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POST FLOOD ASSESSMENT IN PERAK TENGAH

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Post Flood Assessment In Perak Tengah

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Dissertation submitted in partial fulfilment of
the requirements for the
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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Civil and Environmental Engineering Programme
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Approved by,

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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work 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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NUR NASHA BINTI MUSA

ABSTRACT

The 2014 flood that occurred from December 2014 to January 2015 is considered to be the worst flood in a decade. The impact of this flood left Malaysia with expensive damages and great damage as well. This paper looks into the possible causes of the latest 2014 flood in Perak, evaluating the impact of the flood in terms of losses, damages and costs towards the Perak state particularly and also the means of outlining recommendations for local authorities in reducing future flood risk. The impact of the flood is illustrated by obtaining data and also visuals of the recent flood. Among the important factors that were investigated include inundate flood level, total victims involved and impact to property and living income. This post-flood assessment has been implemented to develop a database for the area of Perak Tengah, which could be of great use to the local authorities in coming up with future planning on reducing similar flood impact.

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CHAPTER 1

INTRODUCTION

1.1 Background

Malaysia is a country situated near the equator. Its climate is labelled as equatorial, where it experiences tropical weather throughout the year. For Malaysia, its standard precipitation is about 250 centimetres per year while its standard temperature is 27 °C. Climate change is expected to have a noticeable impact on the country, where it influences the increase in sea levels and rainfall which later then give an influence on the increasing flooding risks and large droughts (Wikipedia, 2016). Figure 1 illustrates the histogram indicating the average rainfall per month in Kuala Lumpur.

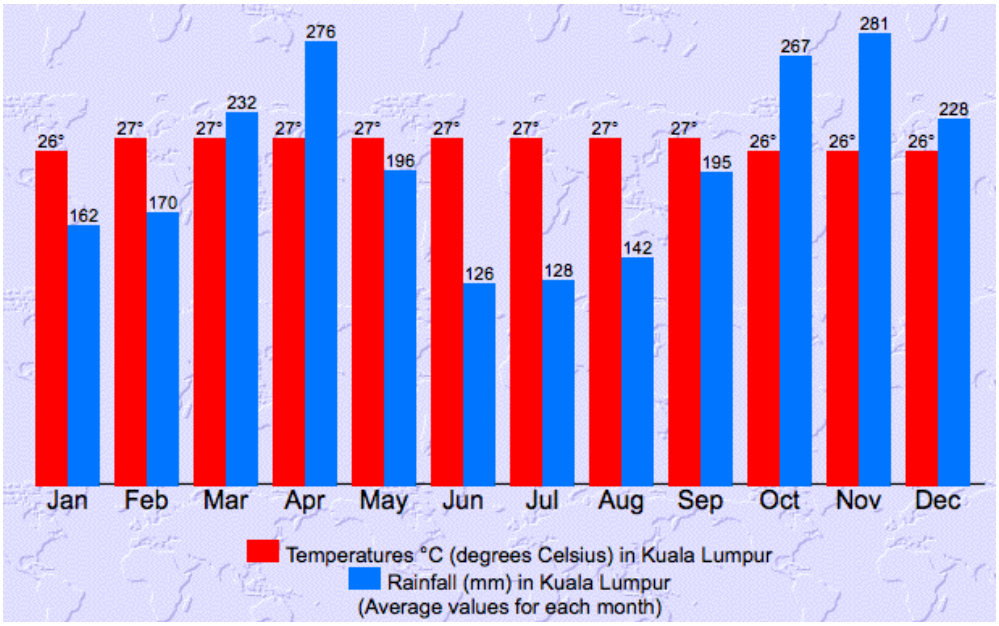
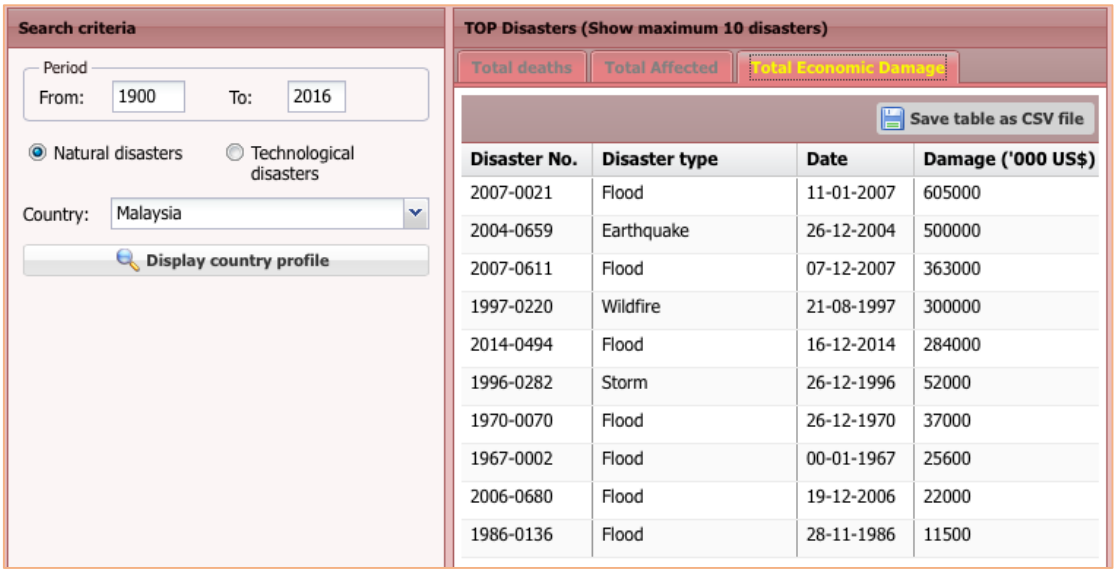


Figure 1: Average Rainfall per month in Kuala Lumpur

(Source: studentsoftheworld.info)

Flooding is a part of the environment. It is the most common natural disaster worldwide. This is due to the massive topographical distribution of river valleys and low-lying coastal areas. Figure 2 shows a table indicating the top disasters in Malaysia from the year 1900 – 2016. The natural disaster that has been categorized as the most damaging which had occurred in Malaysia is flood. There are no official classifications of floods in Malaysia but is frequently categorized as monsoonal, flash or tidal floods.



Disaster No.	Disaster type	Date	Damage ('000 US$)
2007-0021	Flood	11-01-2007	605000
2004-0659	Earthquake	26-12-2004	500000
2007-0611	Flood	07-12-2007	363000
1997-0220	Wildfire	21-08-1997	300000
2014-0494	Flood	16-12-2014	284000
1996-0282	Storm	26-12-1996	52000
1970-0070	Flood	26-12-1970	37000
1967-0002	Flood	00-01-1967	25600
2006-0680	Flood	19-12-2006	22000
1986-0136	Flood	28-11-1986	11500

Figure 2: Table Showing the Top Disasters in Malaysia

(Source: emdat.be)

In Malaysia, flood is being experienced every year, especially during the monsoon season. Malaysia faces two monsoon seasons, the Southwest Monsoon and the Northeast Monsoon. The Northeast Monsoon, occurring from October to March, brings in more rainfall compared to the Southwest Monsoon which occurs from end of May to September (Wikipedia, 2016). Previous flood histories indicate that there is a seasonal pattern of flood events. The east coast and southern area of Peninsular Malaysia are mainly affected by floods during the month of December to January when the Northeast Monsoon strikes.

The flood which hit Malaysia annually, usually have a large impact on areas in Kelantan, Terengganu and Pahang. Conversely, in 2014, Perak was also seriously impacted by the flooding. Earlier, the highest flood level occurred in Perak was recorded on in 1967. However, the impact of this recent flood was greater because it has a longer inundation period compared to the previous one. Therefore, the issue needs to be further investigated in order to come up with sustainable mitigation measures.

1.2 Problem Statement

Flood episodes appears to be getting more often in the recent years. Many preventive measures have been taken to avoid the catastrophe but only few succeeded. The recent 2014 flood in Perak was distinguished as the worst flood case since 1967. This was due to a longer inundation flood period. The flood gave a negative impact to the residents of Perak. Many of their properties were destroyed and it disrupted their social and economic activities.

Besides that, it also caused many economic losses, plus, many crops from the citizens' agricultural activities were damaged due to the flood. Therefore, we need to study the possible factors promoting the flood occurrences in and evaluate the impact of flood damage to the society, economy and environment in Perak. When these are achieved, all the data will be compiled together and recommendations will be outlined for the local authorities in hopes that it could be of use to reduce future flood risk.

1.3 Objectives

The objectives of this project are:

1. Identify the possible causes of latest 2014 flood in the Perak Tengah area
2. Assess and evaluate the impact of severe flood damage in the Perak Tengah area.
3. Develop a comprehensive database for flood impact in Perak Tengah.

1.4 Scope of Study

This study mostly covers Perak Tengah area. This area is chosen as the area of study as it was the district where the most severe flood damage was observed. The Perak Tengah district covers approximately 9,308 hectares. The total population was 88,446 in 1996, which by now could be approximately more than 120,000 population. There are 12 sub-districts in Perak Tengah which are: Blanja, Layang-Layang, Bota, Lambor Kanan, Lambor Kiri, Pulau Tiga, Kampung Gajah, Pasir Panjang Hulu, Pasir Salak, Bandar, Kota Setia and Jaya Baru.

Each sub-districts have their own headman and they all report to the District Council of Perak Tengah. However, due to time constraint and the vast area, the scope of study was further zoomed in to Bota Kanan, Bota Kiri, Lambor Kanan, Lambor Kiri and Kampung Gajah as they were the sub districts which received the worst hit from the 2014 flood. Nevertheless, it was still a challenging task considering the large area and a few difficulty in accessing some of the areas.

CHAPTER 2

LITERATURE REVIEW

2.1 Largest Flood in World History

Over the past century, natural disasters have taken millions of lives and caused billions of dollars in loss. Flooding is categorized as one of the most destructive form of natural disaster in the world. Written in history as the largest flood in the world is the 1931 Yellow River Flood in China. According to Staff (2009), the Yellow River or also known as Yangtze River, flows through the southern part of China. Most of the area's communities, depended on the river for water supply for both personal and agriculture necessities. In April, the river-basin area received a volume of rainfall far more than the usual. When heavy rains stroke again in July, the area was already set for disaster (Staff, 2009).

Figure 3: 1931 Yellow River Flood in China

(Source: emaze.com)

Figure 3 shows the situation of China citizens during the 1931 Yellow River Flood. In the article, Staff (2009) also mentioned that water from the Yellow River flooded an area over a 500-square-mile. The increase in water level drove 500,000 people from their residences by the beginning of August. Waters continued rising and rain poured down even more.

The paddy fields which conquered the landscape were flooded resulting in the destruction of crops. Citizens living in main capital cities such as Wuhan and Nanjing, which depended on the crops were starved to death. The enormous amount of people who died from this flood suffered from starvation and disease, long after the flood had ebbed (Staff, 2009).

2.2 Review on Some of Malaysia's Past Flood

Like all the other countries in the world, Malaysia also has its own areas prone to flood. Over the years, Muar River Basin, in Johor has undergone many flooding. There had been series of heavy rainfall events that had caused flooding within the Muar River Basin catchments. The documented floods from 1980 to 2010 had reached a total of 29 flood occurrences (Ching et al., 2013).

Another enormous flood in the Malaysian flood disaster history also happened in Johor. The flood incident commenced when the Northeast monsoon brought heavy rain through series of persistent rainstorms, producing damaging downpour in Kota Tinggi, Johor (MNRE 2007a). The flood occurred as a result of two waves, on December 2006 which lasted for 13 days and January 2007 which lasted for 7 days.

The series of floods were rare as the 2006 standard rainfall return period was 50 years while the 2007 had more than 100 years of return period (Shafie 2009, Badrul Hisham et al., 2010). The flood was damaging with the maximum water level documented reached 2.75 m. It was the highest level ever documented since 1950. The flood also caused evacuation of more than 100,000 people and the death of 18 people recorded (MNRE 2007)

2.3 Common Causes of Flood

Floods are caused by a variety of factors, both physical and man-made. The common cause of flooding is large intensity of rainfall in catchment area. Whenever there is a heavy precipitation over a catchment area, the river will have to carry a high water flow and thus leads to river flooding (Tandon, 2014). Another natural cause of flooding is the sedimentation of rivers and reservoirs. The reduction in flood control capacity of river due to unchanged heavy silting will cause the water to overflow from the river, causing flood.

Besides that, Tandon (2014) also discussed that flooding is also caused by obstructions in river flow. These obstructions may be a result of landslides, illegal logging or deforestation and disposal of solid wastes into rivers. The presences of these obstructions forces the river to change its course and the result of its course detour would be flooding as the river will be flowing over land outside its channel. On the other hand, the common manmade cause of flooding would be the unsystematic drainage system. In some areas prone to flood, the drainage system is inadequate to cater the high flood flow and water level rise on the upstream side may submerge the surrounding area (Tandon, 2014).

2.4 Flood Plain

A flood plain is a generally flat area of land next to a river or stream. It stretches from the banks of the river to the outer edges of the valley. Flood plain areas were the place of attraction for villagers back in the days to build their home as it is easier for them to get water and food supply from the near river. However, it is a dangerous area to settle down as it is prone to flood during heavy rainfalls.

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).

The flood prone areas around Peninsular Malaysia is shown in Figure 4.

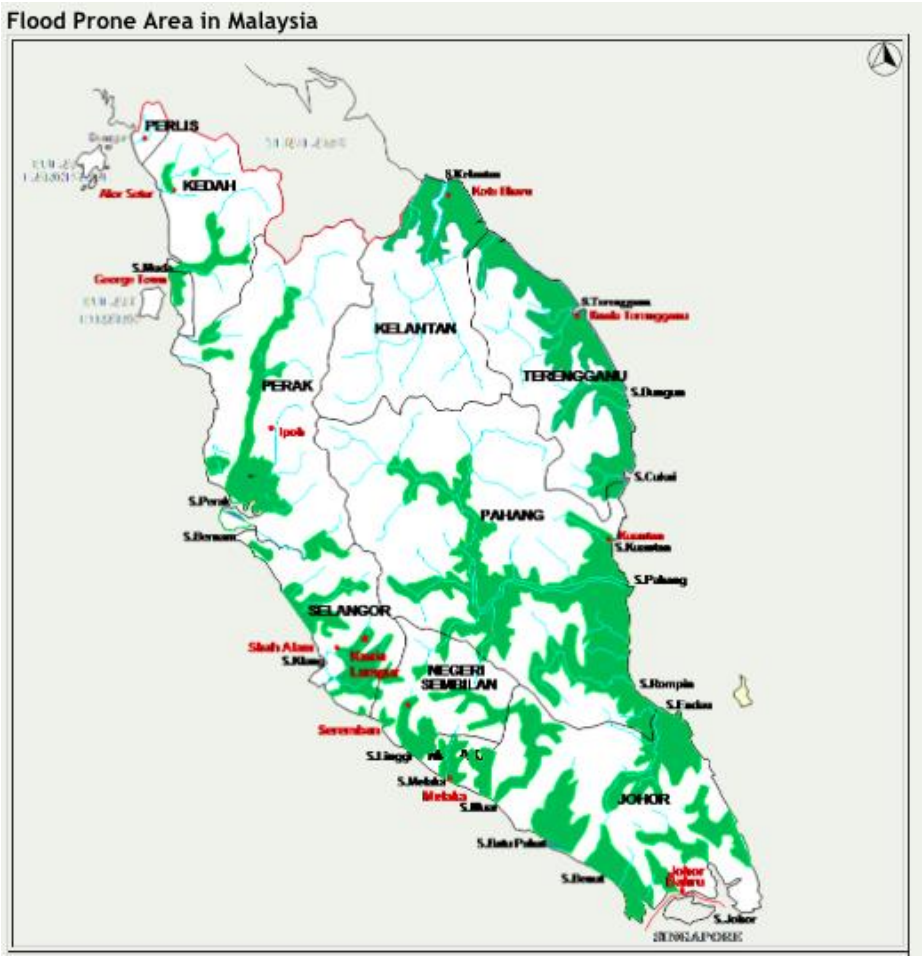


Figure 4: Indication of Flood Prone Areas in Peninsular Malaysia (Source: water.gov.my)

2.5 Previous Mitigation Measures Taken

In order to overcome and reduce the impact of flooding towards the society, environment and development of the area, authorities did take a few mitigation measures over the years. According to Ministry of Natural Resources and Environment (2010), among the measures taken were building dams, improving infrastructural works and undergo river improvement works. Figure 5 shows the few actions taken by the local authorities to overcome future floods in Malaysia.

Figure 5: Actions Taken to Overcome Flood

(Source: water.gov.my)

One of the completed major flood mitigation project in Malaysia is the SMART – Storm water Management and Road Tunnel. The tunnel starts at Kg. Berembang where the diversion weir at the convergence of Sg. Klang and Offtake Structure deter flood water to the holding pond. The water then flows through the intake bell mouth structure into the tunnel and discharged at Taman Desa attenuation pond. Flood water is being stored in this pond

before released into Sg. Kerayong through the twin box culvert (Ministry of Natural Resources and Environment, 2010).

2.6 Perak Flood in 2014

After doing further literature reviews on the past 2014 flood in Malaysia, it is discovered that Malaysia was ranked as the highest number of evacuees among the South East Asian countries with a total number of 237,037 people. The ranking is followed by Indonesia, Sri Lanka and Thailand. The number of evacuees from SEA countries can be observed in Figure 6 below.

Country	Fatalities	Evacuees	Sources
Indonesia	0	120,000	Insurance Journal, (2014)
Malaysia	21	237,037	Malaysiakini, (2014)
Thailand	15	10,000	ABC Online, (2014)
Sri Lanka	39	50,832	Customs Today, (2015)
Total	75	417,869	

Figure 6: Number of Evacuees from SEA Countries

(Source: jsrad.org)

The recent Malaysia flood which happened from 15 December 2014 – 3 January 2015, has been described as the worst floods in decades, where more than 200,000 people were affected while 21 people were killed due to this. There were many residents in affected states were required to be evacuated to higher and safer grounds. The number of evacuees for each state is illustrated in the Figure 7.

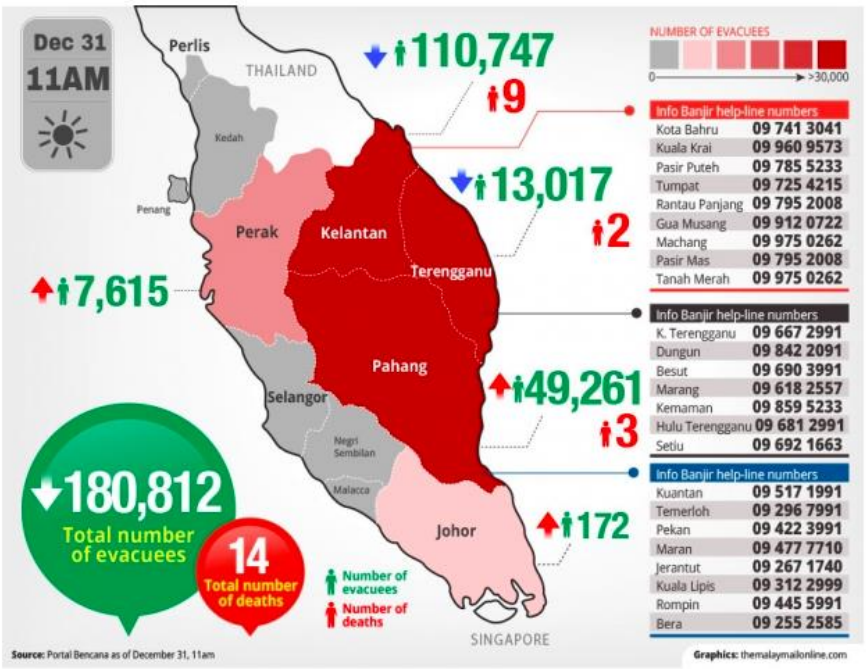


Figure 7: Total Number of Evacuees from States in Malaysia

(Source: themalaymailonline.com)

The distribution of number of evacuees varies according to states in Malaysia. In Perak, the flood situation in Perak Tengah, Kuala Kangsar, Hulu Perak and Kerian as on December 31st 2014, shown an increase in the number of flood victims, from 7,577 (2,022 families) to 7,748 people (2,066 families). The number of flood victims in Perak Tengah, which is worst affected, totalled 4,891 people, followed by Kuala Kangsar (1,706), Hulu Perak (794) and Kerian (321).

CHAPTER 3

METHODOLOGY

This section will discuss the way the work will be executed to meet the objectives and discuss the selections of approach. The discussion of these aspects will provide a better comprehension of the suitability of the research approach executed and its ability to provide suitable answers to the study subjects.

3.1. Research Methodology

The project started off by collecting information through literature review, which covered the history of flood occurrences in the world, history of floods in Malaysia, possible causes of the floods happening in Malaysia, evaluation of the flood damage impact in Perak and the previous measures taken by any parties to minimize the impact of future floods.

Several interview sessions were conducted with personnel from different government state departments. The first interview was conducted at Jabatan Pengairan dan Saliran Ipoh with Encik Sharifudin Jamil, the Hydrology Officer. Second interview was with Encik Hisham, the Chief Assistant District Officer of Perak Tengah district at Pejabat Tanah dan Daerah Perak Tengah. The third interview was done at Pejabat Penghulu Mukim Bota with the Headman himself, Encik Syed Baharuddin.

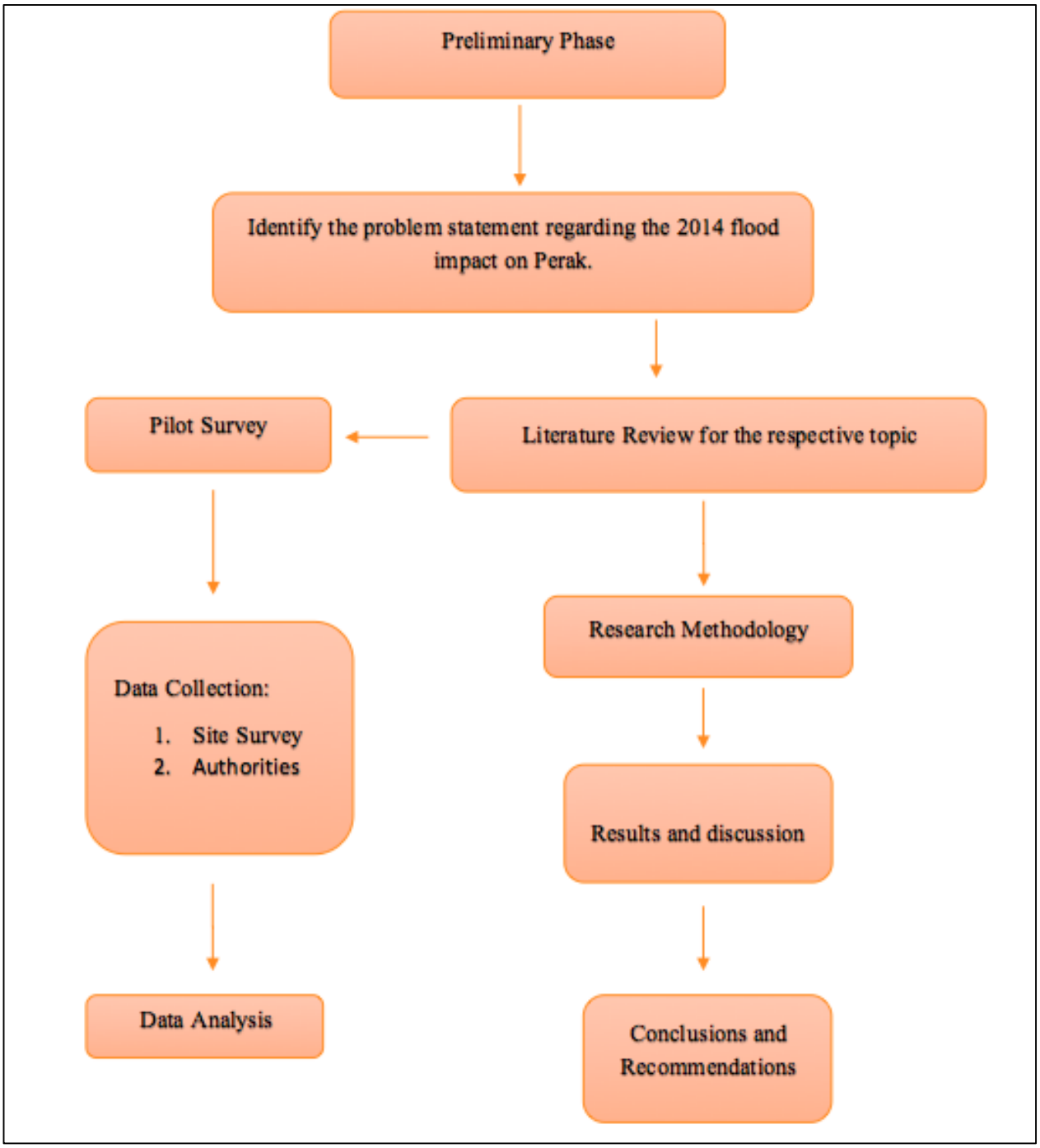
All interviews were conducted by using a structured interview method where they were all being asked with the same questions. This is to ensure the authenticity of the information given by each individual. Besides that, few data related to the number of families involved in the Perak 2014 flood were obtained. These include the number of families transferred to a flood shelter, number of provided flood shelters, the height of flood throughout the entire flooding period and the flood inundation period.

The next and final method was the Field Survey or Field Observation which was carried out to study the causes and impact at the areas in Perak which were affected by the flooding in 2014. This survey is essential to have the direct information, in order to be aware of the unclear problems which contributed to the occurrence of flooding besides the obvious causes. The objective of doing a field survey in this study is to clarify the outcomes from literature review.

Other data collections include, survey forms and interviews which were also carried out. Interviews were conducted with the villagers and headmen. The interview should be conducted to gain accurate and up-to-date information directly from respondents in the study area. Survey forms were distributed and filled by the respondents to allow further study regarding the issue.

After all the data have been collected from all the mentioned sources, they were analysed to obtain the flood inundation period, total number of relocated villagers, total cost of damage inflicted by the flood and also identify the location which received the worst food impact. With the analysed data, a comprehensive database is produced with the hopes of being able to be of assistance to the local authorities in coming up with a suitable flood mitigation measure.

3.2. Flow of Work



3.3 Gantt Chart and Key Milestones for FYP1

No.	Detail / Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Topics Selection														
2	Preliminary Research Work/Literature review • Online newspaper articles • Online Journals	20/5													
3	Collection of Data and Research Work • Data collection from JPS Ipoh					16/6									
4	Preparation of Extended Proposal Report						23/6								
5	Preparation for Proposal Defence Presentation									14/7					
7	Continue Research Work and Collection of Data • Data collection from JPS Perak Tengah and Perak Tengah Distict Office • Field Survey at Perak Tengah area • Interview with the local residents of affected flood areas in Perak Tengah														
8	Preparation of 1st Draft Interim Report													11/8	
9	Preparation for Final draft of Interim Report														18/8

Key Milestones:

- 20/5/2016: Start of online research for Literature Review
- 16/6/2016: Collection of data from JPS Ipoh
- 23/6/2016 : Submission of Extended Proposal
- 14/7/2016: Proposal Defence Presentation
- 11/8/2016: Submission of 1st Draft Interim Report
- 18/8/2016: Submission of Final Draft of Interim Report

3.4 Gantt Chart and Key Milestones for FYP2

No.	Week / Details	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
1	Continuation of Project Work ▪ Collection of data ▪ Went on site visits ▪ Gave questionnaires to the villagers on site															
2	Progress Report Submission ▪ Comparison of data from literature review and from site visits ▪ Analysis of collected data up to the submission date						26/10									
3	Pre-Sedex ▪ Poster preparation									16/11						
4	Submission of Final Report/Dissertation ▪ Analysis of all collected data ▪ Compilation of all analysed data											30/11				
5	Submission of Technical Paper													7/12		
6	Viva ▪ Preparation of slides for presentation purpose														13/12	
7	Submission of Hardbound Dissertation															4/1

3.5 Detailed Key Milestones for FYP2

Date	Activities
20th September 2016 – 7th October 2016	**Collection of data:** ❑ **From site observations and interview sessions with local authorities** ❑ **Handing out questionnaires to the villagers**
11th October 2016 – 20th October 2016	❑ **Comparison of data from literature review and site observations** ❑ **Analysis of collected data up to the submission date**
26th October 2016	**Submission of Progress Report**
16th November 2016	**Pre-Sedex Presentation**
22nd November 2016 – 26th November 2016	❑ **Analysis of all collected data** ❑ **Compilation of all analysed data**
30th November 2016	**Submission of Final Report**
7th December 2016	**Submission of Technical Paper**
13th December 2016	**Viva Presentation**
4th January 2016	**Submission of Hardbound Dissertation**

CHAPTER 4

RESULTS AND DISCUSSION

The flood which hit Perak in 2014 was distinguished as the worst flood hit since 1967. This was mainly due to the longer flood inundation period causing a large number of destructions around the Perak state. One of areas marked as the most severe flood impact was the Perak Tengah district.

The flood which occurred from 23rd of December 2014 until 23rd of January 2015 involved all of the sub-districts in Perak Tengah. 54 villages were flooded covering Mukim Lambor, Mukim Bota, Mukim Pulau Tiga, Mukim Pasir Salak, Mukim Kampung Gajah and Mukim Bandar. Most of these impacted areas were located nearby Sungai Perak. Generally, it was discovered that the flooding was caused by these factors:

- Non-stop pouring rain which struck for a duration of almost a week at a few sub-districts.
- The additional water discharge from Chenderoh Dam.
- Many houses were built around the low- lying areas, nearby Sungai Perak.
- Unsystematic drainage system.

The areas around Perak which were impacted by the flood are shaded accordingly in Figure 8.

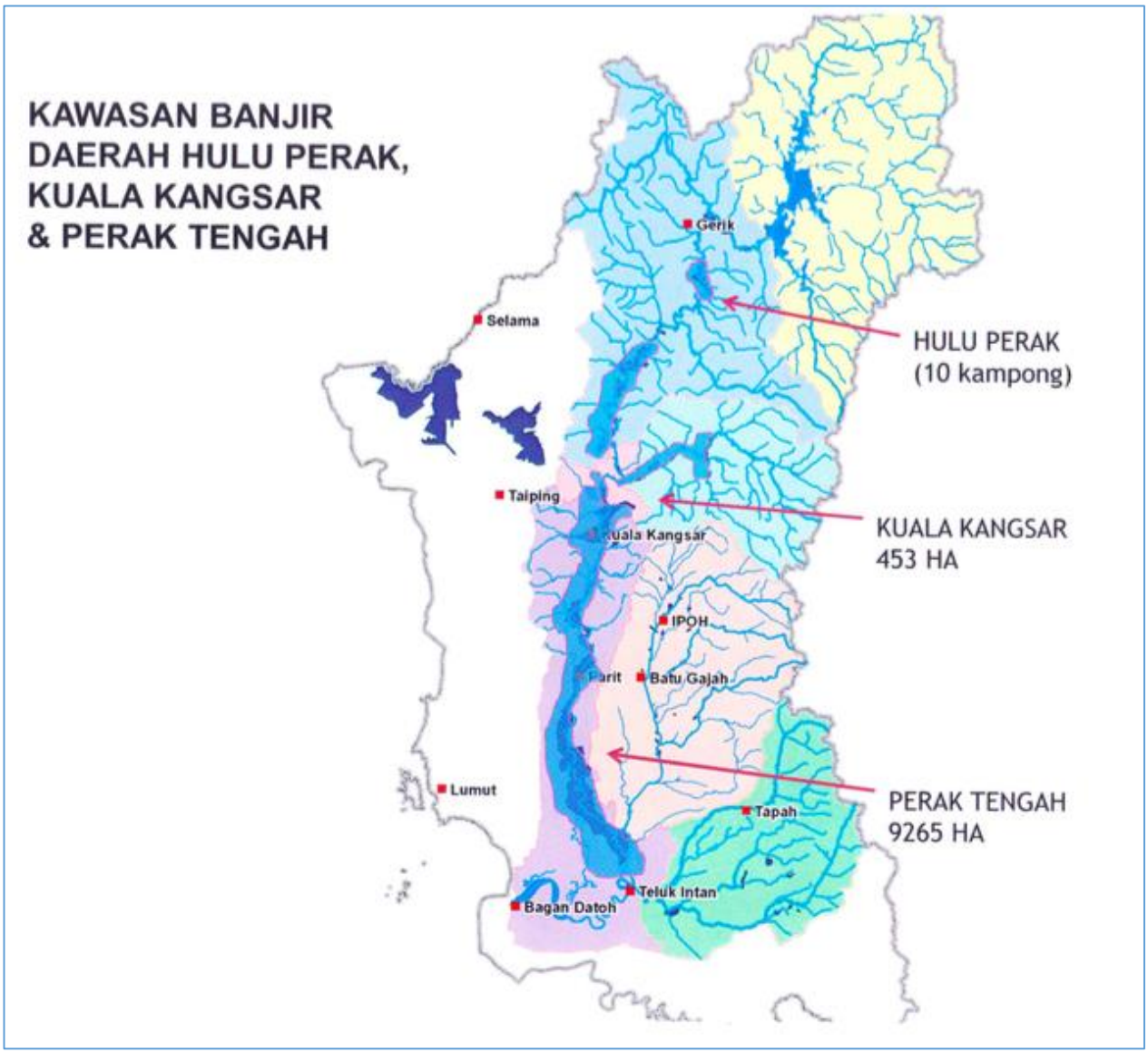


Figure 8: Areas Affected by the 2014 Flood in Perak

(Source: JPS Ipoh)

4.1 Non-stop pouring rain

Based on previous flooding events in not only Malaysia, but also in all other countries around the world, the initiator of a flooding event is always the non-stop pouring rain which occurs for a few days. In some places, the rain goes on for weeks. As for the flooding incident in Perak Tengah, the raining went on for approximately one week. It varies according to the sub-districts.

The continuous rain resulted in the flood which height ranged from 0.1m to 2m and left the worst impact to the Kg. Gajah sub district, followed by Pasir Salak, Lambor and Bota. The map below indicates the areas which got hit by the 2014 flood in Perak Tengah.

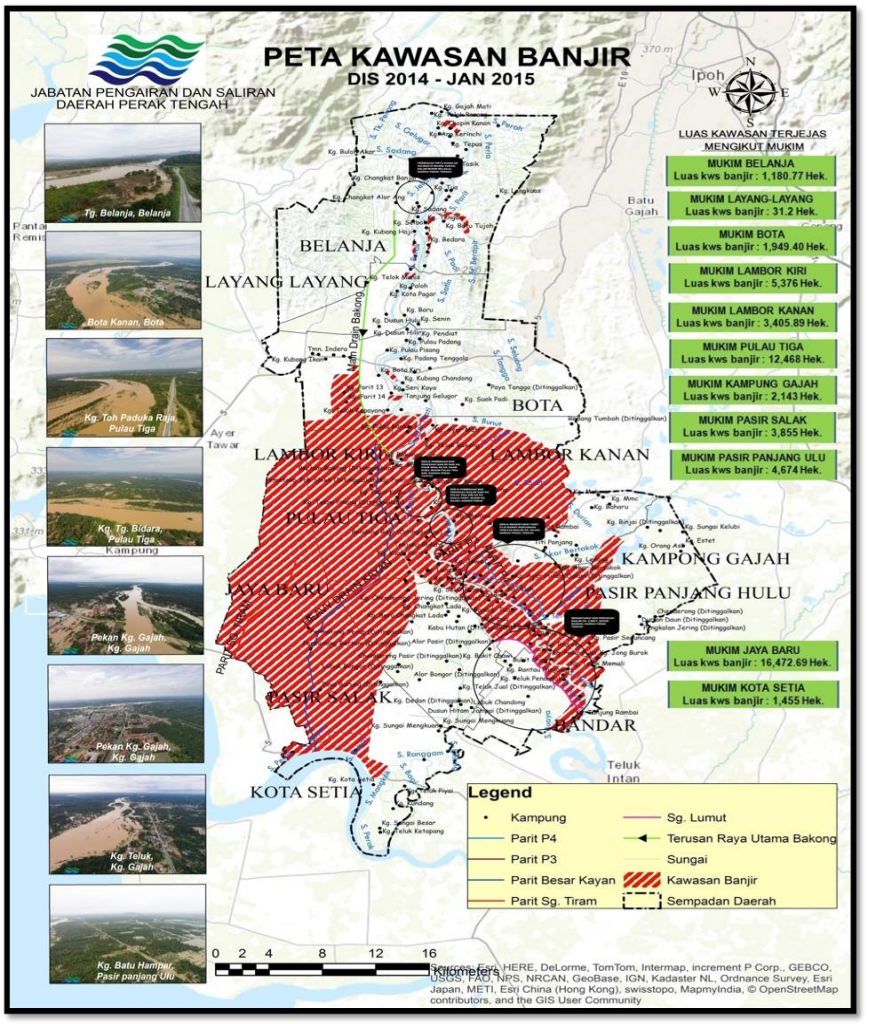


Figure 9: Perak Map Indicating the Flood Areas

(Source: Pejabat Daerah dan Tanah Perak Tengah)

During the flooding event, a few of the flood victim relief centres were moved to a new location because the flood was already approaching the relief centres' area. The victims from 'Pusat Pemindahan Sarjana' and ' Bilik Gerakan dan Dewan Millinium' were moved to 'Pusat Pemindahan MRSM Pasir Salak' while the victims from 'Pusat Pemindahan SK Dato Sagor' were moved to 'Pusat Pemindahan Pusat Latihan UiTM' as the authorities were concerned of the water level at the original transfer area was approaching hazard level. Table 1 below shows the number of relief centres opened to cater the flood victims at each sub district.

No.	Item	Seri Iskandar	Kg Gajah
1	Operational Room	Open: 24th December 2014	Open: 24th December 2014
		Close: 18th January 2015	Close: 23rd January 2015
2	Total Relief Centre	15	4
3	Total Families Involved	684 (as of 2nd January 2015)	862 (as of 5th January 2015)
4	Total Victims	2790	3138
5	Total Victims not moved to relief centres	1052	2270
6	Total Villages Involved	23	31
7	Damages Faced	Houses, Roads, Mosques, Surau, Agriculture,	

Table 1: Transfer Centers During the 2014 Flood in Perak Tengah
(Source: Pejabat Penghulu Bota)

4.2 Additional water discharge from Chenderoh Dam

The severe flooding event in Perak was mainly caused by the additional water discharge from Chenderoh Dam. The incident started on the 16th December 2014, when heavy rain started to pour with a precipitation of 114 mm/min at Tasik Banding, Perak. The situation worsens when the water level at Temengor Dam reached 248 m which had exceeded the danger level.

In order to reduce the water level, Tenaga Nasional Berhad (TNB), channeled the water into the Perak River until it reached a maximum volume of 1442 cumec. According to Jamil (2016), normally TNB only channel 450 cumec out of the dam to supply the residents. The period of water flow during the 2014 Perak flood could be observed in Figure 10.

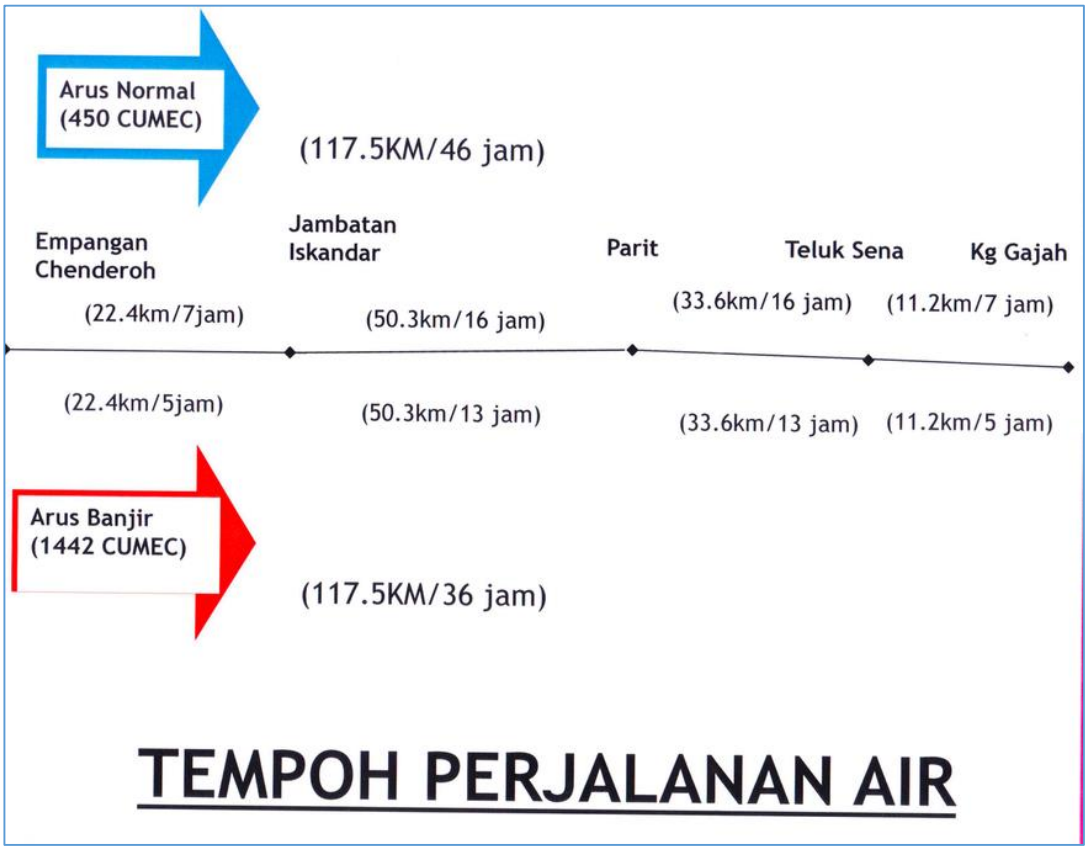


Figure 10: Period of Water Flow during 2014 Perak Flood

(Source: JPS Ipoh)

The three times increase in water channelization led to the flooding of Hulu Perak District, Kuala Kangsar and Perak Tengah. The water level at Iskandar Bridge, Kuala Kangsar reached a level of 37.26 m, which categorized the 2014 flood as the second worst flooding event that had occurred in Perak after 1967.

This information is further strengthen by the statement from Mr Syed, the Headman of Bota sub-district, where he emphasized that the cause of the flood was the water release from several dams at the upstream of Sungai Perak. At that time, it was observed that the flood level at Parit has reached a level of 21.55 m. It later then spread to Bota Kanan and Bota Kiri. The map below shows the location of villages in the Bota Sub District.

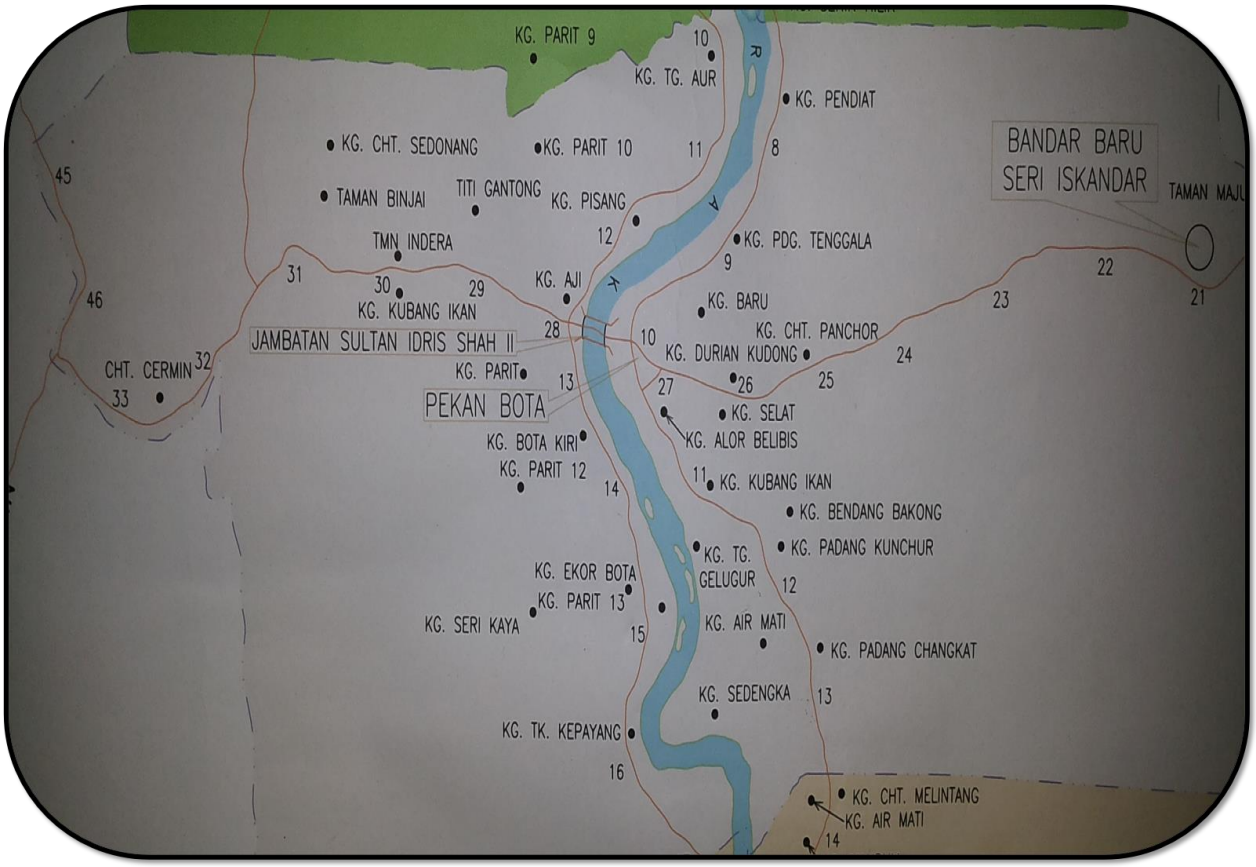


Figure 11: Map of Bota Sub District

(Source: Pejabat Penghulu Bota)

Many of the villagers do live around the flood plain area or nearby the riverbanks (Syed, 2016). However, according to Syed, 2016, that flooding rarely occurs around the area. The 2014 flooding event was mainly caused by the excessive water release from the upstream dams. For Bota sub district, there were five villages which got hit by the flood. The victims from each village were transferred to the respective relief centres:

Village	Transfer Center
Kampung Pulau Pisang	Dewan Orang Ramai Kampung Pulau Pisang
Kampung Teluk Kepayang	Sekolah Teluk Kepayang
Kampung Selat Bota	Dewan Dato' Hambal Bota Kanan
Kampung Sedinggka/Air Mati	Sekolah Padang Changkat
Kampung Parit 13 & Parit 14	Dewan Orang Ramai Parit 13

Table 2: Transfer Centers for each Village in Bota

(Source: Pejabat Penghulu Bota)

Out of all the villages which got hit by the flood in Bota, Kampung Teluk Kepayang Faced has the most number of victims being moved to the relief centres, with a total of 86 families, followed by Kampung Parit 13 & Parit 14 (60 families), Kampung Sedinggka/Air Mati (37 families), Kampung Selat Bota (14 families) and Kampung Pulau Pisang (5 families). The total distribution of transferred victims for each village could be observed from the Figure 12 below.

Tarikh : 4 Januari, 2015
Masa: 8.00 pg

JUMLAH KELUARGA DAN ISI RUMAH MANGSA BANJIR MUKIM BOTA 2015

BIL.	KAMPUNG	MASA	JUMLAH KELUARGA	DEWASA		KANAK-KANAK		JUMLAH BERPINDAH	PUSAT PEMINDAHAN
				(L)	(P)	(L)	(P)		
1.	KG. PULAU PISANG	8.00 pg	5	13	11	2	4	30	DEWAN ORANG RAMAI KG. PULAU PISANG
2.	KG. TELUK KEPAYANG	8.00 pg	86	84	97	32	33	246	SK. TELUK KEPAYANG
3.	KG. SELAT BOTA	8.00 pg	14	20	19	8	9	56	DEWAN DATO' HAMBAL BOTA KANAN
4.	KG. SEDINGGKA/ AIR MATI	8.00 pg	37	40	42	10	15	107	SK. PADANG CHANGKAT
5.	KG. PARIT 13 DAN PARIT 14	8.00 pg	60	77 OKU - 2	74 OKU - 1	46 (BL-2)	34 (BP-1)	231	INSTITUT PERTANIAN TITI GANTONG (PINDAH DARI DEWAN ORANG RAMAI PARIT 13)
JUMLAH			202	234	243	98	95	670	

Figure 12: Total Distribution of Transferred Victims for Each Village in Bota (Source: Pejabat Penghulu Bota)

All the flood victims received help in terms of food and other essentials from various authorities and charity bodies. The total flood inundation period in Perak Tengah was approximately one month. The victims started to move to relief centres on 26th December 2014 and the relief centres were fully evacuated on the 18th of January 2015.

After returning to their own home, the villagers did a 'gotong royong' session to clean up their house and the surrounding areas. According to Mr Syed, after the flood disaster a few of the villagers came down with a slight fever and flu, but no one faced any serious illness. The sick villagers were treated at 'Pusat Rawatan Changkat Melintang'.

4.3 Houses built around low-lying area

A questionnaire was handed out to 20 families in each sub-districts. Each family consists of minimum three members and a maximum of six Therefore the each questionnaire answered is representing an average of five people. The number of population of Perak Tengah is approximately 150,000 people scattered in 11 sub-districts. Mathematically, each sub-district consists of approximately 13636 people.

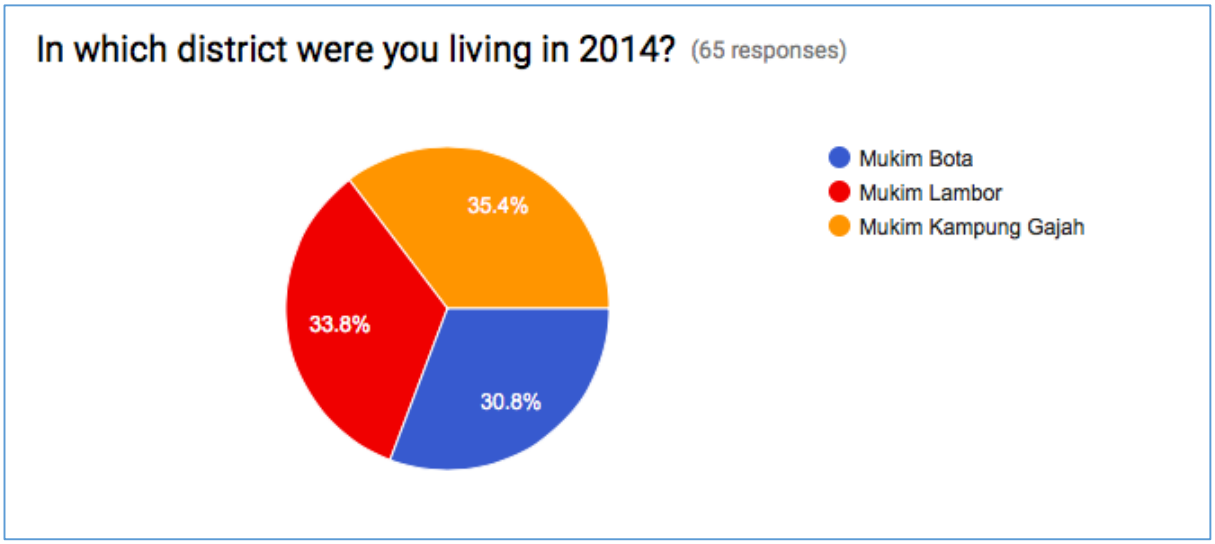


Figure 13: Origin of Respondents

With the margin of error of 5% and level of confidence of 95%, the sample size required to ensure the validity of the answered questionnaire is approximately 300 people. 20 representative respondents were from Bota, 20 from Lambor and 25 more were from Kampung Gajah. From the collected answered questionnaires, it is found that a majority of 40% of the surveyed flood victims were staying around the flood plain area when the flood hit back in 2014.

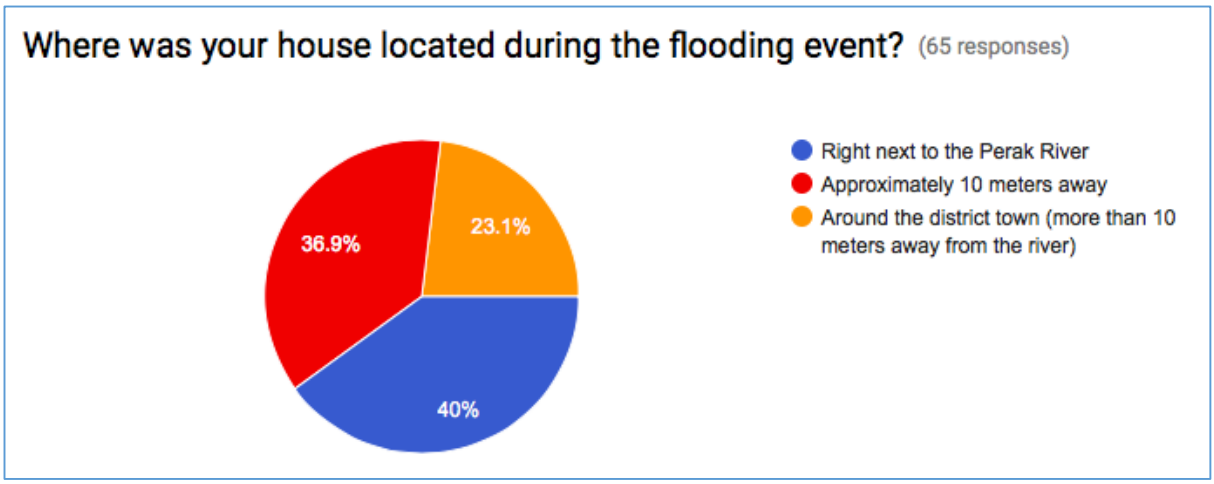


Figure 14: Location of Houses of the Flood Victims

Flood plain areas are areas prone to flooding. According to the JPS guideline, a gap must be put between the start of housing areas and the river banks in order to avoid direct flooding as per what happened in Perak Tengah. However, many of the villagers insisted that they have been living around the area far too long and most of them depend on the river water to carry out their everyday works.

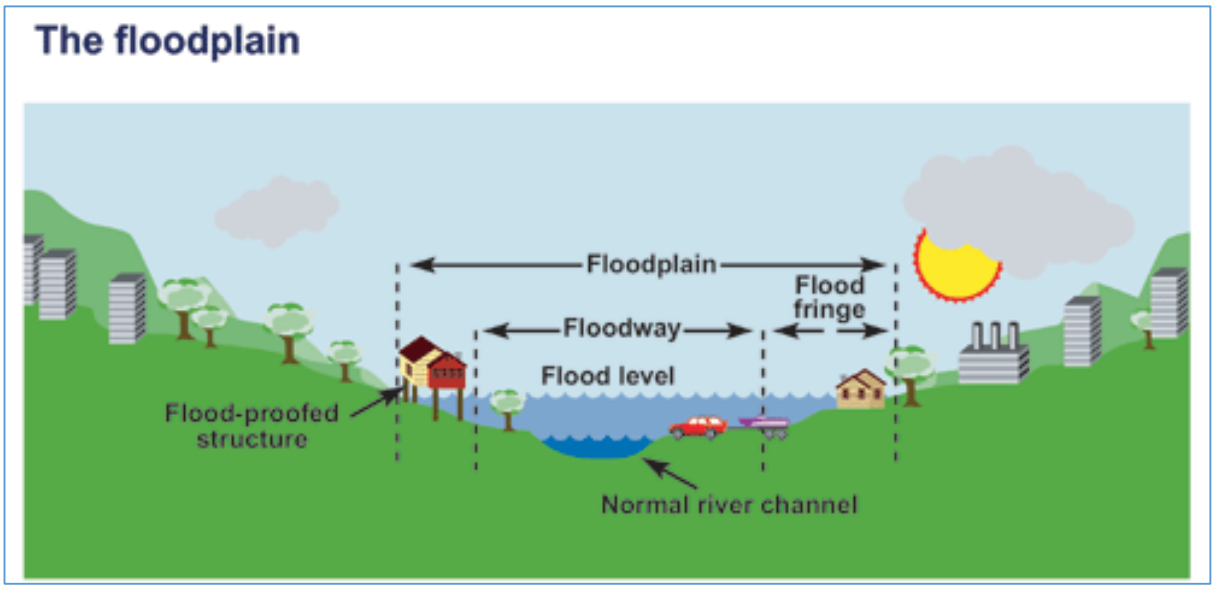


Figure 15: Indication of Flood Plain Area (Source: ec.gc.ca)

4.4 Unsystematic Drainage System

Based on the result of the questionnaire, it is also identified that the drainage system around the villages was also one of the causes contributing to the flooding event. 49 out of 65 respondents agreed that the drains around their villages were not cemented. The natural earth drains caused the dug up soil to erode during rainfalls, causing drain clogs and the rain water was unable to be flowed through to the river.

Besides that, 46 out of 65 respondents insisted that no drains were made at areas where water prone to be stagnant. There may be a nearby drain, however the gradient of the road is not sufficient in order to allow the stagnant water to flow to the drains. In addition to that, 40 out of the 65 questionnaires shows that even the existing drains were not maintained properly. Majority of the drains were clogged by plastics, cans and other wastes.

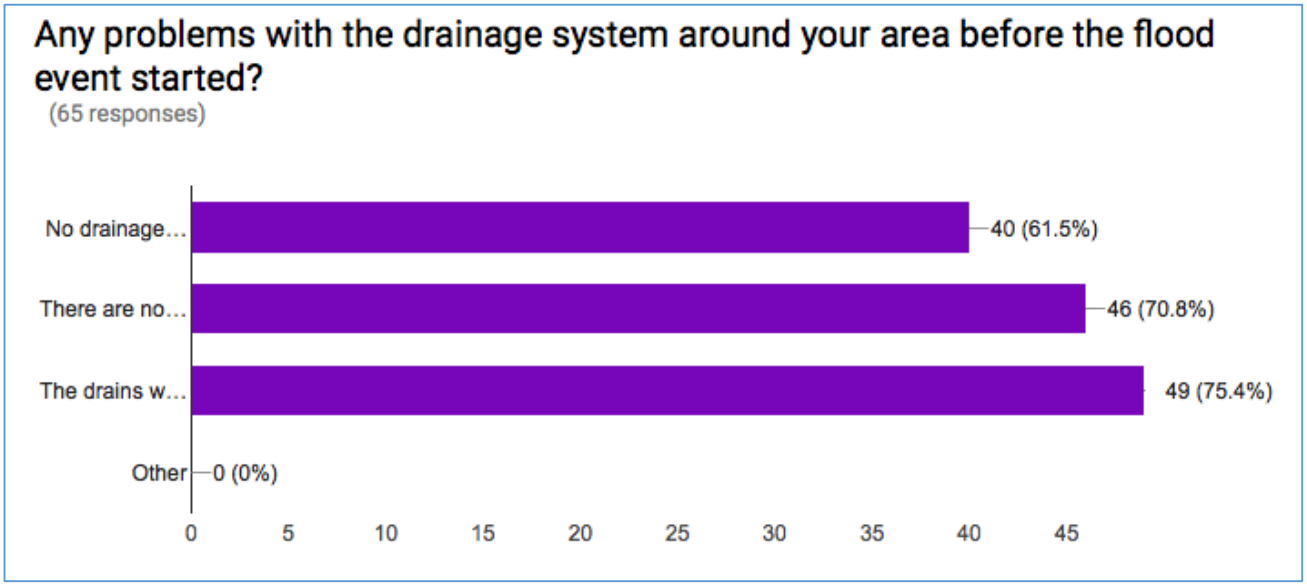


Figure 16: Drainage Related Problems at the Impacted Villages

4.5 Cost of damages inflicted by the flood event

The findings from literature review also revealed that there were also severe damages inflicted by the 2014 flood in Malaysia. The reported damages that were caused by the floods extensively in parts of peninsular Malaysia was expected to cost Putrajaya and state the governments over RM1 billion. The cost tabulation of damages afflicted by the 2014 flood is shown in Table 3.

No.	States	Cost of Damages (RM)
1	Kelantan, Pahang, Terengganu	204 million
2	Johor, Melaka, Negeri Sembilan	78 million
3	Perak, Kedah, Perlis	55.6 million

Table 3: Cost of Damages Afflicted by the 2014 Flood

(Source: jsrad.org)

Based on the results of the questionnaire, it is found the category of item which was the houses, where 62 out of 65 respondents claim that they faced damages to their houses which costs a lot of money. This is followed by the damage of appliances, vegetation, live stocks and transportation.

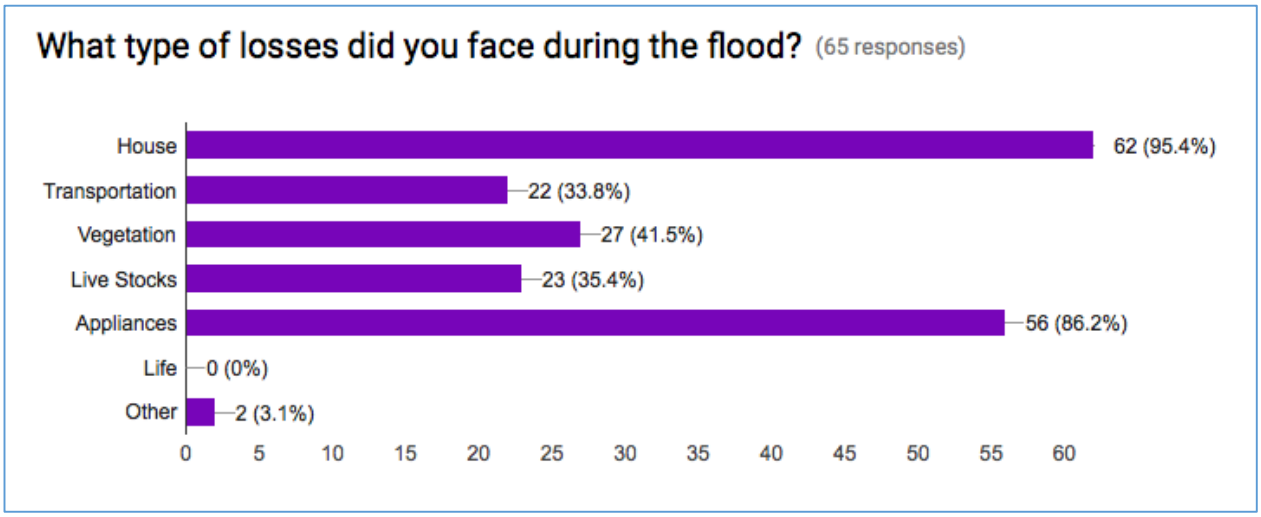


Figure 17: Distribution of Losses due to the Flooding Event

4.6 Database Outcome

Based on all the collected information and data, a database was created consisting of:

I. Table

Location	Number of people involved	Causes	Implications
Bota Sub-District			
Kg. Padang Changkat	▪ 80 houses ▪ 230 people	▪ **Clogged drains** because the cement drains were not being used. ▪ Many villagers were living around the **low lying area** and many of their houses were made out of wood ▪ **Extra water discharge** from the dam	▪ Longer flood inundation period ▪ A majority of 48% of Bota villagers were impacted with flood damage cost of more than RM10,000. ▪ 100% of the villagers agreed that the river profile changed after the flooding event (sediment build up) ▪ Damaged some of the existing river gates and bunds ▪ Electricity disruptions for the first few days after the flood ebbed
Kg. Teluk Kepayang	▪ 40 houses ▪ 120 people		
Kg. Aji	▪ 30 houses ▪ 90 people		
Lambor Sub-District			
Kg. Lambor Kanan	▪ 50 houses ▪ 140 people	▪ **No maintanence** work was carried out on existingly clogged drains ▪ Many villagers were living around the **low lying area** ▪ **Extra water discharge** from the upstream dam	▪ A majority of 61% of Lambor villagers faced a total lost ranging from RM5000 – more than RM10,000 ▪ 100% of the villagers stated that there was a noticable change in the river profile after the flood ebbed ▪ Electricity disruptions
Kg. Lambor Kiri	▪ 20 houses ▪ 80 people		
Telok Sena	▪ 15 houses ▪ 70 people		
Kg. Gajah Sub-District			
Kg. Bandar Lama	▪ 90 houses ▪ 260 people	▪ **Unstrategic drainage** location ▪ Some of the villagers were living around the **low-lying** areas ▪ **Extra water discharge** from the upstream of the Perak River	▪ Longer flood inundation period ▪ A majority of 90% of the villagers in Kg Gajah area faced a total loss ranging from RM5000 – more than RM10,000 due to the flooding ▪ All the respondents agreed that the river profile changed after the flood event ▪ Electricity disruptions ▪ Longer flood inundation period
Kg. Tanjung	▪ 75 houses ▪ 220 people		
Kg. Selat Pulau	▪ 70 houses ▪ 220 people		

II. Map Overlay

After overlaying the map indicating the flooded area around Perak Tengah with the map indicting the areas where the survey activities were conducted, it can be observed that the areas were exactly located in the flood impacted area as shown in Figure 18 to 21.

Figure 18: Overlay of Flood Indication Map and Surveyed Area

III. Map of Sub-Districts

- Bota Kanan & Bota Kiri

Figure 19: Map of Bota Kanan and Bota Kiri

- Lambor Kanan & Lambor Kiri

Figure 20: Map of Lambor Kanan and Lambor Kiri

- Kampung Gajah

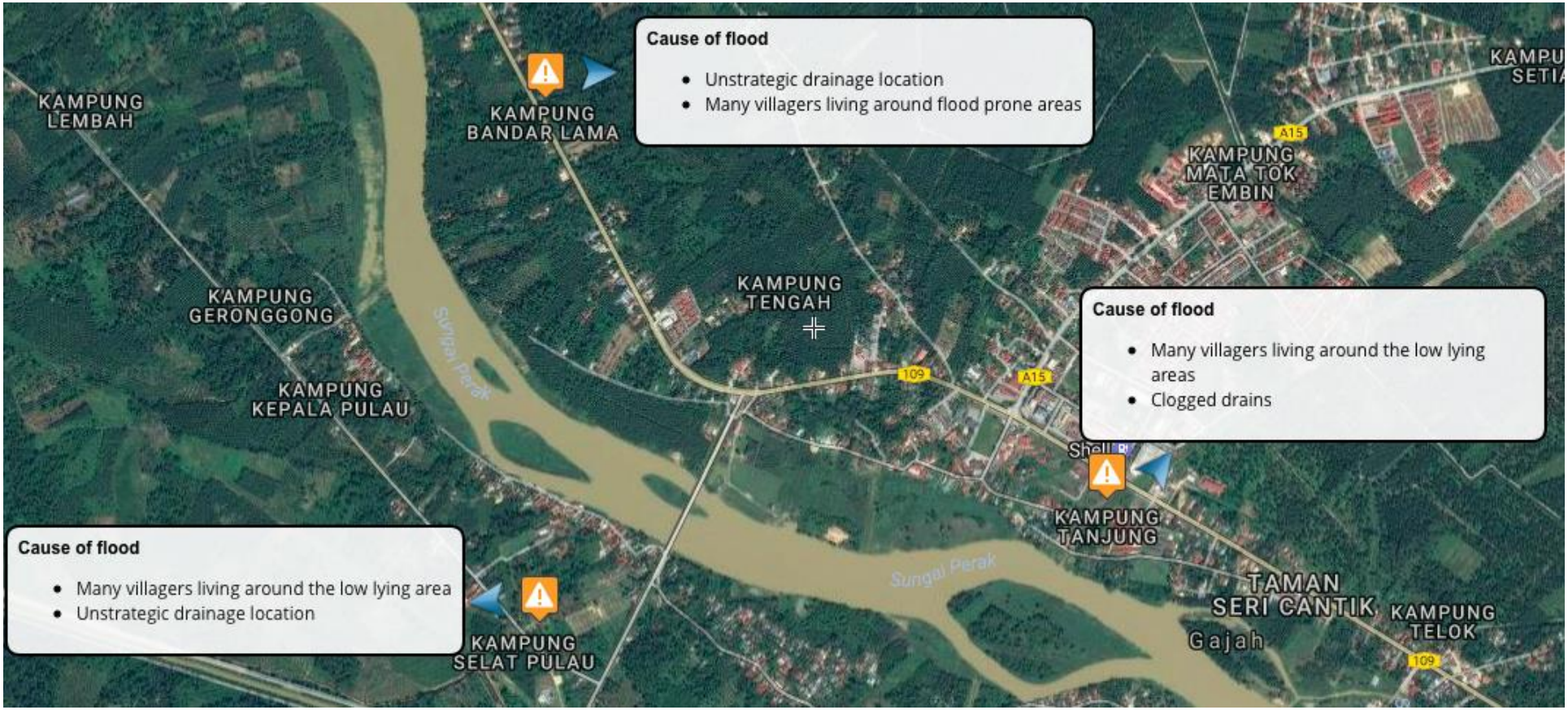


Figure 21: Map of Kampung Gajah

4.7 Restoration and Improvement Works

Even so, after the flood occurrence in 2014, a few restoration and works were carried out by Jabatan Pengairan dan Saliran Perak to minimize the probability of similar flood occurrence as 2014 in the near future. The few measures taken were:

a. The replacement of leaking river gates at the palm oil plantation zones which cover an area of 100 hectares and 200 residential houses. This is to avoid the spilling of water from Bakong River into the palm oil plantation zone. The reinstallation works could be observed as Figure 22.

Figure 22: Works of Reinstalling Water Gates
(Source: JPS Ipoh)

b. The installation of chequered plates at four locations indicated in the 'Rancangan Saliran Changkat Cermin' in order to prevent the back flowing of water from Bakong River. This taken measure could save an approximately 200 houses with a total area of 500 hectares. This activity could is carried out as Figure 23.

Figure 23: Installation of Chequred Plates

(Source: JPS Ipoh)

c. The bunds along Perak River were topped up to reduce the overflowing of river water and saving nearly 200 houses around the area, as of Figure 24.

Figure 24: Topping Up Bunds Along Perak River

(Source: JPS Ipoh)

d. Performing the works of digging up new drains and opening up 7 existing crossing culverts to smoothen the water flow from Pasir Gajah Village in Mukim Blanja, in order to save a paddy field with an area of 300 hectares.
e. The bunds along Bakong River were topped up to prevent water from overflowing into the Bota Kiri paddy field and palm oil plantation area on the lee side of the bund which has an area of 50 and 70 hectares respectively.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

In this study, it is identified that the excess discharge of water from the dam significantly contributed to the flood. This was further amplified by the location of villagers, living around the low lying area. The villagers who lived within the impacted areas for the past few decades suggested that flood is already considered as an annual event as it occurs every year during the Northeast Monsoon. The only factor that differs the impact of the flooding every year is the period of non stop heavy rain.

The study also indicates that the properties such as houses, livestock, agriculture, and transportation are the most inflicted with total losses more than RM10,000 per household. In order to prevent similar flood impacts from occurring in the future, serious mitigation measures should be taken by the local authorities. As a start, the implementation of simple measures could be carried out to reduce the impact of flooding towards targeted areas.

Flood is an annual natural disaster which occurs in Malaysia. This recurrent natural disaster could be prevented by having precaution steps and self-awareness. Efficient planning in flood management system reflects practical cooperation among involved parties in the preparation of facing the flood disaster. Hopefully that the findings from this study will enable better preparation by the local authorities in reducing future flood impacts.

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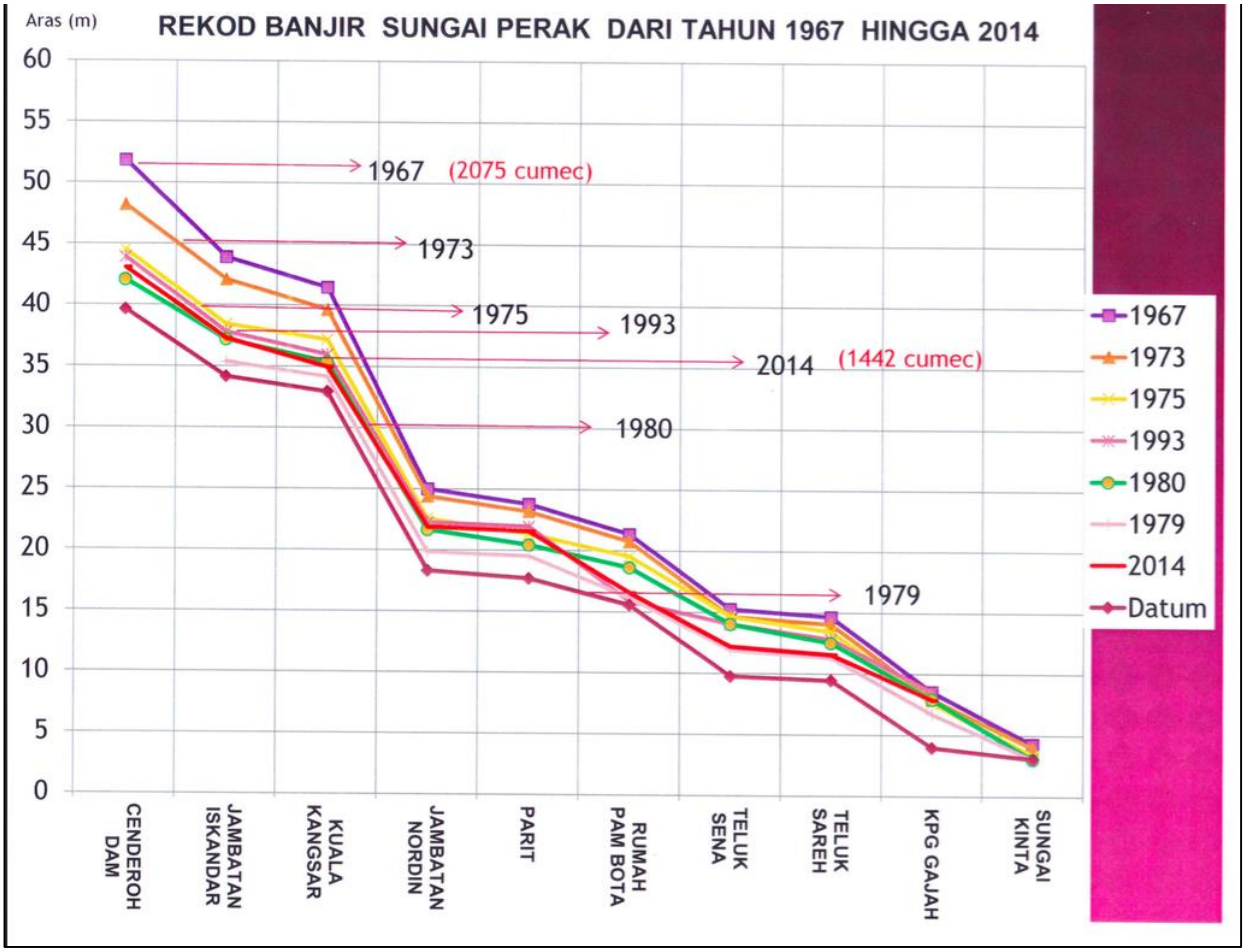
APPENDICES

APPENDIX A: Perak Flood Level Record



APPENDIX B: Questionnaire Distributed to the Villagers

Post Flood Assessment in Perak Tengah

A questionnaire to survey the victims perspective of the 2014 flood which hit Perak Tengah Area

1. In which district were you living in 2014? *
   - Mukim Bota
   - Mukim Lambor
   - Mukim Kampung Gajah

2. Were you affected by the flooding event in 2014? *
   - Yes
   - No

3. How often is the flood frequency at your area? *
   - Once a year
   - Twice a year
   - Other :

4. Where was your house located during the flooding event? *
   - Right next to the Perak River
   - Approximately 10 meters away
   - Around the district town (more than 10 meters away from the river)

5. What type of losses did you face during the flood? *
   - House
   - Transportation
   - Vegetation
   - Live Stocks
   - Appliances
   - Life
   - Other:

5. How many times have you encounter the same type of damages due to flooding? *
   - 1
   - 2
   - 3
   - Other :

6. Average amount of loss that you faced during the 2014 flood event? *
   - <RM1000
   - RM1000 - RM5000
   - RM5000 - RM10000
     - RM10000
   - Other :

7. How long were you placed at the flood relief centre? *
   - One week
   - Two weeks
   - Three weeks
   - Four weeks

8. Were there any electric disruptions after the flooding event? *
   - Yes
   - No

9. Were there any changes to the river profile after the flood subsided? *
   - Yes
   - No