integrating and link all components and features in a river basin into consideration. Factors like zoning for river corridors, riparian areas, natural flood plains, conservation of wetlands, storage ponds, etc. will be taken into account in preparing flood management plans (Chia, 2004). In other words, the IRBM can be considered as one of the resilience approaches which encompasses the integration between flood risk management and urban planning.

In addition, IRBM encompasses both, conservation and development coordination of water, land and related resources across sectors within a given river basin, in order to maximise the economic and social benefits (DID, 2009). There are seven key elements to a successful IRBM initiative, as follow:

- i. A long-term vision for the river basin, agreed to by all the major stakeholders;
- ii. Integration of policies, decisions and costs across sectoral interests such as industry, agriculture, urban development, navigation, fisheries management and conservation, including through poverty reduction strategies;
- iii. Strategic decision-making at the river basin scale, which guides actions at sub-basin or local levels;
- iv. Effective timing, taking advantage of the opportunities as they arise while working within a strategic framework;
- v. Active participation by all relevant stakeholders in well-informed and transparent planning and decision-making;
- vi. Adequate investment by governments, the private sector, and civil society organisations in capacity for river basin planning and participation processes; and
- vii. A solid foundation of knowledge of the river basin and the natural and socio-economic forces that influence it.

However, regarding to the current flood management in Kuala Lumpur, the implementation of IRBM so far has been generally based on the application of engineering solution and has not incorporated environmental and ecological considerations (Ramadas et al., 2000). Most of the flood measures still focus on the structural and 'heavy infrastructure' for example river channelization, embankments etc. A non-structural measures or more adaptive flood management such as land use planning, flood plain zoning or flood insurance have been ignored and are not being implemented at full scale, even though their importance has been stated in the integrated river basin management strategies.

### 5.3 Process Analysis

#### 5.3.1 Intellectual Capital

With regards to the study area, Kuala Lumpur, the dialogue and consultation sessions between local authorities and citizens especially the affected community is one of the practical medium for sharing and gaining knowledge. As mentioned in the previous chapter, local authority, led by Kuala Lumpur City Hall (DBKL) with several other government agencies, such as DID have conduct several dialogue sessions to discuss about the flood risk management. In addition to the scientific studies, knowledge and experience possessed by the local community especially the one who affected by the flood is one of the precious information in developing the strategies and policies for flood management.

A second source of knowledge was gathered from the publicity and public participation process in the formation of the development plan. The procedure provides an opportunity for the local community to get involved in the preparation of development plans. In addition, knowledge sharing among different fields and expertise is perceived through the implementation of flood risk mapping as a component in the preparation of development plans such as Local Plan. A Flood Risk Map provides a quantified assessment of risks associated with floods. Spatial information from the system is used by the policy makers in deciding the level of investments in a potentially flood prone area. For example, the Local Governments such as DBKL can use it to assess economic and social viability for certain investments such as for flood mitigation projects or as a basic reference in developing strategy and propose development in the Local Plan.

#### 5.3.2 Social Capital

This part relates the collaboration between a wide-ranging of actors in order to achieve support and enhance the capacity to coordinate decisions and actions capacity. Moreover, social capital also encourage a good relation between water managers and spatial planners, raise public awareness and educate community especially to those who live in the affected and most vulnerable area about the important of flood risk management.

Partnership and cooperation in diverse stakeholder especially between government agencies, especially water managers and spatial managers can be seen almost in every government level; national, state and local. The establishment of State Planning Committee (SPC) which consists of representatives from various agencies seem as a perfect medium for building consensus decision-making process. In addition, the formation of the committee also serves as a platform to create decent relationships and communication between stakeholders. Besides that, partnership and collaboration between public and private sector also important in a flood-resilient city. According to interviewee B, the collaboration between public-private sectors has been long practised in Malaysia, particularly in Kuala Lumpur. The River of Life Project - is one of the latest projects in Kuala Lumpur City Centre that promote high collaboration between DBKL and private developers. The River of Life project has three major component which aimed to transform the Klang River into a vibrant and livable waterfront with high economic value, namely; (i) River cleaning; (ii) River master planning and beautification; and (iii) River development. However, according to him, the project is still in its early stages, and the formation of a more detailed planning is required in the next few years.

In addition, through document analysis, there are a few policy documents that have mentioned the public participations in the policy-making process. However, the public engagement and involvement mostly perceived in physical/urban planning compares to flood risk management. Two main planning documents at the national level, the National Physical Plan 2 (2010-2015) and National Urbanisation Policy (NUP) (2006) addressed the public participation as a prerequisite in the planning process. Moreover, documents analysis on the local level, such as KLSP 2020 and KLCP 2020 encourage the local community to give an opinion as a constructive input into city planning through the public participation process.

The public participations and involvement in this context can be summarized by a wider role of the public in spatial planning activities that include the process of formulating the spatial and development plan, space utilization, controlling and monitoring the implementation of the statutory development plan (National Physical Plan, State Structure Plan, and Local Plan). In addition, under the provisions of Town and Country Planning Act (Act 172) (1976), the public is allowed to involve in the planning process especially in the preparation of spatial and development plan preparation.

On the other hand, public participations and effort to raise public awareness is less perceived in terms of flood risk management. According to Chan (2001), since colonial eras, the central government is a sole provider in developing flood measures and policies throughout the country. Indirectly this has caused the majority of the public have put trust and rely entirely on the government to ensure that flood risk management is under control. The existing system (top-down approach and centralized) is seen less efficient and has numbers of disadvantages in dealing with the issue in flood management (Chan, 2001).

The Department of Irrigation and Drainage Malaysia (DID) is expected as the responsible agency that handles the drawing up the education programs and awareness campaigns on flood management and river in Malaysia. However, in-depth interview reveals that the public awareness campaign and education programs were conducted as an internal initiative from the department itself. In fact, there is no provision in any policy documents related to flood

management that clearly states the need to ensure a participatory approach. Based on the document analysis, the National Water Resources Policy (2000-2050) did not mention any point about public involvement and participation campaign. In addition, there are no formal documents that describe the procedure and process on how to run the programme.

Most of these programs are carry out in collaboration with non-governmental agencies (NGOs) such as river-related conservation program by the Global Environment Centre (GEC) and WWF-Malaysia at Sungai Penchala, Kuala Lumpur (Chan, 2005). However, the main objectives of the program is to create awareness among public about the conservation and beautification of the river system. Despite aiming to increase the cleanliness and image of the river, the campaign also raises awareness among public to help continuously to reduce the flood risk. Moreover, to gain more support from the public, DID also carried various campaigns through electronic and print media in order to raise public awareness such as by the "Love Our River" campaign. Numbers of brochures and documents related to the river management are widely distributed to the public. However, most of the campaign and efforts are carried on the basis of the ad-hoc program and conducted in the specific time frame, in particular between September-December (Monsoon season). According to Chan (2001), education and awareness program among public on flood management, should be carried out continuously to ensure maximum effect and impact

Besides that, numbers of dialogue sessions between authorities and local community especially the flood victims were constantly held in order to improve the flood risk management system inclusively. According to the interviewee B, every year DID and DBKL have arranged numbers of sessions with society and their representative especially from the flood-prone area community. The session provides a platform for knowledge and experience exchange between various actors (Zahari and Ariffin, 2013). For instance, after experiencing many flood events, the affected community may have develop several precautions that are common knowledge among themselves and subsequently this knowledge may be useful for authorities to improve existing strategy and policy for flood risk management.

### 5.3.3 Political Capital

There are three main criteria used to determine the extent to which Kuala Lumpur is capable of operationalizing and mobilizing the flood risk management with regards to the resilience strategy. First, the political awareness of flood risk. Second, the integration of flood management and urban planning and last but not least, the financial availability to conducts the resilience strategy.

In the context of Malaysia, particularly in Kuala Lumpur, river and flood management is one of the challenging tasks to be carried out. This is caused by the physical and hydrological characteristics of the river basin itself where it flows from one jurisdiction area to another jurisdiction area. As Chan (2005) highlighted, there always been the contention between the Federal, State and Local Governments in term of river management. As stated by the Interviewee B, most of the major river that pass through Kuala Lumpur are located under the

jurisdiction of the federal government through. Therefore, DBKL as a local authority must comply with any strategy and policy with regards to the river management. Furthermore, since land matters belong to the State Government, it is hard to manage and control all the development within the river basin. Furthermore, various local authorities and administrative borders also have made the river and flood management harder to implement. Therefore, the IRBM Plan can be as a mechanism that can merge coordination and seek cooperation not only across the sector but also across political and administrative borders of the Malaysia river system.

Moreover, the provision of infrastructures and utilities especially flood management are classified as a public goods. Therefore, the government is perceived as a sole provider to establish the flood management strategy for the entire country. In regards to the financial availability and resources, the State and Local Governments are relied on the funding from the Federal Government in order to establish the flood management strategy. To conduct a flood management strategy, especially the large-scale mega flood mitigation projects, most States do not have strong financial power and heavily depended on the Federal Government (Chan, 2005). As highlighted by the interviewee, lack of financial resources is one of the obstacles for local authorities such as MBMB to develop and implement a more efficient and large-scale flood management system.

Through the five-year development plan which known as Malaysian Plan (MP) and the annual budget, Federal Government has allocated a huge of amounts of the fund for infrastructure and facilities sector to provide better service for public. Since the implementation of MP-2 (1971-1975) until MP-8 (2001-2005), the government has allocated a total of RM4.5 billion for the development of flood mitigation projects across the country. Every year, the allocation and provision are expected to be increase to ensure the development of infrastructure and flood management systems are effective enough to cope with the emergent flood threat. However, the question remains whether spending a lot of money on expensive-mega infrastructures such as dams and construction of massive flood diversion channel, is the smart way to solve the flood problems or spending it wisely on more economical and people-friendly is the smartest choice.

## 6 REFLECTION AND RECOMMENDATIONS

The final chapter consists of a synthesis of the previous chapters and conclusion of the study. This chapter consists of three main parts, including theoretical reflection, empirical reflection and ends with the recommendations. The first part, the theoretical reflection will summarize the understanding of resilience notion and their significance for flood risk management and cities. Second part consists of a summary of the empirical study - Kuala Lumpur. Based on the assessment framework, this study attempt to look to what extent Kuala Lumpur is resilient to flooding. Last but not least, some recommendations are given as an input and reference to improve the existing situation of the case study.

### 6.1 Theoretical Reflection

In general, this section will summarize how this thesis addressed the research questions that have been highlighted at the beginning of this study. Through the literature on resilience and others related aspect, this study concludes that the built up of flood resilient city can be summarize in this simple equation. (*Resilience = Resistance + capacity building + transformability*). Resistance refers to the ability to withstand or reduce the impact of a flood hazard. In regards to the flood risk management, this strategy emphasises on to keep the flood away from people or urban area (Meijerink and Dicke, 2008; Oosterberg et al., 2005). In addition, resistance strategy also can be links to robustness as one of the properties in resilience. In order to become robust or withstand to the flooding, a city should have numbers of measures usually based on the technical and engineering measures. This equation shows that resistance strategy is not contrary to a resilience strategy, but it is part of the strategy because a city still needs a certain degree of robustness to be resilient.

Capacity building is another important element for flood resilient city. Capacity building often understood as an ongoing effort by individuals, groups, organizations and societies to enhance their ability to identify and meet development challenges as well as to create effective institutions. In a flood resilient city, institutional capacity refers to the ability of a city to cope with the hazard impact and able to continue its normal function without permanent damage to society, health or well-being. Furthermore, capacity building in institutional considers in each of the disaster cycle phase. At the time of disaster, it depends on the effective delivery of emergency assistance and relief and access to essential services. While at the preparation disaster, it is important to make sure a city and its institutional system have the capacity to identify and monitor the current and future vulnerable and hazard impact. Furthermore, institutional capacity is enhanced by a strong social networks and a high level of awareness of emergency procedures capacity and adaptive capacity.

In addition, building an adaptive capacity within the city and its components also crucial in flood resilient city. Adaptive capacity is needed to ensure that past mistakes are not repeated and a city can be flexible to changing conditions, by making changes to current policy and practice in order to improve resilience for the future. In this context, high adaptive capacity requires institutional to learn especially from the previous experience event, as well as allow

and be more open toward the latest scientific knowledge to feed into policy. Investment in hazard research and collaboration between all relevant stakeholders are important, so that adaptation strategy is coordinated and complementary across sectors and scales. Moreover, adaptive capacity also seeks to incorporate all components of resilience, at all stages of the disaster cycle, which encompasses from pre-disaster preparations, ability to withstand at the time of hazard impact, capacity for recovery after an event, and ability to learn and apply knowledge to improve and transform into a new resilience system in the future. For example, an effective recovery phasing is facilitated by the strength of local socio economies and the diversification of institutional support. In addition, an effective transformability may require strong political intervention and support to provide necessary funding and resources.

Reflecting on the idea that a strategy planning encompasses multidimensional and broader perspective which includes three dimensions; content dimension, process dimension, and context dimension, this study has suggested a practical framework that can be used by scientists and practitioners as a qualitative assessment tool to analyse the flood resilience of cities. In the first dimension, *context* implies the external and internal factors that determine the chosen content (strategy/policy) and process (implementation) which have a strong impact on decision-making process. Through context dimension, we as practitioners would be able to identify the social and institutional fragmentation that could affect the integration and effectiveness of flood management in urban planning. Besides that, further improvement can be formed and suggested immediately to enhance the resilience strategy in the future.

While in *Content* dimension, Hutter (2006) highlights the importance of goal and specific target in strategic planning approach. However, a nice goal and specific target in policy documents does not mean that it will run smoothly and surely be realised in real practice. For example, as illustrated in the empirical study, even though it has been stated in a planning and policy document about the public consultation and participation, it is still less perceived in the decision making process in local authority. Therefore, a new form of implementation strategy must be found in order to make strategy feasible. In addition, *Content* dimension also includes the possible measures and policy instruments taken by the government to reduce the flood risk. Regarding to this context, the measures and policy instruments encompass three key components in flood resilient city, which are robustness, adaptability and transformability.

*Process* dimension will help to provide information and understanding on who are involved and what kind of capacities and responsibilities need by each of stakeholders that related to flood resilience of city. In this context, building capacity within organizations as well as individual actors are considered important in order to build a flood resilient city. Further capacity-building among involved stakeholders especially the administrative actors as well as citizens is needed to increase and hasten the implementation of resilience strategy. However, the framework still cannot be claimed as fully completed, there still has some area for improvement and enhancement. One of the limitations is, the framework was developed to cater only for the qualitative assessment. To ensure the framework is completely accountable and valid, quantitative assessment and more context-specific indicators should be included as part of the framework in the future research. Moreover, the framework may seem to be quite rigid and

only focus on the current state of a city (Restemeyer et al., 2015). However, the framework can easily be adjusted according to the specific and dynamic context of city and its system.

## 6.2 Empirical Reflection

Kuala Lumpur is one of the major city in Malaysia, which best known as the centre of economy, administration, society, culture and finance. However, rapid urbanization puts pressure on standard living of citizens, especially on infrastructure system. At present, Kuala Lumpur has some troubles of flooding because of heavy rain, low topography, and uncontrolled development. Flooding has affects many corners of life such as daily routine, construction, economic damage and planning. In the near future, warning of climate change has put more burden for government, especially flood manager. Therefore, it needs to share responsibility among them and effective solution with long-term strategy by cooperation with other key stakeholders such as planners, environmentalist, engineers, private companies, NGOs, etc.

Reflecting on the empirical study, Kuala Lumpur has taken various measures that are necessary to overcome the flood issue which embedded since past decades. Much effort has been devoted by government, either at the Federal, State or Local level to finding a solution to this problem. However, this study demonstrates that the government keen to use the structural measures which aimed to control the probability of flood instead of non-structural measures or combination of both. The structural measures comprises of the construction of dams, embankments and river diversion. Although the measures perceived a positive impact in mitigating the flood, nonetheless for a long-term planning, a more practical and holistic approach is necessary. Though, government has started to implement more adaptive management. For example, through the integration and consideration environmental aspects (flood management) as a one of the aspect in determining the spatial planning strategy.

However, the integration between urban/spatial planning and flood risk management is still minimum and less perceived and slow in progress. Although several new and integrated approaches have come out, such as the "Integrated River Basin Management and Integrated Flood Management", it just limits in the research discussion without any serious attempt to enforce or implement it in real practice. Even though there is an efforts being made to enforce it in the current flood risk management, but the empirical study proved that engineering and structural solutions are favoured instead of non-structural measures such land use planning.

The current planning system of Malaysia in general and of Kuala Lumpur in particular are quite strong in vertical link instead of horizontal cooperation. This has remains as one of the major challenge to become a flood resilient city. This is perceived through the implementation of three-tier government system that is consists of Federal Government, State Government and Local Government. From the urban planning to the flood risk management, government still plays a crucial role and prevails over others stakeholders such as private parties, NGOs or citizens in decision-making phase. Furthermore, as a typical developing country, most of decisions are heavily affected by economic reasons. For that reason, the final decision is quite arbitrary and ineffective, which could harms environment and society. The shift from traditional top-down approach towards implementation of bottom-up approach will provide

more opportunities and space for other stakeholders such as public to participate in the formation of flood risk management and strategy.

In addition, the empirical study also showed that capacity-building still remains as the major challenge for Kuala Lumpur to become flood resilient. The cooperation and collaboration between specific institutions such as between spatial planners and flood risk managers still least perceived. They work independently using their own language. Water managers focus on engineering and technical water-based solutions while planners and urban designers focus more on the spatial development and urban form. Even though, the DID is the main and responsible agency for flood management, their task only centred in the water based management which is focus on irrigation and drainage system. Their role and jurisdiction in influence the spatial planning and urban development is very limited. Besides that, further capacity-building among political group and citizens also needed, either in the affected areas or in the non-affected areas. A broader integration of both group should be strive in order to establish a holistic flood resilience strategy.

Linking the empirical study to the three dimensions of resilience; robustness, adaptability, and transformability, this study has come to a conclusion that Kuala Lumpur's resilience is still rather incomplete. Malaysia (Kuala Lumpur) has succeed in taken several measures includes both structural and non-structural measures in order to solve the flood problem. However, these efforts are seen less effective and encountered several issues while in the formation and implementation process. Relying too much on both structural and non-structural measures to address the flood problems could result in limiting and narrowing the scope of the flood management itself. In flood resilience city, there is a needs to be cross-disciplinary in measures and flood authorities should address and incorporate other aspect such issues of flood management policies, socio-economic aspect of flood management and etc. Moreover, the fragmentation within the organisational structure especially in two important component in flood resilient city, urban planning and flood management also need further improvement. As Chan (1999) highlighted that, political and economic barriers significantly reduces the application of both measures and this has limited overall effectiveness. Moreover, the gap between the rural and urban areas especially in practicing and adapting new technology/measures also cost the mutual effectiveness.

### 6.3 Recommendations

The study has some strategic recommendations to improve further the flood risk management and flood resilience in Kuala Lumpur. As stated early, cities are complex and dynamic metasystems in which technological components and social components interact. They are made up of dynamic linkages of physical and social networks. Planning for resilience in the face of urban disaster requires designing cities that combine seemingly opposite characteristics, including redundancy and efficiency, diversity and interdependence, strength and flexibility, autonomy and collaboration, and planning and adaptability.

The strategy is based on a multi-sector/multi-disciplinary approach to spatial planning and flood risk management. The concept of urban flood resilience in the case of Kuala Lumpur needs to be focused on increasing social and political capital as this research has shown that the low level of these capitals causes problems in implementation and management field especially in engaging with the public. Community involvement is an important and effective approach to forming an inclusive and practical flood risk management. Affected communities are the main focus group that should be emphasized and provide more opportunity for them to communicate and sharing knowledge among themselves and also with the implementation or decision making parties.

Zahari and Ariffin (2013) have pointed out the important of community involvement who experience the disaster by themselves rather than for those coming from the official channels. Despite the scholarly sources and inputs from various agencies involved, sharing knowledge among the affected community group also vital to producing a policy and comprehensive framework for flood risk management.

### 6.3.1 Institutional Policy

The government as central water manager has to create a new and clear regulation to manage water, including flood risk management. This regulation has to be made separated from other issue and threads that are not related and has to accommodate the multi-level governance (inter and intra-organism) to participate in the water management dilemma including the flood risk management. A clear role of each level of governance in term of its action capacities and responsibilities has to be stated to avoid the repetition of stakeholder efforts (double or even triple efforts). The institutions and organizational structures have to be evaluated to be more adaptive by making the regulation and role of each stakeholder to be more flexible to deal with the dynamic situation of the flood events. It is also imperative to allow the DID to assume a more protagonist and strategic role in coordinating action, knowledge and forecast; this key institution cannot be considered anymore as an advisory agency. The DID has the capacity to coordinate all pre-during -and after disaster scenarios.

### 6.3.2 Raise Public-Private Partnership

Concerning power, it must be distributed along all the grid of governance institutions, enabling all involved actor to participate in the decision-making processes. On the other hand, this should be taken further, PPP projects should be encouraged by all political structures, making them more feasible. Overall, politician must contribute to the 'Planning Intelligence' (Ike et al. 2004) to support the early stages of planning and programming for arriving at 'informed decision making' and to lubricate and reduce the transition between all levels and stakeholders in governance. Another important point refers to the lack of legislation: An appropriate and effective act should be legislated as a mechanism to assess the stakeholders involved. The implementation of MSMA for all proposed development should be enforced by using this empowering act. Fundamentally, this act would provide a legal basis for the formulation of

each development plans, such as the national physical plan, state structure plans, district local plans and action area plans.

### 6.3.3 Research, Education and Exchanged Knowledge

More research on floods is necessary for a better understanding of effective measures in preventing and managing floods in Kuala Lumpur. More proactive efforts should be focus on forecasting, protection, adaptation as well as mitigation even in the times of no floods. For example, forecasting and early warning systems must be better linked together with a strong horizontal and vertical cooperation and coordination between stakeholders and different administrative levels. Besides that, the government should arrange more international co-operation, sharing of experiences and opportunities to learn from each other. The exchange of knowledge and experience can take place within government and professional bodies or societies at each level of government; federal, state and local. In addition, to ensure a good delivery system, staff and officer at the local authority and the related agencies such as DBKL must be equipped with knowledge and be included in continuously training and education programmes. These group of officers are crucial in implementing all the strategies and policy on flood risk management.

### 6.3.4 Public/Community Awareness, Preparedness and Participation

Disaster preparedness is one aspect of disaster management that clearly needs to be improved, especially in the context of flood disasters. Therefore, education and training programs need to strengthens especially for the affected group in the vulnerable area. It is essential that people recognise flooding as part of their environment. Communities must be aware of being at risk. In order to be aware, public especially the vulnerable community have to recognise and knowing about the danger, including all important parameters, such as type of flooding, intensity (flooding depth, flow velocity) and extent of the impact. These knowledge must be informed convincingly on all actors.

In general, flood risk management in Malaysia traditionally been over-focused on a top-down government approach. Most of the strategies and policies are formulated with less consideration to the local context. This approach may workable and efficient in the past since the population, and the urbanization growth were still sparse. However, this approach seems less efficient due to current environment with more educated and awareness citizen. It is time for a radical change towards a more people-friendly “bottom-up” approach. People, especially the affected community and disaster victims, need to be engaged and empowered to be more resilient. When people or public are actively engaged and involved, their ability to respond to flood or other disasters will be more effective and appropriate. Otherwise, if not, they remain highly dependent on government aid and support, and this is not what the Malaysian Government wants in the future.

#### 6.4 Suggestion for Further Research

There are some points that can be highlighted from this study is probably useful for self-evaluation as well as for further research. The aim of this research is to provide the understanding of the resilience concept and its relations with flood risk management and urban planning practice. As discussed in this study, there are different ways to understand the resilience concept, and it depends on which context are we refer. It is an opportunity for further research to study on resilience concept from a different context, for example, the adaptive capacity on resilience which is focused on community or local government. For this purpose, this study could serve as a basis for carrying out a more detailed study in the future.

Besides, there are some limitations found while doing the thesis such as the quality of data and limitations of time. There is a few interesting point that could be further study such as the implementation of the Integrated River Basin Management (IRBM) in Malaysia as one of the approaches that promote the resilience thinking. In addition, the implementation of UNISDR – Making Cities Resilient, also another interesting point to study and discover. Last but not least, further research by exploring possibility to incorporate the flood resilience thinking into other field such economics, social, etc. can widen the perspective in understanding the resilience concept as well as flood risk management.



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## APPENDIX 1

Interview questions and guidelines with the government officers.

- a) The Federal Department of Town and Country Planning Peninsular Malaysia
  1. What is the function of this department in development planning?
  2. How environmental/flood management elements were considered in development planning?
  3. To what extent planning development (spatial planning strategies and policies) in overcome the flood problems in Malaysia?
  
- b) The Department of Irrigation and Drainage of Malaysia
  1. What is the current status of flash floods in Kuala Lumpur and Malaysia?
  2. How is this department deal with flash flood problems in Kuala Lumpur?
  3. What is the action and measures taken by the department in managing and controlling floods in Kuala Lumpur?
  4. What is the latest project for flood mitigation in Kuala Lumpur?
  5. How is this department deal with flash flood problems particularly in relation with land use development?
  6. Suggestion/recommendation to improve the current flood risk management?
  
- c) The Kuala Lumpur City Council (Civil Engineering & Drainage Department)
  1. What is the function of the department in flood management in Kuala Lumpur?
  2. How is this department deal with flood problems in Kuala Lumpur?
  3. What is the action and measures taken by the department in managing and controlling floods in Kuala Lumpur?
  4. Suggestion/recommendation to improve the current flood risk management?
  5. What are the purposes participating in the "Making Cities Resilient: My City is Getting Ready", program and the extent of its implementation in Kuala Lumpur.
  
- d) The Kuala Lumpur City Council (Urban Planning Department)
  1. What is the function of the department?
  2. To what extent the department considers flood management in development planning (land use/spatial planning) in Kuala Lumpur?
  3. How is the department in flood management in Kuala Lumpur?
  4. What is the action and measures taken by the department in managing and controlling floods from the perspective of development planning?
  5. What is the regulation that has needed to be followed for development on the flood plain areas?
  6. Is the development proceed on the flood plain areas were followed the specific guidelines provided by the DID?
  7. Suggestion/recommendation to improve the current flood risk management?

APPENDIX 2

Interview transcripts

Interviewee A: Officer (Flood Management Division) at Department of Irrigation and Drainage of Malaysia (DID)

Bahasa Malaysia	English
<p><b>Soalan:</b>  <i>Apakah status semasa bencana banjir dan faktor berlakunya banjir di Kuala Lumpur dan Malaysia?</i></p> <p><b>Jawapan:</b>  <i>Banjir kerap kali berlaku terutamanya apabila hujan lebat turun melebihi 2 jam. Namun keadaan ini masih lagi terkawal dan tidak terlalu kritikal. Banjir disebabkan oleh 2 faktor utama: (1) Sistem saliran dan perparitan yang kurang sempurna, tidak mampu menampung lebihan air. Dan (2) Kebanyakan kawasan tadahan air semula jadi/dataran banjir telah dibangunkan (perumahan dan pusat komersil). Secara amnya, faktor berlakunya banjir di Malaysia boleh dikategorikan kepada 2 faktor utama iaitu sebab semula jadi, dan faktor manusia.</i></p> <p><i>Antara faktor semula jadi yang mendorong berlakunya banjir ialah seperti:</i></p> <ul style="list-style-type: none"> <li><i>i. Monsun angin amat mempengaruhi cuaca di Malaysia dan oleh itu banjir. Utara-timur monsun (Oktober-Mac)</i></li> <li><i>ii. Malaysia amat terdedah kepada banjir kerana faktor fizikal dan topografi yang mana hampir 9% daripada keluasan keseluruhan merupakan kawasan rendah, dan sering berlaku banjir.</i></li> <li><i>iii. Sebab semula jadi lain banjir adalah tanah runtuh dan tebing sungai slip bahawa blok sungai mengalir. Aliran lumpur di sungai juga mengurangkan air membawa kapasiti sungai.</i></li> </ul> <p><i>Kesan daripada aktiviti manusia pula terdiri daripada:</i></p> <ul style="list-style-type: none"> <li><i>i. Pembangunan/urbanisasi tidak terkawal, terutamanya di kawasan yang sering dilanda banjir</i></li> <li><i>ii. Pembangunan yang tidak menepati piawaian, terutamanya ketika peringkat pembinaan. Boleh mengakibatkan saliran sedia ada tersumbat dengan keladak.</i></li> </ul>	<p><b>Question:</b>  <b>What is the current status of floods / flash floods in Kuala Lumpur and Malaysia?</b></p> <p><b>Answer:</b>  Flood often occur in Kuala Lumpur especially after heavy rain fall (&gt;2Hours). However, this situation is still manageable and not too critical. Two main factors of flood : (1) Inefficient and inadequate irrigation and drainage system, and (2) Most of the natural watershed / flood plain have been developed (housing and commercial) In general, there is two main factors that cause flooding in Malaysia; first, Natural causes of floods, and second, Human induced floods.</p> <p>Among the natural causes of floods are as follow:</p> <ul style="list-style-type: none"> <li>i. The Monsoon winds greatly influence Malaysia’s weather and therefore floods. The north-east monsoon (October-March)</li> <li>ii. Physical characteristics and topography of Malaysia, which is 9% of total area are indicated as a flood prone area. This kind of area will naturally be flooded when rains occur especially if the levels are lower than the nearest river.</li> <li>iii. Other natural causes of floods are landslides and river bank slips that block river flows. Mudflows in rivers also reduce the capacity of water of rivers.</li> </ul> <p>The impact of human activity consists of:</p> <ul style="list-style-type: none"> <li>i. Land use changes due to development / uncontrolled urbanization, particularly in areas prone to flooding;</li> <li>ii. The process of development itself can be the cause of floods. At this land clearing stage, erodible soils are carried by the surface flow into the rivers during rains. These are gradually deposited on river beds, reducing the river flow carrying capacity.</li> </ul>

<p>iii. Kelemahan sistem pengurusan sedia ada dan kegagalan sistem seperti infrastruktur berfungsi dengan baik.</p>	<p>iii. Due to the poor designs such as constrictions at bridges and culverts and as a result of operational requirements of structures and also due to structural failures.</p>
<p><b>Soalan:</b>  <b>Bagaimana Jabatan (DID) melihat masalah banjir di Kuala Lumpur?</b>  <b>Jawapan:</b>  Banjir adalah masalah utama nasional. Masalah banjir di KL bukanlah satu isu baru yg perlu diberi perhatian kerana masalah banjir kini boleh dikatakan berada dalam keadaan kritikal kerana kekerapan kejadian banjir semakin meningkat saban tahun. Bahkan, keadaan banjir seperti banjir kilat semakin kerap terutamanya pada musim hujan atau ketika keadaan cuaca yg tidak menentu sejak kebelakangan ini. Hujan yang lebat membekalkan air yg berlebihan sehingga tidak dapat ditampung oleh sistem saliran dan kesannya boleh meningkatkan air dipermukaan bumi dan menyebabkan berlakunya banjir. Apabila berlakunya kejadian banjir, keadaan di KL sangat membimbangkan. Impaknya jelas dapat dilihat, berlakunya kesesakan lalu lintas, banyak kenderaan terperangkap di jalan raya, kemusnahan harta benda awam dan premis-premis perniagaan dan juga merosakkan struktur jalan raya. Kos membaikpulih jalan raya dan ganti rugi kerosakan menelan belanja yang tinggi.</p>	<p><b>Question:</b>  <b>How is this department deal with flash flood problems in Kuala Lumpur?</b>  <b>Answer:</b>  Flood is a major problem of nationwide. As we realizes, flood is not a new issue that needs to be addressed because flooding can these days be said in critical condition because the frequency of floods is increasing every year. In fact, the flood situation such as flash floods become more frequent, especially during the rainy season or when the weather is uncertain lately. Heavy rainfall water supply surplus that cannot be accommodated by the irrigation system and its effects may increase ground surface water and cause flooding. In the event of flooding, the situation is very worrying in KL. Its impact can clearly be seen, traffic congestion, many vehicles stuck on the highway, destruction of public amenities and business and commercial premises as well as damaging the road structure. The cost of road maintenances and damages is costly.</p>
<p><b>Soalan:</b>  <b>Apakah langkah yang telah diambil bagi mengatasi masalah banjir ini, khususnya di Kuala Lumpur?</b>  <b>Jawapan:</b>  Secara amnya, kerajaan Malaysia melalui agensi yang terlibat khususnya DID telah mengambil pelbagai langkah yang dirasakan perlu bagi mengatasi dan mengawal masalah banjir ini. Pelbagai projek dan langkah pengurusan banjir telah diambil diseluruh negara terutamanya di kawasan-kawasan yang berisiko tinggi. Langkah-langkah ini boleh dikategorikan kepada 2 langkah utama iaitu 'structural measures' dan 'non-structural measures'.  Merujuk kepada konteks Kuala Lumpur dan Lembah Klang, sejak beberapa dekad yang lalu, kerajaan telah mengambil pelbagai langkah serius bagi mengatasi masalah banjir yang berlarutan ini. Antaranya ialah seperti berikut:</p> <p>i. Pelaksanaan projek tebatan banjir Kuala Lumpur</p>	<p><b>Question:</b>  <b>What is the action and measures taken by the department in managing and controlling floods in Kuala Lumpur?</b>  <b>Answer:</b>  In general, the Malaysian government through the agencies such as DID particularly has taken several measures and approach to control and mitigate the flooding problem. Various projects and flood management measures have been built across the country, particularly in flood prone and high risk areas. These measures can be categorized into two main steps, namely structural measures and non-structural measures.  Regarding to the context of Kuala Lumpur and the Klang Valley, over the past few decades, the government has taken serious measures to address this perennial flooding problems. Among them are as follows:</p> <p>i. Implementation of Kuala Lumpur Flood Mitigation Project</p>

<ul style="list-style-type: none"> <li>ii. <i>Pembinaan Empangan Batu dan Empangan Klang Gates</i></li> <li>iii. <i>Kerja-kerja menaik taraf dan mendalamkan sungai-sungai utama di Kuala Lumpur</i></li> <li>iv. <i>Perlaksanaan MSMA dalam pembangunan kawasan baru</i></li> <li>v. <i>Pembinaan Terowong SMART</i></li> <li>vi. <i>Penubuhan Jawatankuasa Pengurusan Banjir di setiap peringkat kerajaan.</i></li> <li>vii. <i>Perancangan lembangan sungai</i></li> <li>viii. <i>Sistem amaran banjir</i></li> </ul> <p><i>Sila rujuk laman sesawang Jabatan Saliran untuk maklumat lanjut.</i></p>	<ul style="list-style-type: none"> <li>ii. Construction of Batu Dam and Klang Gates Dam</li> <li>iii. River improvement and canalisation works for the main rivers in Kuala Lumpur</li> <li>iv. The implementation and establishment of MSMA and storm water management guideline in development planning</li> <li>v. Construction of SMART Tunnel</li> <li>vi. The establishment of Flood Machinery and Relief Committee</li> <li>vii. River basin study and integrated river basin management</li> <li>viii. Early warning system and flood forecasting</li> </ul> <p>For further references: Refer to DID's website.</p>
<p><b>Soalan:</b> <b><i>Apakah langkah / projek mengatasi banjir yang terkini di Kuala Lumpur?</i></b></p> <p><b>Jawapan:</b> <i>Pembangunan terowong SMART merupakan antara projek pencegahan dan pengurusan banjir utama dan berskala besar yang telah dijalankan di Kuala Lumpur. Melalui pembukaan terowong ini, masalah banjir kilat yang sering melanda Bandaraya Kuala Lumpur telah dapat dikurangkan. Selain itu, kerajaan juga masih dalam peringkat perancangan bagi membangunkan beberapa lagi projek pencegahan banjir di sekitar kawasan Kuala Lumpur. Selain projek dan langkah pengurusan yang berskala besar, pelbagai langkah sedia ada seperti kerja-kerja pembersihan dan pendalaman sungai akan terus dijalankan oleh DID dari masa ke semasa bagi memastikan masalah banjir ini dapat diatasi sepenuhnya.</i></p>	<p><b>Question:</b> <b>What is the latest project for flood mitigation in Kuala Lumpur?</b></p> <p><b>Answer:</b> The construction of SMART tunnel project is one of the main and large-scale flood mitigation project that has been conducted in Kuala Lumpur. Through the establishment of this tunnel, flash floods that often hit the city of Kuala Lumpur has been prevent. In addition, the government is still in the planning stages of developing numbers of projects to prevent flooding in the vicinity of Kuala Lumpur. In addition to the projects and large-scale infrastructure measures, existing measures such as the river improvement work still be maintained and continued to be undertaken by DID from time to time to ensure that flood problems can be solved in a comprehensive way.</p>
<p><b>Soalan:</b> <b><i>Bagaimana Jabatan melihat potensi dan peranan perancangan guna tanah dalam mengatasi banjir?</i></b></p> <p><b>Answer:</b> <i>Jabatan Saliran sememangnya telah menyedari kepentingan dan potensi perancangan spatial dan guna tanah sebagai salah satu elemen penting dalam memastikan pengurusan banjir yang seimbang dan efektif. Menyedari tentang keperluan ini, DID telah memperkenalkan startegi pengurusan banjir yang lebih</i></p>	<p><b>Question:</b> <b>How the department deal with flood/flash flood problems particularly in relation with land use development?</b></p> <p><b>Answer:</b> DID recognize the importance and potential of spatial planning as one of the key elements in ensuring a balanced and effective flood management. With regards to these needs, DID has introduced an integrated flood management and integrated river basin management, which aimed to combine the planning aspect and management of water resources especially in the river basin areas.</p>

<p><i>cekap dengan menggabungkan perancangan lembangan sungai dan pengurusan sumber air.</i></p> <p><i>Di bawah sistem dan strategi ini, pembangunan yang melibatkan kawasan lembangan sungai akan dilihat dalam konteks yang lebih menyeluruh, yangmana pelbagai faktor akan diambil kira semasa proses perancangan seperti faktor alam sekitar, sosio ekonomi dan sebagainya.</i></p> <p><i>Namun begitu, startegi perancangan ini memerlukan koordinasi dan kerjasama yang tinggi antara pelbagai pihak, terutamanya di peringkat agensi yang terlibat. Ketika ini, koordinasi antara agensi dan pihak yang berkepentingan di sesuatu kawasan yang terlibat itu masih lagi rendah. Ini menyukarkan untuk proses pelaksanaan strategi pembangunan secara integrasi ini. Masih banyak perkara dan ruang yang boleh dipertingkatkan dan dibaik lagi bagi memastikan strategi ini dapat berjalan dengan lancar.</i></p>	<p>In this strategy, the development of river basin area will be seen from more comprehensive and broad perspectives, which numbers of factors will be taken into considerations during the planning process, such as environmental factors, socio-economic and etc.</p> <p>However, the integrated flood management requires high coordination and cooperation between the various stakeholders, especially within the involved agencies. Presently, coordination between agencies and stakeholders in Malaysia with regards to planning and flood management is still poor. Most of the related agencies work independently within their jurisdiction. This makes it difficult for the implementation of the integrated strategy. There is still a lot of things and space for further improvement to ensure this strategy can go smoothly.</p>
<p><b>Soalan:</b> <b><i>Cadangan penambahbaikan bagi sistem sedia ada?</i></b></p> <p><b>Jawapan:</b> <i>Pada pandangan peribadi saya, sistem sedia ada yang telah dipraktikkan sejak sekian lama sedikit sebanyak telah memberikan impak yang positif dalam mengurangkan masalah banjir. Namun begitu, masih banyak ruang untuk penambahbaikan bagi memastikan sistem pengurusan banjir ini terus relevan di masa hadapan. Antara cadangan yang boleh diambil kira adalah seperti berikut:</i></p> <ol style="list-style-type: none"> <li><i>i. Memberi lebih banyak kuasa kepada pihak berkuasa terutamanya DID bagi menjalankan kerja-kerja pengurusan banjir yang lebih berkesan.</i></li> <li><i>ii. Merangka satu rang undang-undang khas mengenai pengurusan banjir yang lebih menyeluruh dan efektif, kerana undang-undang sedia ada agak terhad.</i></li> <li><i>iii. Membangunkan satu rangka kerja dan polisi berkenaan pengurusan banjir di peringkat nasional. Bagi menjadi asas rujukan kepada perancangan dan pengurusan banjir yang lebih teratur di peringkat bawahan dan di masa hadapan.</i></li> </ol>	<p><b>Question:</b> <b>Suggestion/recommendation to improve the current flood risk management?</b></p> <p><b>Answer:</b> From my personal view, the current flood management and system that has been practiced over the years have brought a positive impact in reducing and mitigating the flood impact. However, there is still plenty of room for improvements to ensure that it remains relevant in the future. Among the suggestions and recommendations are as follows:</p> <ol style="list-style-type: none"> <li>i. Give more legislative power to local authorities (DID) to carry out their work in managing flood.</li> <li>ii. Drafted a new law and regulation with aimed to integrated the flood management and planning. The existing law is quite restricted and has limit the authorities to have fully control on all aspect of water and spatial management.</li> <li>iii. Malaysia still do not have any water or flood management policy. There is strong need to develop a policy and framework for these aspect at the national level. These framework and policy could be the basic reference for the planning and management of floods especially at the local level.</li> </ol>

Interviewee B: Officer (Civil Engineering & Drainage Department) at Kuala Lumpur City Council (DBKL)

Bahasa Malaysia	English
<p><b>Soalan:</b> <i>Apakah fungsi dan peranan Jabatan ini dalam mengatasi masalah banjir di Kuala Lumpur?</i></p> <p><b>Jawapan:</b> <i>Jabatan Kejuruteraan Awam dan Saliran memberikan perkhidmatan sokongan kepada jabatan-jabatan dalam organisasi DBKL. Seiring dengan perkembangan fungsi DBKL, jabatan turut berurusan secara langsung dengan agensi-agensi kerajaan dan juga pihak awam dalam bidang yang berkaitan dengan kejuruteraan awam dan saliran termasuk operasi penguatkuasaan dan bantuan kecemasan.</i></p> <p><i>Fungsi Bahagian Kawalan Infrastruktur</i></p> <ol style="list-style-type: none"> <li><i>i. Bertanggungjawab menyemak pelan-pelan cadangan kebenaran merancang dan pelan pendirian bangunan.</i></li> <li><i>ii. Bertanggungjawab menyemak dan meluluskan pelan-pelan kerja tanah dan infrastruktur (jalan, parit dan lampu jalan) bagi pembangunan kawasan baru.</i></li> <li><i>iii. Memproses dan mengeluarkan permit-permit kerja tanah (permit membina laluan masuk/keluar sementara dan permit mengangkut tanah atas jalan awam).</i></li> </ol> <p><i>Fungsi Bahagian Saliran</i></p> <ol style="list-style-type: none"> <li><i>i. Menyelaras aduan-aduan untuk tindakan Bahagian.</i></li> <li><i>ii. Merancang, mengurus dan meyelaras kerja-kerja penyelenggaraan parit-parit besar di dalam kawasan pentadbiran DBKL.</i></li> <li><i>iii. Menyelaras segala aduan berkenaan banjir.</i></li> </ol>	<p><b>Question:</b> <b>What is the function of the department in flood management in Kuala Lumpur?</b></p> <p><b>Answer:</b> Department of Civil Engineering and Drainage provides support services to other departments in the organization of City Hall. Along with the development of the City Hall, the department also deal directly with government agencies and the public in the areas related to civil engineering and drainage including enforcement and emergency relief operations.</p> <p>Infrastructure and Control Division</p> <ol style="list-style-type: none"> <li>i. Responsible for reviewing the plans proposed establishment of planning permission and building plans.</li> <li>ii. Responsible for reviewing and approving plans for land and infrastructure (roads, sewers and street lighting) for the development of new areas.</li> <li>iii. Processing and issuance of work permits for land (building permit entrance / exit permit temporary and land transport on public roads).</li> </ol> <p>Drainage Division</p> <ol style="list-style-type: none"> <li>i. Managing complaints for action parts.</li> <li>ii. Plan, manage and coordinate the work of the maintenance of these drains within the DBKL areas.</li> <li>iii. Coordinate all complaints regarding flooding.</li> </ol>
<p><b>Soalan:</b> <i>Apakah langkah pencegahan yang telah diambil oleh pihak dewan bandaraya dalam mengurus dan mengawal banjir di Kuala Lumpur?</i></p> <p><b>Jawapan:</b> <i>Sebagai Jabatan yang bertanggungjawab secara langsung ke atas aspek pengurusan saliran dan masalah banjir di Kuala Lumpur, Jabatan Kejuruteraan Awam dan Saliran telah mengambil pelbagai yang dirasakan perlu bagi</i></p>	<p><b>Question:</b> <b>What is the action and measures taken by the department in managing and controlling floods in Kuala Lumpur?</b></p> <p><b>Answer:</b> As the responsible department that involve directly in the drainage management and flooding problems in Kuala Lumpur, the Civil Engineering and Drainage</p>

<p><i>mengurangkan kejadian banjir di sekitar Kuala Lumpur. Antara langkah-langkah yang telah diambil ialah:</i></p> <ol style="list-style-type: none"> <li><i>i. Pelaksanaan dan penguatkuasaan garis panduan MSMA bagi semua pembangunan yang ingin dijalankan di Kuala Lumpur. Walau bagaimanapun, pelaksanaannya masih kurang berkesan kerana ketiadaan peruntukkan undang-undang yang boleh memaksa sektor swasta dan awam untuk mengikuti garis panduan dan standard yang telah ditetapkan.</i></li> <li><i>ii. Pelaksanaan berterusan program penyelenggaraan sungai (pembersihan sungai). Program ini kebanyakkan diadakan di sungai-sungai dan longkang yang terletak dibawah bidang kuasa dan pengurusan DBKL.</i></li> <li><i>iii. Meningkatkan program tebatan banjir melalui mewilayahkan dan merasionalkan sungai kita, pembinaan perangkap pencemar kasar, pembinaan rawatan air rebut tumbuh-tumbuhan,</i></li> <li><i>iv. Pelaksanaan kod bangunan disemak semula pada pematuhan kepada kehendak Perakuan Siap dan Pematuhan (CCC).</i></li> <li><i>v. Pemetaan Kawasan Sensitif Alam Sekitar (KSAS) mengikut penemuan Jabatan Geo-sains untuk melindungi dan menguruskan kawasan-kawasan yang kawasan sensitif alam sekitar terutamanya kawasan yang sering berlaku banjir.</i></li> <li><i>vi. DBKL juga merupakan salah satu agensi yang terlibat di bawah Jawatankuasa Pengurusan Bencana dan Bantuan Jawatankuasa Bantuan Disaster Management and Relief Committee di peringkat tempatan. Bertanggungjawab dalam merangka pelan pengurusan dan pemindahan mangsa banjir. Menyediakan bantuan logistic seperti pengangkutan, pusat pemindahan, khidmat nasihat dan sebagainya. Selain itu, setiap kali tibanya musim banjir, DBKL dan beberapa agensi lain yang berkaitan akan mengadakan sesi perbincangan bersama penduduk setempat dan mangsa banjir bagi memberi bantuan yang diperlukan serta mencari penyelesaian kepada masalah banjir ini.</i></li> </ol>	<p>Department (DBKL) has taken various measures to reduce and mitigate the flooding around Kuala Lumpur, such as:</p> <ol style="list-style-type: none"> <li>i. Implementation and enforcement of MSMA guidelines for all development in Kuala Lumpur. However, the implementation is still less effective because of the absence of legal provisions that could force the private and public sectors to follow the guidelines and standards that have been set.</li> <li>ii. The continued implementation of the program of maintenance (cleaning the river). The continuous implementation of river maintenance program (river cleansing). The program is held in many rivers and drains that are under the jurisdiction and management of City Hall.</li> <li>iii. Increase the flood mitigation program through regionalize and rationalize our rivers, construction of gross pollutant traps, construction of storm water treatment plants and etc.</li> <li>iv. Implementation of revised building code in compliance to the requirement of the Certification of Completion and Compliance (CCC).</li> <li>v. Mapping out Environmentally Sensitive Areas (ESA) in accordance with the Geo-science Department findings to protect and properly manage areas that are environmentally sensitive areas.</li> <li>vi. DBKL also one of the agencies involved in the Disaster Management and Relief Committee at the local level. DBKL responsible for drawing up management plans and evacuation plan for all the victims. Provide logistical support such as transport, evacuation centres, advisory services and etc. In addition, every year due to the arrival of the flood season, DBKL and other relevant agencies will hold discussions with local residents and flood victims to provide the necessary assistance and finding solutions to problems this flood.</li> </ol>
<p><b>Soalan:</b> <b><i>Cadangan penambahbaikan sistem sedia ada?</i></b> Jawapan:</p> <ol style="list-style-type: none"> <li><i>i. Satu peruntukkan undang-undang diperlukan bagi memastikan pelaksanaan MSMA dapat dipertingkatkan terutamanya dalam kalangan pihak pemaju.</i></li> </ol>	<p><b>Question:</b> <b>Suggestion/recommendation to improve the current flood risk management?</b> Answer:</p> <ol style="list-style-type: none"> <li>i. The provisions of the law and regulation is needed to ensure the implementation of MSMA can be improved, particularly among the private and public sectors.</li> </ol>

<p>ii. <i>Menyediakan dan memberikan lebih banyak insentif dan kemudahan kepada pihak swasta khususnya pemaju yang mematuhi garis panduan dan</i></p> <p>iii. <i>Meningkat dan menggalakkan kerjasama dan koordinasi dua hala antara pihak berkuasa tempatan yang terletak di dalam lembangan sungai klang dan Kuala Lumpur. Penyelarasan strategi pengurusan sumber alam sekitar dan perancangan spatial khususnya di beberapa sungai utama di Lembah Klang amat penting bagi memastikan masalah banjir ini dapat diatasi secara menyeluruh.</i></p> <p>iv. <i>Meningkatkan koordinasi antara pihak berkuasa di setiap peringkat (persekutuan, negeri dan tempatan) bagi mengurangkan kerenah birokrasi dan pertindihan bidang tugas dan kepentingan.</i></p> <p>v. <i>Menjalinkan lebih banyak kerjasama antara pihak berkuasa tempatan dan pihak swasta dalam membangunkan projek-projek yang berimpak tinggi, khususnya berkaitan pembangunan infrastruktur. Sebagai contoh, kerjasama antara DBKL dan pihak pemaju swasta dalam membangunkan projek River of Life di Kuala Lumpur. Selain berkongsi dan bertukar kepakaran, kerjasama ini dapat membantu mengurangkan beban yang terpaksa dihadapi oleh pihak berkuasa tempatan khususnya DBKL dalam menguruskan infrastruktur dan fasiliti.</i></p>	<p>ii. Provide more incentives to the private sector, especially developers who comply with the planning guidelines and environmental assessment.</p> <p>iii. Enhance and promote bilateral cooperation and coordination between the local authorities located in the Klang river basin. The coordination, especially in managing environmental resources and spatial planning, is crucial to ensure flood problems can be solved thoroughly.</p> <p>iv. Improve coordination between the authorities at all levels (federal, state and local) to reduce bureaucracy and duplication of duties and interests.</p> <p>v. Encourage more cooperation between local authorities (DBKL) and the private sector in developing and controlling the high impact projects, particularly on infrastructure development. For example, the collaboration between DBKL and the developers in the development of the River of Life in Kuala Lumpur. Besides sharing and exchange the expertise, collaboration can help to ease the burden faced by local authorities especially DBKL in managing infrastructure and facilities in term of financial aspect.</p>
<p><b>Soalan:</b>  <i>Apakah tujuan DBKL menghantar penyertaan bagi menyertai program "Making Cities Resilient: My City is Getting Ready" anjuran UNISDR dan sejauh mana perlaksanaanya di Kuala Lumpur.</i></p> <p><b>Jawapan:</b>  <i>Tiada maklumat</i></p>	<p><b>Question:</b>  What are the purposes participating in the "Making Cities Resilient: My City is Getting Ready", program and the extent of implementation in Kuala Lumpur.</p> <p><b>Answer:</b>  <i>No information</i></p>

Interviewee C: Officer of Urban Planning Department at Kuala Lumpur City Council (DBKL)

Bahasa Malaysia	English
<p><b>Soalan:</b> <b>Apakah fungsi utama Jabatan ini?</b></p> <p><b>Jawapan:</b> Peranan dan fungsi Jabatan ini dapat dibahagikan kepada 3 bidang tugas utama, yang merangkumi:</p> <ol style="list-style-type: none"> <li>i. Kawalan Pembangunan - Memproses permohonan, menyelaras dan mengawal semua pembangunan fizikal bagi menentukan pembangunan yang sesuai dan teratur dalam kawasan Majlis berdasarkan kepada rancangan pemajuan dan perancangan yang wajar.</li> <li>ii. Rancangan Pemajuan dan Penyelidikan - Memastikan Kuala Lumpur mempunyai Rancangan-Rancangan Pemajuan seperti yang dikehendaki di dalam Akta Perancang Bandar Dan Desa (Akta 172).</li> <li>iii. Penguatkuasaan Perancangan - Memastikan pembangunan bandar yang teratur dan mematuhi peruntukan Akta Perancang Bandar dan Desa, 1976 (Akta 172) serta undang-undang yang berkaitan.</li> </ol> <p>Walaupun, Jabatan tidak mempunyai tugas khusus dalam aspek pengurusan banjir di Kuala Lumpur. Lebih kepada membantu dan bekerja sama dengan Jabatan lain seperti Jabatan Kejuruteraan Awam dan Saliran bagi merancang dan membangunkan rangka kerja pengurusan banjir. Selain itu, Jabatan juga memainkan peranan penting dalam memastikan perancangan guna tanah yang seimbang dan tidak mendatangkan kesan buruk kepada alam sekitar.</p>	<p><b>Question:</b> <b>What is the main roles of the department?</b></p> <p><b>Answer:</b> In general, the roles and responsibilities of the Department can be categorised into 3 main aspects, namely:</p> <ol style="list-style-type: none"> <li>i. Development Control - Processing applications, coordinating and controlling all physical developments to ensure that suitable and systematic development within the Council's area follows the appropriate development and planning.</li> <li>ii. Research and Development Plan - To ensure that DBKL (Kuala Lumpur) has the Development Plans as required in the Town and Country Planner Act (Act 172).</li> <li>iii. Planning Enforcement - To ensure a systematic town development and complying with the provisions under Town and Country Planner Act, 1976 (Act 172) and related laws.</li> </ol> <p>However, the Department does not have a specific task in the flood management o in Kuala Lumpur. The Department more to assist and cooperate with other departments such as the Department of Civil Engineering and Drainage in designing and developing a framework for flood management (from the planning perspective). In addition, the Department also plays a key role in ensuring a balanced land use and zoning plan which could lead into a sustainable development.</p>
<p><b>Soalan:</b> <b>Sejauh mana aspek pengurusan banjir di titik beratkan di dalam pembangunan guna tanah di Kuala Lumpur?</b></p> <p><b>Jawapan:</b> Dalam merangka strategi pembangunan di Kuala Lumpur, DBKL telah mengambil kira pelbagai aspek yang dirasakan perlu dan berkaitan sebelum sesuatu strategi itu dilaksanakan. Sebagai contoh, beberapa kawasan yang berisiko tinggi untuk dilanda bencana alam khususnya banjir telah di zonkan dibawah kawasan sensitif alam</p>	<p><b>Question:</b> <b>To what extent the department considers flood management in development planning (land use/spatial planning) in Kuala Lumpur?</b></p> <p><b>Answer:</b> DBKL has taken into account many aspects that are necessary and relevant before a strategy or policy is proposed or implemented in the development plan. For example, several sensitive and high-risk areas for natural disasters, especially flood has been allocated as an environmental sensitive areas/zones. Under the</p>

<p>sekitar. Di bawah zon sensitif alam sekitar ini, setiap perancangan dan pembangunan di kawasan ini akan diberikan perhatian dan diteliti terlebih dahulu sebelum sesuatu kelulusan diberikan. Selain itu, melalui perancangan guna tanah yang efisien, beberapa kawasan telah digazet kan sebagai kawasan untuk kolam tadahan dan takungan air sebagai salah satu initiative bagi mengurangkan masalah banjir di Kuala Lumpur.</p>	<p>environmentally sensitive zone, any new development in this area will be evaluated and careful planning before any approval is granted. In addition, through efficient land use planning, some areas have been gazetted for water bodies land use such as detention ponds and water reservoirs as one initiative to reduce flooding in Kuala Lumpur.</p>
<p><b>Soalan:</b>  <b>Apakah langkah-langkah yang telah di ambil (dirancang) oleh pihak Jabatan bagi mengatasi dan mengawal banjir khususnya dari perspektif perancangan fizikal?</b>  <b>Jawapan:</b>      Di bawah Jabatan Perancangan, tiada langkah khusus yang di ambil oleh Jabatan yang menjurus kepada pengurusan banjir. Namun dalam konteks perancangan fizikal dan spatial, perancangan guna tanah yang seimbang dan mapan mampu memainkan peranan yang penting dalam aspek pengurusan banjir. Sebagai Jabatan yang bertanggungjawab dalam perancangan guna tanah dan fizikal, sudah menjadi tugas utama jabatan dalam memastikan setiap perancangan di Kuala Lumpur haruslah selaras dengan aspirasi diperingkat yang lebih tinggi seperti Persekutuan dan Nasional.</p>	<p><b>Question:</b>  <b>What is the action and measures taken by the department in managing and controlling floods from the perspective of development planning?</b>  <b>Answer:</b>      Basically, there is no specific approach / measures taken/implemented by the Department that focus to flood management. But in the context of physical and spatial planning, land use planning, balanced and sustainable could play an important role in aspects of flood management. As the Department responsible for land use and physical planning, it has become the main task of the Urban Planning Department to ensure that any development scheme in Kuala Lumpur should in line with the aspirations of a higher level such as the National and Federal policy.</p>
<p><b>Soalan:</b>  <b>Adakah pembangunan sedia ada di Kuala Lumpur mematuhi piawaian yang telah ditetapkan oleh Jabatan Pengairan dan Saliran?</b>  <b>Jawapan:</b>      Sebelum sesuatu pembangunan diberikan kelulusan perancangan, ia perlu melalui proses permohonan kebenaran merancang dan perlu diteliti oleh setiap agensi yang terlibat seperti Jabatan Perancangan, Jabatan Saliran dan etc. Setiap pembangunan ini perlu mematuhi setiap piawaian perancangan yang telah ditetapkan oleh setiap agensi. Walaubagaimanapun, tidak dinafikan pembangunan yang pesat di kuala Lumpur dan kawasan sekitar sedikit sebanyak telah menyumbang kepada bencana banjir. Walau garis panduan dan prosedur telah dikuat kuasakan, masih banyak ruang yang boleh diperbaiki bagi meminimumkan risiko berlakunya banjir di masa hadapan.</p>	<p><b>Question:</b>  <b>Is the development proceed on the flood plain areas were followed the specific guidelines provided by the DID?</b>  <b>Answer:</b>      For any new development in Kuala Lumpur must go through planning approval/permissions procedure before any construction can take place. Under this procedure, any development complied with all the planning standard and guidelines before granted the planning approval. This is one of the approach taken by local authority to ensure a balance and sustainable development in Kuala Lumpur. However, it goes without saying that the rapid development in Kuala Lumpur and the surrounding area has to some extent contributed to the disaster especially floods. Even though, all the guidelines and procedures were enforced, there is still much room for improvement in order to minimize the risk of flooding in the future.</p>

Interviewee D: Office at Federal Department of Town and Country Planning Peninsular Malaysia (JPBD)

Bahasa Malaysia	English
<p><b>Soalan:</b> <b>Apakah fungsi utama Jabatan ini?</b></p> <p><b>Jawapan:</b> Fungsi utama JPBD terbahagi kepada 3 peringkat utama kerajaan (Persekutuan, Negeri dan Tempatan). Fungsi utama ialah bagi memastikan perancangan kegunaan, pembangunan dan pemeliharaan tanah yang sempurna.</p> <p><b>Peringkat Persekutuan</b> Memberi nasihat kepada Kerajaan Persekutuan dalam semua hal perancangan bandar dan desa;</p> <ol style="list-style-type: none"> <li>i. Bertindak sebagai urus setia kepada Majlis Perancang Fizikal Negara (MPFN) yang ditubuhkan di bawah Akta Perancangan Bandar Dan Desa 1976 (Akta 172);</li> <li>ii. Menggalakkan sistem perancangan yang komprehensif, efektif dan efisien melalui undang-undang, prosedur perancangan serta kajian penyelidikan dan pembangunan;</li> <li>iii. Menterjemahkan dasar-dasar sosial, ekonomi dan alam sekitar negara ke dalam dimensi spatial;</li> <li>iv. Menyelia dan menyelaraskan pangkalan data guna tanah negara.</li> </ol> <p><b>Peringkat Negeri</b></p> <ol style="list-style-type: none"> <li>i. Memberi nasihat kepada Kerajaan Negeri dalam semua hal-ehwal perancangan bandar dan desa dalam menyelaraskan pelaksanaan Akta 172 di peringkat Negeri;</li> <li>ii. Bertindak sebagai urus setia kepada Jawatankuasa Perancang Negeri (JPN) yang ditubuhkan di bawah Akta 172;</li> <li>iii. Membantu dalam perancangan projek-projek khas yang dikendalikan Kerajaan Negeri;</li> <li>iv. Menjalankan kajian penyelidikan dan pembangunan mengenai perancangan bandar dan desa;</li> <li>v. Menyedia dan menyelaraskan pangkalan data guna tanah Negeri.</li> </ol>	<p><b>Question:</b> <b>What is the function of this department in development planning?</b></p> <p><b>Answer:</b> The function of JPBD is to ensure the ideal use, development, and land conservation at three levels of government: Federal, State and Local.</p> <p><b>Functions at Federal Level</b> To advise the Federal Government on all planning matters related to the use and development of land;</p> <ol style="list-style-type: none"> <li>i. To act as the Secretariat to the National Physical Planning Council formed under the Town and Country Planning Act 1976 (Act 172);</li> <li>ii. To encourage comprehensive, effective and efficient planning through planning laws, methodology, research, standards and procedures.</li> <li>iii. To translate national socioeconomic policies into physical and spatial strategies/forms based on land use and settlement programmes;</li> <li>iv. To monitor, update and publish statistics, bulletins and rules related to town and country planning.</li> </ol> <p><b>Functions at State Level</b></p> <ol style="list-style-type: none"> <li>i. Main advisor to the state government in all planning matters, including the use and development of land;</li> <li>ii. Secretary to the State Planning Committees formed under the Town &amp; Country Planning Act 1976 (Act 172);</li> <li>iii. To advise local authorities regarding the policies and control of land use and buildings;</li> <li>iv. To assist state governments in preparing layout plans for special state projects; and,</li> <li>v. To conduct research and studies on land use and development.</li> </ol> <p><b>Functions at Local Level</b></p>

<p><i>Peringkat Tempatan</i></p> <ol style="list-style-type: none"> <li>i. <i>Merancang, menyelaraskan dan mengawal penggunaan dan pemajuan tanah dan bangunan dalam kawasan pihak berkuasa perancang tempatan (PBPT)</i></li> <li>ii. <i>Melaksanakan tugas-tugas lain yang dipertanggungjawabkan oleh Pihak Berkuasa Negeri (PBN) atau Jawatankuasa Perancang Negeri (JPN) dari masa ke semasa.</i></li> </ol>	<ol style="list-style-type: none"> <li>i. To plan, coordinate and control the use and development of land and buildings in the local authorities' areas;</li> <li>ii. To perform other related tasks entrusted by the State Authority or the State Planning Committee.</li> </ol>
<p><b>Soalan:</b>  <i>Sejauh manakah aspek pengurusan alam sekitar dan pengurusan banjir di titik beratkan di dalam perancangan pembangunan?</i></p> <p><b>Jawapan:</b>  <i>Dalam konteks perancangan dan pembangunan di Malaysia, aspek pengurusan alam sekitar memang diberi perhatian serius oleh kerajaan. Ini dapat dilihat didalam beberapa strategi dan polisi pembangunan. Contoh rujukan: Rancangan Fizikal Negara, pelaksanaan EIA dan sebagainya.</i></p>	<p><b>Question:</b>  <b>How environmental/flood management elements were considered in development planning?</b></p> <p><b>Answer:</b>  In the context of planning and development in Malaysia, aspects of environmental management is to be taken seriously by the government. This can be seen in a number of strategy and policy development. Further reference: National Physical Plan, implementation of EIA etc.</p>
<p><b>Soalan:</b>  <i>Sejauh mana aspek perancangan (strategi dan polisi pembangunan spatial) di aplikasikan dalam pengurusan banjir di Malaysia?</i></p> <p><b>Jawapan:</b>  <i>Dari aspek pembangunan fizikal dan spatial, pembangunan guna tanah dan zoning merupakan antara elemen penting yang memainkan peranan dalam mengawal kejadian banjir. Pembangunan guna tanah dan zoning yang telah mengambil kira pelbagai faktor seperti alam sekitar dapat mengurangkan risiko banjir. Sebagai contoh, melalui penggunaan rizab sungai/saliran dalam setiap pembangunan. Rujukan: Rancangan Fizikal Negara, Rancangan Struktur Negeri dan Rancangan Tempatan.</i></p>	<p><b>Question:</b>  <b>To what extent planning development (spatial planning strategies and policies) in overcome the flood problems in Malaysia?</b></p> <p><b>Answer:</b>  The application of land use and zoning plan is one of the key component in managing and mitigating flood in Malaysia. The land use and zoning plan which took into account various factors such as the environment can reduce the risk of flooding in certain area. For example, through the use of the reserve of river / drainage in every development (land use plan). Further reference: National Physical Plan, State Structure Plan and Local Plan.</p>

## APPENDIX 3

Table of name of organisations that involved in development planning and flood management in Kuala Lumpur.

Name of organisation	Functions
Economic Planning Unit (EPU)	Formulate policies and strategies for socio-economic development, prepare project budget, advise government on economic issues
Ministry of Urban Wellbeing, Housing and Local Government (KPKT)	To establish and implement comprehensive an uniform nationwide rural and urban planning and to ensure adequate comfortable and balanced housing development
Ministry of Natural Resources and Environment (NRE)	Secretariat for National Water Resources Council Secretariat for National Land Council Secretariat for National Forestry Council Secretariat for Cabinet Committee for Highlands and Islands Development
Ministry of Federal Territories	Conduct study for National Water Resources Policy Set up in 2003, replaced the Secretariat. Manage 3 Federal Territories (Labuan, Putrajaya, Kuala Lumpur)
Federal Department of Town and Country Planning Peninsular Malaysia (JPBD)	Prepares guidelines and development planning for the whole country. Secretariat for National Physical Council. Secretariat for State Planning Committee Secretariat for One Stop Centre. Advisor for State Governments and local Authorities on planning, land use control and building policies. Establishes and conducts studies for Local and Structure Plans and research on land use and development
Department of Irrigation and Drainage (DID)	Secretariat for Permanent Flood Control Commission Establishes and conducts study and work on: <ul style="list-style-type: none"> <li>- Flood mitigation study, design and mitigation works</li> <li>- Urban drainage study, design and local flooding mitigation works</li> <li>- IRBM study</li> <li>- Rivers/river mouths, regional ponds and main drains maintenance</li> </ul> Permanent Technical Advisor for flood mitigation, rivers, urban drainage, water extraction and sand mining works at Federal, State and Local Governments Technical Advisor for One Stop Centre (OSC) i.e. Drainage Layout Plans and ESC Plans. Hydrology data collection, monitoring and information dissemination on floods. Prepare guidelines for rivers and drainage system. Implement campaign to improve public awareness on rivers, floods etc.
Department of Environment	To promote, ensure and sustain sustainable environmental management in the country. Monitor and control activities relating to sewage and waste management

Kuala Lumpur City Hall (DBKL)

Secretariat for EIA on 26 numbers of prescribed activities  
Providing technical assistance, prepare regulations and guidelines.  
Water quality data collection (privatized to ASMA since 1995).  
Conducting studies to improve river water quality  
Administrative and local government for Kuala Lumpur  
Conducts urban drainage works for tertiary drains  
Maintenance of tertiary drains including rubbish collection  
Permits for tertiary drains diversions and conversions  
Approvals for Drainage Layout Plans and ESC Plans  
Enforcement for construction works.  
Establishes and operates the planning and development control.  
Provides the planning approval and permissions

## APPENDIX 4

List of documents reviewed.

Year	Title	Level of Governance	Focus on	Produced by
2010	National Physical Plan 2 ( <i>Rancangan Fizikal Negara ke-2</i> )	National	Establishing a spatial framework for physical development	Federal Department of Town and Country Planning Peninsular Malaysia Ministry of Urban Wellbeing, Housing and Local Government
2006	National Urbanisation Policy ( <i>Dasar Perbandaran Negara</i> )	National	Establishing a framework for government to plan, implement and manage urban development and service.	Federal Department of Town and Country Planning Peninsular Malaysia Ministry of Urban Wellbeing, Housing and Local Government
2009	National Policy on Climate Change ( <i>Dasar Perubahan Iklim Negara</i> )	National	Framework to mobilise and guide government and other stakeholders in addressing the challenges of climate change in a holistic manner	Ministry of Natural Resources and Environment Malaysia
2012	National Water Resources Policy ( <i>Dasar Sumber Air Negara</i> )	National	To address the issues and challenges in managing the country's water resources. To ensure the existing and proposed policy directions from multiple sectors related to water as a whole are complementary.	Ministry of Natural Resources and Environment Malaysia Department of Irrigation and Drainage of Malaysia
2003	Kuala Lumpur Structure Plan 2020 ( <i>Rancangan Struktur Kuala Lumpur 2020</i> )	State/Local	Spatial development plan for the whole Kuala Lumpur	Federal Department of Town and Country Planning Peninsular Malaysia Ministry of Federal Territories Kuala Lumpur City Council (DBKL)
-	Kuala Lumpur City Plan 2020 ( <i>Rancangan Tempatan Kuala Lumpur 2020</i> )	State/Local	Spatial development plan for the whole Kuala Lumpur (Local Context)	Federal Department of Town and Country Planning Peninsular Malaysia Ministry of Federal Territories Kuala Lumpur City Council (DBKL)

## APPENDIX 5

### List of Law and Regulation Related to Planning and Flood Management

Name	Owner	Regulator	Relevant Clause	Impacts
Constitution	Malaysia	Parliament	<ul style="list-style-type: none"> <li>Federal List, Item 11 – <i>Federal works and power, including (a) Public works for federal purposes and (b) Water supplies, rivers and canals, except those wholly within one State or regulated by an agreement between all the States concerned; production, distributions by supply of water power.</i></li> <li>State List, Item 6 – <i>State works and water, that is to say (c) Subject to the Federal List, water (including water supplies, rivers and canals); control of silt; riparian rights</i></li> <li>Concurrent List, Item 8 – <i>Drainage and Irrigation.</i></li> <li>Concurrent List, Item 9 – <i>Rehabilitation of timing land and land which has suffered soil erosion</i></li> </ul>	<ul style="list-style-type: none"> <li>Federal funding to reduce flood events and flood damages.</li> <li>Funding shared by Federal and State Governments. Only covers water bodies in gazetted drainage and irrigation areas for both development and maintenance programs.</li> <li>Federal and State collectively review various laws to contain erosion problems caused by land opening. Less sedimentation shall flow into water bodies; thus, less flood and mud flood events, and damages.</li> <li>State Government gives permits and enforces compliances to land opening operators (developers, miners, farmers and etc.), water extraction operators, sets, gazettes river reserve and river maintenance i.e. desilting works</li> </ul>
National Land Code, 1965 (Act 56)	Federal Government	State Government Director of Lands and Mines (PTG)	<ul style="list-style-type: none"> <li>Section 13 defines water bodies covered by this Code</li> <li>Section 62 allows river reserve to be gazetted</li> </ul>	<ul style="list-style-type: none"> <li>Covers natural and artificial water bodies inclusive of all natural rivers, brooks, streams, canals and drains.</li> <li>50 meter left and right of river banks shall be declared as rivers (gazette).</li> </ul>
Water Act, 1920 (Act 418)	Federal Government		<ul style="list-style-type: none"> <li>Section 4 compulsory restoration of river banks</li> <li>Section 5 prohibits any acts along rivers</li> <li>Section 7 prohibits any water diversion works</li> <li>Section 14 restricts construction of structures</li> <li>Section 15: Penalties and sanctions for prosecution for Section 4, 5 and 7</li> </ul>	<ul style="list-style-type: none"> <li>Covers natural water bodies inclusive of its tributaries. Also covers canals if gazetted.</li> <li>Any works create interference on the river banks shall restore back to its pre-disturbed state.</li> <li>Applicants must have permit to do any acts i.e. fell any tree, obstruct or interfere or build structures</li> <li>Applicants must get permit to extract or build structures for water diversion purposes.</li> </ul>

Drainage Works Act, 1954 (Act 354)	Federal Government	State Government Department of Irrigation and Drainage (DID)	<ul style="list-style-type: none"> <li>• Section 2 defines drainage area and drainage works</li> <li>• Section 3: Declaration of drainage area</li> <li>• Section 4: Appointment of Drainage Board</li> <li>• Section 7: Imposition of drainage rate</li> <li>• Section 11: Interference on drainage works</li> <li>• Section 12: Illegal drain construction</li> <li>• Section 13: Illegal use of vehicles and boats</li> <li>• Section 18: Power to compound</li> </ul>	<ul style="list-style-type: none"> <li>• Prohibits construction of walls and buildings within 50 feet from both banks or flood channels</li> <li>• Section 4 – fines RM500. Continue offence – RM10 per day</li> <li>• Section 5 or 7 – fines RM1000</li> <li>• Demarcation of drainage area through a declaration</li> <li>• Notification through a gazette</li> <li>• DID as secretariat</li> <li>• Notification through a gazette for annual rate</li> <li>• Section 11 – fines RM500; jail 6 months or both. Offence through 14 days written notice</li> <li>• Section 12 – fines RM500; jail 6 months or both</li> <li>• Section 13(6) – fines RM200; jail 3 months or both</li> <li>• Section 18 – compound RM75</li> <li>• Section 69 – fines RM2, 000; jail 1 year or both. Continue offence RM500 per day</li> <li>• Section 70 – fines RM5, 000; jail 2 years or both. Continue offence RM500 per day</li> <li>• Mitigation works required to cater extra discharge from new developments shall be taken care through drainage contributions</li> </ul>
Local Government Act, 1976 (Act 171)	Federal Government	State Government Local Authority	<ul style="list-style-type: none"> <li>• Section 69: Committing nuisance in streams</li> <li>• Section 70: Pollution of streams with trade refuse</li> <li>• Section 132: Drainage rate</li> </ul>	<ul style="list-style-type: none"> <li>• Submission of Drainage Layout Plans and ESC Plans. Section 70A (9) –fines RM50, 000; jail 5 years. Continue offence RM 500 per day.</li> <li>• Section 70A (17) (d) – fines RM2, 000. Continue offence RM100 per day</li> <li>• Section 71 – fines RM500,000; jail 10 years or both</li> <li>• Any development should conform to local Plan</li> <li>• Exception for Local Authorities</li> <li>• Project proponents must follow planning permission</li> <li>• Local Authority has the right to revoke and modify approved planning permissions</li> <li>• Section 18 – fines RM500; jail 2 years or both.</li> </ul>
State Drainage and Building Act, 1974 (Act 133)	Federal Government	State Government Local Authority	<ul style="list-style-type: none"> <li>• Section 70A: Earthworks</li> <li>• Section 70A(17) may formulate bylaw i.e. Earthwork By-Laws for submission of Earthwork Plans</li> <li>• Section 71: Penalty for failure of earthworks (enforcement)</li> </ul>	
Town, Country and Planning Act, 1976 (Act 172)	Federal Government	State Government Local Authority	<ul style="list-style-type: none"> <li>• Section 18: Land usage</li> <li>• Section 19 prohibits development without planning permission</li> <li>• Section 20 prohibits development contrary to planning permission</li> <li>• Section 25: Revocation and modification of planning permission and approval of building plans</li> </ul>	

			<ul style="list-style-type: none"> <li>• Section 26: Offences to unauthorized developments for Section 18</li> <li>• Section 27(6): Enforcement for Section 19</li> <li>• Section 27(9): Enforcement for Section 19</li> <li>• Section 28(6): Enforcement for Section 20</li> <li>• Section 28(9): Enforcement for Section 20</li> <li>• Section 29(4): Enforcement for Section 25</li> <li>• Section 29(6): Enforcement for Section 2</li> <li>• Section 30: Requisition notice</li> </ul>	<ul style="list-style-type: none"> <li>• Continue offence – fines RM5000 per day</li> <li>• Section 19 – fines RM100, 000; jail 6 months or both. Continue offence – fines RM5000 per day</li> <li>• Section 19 – fines RM100, 000; jail 6 months or both. Continue offence – fines RM5000 per day</li> <li>• Section 20 – fines RM100, 000; jail 6 months or both. Continue offence – fines RM5000 per day</li> <li>• Section 20 – fines RM100, 000; jail 6 months or both. Continue offence – fines RM5000 per day</li> <li>• Section 20 – fines RM100, 000; jail 6 months or both. Continue offence – fines RM5000 per day</li> <li>• Section 20 – fines RM100, 000; jail 6 months or both. Continue offence – fines RM5000 per day</li> <li>• Section 20 – fines RM100, 000; jail 6 months or both. Continue offence – fines RM5000 per day</li> <li>• Section 20 – fines RM100, 000; jail 6 months or both. Continue offence – fines RM5000 per day</li> <li>• Section 16(2) – fines RM25, 000; jail 2 years or both. Continue offence RM1000</li> <li>• Section 18(3) – fines RM50, 000; jail 2 years or both. Continue offence RM1000</li> <li>• Section 25(3) – fines RM100, 000; jail 5 years or both. Continue offence RM1000</li> <li>• Section 31(3) – RM25,000; jail 2 years or both</li> <li>• Section 33(2) – fines RM50, 000; jail 5 years or both. Continue offence RM1000</li> <li>• Section 34A – fines RM100, 000; jail 5 years or both. Continue offence RM1000</li> <li>• Section 34B – fines RM500,000; jail 5 years or both</li> <li>• Section 45 – compounds not exceeding RM2000</li> <li>• Notification through a gazette</li> <li>• Allows control through annual permit. DID can impose ESCP for short term crop activities</li> <li>• Fines RM5,000; jail 6 months</li> <li>• Land Office specifies types of mitigation works should be complied by land owners to rectify problems through advice of DID</li> </ul>
Environmental Quality Act, 1974 (Act 127)	Federal Government	Federal Government Department of Environment (DOE)	<ul style="list-style-type: none"> <li>• Section 16: Guilty of license holder</li> <li>• Section 18: Guilty of prescribed premises</li> <li>• Section 25 restricts pollution on inland waters</li> <li>• Section 31: Power to instruct repair</li> <li>• Section 33: Power to prohibit or control licensed persons from discharging</li> <li>• Section 34A: EIA Report</li> <li>• Section 34B prohibits against depositing scheduled waste</li> <li>• Section 45: Compound</li> </ul>	
Land Conservation Act, 1960 (Act 385)	Federal Government	State Government PTG Land Office	<ul style="list-style-type: none"> <li>• Section 3: declaration of hill lands</li> <li>• Section 5 prohibits farming of short term crop without permit</li> <li>• Section 18: Penalty</li> <li>• Section 19: Maintenance work</li> </ul>	

