Flood Damage Assessment for Perak Tengah District

By

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the requirements for the
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(Civil Engineering)

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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
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Approved by,

_____

A.P AHMAD MUSTAFA BIN HASHIM

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons

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WAN NOORAISHAH BINTI WAN ABDUL KADIR

ABSTRACT

Malaysia experiences flood every year, especially during the rainy season. Floods are one of the most destructive natural hazards in Malaysia, causing the highest number of casualties and material damage. Recently, Malaysia experienced a very serious flood which extended even to Perak, particulary in Perak Tengah. Thus, this studdy on flood damage assessment is carried out to establish the extent of impact of the flood for better future planning. Among the important factors that were investigated inunded flood level, impact to property and livelihood, and other physical damages as well as the effect on health and psychology level. This flood damage assessment has been implemented to derive a complete database spanning the area of Perak Tengah district which took into account the flood history. The records were carefully manged with proper identification on the respective locations. This research eventually revealed the extent and distribution of the physical damage as well as the impacts on the perception and psychological of the affected victims. This report concludes the findings with brief actions plans that can further explored.

ACKNOWLEDGEMENT

There are several parties that I owe gratitude for, for helping me throughout my thesis production.

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CHAPTER 1
INTRODUCTION

1.0 Introduction

Malaysia has an equatorial climate with constant high temperatures and high relative humidity. The climate is influenced by the northeast and southwest monsoons. The former, prevailing between November and February, brings heavy rainfall, as much as 600 mm in 24 hours in extreme cases. It occurs predominantly to the east coast of Peninsular Malaysia and to Sabah and Sarawak. Rain-bearing winds also come with the southwest monsoon from April to September, although rainfalls during this period are generally less heavy compared to those during the northeast monsoon. There are, in addition, two transitional periods between the monsoons when convectional thunderstorms occurs.

Flood is defined as the covering of normally dry land by water that has escaped or been released from the normal confines of: any lake, or any river, creek or other natural watercourse, whether or not altered or modified; or any reservoir, canal, or dam.

There are two basic types of rainfall causing flooding viz.

i. Moderate intensity, long-duration rainfall covering a wide area; and

ii. High intensity, short-duration localized rainfall.

Flood records indicate that there is a seasonal pattern of flood occurrences. The east coast and the southern part of Peninsular Malaysia, Sabah and Sarawak are mainly affected by floods during December to January when the northeast monsoon happens. During this period, the flooding occurs due to widespread and prolonged heavy rainfall, resulting in a large concentration of runoff which is very much in excess within the capacities of streams and rivers. Extensive areas are often affected during this period.

With 189 river basins throughout Malaysia, the rivers and their corridors of flood plains fulfil a variety of functions for human use as they are a fundamental part of the natural, economic and social system of this country. However, rivers might also be the largest threat to entire corridor areas as flooding has become the most significant natural hazard in Malaysia.

The study is related to the flooding that happened in Perak Tengah. The main focus of the study is to look at the impact on livelihood and social environment as a result of the floods which occurred in the aforementioned district. This study also conducted to determine the causes which have led to the flood event. Findings from this study is also expected to help local authorities to develop better planning in order to reduce future flood damage. In addition, this study also assessed the views of the flood victims for better preparedness for future disaster.

In another context, this study can also give a useful exposure to the general public on the issues and problems about floods as well as to assess the impact felt by the victims. This is important so that they better understand the root cause of the incident and to prevent future casualities. For example, one of the reasons of flood is due to prolonged heavy rain. This illustrates that the issue of rain is very important and people should be given the exposure and knowledge about this cause and the impact it might bring, so that they can understand this issue clearly.

The presentation of this paper adopts the following outline: Chapter 2 summarizes prior studies on flood characterization across Perak Tengah. The methodology adopted to develop the achievement and basic statistics are reported in Chapter 3. Chapter 4 provides results and discussions on characterization of the events in terms of climate and this chapter also devoted to the analysis of the flood-generating rainfall. Finally, the implications for flood risk management are examined in Chapter 5, together with the conclusions from the research.

1.1 Project Background

Flood happens severely in east coast states namely; Kelantan, Terengganu, and Pahang. However, the extent of recent floods has also spread to Perak Darul Ridzuan.

Figure 1: States that were highly involved with floods (Source: St Graphics).

Figure 2: Flood that affected in Stadium Sultan Muhammad IV, Kelantan

(Source: The Star Online).

Many properties that been damaged caused by flood, such as Stadium Sultan Muhammad IV, Kelantan, as in Figure 2. As been mention in figure 1, worst states that involves in flood are in east coast like Kelantan, Terengganu and Pahang, but some extended to Perak. In Perak, some places have an inundation period for more than two weeks. Furthermore, some locations were more affected with critical flood levels, with waters reaching waist level. Most of these places suffered from a more severe flood due to location, as these places are closed to Sungai Perak.

Essentially, the worst flood level occured in Perak recorded was in 1st June 1967 (in figure 3) However, impact of this recent flood was greater because the inundation period longer compare to previous one.

Figure 3: Flood waters reaching the head level (Courtesy of Raja Mohar Baadiozaman Sukri).

In Perak, the affected locations were Hulu Perak, Kuala Kangsar and the worst hit area was Perak Tengah. Therefore, it is crucial to reduce the flood so that authorities can minimize the impact. This research is undertaken to understand the mechanism and causative factors, in order to lessen flood risk and for better improvement. It is impossible to stop the flood, but this research is hoped to provide useful guidance for future development in reducing the risks.

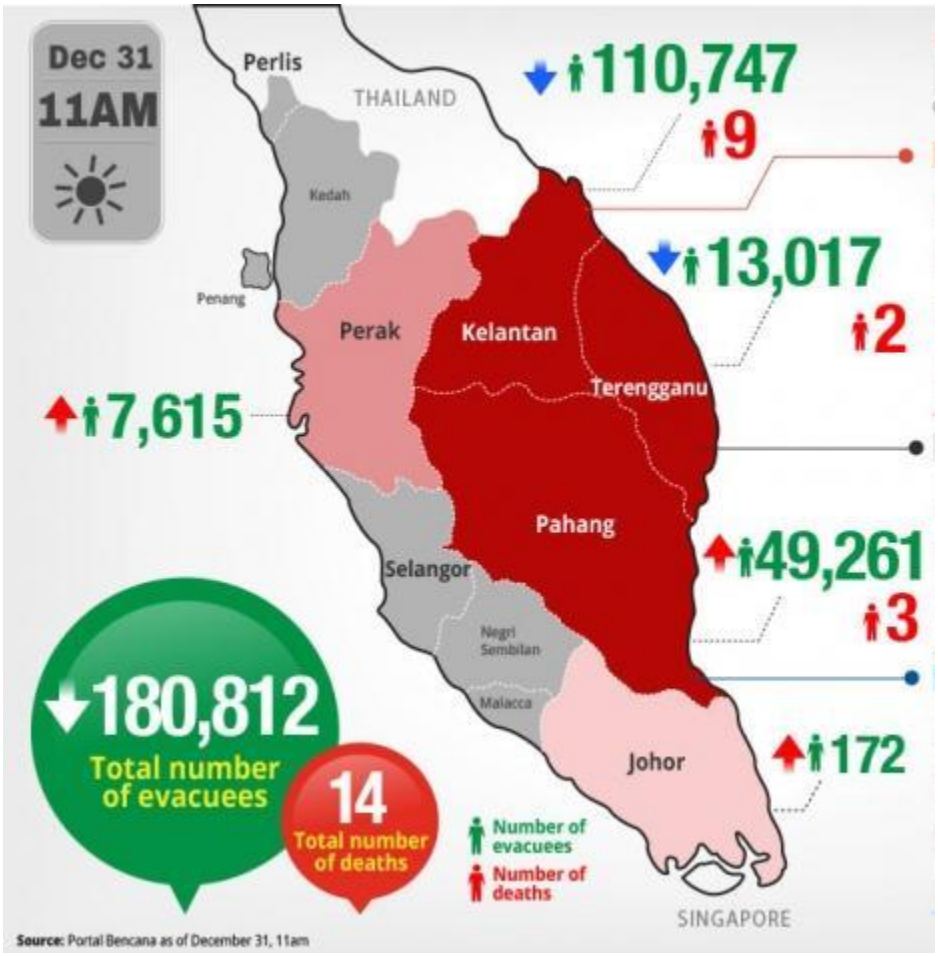


Figure 4: Statistics on Flood Impact as of on 31st December 2014

(Source: themalaymailonline.com)

1.2 Problem Statement

Flood is a natural disaster that frequently happens during the monsoon season. The recent flood in Perak Tengah was noted to be the worst case of floods since 1967, and this has caused difficulty for the victims. The level of damage is considerably quite high during this time, and has affected daily life of many of the victims. Furthermore, business activities had been halted due longer inundation period.

When people began to carry out activities for development, ecological balance and the hydrological cycle has been disturbed, either directly or indirectly. Thus, disruption of this system has instigated flood events to occur in the district of Perak Tengah. Flood phenomenon also has implications to humans and the environment. The underlying problem was partially due to developments without maintaining features to protect the environment.

Although such extreme flood does not exist in Perak Tengah often, but the frequency, the total area involved and the impact on the communities involved must be assessed and best approach to deal with these events from happening again in the future must be established. Mostly villagers tend to live at floodable area, which is nearby the river as shown in figure 5. Floods can be overcome if all parties comply with the regulations and laws in an effort to preserve the environment.

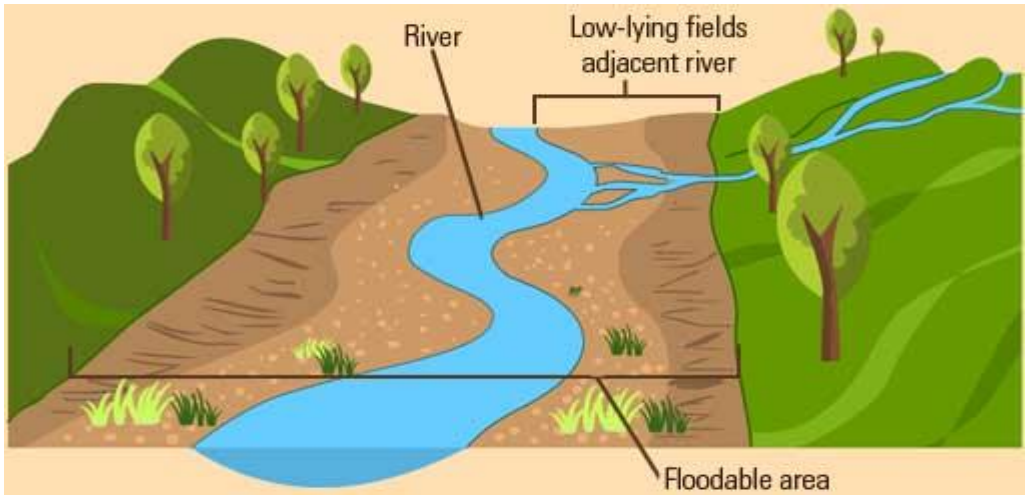


Figure 5: Flow of River Water to Floodable area (Source: EschoolToday.com)

1.3 Objectives

The main objectives of this research include:

1. Identify the causative factors and mechanisms that cause floods that occurred in Perak Tengah.

2. To assess and develop comprehensive database for flood extent and damage

3. To outline recommendations for local authorities to reduce future risk and thus aid in better development.

1.4 Scope of Study

The overall area for Perak is 2,103,500 hectares, whereas Perak Tengah covers approximately 12,205 hectares. The total population was 101,128 people. There are 11 sub- districts (mukim) in Perak Tengah which are: Layang- Layang, Bota, Pulau Tiga, Kg Gajah, Pasir Panjang, Bandar, Kota Setia, Pasir Salak, Jaya Baru, Lambor and Belanja. The authorities in charged for Perak Tengah are the District Council of Perak Tengah.

As mentioned above, it is not possible to extensively cover the entire Perak state. Due to time constraint and the vast area. Thus, the scope of study was limited to Perak Tengah as one of the worst hit areas. Nevertheless, it was still a challenging task considering the long stretch and the difficulty in accessing some of the areas

CHAPTER 2
LITERATURE REVIEW

2.1 Definition of Disaster and Flood

A definition of flood event initially based several factors, namely: on the duration of the causative rainfall, the size of the catchments impacted by the flood, and the severity of the event. According to Marchi (2010), floods are associated with short, high-intensity rainfalls, mainly of convective origin that occur locally. Floods is a natural hazard that happen annually in Malaysia during the monsoon season.

2.2 Rainfall in Malaysia

Generally, during November 2014, Malaysia had faced Northeast Monsoon season, that cause nonstop heavy rainfall from four to seven days due to wind blowing consistently from northeast brought humidity (Ministry of Science, Technology and Innovation (MOSTI), n.d.)

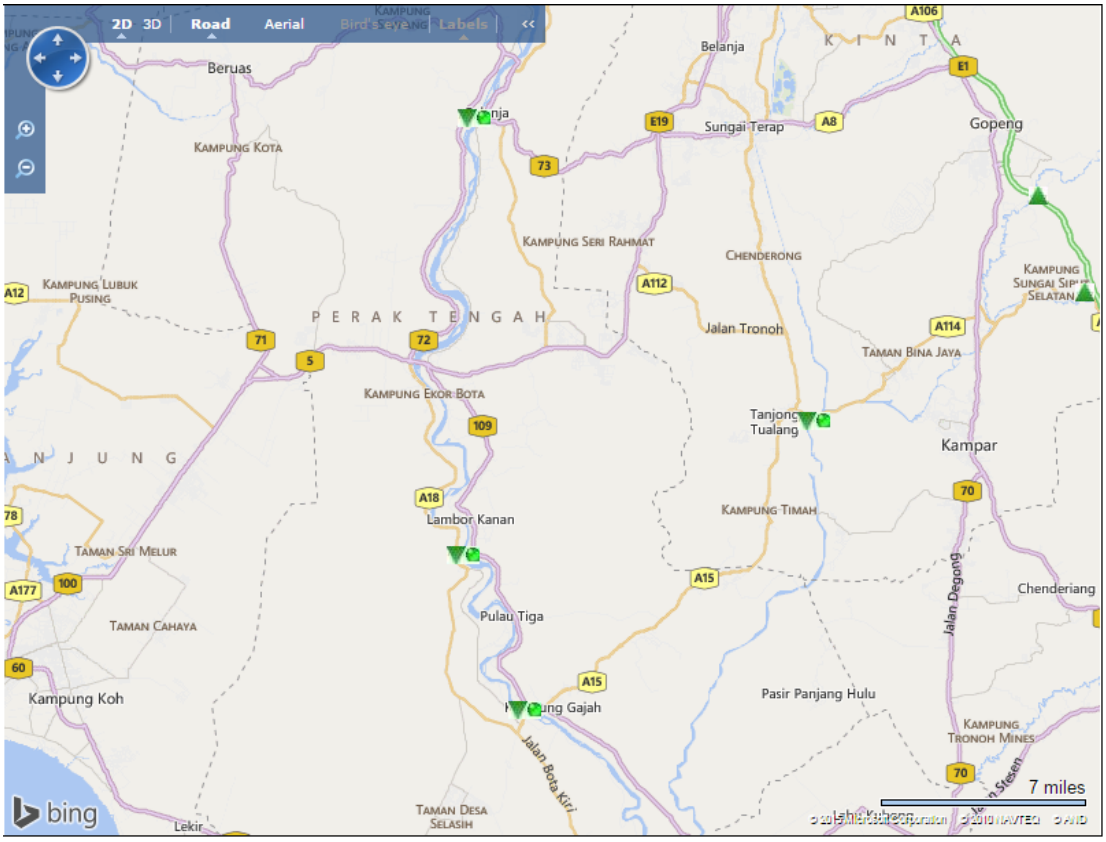
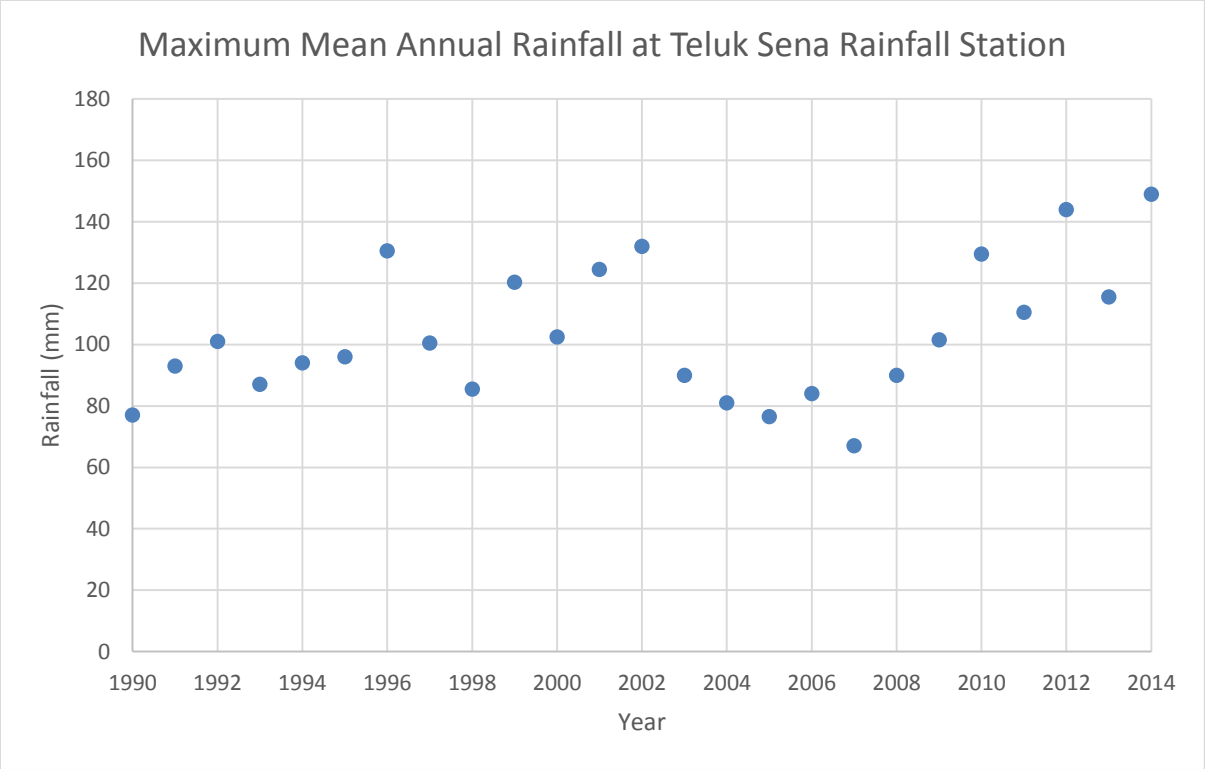


Figure 6: Rainfall and water level station in Perak Tengah (Source: Bing)

There are only two rainfall and water level station located in Perak Tengah, which are located at Teluk Sena and Batu Gajah as shown in Figure 6.



Graph 1 : Maximum Mean Annual Rainfall at Teluk Sena rainfall station

Graph 1 indicated that rainfall at Teluk Sena rainfall station was recorded to be highest in 2014. Southeast Asia has long experienced a monsoon climate with dry and wet seasons. With mean annual rainfall precipitation of 5000 mm, the very intense rainstorms in the steep mountains of Malaysia have caused frequent and devastating flash floods. In the valleys, floodwaters spread over very wide flood plains developed for agriculture, predominantly, rice paddies and oil palm.

For centuries, Malaysians have built houses on stilts to cope with frequent floods, and longhouses were built along the main rivers. More recent industrial developments and rapid urbanization foster lifestyle changes. Flood control is subject to drastic changes, with a lot of cars and housing closer to the ground (Md nor, Syed Hussain, & Ismail, 2014). Urbanization also exacerbates flooding problems due to the increased runoff from impervious areas. As a result, the sediment transporting capacity of rivers also increases.

In December 2014, several areas have received rainfall in excess of 60% of the average level, namely: Kelantan, Terengganu, Pahang, Perlis, Kedah, Penang, North Perak, Negeri Sembilan, and the south of Selangor. Furthermore, as shown in Figure 7, three states, namely Kelantan, Terengganu, and Pahang recorded monthly rainfall exceeding 1200 mm. Meanwhile, south Perak and south Johor recorded below average rainfall with values of less than 200 mm (Jabatan Meteorologi Malaysia, 2015).

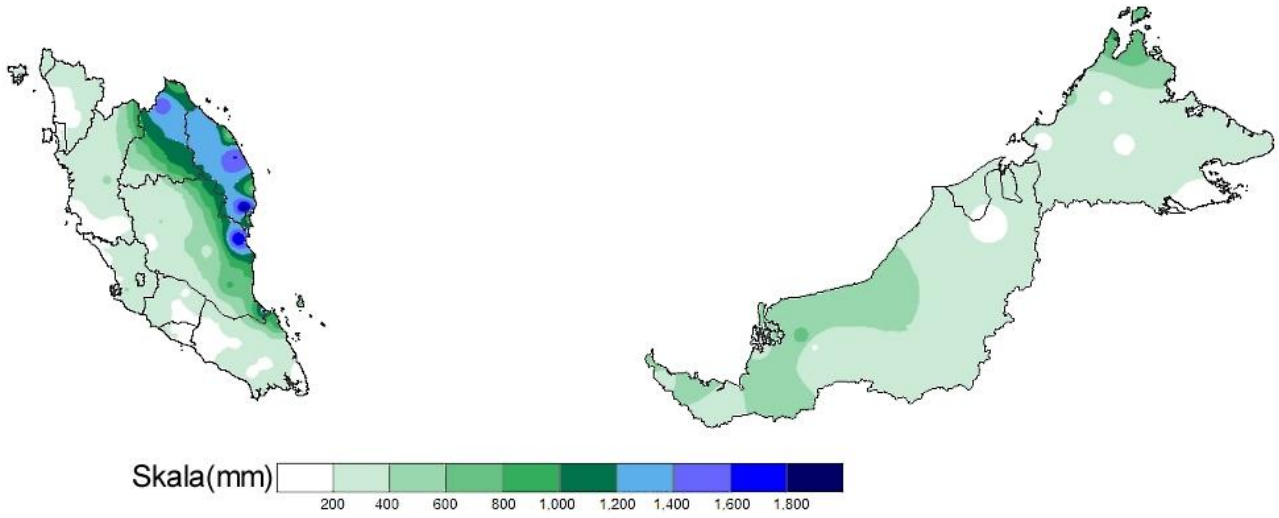


Figure 7: Rainfall rate for December 2014. (Source: Malaysia Meteorology Department)

2.3 Flood Plain Area

The lure and attractiveness of the flood plain as a place of occupancy is well documented in the flood literature. It has been estimated that at least 3.5 million people live on flood plains and are vulnerable to flood of varying probabilities in Malaysia. This number is anticipated to continue to increase and to exacerbate flood plain encroachment due to a few factors, such as rural-urban migration, land pressures, and other structural forces (Ali Khan, Shaari, Achmad Bahar, Baten, & Nasaruddin, 2014). Flood plains as shown in Figure 8 are also regions where a significant proportion of the country's population and much of the economic activity are concentrated. However, there is an increased potential for damage and loss with the increase of people occupying flood plains, and with the increase of properties and infrastructures built on these plains.

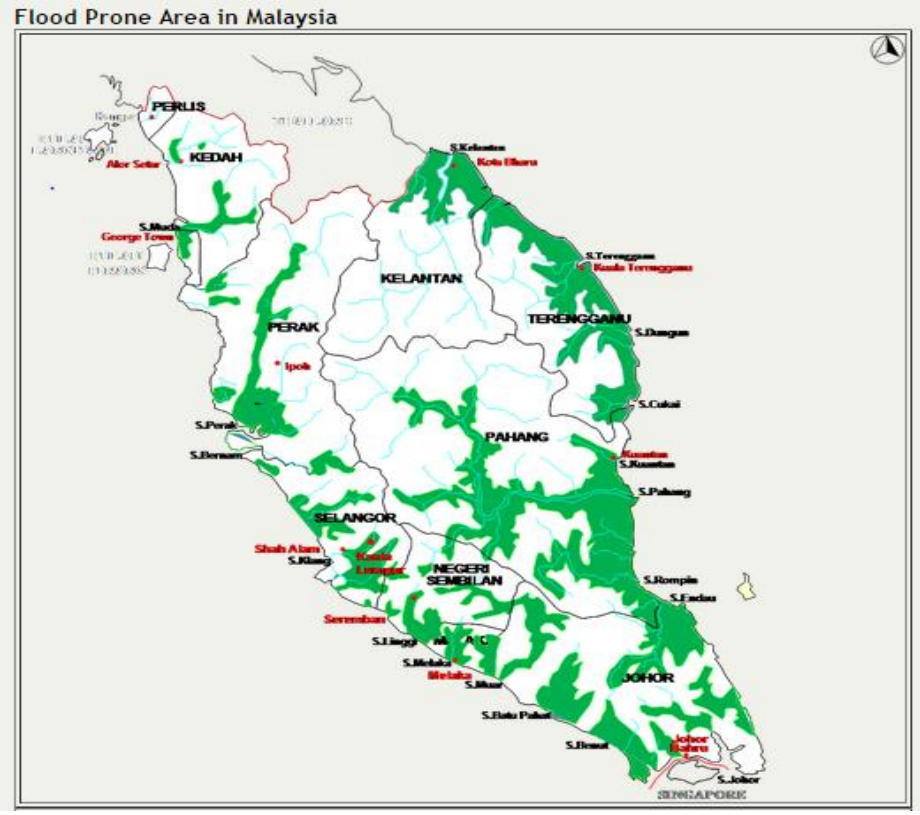


Figure 8: Flood prone in East Malaysia (Source: Marufish.com)

2.4 Flood Impacts

The social disruption caused by floods can seriously undermine the quality of life of the affected individuals and impact on affected communities. Firstly, there is a concern regarding physical and health dangers of flood waters (Chan, 2012). Furthermore, there are psychological impacts of the emergency and the aftermath causes longer term effects. The affected individuals would also have to face stressful activity affected such as having to move out of the home, negotiating with insurers, cleaning up, and getting goods replaced and damage repaired. Moreover, the survivors would face difficulties such as the ongoing risk of the flood, difficulties in obtaining insurance, and the effect on house prices as well as community cohesion, even when the 'recovery' phase is over.

2.5 Flood Mitigation Structural Measures

In 1972, with the approval by the government, the Department of Irrigation and Drainage (DID) has decided to form Natural Disaster Relief Committee. This committee is responsible for coordinating flood relief at the district, state, and national level in order to reduce flood damage and to prevent loss of human lives. Based on Operation Procedure No. 29 published by National Security Council, DID is one of the committee members for the organization of flood relief efforts. Other than that, DID has published the "Guidelines for Management of Flood Disaster during the Monsoon Season and Flash Floods", which works to coordinate the preparation of flood relief operations at federal, state and also district levels. (Floods in Malaysia, 2015)

According to Wing (2015), there are several engineering solution for floods problems, such as flood control dams, downstream of the stream protection, storage pond, poldering, canalization, and much more as stated in Figure 9.

Figure 9: Flood prevention in Malaysia (Source: water.selangor.gov)

2.6 Non-structural measures of Flood Mitigation

Flood management focuses on the urgent need to provide immediate flood relief, as well as to implement various major flood mitigation projects to follow the trending urban development. *Manual Saliran Mesra Alam* is a new medium that been introduced for non-structural measures (humanity- based). Some of the non-structural measures in flood prevention in Malaysia are relocation, flood proofing, flood forecasting & warning, and much more as shown in Figure 10. It is a compulsory for all urban developments to comply with this guideline (Department of Irrigation and Drainage, 2015).

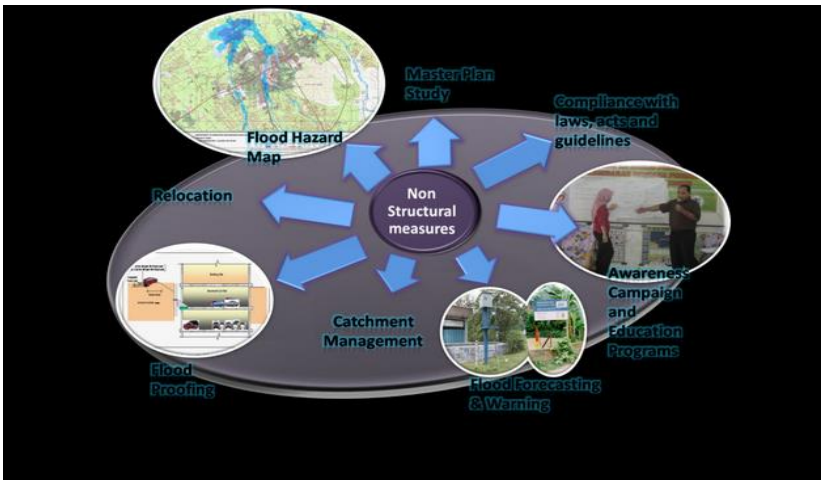


Figure 10: Non-structural measures in flood prevention in Malaysia (Source: water.selangor.gov)

CHAPTER 3
METHODOLOGY

Various types of methods to collect data and information related to this study have been reviewed. For this study, several methods have been identified and can be used, among which are the methods of questionnaires, interviews, and several secondary sources to obtain accurate data and information. The methods undertaken are listed below.

3.1 Early Stage

3.1.1 Literature Review

To prepare a desk study about the overall trend of flood, current issues and much more through conference discussion, article reading, journal research and discussion with certain related agencies. Figure 11 show the site of the survey.

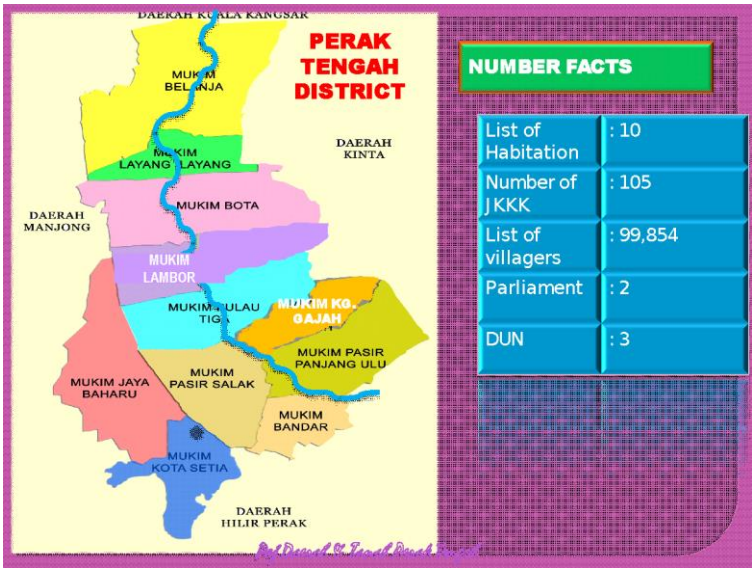


Figure 11: Perak Tengah Location Data (Source: Kampung Gajah District Council)

3.1.2 Early observation

To undertake preliminary observation covering the physical aspects and problems that occured regarding to flood.

3.2 Middle Stage

3.2.1 Data collection

3.2.1.1 To collect data that was recorded by related authorities, including rainfall data, number of evacuees and other related information.

Agencies	Information
Drainage & Irrigation Department	Flood levels, river level
Welfare Department	Relief centre
Public Works Department	Damages infrastructures

Table 1: Agencies Related to Flood (Source: Kampung Gajah District Council)

3.2.1.2 To conduct field survey and site assessment covering study area in order to identify flood extend based on the physical evidence such as mud marks, damage furniture and so on.

Personal interview also conducted during site assessment, to assess on their quality of life and effects toward social factors, economic factors, health issues, and many more.

3.3 Final Stage

3.3.1 To compile data and conduct analysis

Data obtained were evaluated and analyzed. The recorded databases were gathered and sorted.

3.3.2 To report on recommendations and precautions

3.4 Sample Method

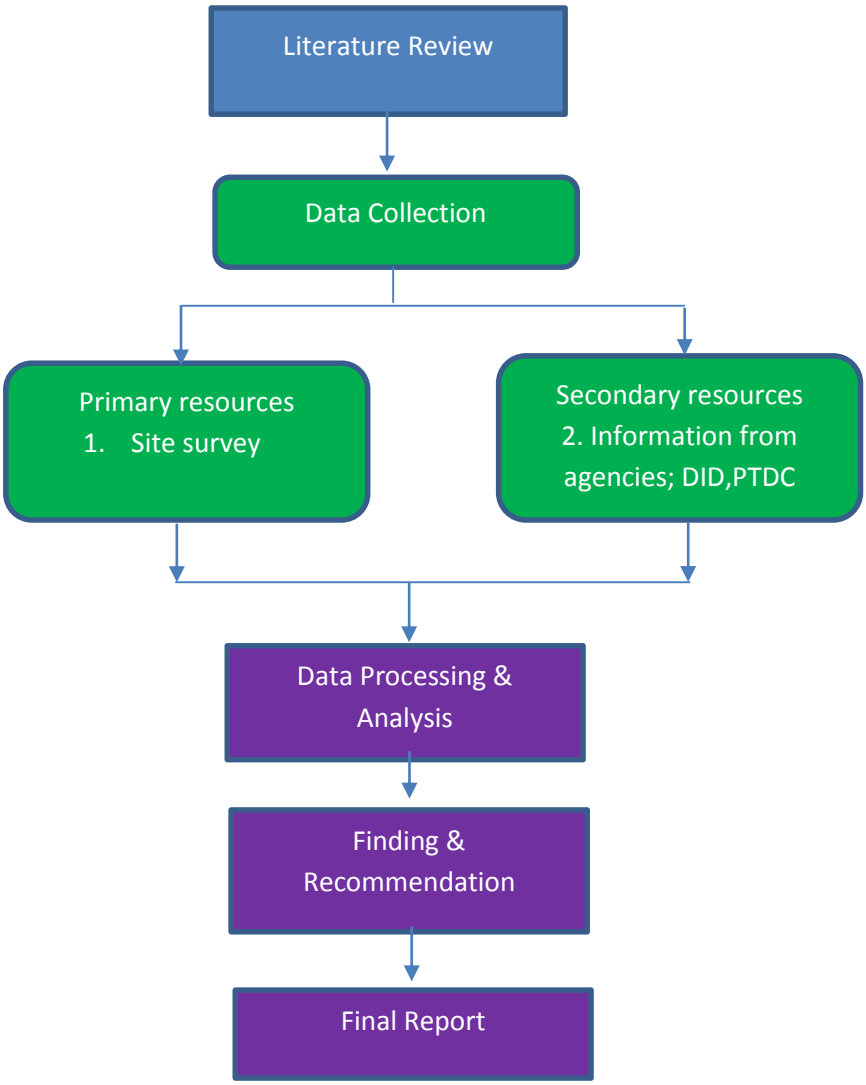
A subset of the population has been selected as the sampling frame. The type of sampling used was systematic sampling.

Sampling was done by obtaining a list of homes in the district budget Perak Tengah and then make a selection systematically. The results then used as the interval between the list of the number of residents.

The study covered Perak Tengah district. The selection of the respondent was based on the worst flood hit area and the most frequent occurrence of flood for each of the habitations involved. For example, the Kampung Pulau Tiga area, had been chosen to represent the location because the area was worse-hit by recent flood. Based on same principle, the sub district that were involved in the selection of respondents were Bota, Lambor kanan, Kg Gajah, Pulau Tiga Kiri, and Pasir Panjang Hulu with a total respondent of 88 people.

There are four section in the questionnaires namely general information,properties,perception, and psychology. Respondents were selected from flood victim relocated to each habitation. A total of 88 respondents were chosen using the said technique for each habitation. Sample size of 88 is adequate for the purpose of inferential statistics.

FLOWCHART OF METHODOLOGY



3.5 Method of Study

Information was obtained through reviews of literature and gathering of statements regarding flood. These information were obtained from various resources such as the library of the University of Teknologi Petronas, Department of Irrigation and Drainage (DID) Perak Tengah, Perak Tengah District Council (PTDC), as well as through the internet. This method was implemented from time to time to evaluate whether the adjustment has been made by the parties concerned. The areas that were often hit with flooding and the flows that are associated with flooding such as the downstream of Perak Tengah were also reviewed.

Additionally, instruments such as survey forms and interviews were used. Interviews were conducted with villagers, local authorities such as Drainage and Irrigation Department (DID), Work Department (WD) and Perak Tengah District Council (PTDC). Interviews were conducted so that the researcher can obtain accurate and up-to-date data directly from respondents in the study area. Survey forms were also distributed and filled in by the respondents. By this method, the researcher can easily make analyses, jot down important notes and pick out interesting findings from the survey answers. Lastly, important documents were gathered from government departments to facilitate data analysis.

3.6 Gantt chart for Final Year Project I

	Detail	Week													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Title Selection/ Proposal														
2	Confirmation of Project Title														
3	Preparation of Extended Proposal														
4	Extended Proposal Submission														
5	Preparation of Proposal Defence														
6	Further research on Literature Review														
7	Do field work throughout the research area														
8	Flood assessment Methodology														
9	Proposal Defence & Progress Evaluation														
10	Interim Report Preparation														
11	Data Gathering														
12	Data Analysis from the survey														
13	Plan for future work and activities on next semester (FYP 2)														
14	Interim Report Draft Submission														
15	Interim Report submission														

Key milestone Process Table 2: Gantt chart for Final Year Project 1

Gantt chart for Final Year Project II

	Detail	Week													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Research continuation														
2	Poster Preparation														
3	Pre- SEDEX Presentation														
4	Preparation of Final Report draft														
5	Submission of Final report														
6	Preparation of Technical report														
7	Submission of Technical report														
8	VIVA Preparation														
9	Completion of Dissertation														
10	Submission of Dissertation														

Key milestone Process Table 3: Gantt chart for Final Year Project II

3.7 Findings and presentation of results

Findings from the assessment and anlysis were tabulated and summarised based on several categories that have been identified. These include

1. Flood level and inundation period chart
2. Assessment on properties damage on transportation, agriculture, and daily life
3. Database on subdistrict (mukim) versus number of villages affected

CHAPTER 4
RESULT AND DISCUSSION

Severe flood had occured in Perak Tengah on 23.12.2014 until 6.1.2015. Generally 54 villages were flooded between 0.10m to about 2 meters covering Mukim Lambor, Mukim Pulau Tiga, Mukim Pasir Salak, Mukim Kampung Gajah, Mukim Pasir Panjang Ulu and Mukim Bandar. Most of these affected areas were next to Sungai Perak or within the low- high areas which can be considered flood prone area.

Basically, it was found that the recent flooding was caused by combination of the following factors:

1. Heavy rain takes place non-stop for a duration of several days at certain locations.
2. Additional discharges from the several of dams upstream.
3. Low- lying areas especially closed to the Sungai Perak
4. Ineffective drainage

The efficiency of flood management system was essentially important because it influences two major factors, the safety human lives and property damages and losses.

Here are the data example of the survey form

	name	tel	education	address	mukim	inudation level (da	mud layer thickne	age	gender	occupation
1	Nuri bt Al-Ahmad	05- 3761424		Teluk Bakong, Batu 15 1/3	Bota	10	0.5'	75	F	Housewife
2	Shaid bin Othman			Teluk Bakong, Batu 15 1/4	Bota	10		75	M	Retire
3	Mad bin Hitam			Teluk Bakong, Batu 15 1/4	Bota	14	1'	67	M	Retire
4	Mohd Fadil Ishak		Secondary	Teluk Bakong	Bota	14	1.1'	31	M	Business
5	Sawiyah bt Kulek Abd Hamid			Teluk Bakong, Batu 15 1/3	Bota	14	0.5'	80	F	Housewife
6	Harun bin Kudarais			Teluk Bakong, Batu 15 1/3	Bota	14	0.5'	80	M	Retire
7	Jamaluddin bin Harun			Teluk Bakong Hilir	Bota	11	0.7'	50	M	Retire/ Gardener
8	Cik Mah bt Yahya			Teluk Bakong	Bota	14	1.5'	80	F	Housewife
9	Cik Nah Mohammad Baki			Teluk Bakong, Batu 15 1/3	Bota	15	1.1'	62	F	Housewife
10	Hogipah bt Arifin			Kg Lambor Kanan, Batu 16 1/3	Lambor kanan	28	0.1'	72	F	Housewife
11	Mat bin Muhammad Arip			kg Lambor Kanan, Batu 16 3/4	Lambor kanan	30		38	M	Security
12	Zainudin bin Yahya	012-6172331	Degree	Kg Ayer Mati	Kg Gajah	30		58	M	JPS officer
13	Syafikah		Degree	Kg Cina Bandar, 36800	Bandar	21		22	F	Student
14	Nur Shihah bt Mohamed Ali Piah	013- 4678170	Degree	Lot 419, Kg Selat Pulau	Kg Gajah	21	2'	20	F	Student
15	Rakyah bt Payung			Kg Selat Pulau	Kg Gajah	21		52	F	Housewife
16	Rashid			48F, Kg Selat Pulau	Kg Gajah	24		42	M	Business
17	Fauziah Sulaiman			Kg Masjid	Pulau Tiga Kiri	21		33	F	Housewife
18	Sabariah Saudi	013- 4190910		Kg Masjid	Pulau Tiga Kiri	22		44	F	Housewife
19	Muhammad Jamal			Kg Masjid	Pulau Tiga Kiri	22		20	M	Mechanic
20	Shahrul Nizam			Kg Masjid	Pulau Tiga Kiri	23		41	M	Business
21	Norazizan bt Jahman	012- 4482124		Kg Masjid	Pulau Tiga Kiri	24		49	F	House
22	Musa bin Mohamed Sadi	019-4976743		Lot 6478, Kg Kuala Parit	Pulau Tiga Kiri	15		55	M	court Notice Delivery
23	Hashim bin Antah			Kg Kuala Parit	Pulau Tiga Kiri	11		50	M	Business
24	Sharoni bt Nayan			Kg Kuala Parit	Pulau Tiga Kiri	25		33	F	Housewife
25	Yamahuri bin Zakaria	013- 4153302		Kg Kuala Parit	Pulau Tiga Kiri	16		52	M	Bus Driver
26	Noriza bt Osman			Kg Kuala Parit	Pulau Tiga Kiri	15		45	F	Housewife

4.1 General Information

The field survey revealed that most of the villages were badly affected badly in recent flood event. About 88 respondents throughout this survey been conduct at Perak Tengah district. There were 54 villages that affected in this 7 out of 11 subdistrict, where approximately 5928 person had been evacuated during this flood event. Results of the interview covering 88 flood victims are summarised in the subsequent sections.

Mukim involved	Number of respondent	Number of evacuees	Number village involved	Population
Bota	9	340	15	26,552
Lambor	2	430	12	10,087
Kg Gajah	34	255	5	7,693
Pasir Panjang Ulu	7	41	7	4,842
Pasir Salak	13	379	7	12,933
Bandar	1	132	4	5,633
Pulau Tiga	22	136	4	4,081

Table 4: list of subdistrict

Age (year)	Female	Male
0-20	1	2
21-40	3	6
41-60	17	11
61-80	21	27

Table 5: Respondents General Information

Based on the field survey, those respondents were housewifes, retired or run their own business. As age been mentioned at above Table 5, most of them were old folks. There are seven subdistrict that been survey as mentioned in Table 4. One of the major factor why a lot of evacuees refused to move out from their houses. Besides, the survey showed that the longest inundation period was up to 28 days long.

4.2 Impact on Properties

1. House

   Almost 62 percent of houses in those village were half brick and half wood. Then, it can be clearly seen that they were the most badly damaged as compared to others,as stated in Figure 12. Approximately, about RM 400,000 for total cost of houses damage. In Figure 13 and 14, the pictures show that level of water reached till shoulder's level and waist's level.

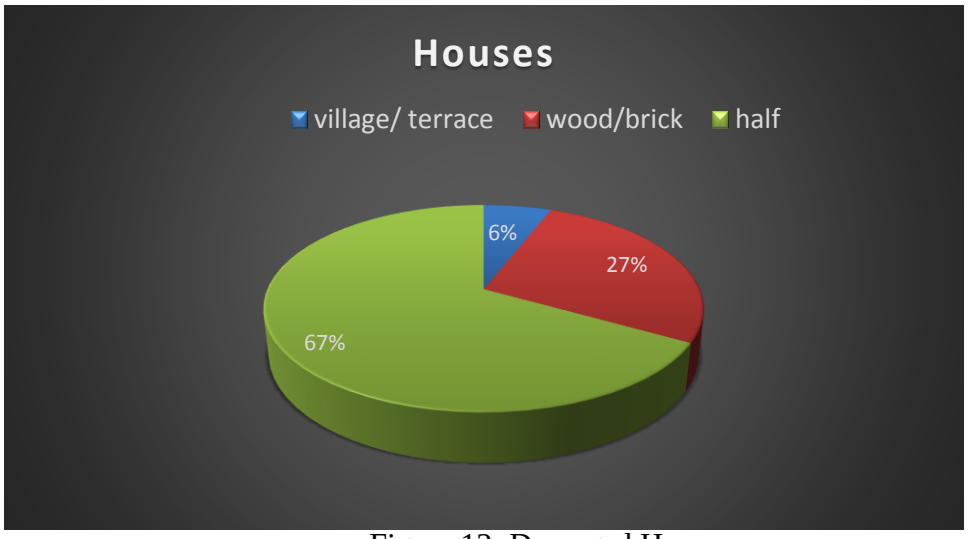


Figure 12: Damaged Houses

Figure 13: Waist level flood

Figure 14: Mud level flood

2. Agriculture

Most of the local villagers were farmer. Based on Agriculture piechart in Figure 15, highest percentage of plantation affected was palm oil. Damage in these rural areas were largely confined to residential properties resulting in the loss of livestock and crops. As can be seen in the chart, other plantations such as jackfruit, lemon-grass, and many more were also badly affected.

Morever, this flood had given some difficulty and caused inconveniences like plantation at one of the villager shown at Figure 16, to affected villagers especially to the farmers that as their crops just grew and the plantation was their major source of income.

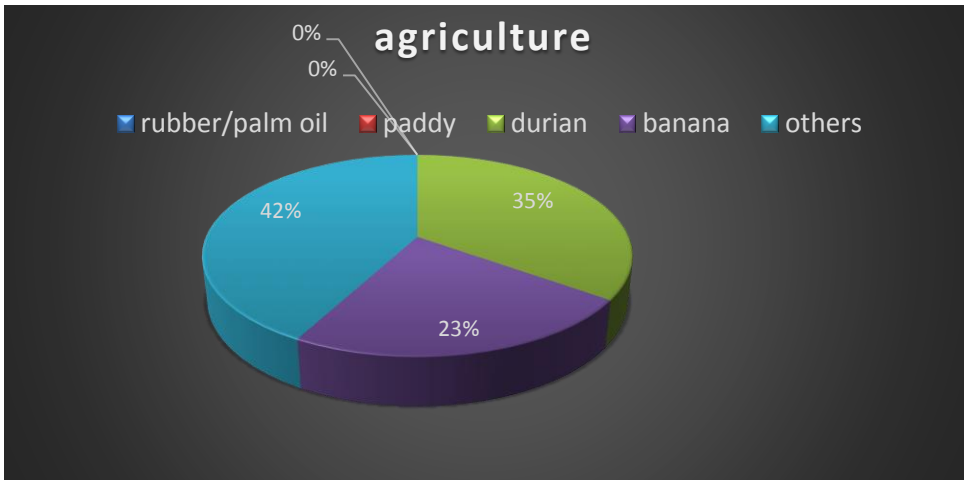


Figure 15: Agriculture Damage

Figure 16 : Damaged crops

3. Livestock

Chicken and ducks were primary livestock in the villages that were surveyed. During the flood event, many chicken and ducks cannot survive inundation by the flood. About 65% of the livestock are chicken and ducks while only 23% comprises of cows or buffalo as indicate in Figure 17.

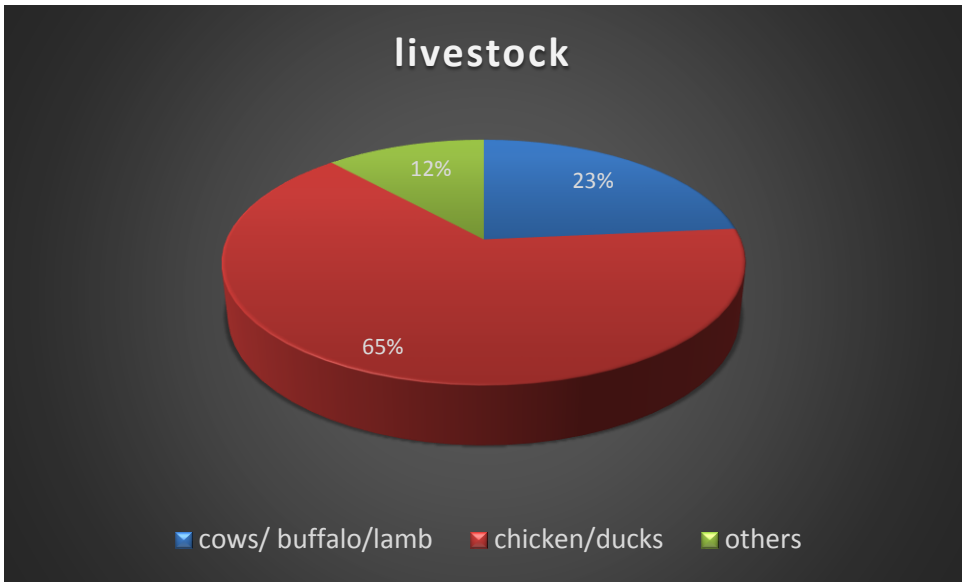


Figure 17: Affected livestock

4. Vehicles

Vehicles play important roles for everyday life. It was discovered that several vehicles particularly motorcycle damaged with the surveyed area.

Fortunately, most of their vehicles like motorcycle, car, lorry and other were safe because they had bring them earlier. But still some of their vehicles like Figure 19 show that could not been transferred in time and were damaged by the flood.

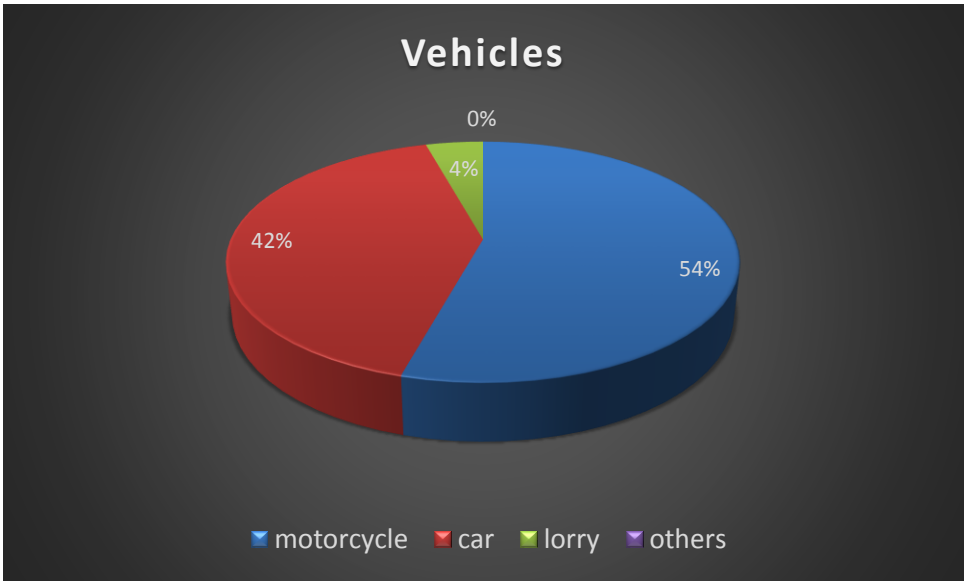


Figure 18: Affected Vehicles

Figure 19: Damaged motorcycle

5. Appliances and Furniture

Most of these villagers own properties such as washing machines, stoves, and refrigerator. However, most badly affected which is 69% of the damage stated were the bed, closet and carpet.

Based on the survey, refrigerators were most affected for appliances. Mostly those villagers tend to have double storey house, so the refrigerator located at ground floor and during the flood event, the victims do not had enough time to bring the item to higher level.

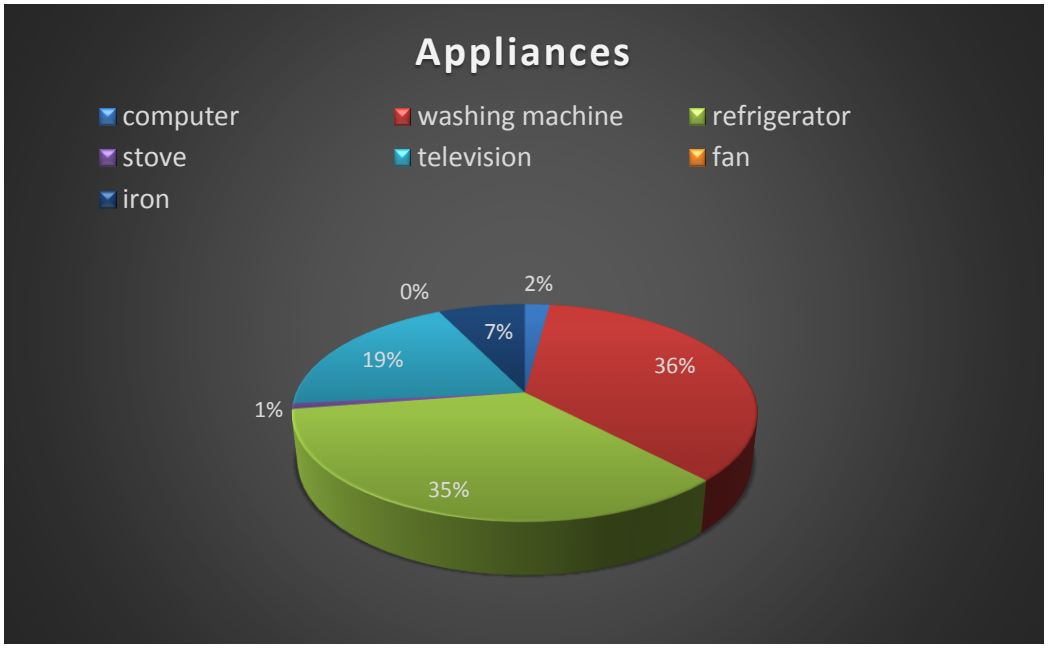


Figure 20: Damaged Appliances

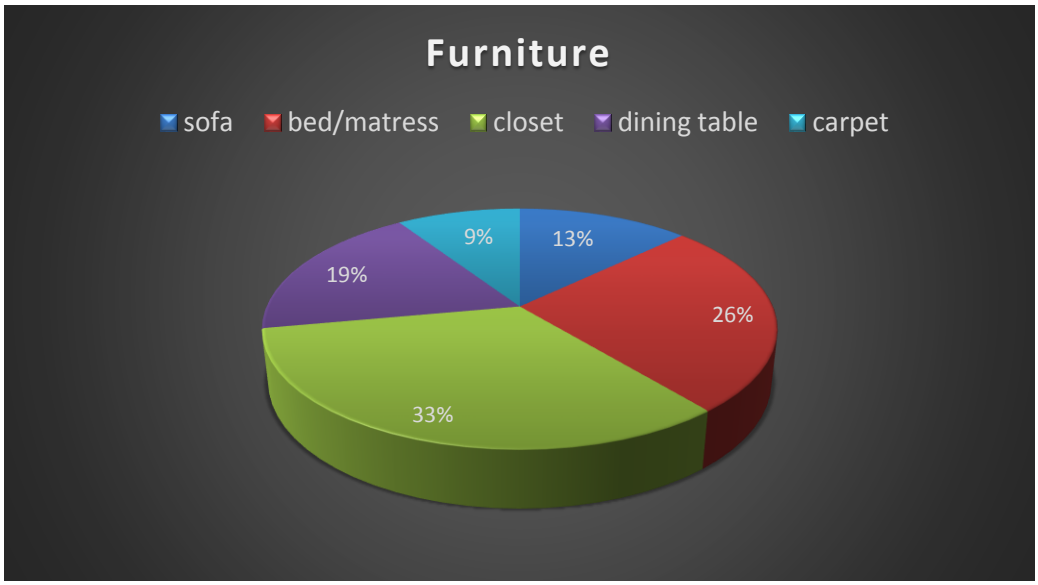
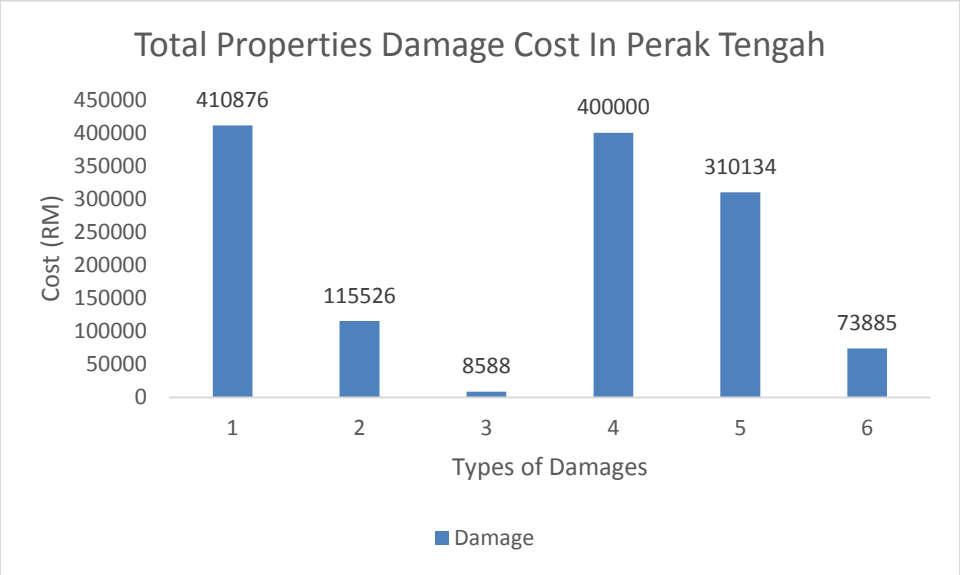


Figure 21: Damaged Furniture

Figure 22:Damaged properties

Flood damage in terms of losses can be direct or indirect,and both include tangible and intangible losses. Overall, the total cost estimate for this flood that occured in Perak Tengah district was approximately RM 1, 319 010. The highest cost impact were the houses which was aboutRM 410,876 and lowest was the livestock that amounted to RM8588. The houses made the highest number because great flood impact towards the houses,long period of inundation, and age of houses that make the houses damaged and need some repair. For the livestock, it has the lowest number because most of the livestock had been transferred to other places.



Legend:

1. Houses
2. Agriculture
3. Livestock
4. Transportation
5. Appliances
6. Furniture

Graph 2 : Total Properties Damage Cost in Perak Tengah Flood

4.3 Impact on psychology

1. Flood perception

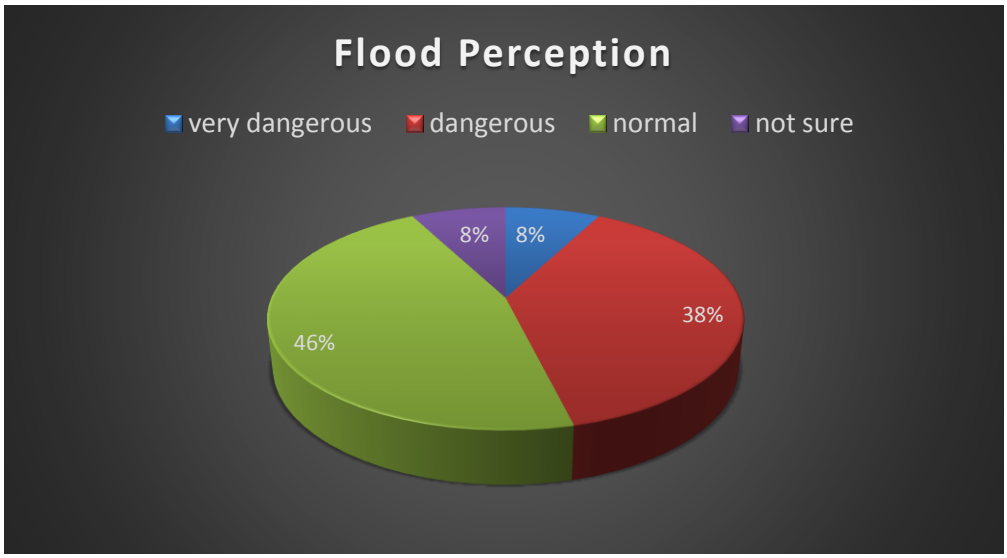


Figure 23: Flood Perception

2. Psychology

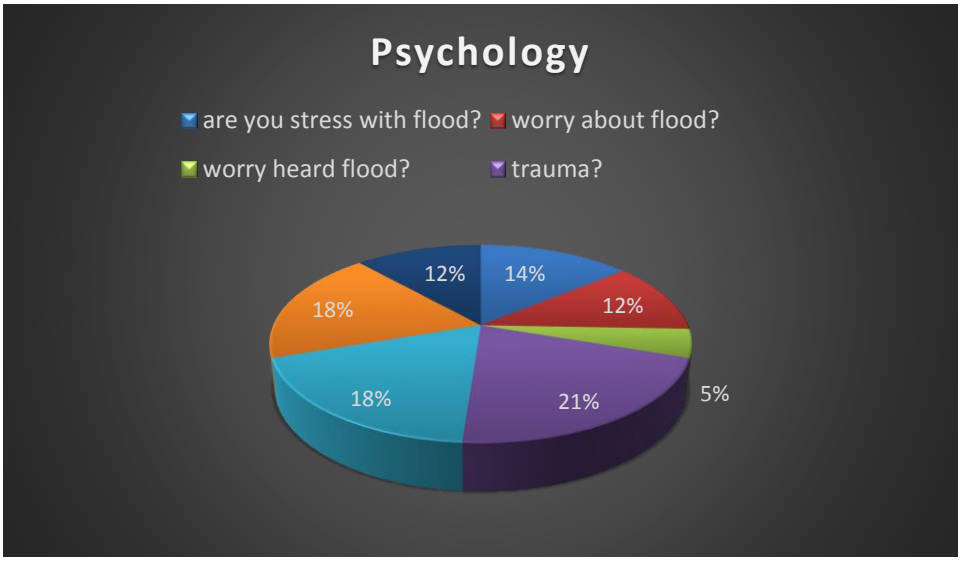


Figure 24: Affected Psychology

A number of studies had shown a range of symptoms resulting from exposure to natural disasters such as flooding. Among these consequences, individuals may experienced symptoms of post-traumatic stress disorder (PTSD), depression and anxiety.

In the analysis in Figure 23 and 24, it mentioned that most of the victims are normal with the flood situation, however they still traumatised because they need to stay in precaution state. Almost 80% of them already acknowledged that the flood would befall while the rest had no idea. Those who know, were from the short announcement from the related agency

There were several perceptions that been stated in the survey form; scale from very dangerous, dangerous, normal and not sure. For this survey, 46% of the affected respondents said that were normal, while 38% said that they not sure. Designated critical levels at a flood warning station in Figure 25 were created so that easier for the local authorities to inform those villagers if flood occur.

They were unwilling to buy the insurance as their mind set that insurance was expensive and non-affordable for them.

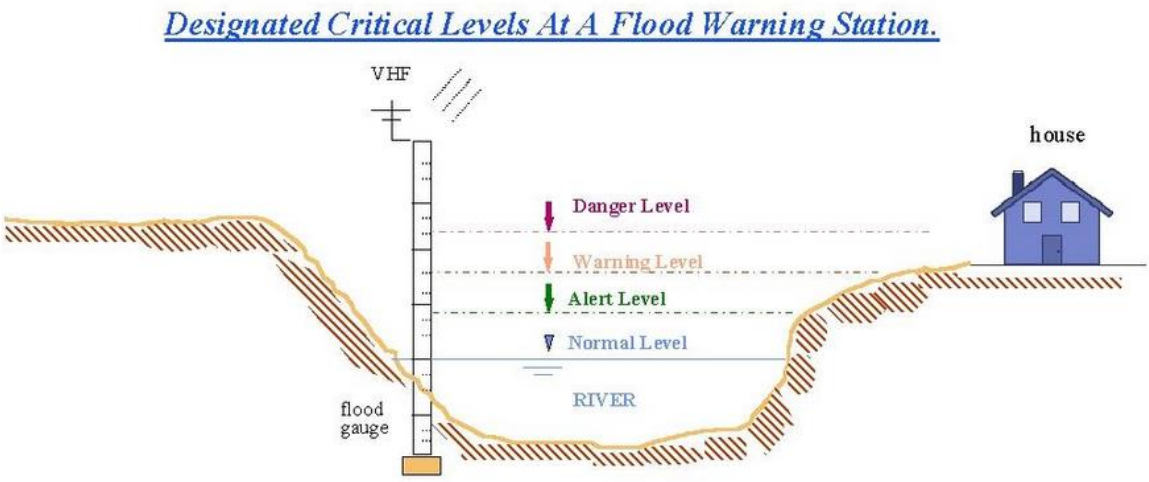


Figure 25: Flood Warning Level

Communities in some areas face the regular threat of destructive climatic events. The devastation caused by severe flooding leaves families destitute. It destroys homes, cultivated land, stored food, livestock and even human life.

The flood victims were also asked for any proper equipments for ease the Civil Defence Department's officer to bring those affected villagers to their nearest evacuation centre. About 20% of the respondents mentioned that they request for boat or any water transportations to transfer their belongings faster while some others had request for lorry for the same reason.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

Some of the locals who lived with the area for the past 20 to 80 years indicated that flood is more or less a possible annual event. The maximum depth of flood was 2 meters. The analysis also shows that the properties such as houses, livestock, agriculture, and transportation are the most affected with losses up to RM8, 000 to RM1,000,000. The disease spreading is still low in rate because of immediate actions taken by the local authorities and government in order to prevent it. Although the electrical and phone distruption still happen in every flood seasons but the occurences are still at low phase. Moreover, future researches should be conducted with more focusing on the main river to identify the changes and prevent it from being the causes of flood in the area.

The essence of flood control risk management is to use structural and non- structural measures while ensuring sustainable development. The two factors are referred to in flood control risk management which are human and nature. Natural science and social science knowledge need to be used to coordinate and solve the problems among people who have different value concept or conflicting interested relation.

Besides increasing awareness to the residents of the flood prone area, several action plans and preparedness can be further undertaken by the local authorities or related agencies.

1. Undertake the risk appropriately

Flood risk is eternal, and its management is a long-term, and complicated. Only undertake some degree of the risk appropriately and share risk in different forms reasonably

2. Standardize human activities

The reasons for flood and waterlogging disaster are natural factors, such as rainstorm and topography, besides human activities. Human social economic activities must be standardized according to law for implementing flood control risk management. It must adapt to rules of flood development, avoid or reduce social turbulence factors resulting in flood.

3. Establishment of enhanced flood disaster relief machinery
4. Implementation of structural measures

   Structural measure are actually engineering methods which include such as flood control dams, bunding of river, storage ponds of flood attenuation, flood diversion and much more.

Flood is a natural annual disaster that occur in Malaysia. This flood happen annual due to the structure of land, the people that live mostly at flood- plain area, and the heavy rainfall. Then, through the survey, it can clearly seen that this disaster affeced various people, specifically on damage cost. For this Perak Tengah district only, the total losses was about RM 1 millions.

This frequent natural disaster can be avoided by having precaution steps and self awareness. Systematic planning in flood management system reflects proactive cooperation among relevant parties in preparation for flood disaster. It is hoped that findings from this study will enable better preparedness in reducing future risk.

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APPENDIX

FLOOD DAMAGE ASSESSMENT IN PERAK TENGAH DISTRICT

NAME:..... AGE: .....

ADDRESS: ..... MUKIM:.....

.....

1. PROPERTIES

1.1 HOUSE	NUM OF ITEM	LEVEL OF DAMAGE	ESTIMATE PRICING (RM)
TERRACE		COMPLETELY ____ HALF ____ OTHER ____	
WOOD		COMPLETELY ____ HALF ____ OTHER ____	
HALF BRICK		COMPLETELY ____ HALF ____ OTHER ____	
HALF WOOD		COMPLETELY ____ HALF ____ OTHER ____	
1.2 FURNITURE			
SOFA		COMPLETELY ____ HALF ____ OTHER ____	
BED		COMPLETELY ____ HALF ____ OTHER ____	
CLOSET		COMPLETELY ____ HALF ____ OTHER ____	
DINING TABLE		COMPLETELY ____ HALF ____ OTHER ____	
UTENSILS		COMPLETELY ____ HALF ____ OTHER ____	
OTHERS		COMPLETELY ____ HALF ____ OTHER ____	
1.3 ELECTRICAL			
WASHING MACHINE		COMPLETELY ____ HALF ____ OTHER ____	
REFRIGERATOR		COMPLETELY ____ HALF ____ OTHER ____	
TELEVISION		COMPLETELY ____ HALF ____ OTHER ____	
IRON		COMPLETELY ____ HALF ____ OTHER ____	
OTHERS		COMPLETELY ____ HALF ____ OTHER ____	
1.4 TRANSPORTATION			
MOTORCYCLE		COMPLETELY ____ HALF ____ OTHER ____	
CAR 1:		COMPLETELY ____ HALF ____ OTHER ____	
CAR 2:		COMPLETELY ____ HALF ____ OTHER ____	
4X4		COMPLETELY ____ HALF ____ OTHER ____	
LORRY		COMPLETELY ____ HALF ____ OTHER ____	
1.5 AGRICULTURE			
LIVESTOCK(CHICKEN, COWS)		COMPLETELY ____ HALF ____ OTHER ____	
PLANTATION		COMPLETELY ____ HALF ____ OTHER ____	