GAP ANALYSIS REPORT: FLOOD DISASTER MANAGEMENT IN MALAYSIA

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Contents

1 SCOPE

The scope of the assessment is a gap analysis related to flood or drought management, hence the scope includes determining of the important and urgent issues in the country; whether flood or drought. Subsequently, data which link to climate change Nationally Determined Contributions (NDCs), the water security strategy in National Development Plans (NDPs), National Action Plans (NAPs), and other global initiatives will be collected. The focus of assessment is to find out the most reliable link which can be used to support issues of flood management and/or drought management in Malaysia, review data, and conduct discussion in local and/or regional levels, then compose the gaps analysis based on all data which have been reviewed and discussed.

2 BACKGROUND

Malaysia is a country rich in water resources, receiving an abundant amount of rain every year, has an equatorial climate with constant high temperatures and a high relative humidity. The average annual rainfall is 2,400 mm for Peninsular Malaysia, 3,800 mm for Sarawak and 2,600 mm for Sabah with heavier precipitation recorded in the east coast of Peninsular Malaysia and the coastal regions of Sabah and Sarawak. 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) 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 though rainfalls during these periods are generally less than during the northeast monsoon. There are, in addition, two transitional periods between the monsoons (inter monsoon) when convectional thunderstorms are common.

Even though Malaysia is not directly affected by serious disasters like earthquake, hurricanes, typhoon, tornadoes, tsunamis and volcanic eruptions, there are some water-related problems which have raised concerns among water engineers and the public. The problems are not about having too little water to satisfy our needs, as in some water-scarce countries in the world, or too much to

cope with, rather, it is a problem of not managing water effectively to achieve our desired objectives. In some river basins, there is already the problem of water shortage especially during periods of prolong droughts, and conversely, the problem of excessive water and floods during the wet season. The country is experienced serious challenges relating to flood in 2014 and drought management years before and in 2015 in several part of the country, as we move towards the year 2020 the challenges are magnified. Per capita availability of water will greatly decrease as a result of a growing population and greater per capita use of water for a better quality of life, urbanization and industrialization. Other potential problems include increased severity and frequency of flash floods, prolong droughts especially during El-Nino years, water and land use conflicts, decreasing crop yields and increasing water demand for food production, pollution control, outbreak of water-borne diseases, declining aquatic biodiversity, deforestation, and uncontrolled erosion and sedimentation. In general, there are two major water-related problems affecting this country, i.e. excess water (floods) and water shortage (droughts). These problems have disrupted the quality of life and economic growth in the country and can result in severe damage and loss of properties, and occasionally loss of human lives as can be seen in the recent December 2006 and January 2007 floods in Johor as well as the 1998 prolong water rationing widespread in the Klang Valley area, 2014 massive floods in Kelantan, Terengganu and Pahang.

3 OCCURRENCE OF FLOOD EVENTS

There are 189 river basins throughout Malaysia, including Sabah and Sarawak in which the rivers and their corridors of flood plains fulfill a variety of functions both for human use and for the natural ecosystem, i.e. they are fundamental parts of the natural, economic, and social system wherever they occur and 89 of them prone to become recurrent flooding. At the same time, rivers might be the largest threat to entire corridor areas when access of water causing flood. Flooding is the most significant natural hazard in Malaysia in terms of population affected, frequency, area extent, flood duration and social economic damage. Since 1920, the country has experienced major floods in the years of 1926, 1963, 1965, 1967, 1969, 1971, 1973, 1979, 1983, 1988, 1993, 1998, 2005, 2006, 2007 (Shakirah et al., 2016; Chan, 2012) and most recently massive flood in December 2014 which occurred in Kelantan, Terengganu and Pahang. Historically, Muar River Basin has

experienced frequent flooding over the years, there had been series of heavy rainfall events that had resulted in flooding within the Muar River Basin catchments. The recorded floods are shown from December 1926 to January 1927, February to April 1967, November 1967 to January 1968, December 1970 to January 1971 and November 1979 respectively. From 1980 to 2010, a total of 29 flood events have been recorded (Diya et al., 2014). Kedah and Perlis also experienced flood in 2010 and also the recent flood in 2014. Sabah and Sarawak experienced high intensity rainfall in January 2015 caused major flooding across several parts of Sarawak and Sabah affecting around 13,878 people had been evacuated with one teenage girl became the only casualty.

The January 1971 flood that hit Kuala Lumpur and many other states had resulted in a loss of more than RM 200 million then and the death of 61 persons. In fact, during the recent Johor 2006-07 flood due to a couple of "abnormally" heavy rainfall events which caused massive floods, the estimated total cost of these flood disasters is RM 1.5 billion, considered as the most costly flood events in Malaysian history. Recent urbanization amplifies the cost of damage in infrastructures, bridges, roads, agriculture and private commercial and residential properties. At the peak of that recent Johor flood, around 110,000 people were evacuated and sheltering in relief centers and the death toll was 18 persons. The massive flood in 2014 affected more than 200,000 in Malaysia especially in Kelantan, Terengganu and Pahang and sadly 21 people killed. The damages cause by the flood in peninsular estimated over 1 billion ringgit with the major types of damage are schools and homes.

The basic cause of river flooding is the incidence of heavy rainfall (monsoon or convective) and the resultant large concentration of runoff, which exceeds river capacity. However, in recent years, rapid development within river catchment has resulted in higher runoff and deteriorated river capacity; this has in turn resulted in an increase in the flood frequency and magnitude. With 60% of the Malaysian population now residing in urban areas, flash flooding in urban areas are perceived to be the most critical flood type (surpassing the monsoon flood) since the mid 1990's. This is reflected in the flood frequency and magnitude, social-economic disruption, public outcry, media coverage and the government's escalating allocation to mitigate them. In the coastal areas, flooding could be attributed to high tides and occasionally aggravated by heavy rains or strong

wind. In the last decade, also of great concern is the increased occurrence of other flood-related disasters such as debris flood flow, mud flow and landslides in mountain streams and hill slopes, not to mention the new threat of tsunami-induced coastal flood disasters. Kong et al., (2010) found out that public believe that urban flooding due to improper drainage system, pollution, management of urbanization, environment factor, weather is the causative agent and dam break.

4 FLOOD MANAGEMENT MEASURES

4.1 Flood Control Measures

Flood control and flood management aims to reduce the likelihood and the impact of floods. Officially, Malaysian flood management is based on structural and technological measures to control floods. New non-structural measures were introduced and the most significant being that required under Manual Saliran Mesra Alam (Environmental Friendly Drainage Manual). Compliance to this manual is now a mandatory requirement for all new urban development projects since 2001. The structural measures could be understood by simplified design in Figure 1.

Figure 1. Simplified design of Structural Measures of Flood Control.

Since the new millennium, the Department of Irrigation and Drainage has adopted the Integrated River Basin Development and the Integrated Flood Management approaches for its flood management programs. These will provide a balanced approach between structural and non-structural measures as well as higher levels of public participation.

Directive No. 20 which contains the Policy and Mechanism of the National Disaster Management and Relief has been developed on May 11 in year 1997 under Keselamatan Negara (Malaysia Security Council) MKN (NSC). Majlis Keselamatan Negara (Malaysia Security Council) MKN have updated that Directive No. 20 in 2012 for been revised to confirm with the current changes, as well as the complexity of disasters is often the case at present. These instructions have outlined a policy on disaster management and has set the role and responsibilities of the agencies involved at the time needed to deal with a disaster (Hussaini, 2007, Khairilmizal, 2016). Earlier experience has shown that the most effective approach is through the development of flood management programs using a holistic approach with respect to the following under five strategies: 1. Prevention -Avoiding construction of properties, houses, and industries in present and future flood prone areas; 2. Protection -Reduce the likelihood and the impact of floods in a specific location, using structural and non-structural measures; 3. Preparedness - Give information to the public, what need to do in the event of flooding and about the risks; 4. Emergency actions - Develops the emergency response, formulate plans and the actions need to take; 5. Recovery and lessons learned - Return to normal after flooding disaster conditions as soon as possible and mitigate both social and the economic impact.

Following the disastrous 1971 flood, the Government took several positive steps to deal with the flood problem. Among these were: (a) establishment of the Permanent Flood Control Commission; (b) establishment of flood disaster relief machinery; (c) carrying out of river basin studies and preparation of drainage master plans for major towns; (d) implementation of structural measures; (e) implementation of non-structural measures; (f) setting up of flood forecasting and warning systems; (g) setting up of a nation-wide network of hydrological and flood data collection stations.

Essentially, the overall objectives of flood management should include:

i. To reduce the adverse impact of floods and the likelihood of floods,
ii. To promote sustainable flood management measures,
iii. To look for opportunities to work with natural processes and to deliver, if possible, multiple benefits from flood management,
iv. To inform the public and relevant authorities about the flood risk and how to deal with it.

4.2 Flood Mitigation Measures

From the studies that have been carried out, various structural (curative) as well as non-structural (preventive) measures have been proposed to alleviate the flooding problem. Under structural measures, engineering methods are used to solve the flooding problem. The river capacity can be increased to accommodate the surplus runoff through channel improvement, construction of levees and embankments, flood bypasses, river diversions, poldering, and construction of flood storage dams and flood attenuation ponds, either singly or in combination. Non-structural measures on the other hand are proposed where engineering measures are not applicable or viable or where supplemental measures are required. They include restriction of development, land use zoning, resettlement of population, flood proofing, and flood forecasting and warning systems. Numerous major flood mitigation projects for urban areas have been executed. Apart from urban areas, the aspects of flood mitigation and flood fighting have also been implemented in fast growing agricultural areas such as the Integrated Agricultural Development Project (IADP) areas namely Perlis IADP, Western Johor IADP, Ketara IADP, Kemasin Semarak IADP and Samarahan IADP. Under the 2nd Malaysia Plan (1971-1975), a sum of only RM14 million was spent for flood mitigation projects. This was followed by the 3rd Malaysia Plan (1976-1980) with an expenditure of RM56 million, the 4th Malaysia Plan (1981-1985) with RM141 million, the 5th Malaysia Plan (1986-1990) with RM155 million, the 6th Malaysia Plan (1991-1995) with RM431 million, the 7th Malaysia Plan (1996-2000) with RM845 million, and the 8th Malaysia Plan (2001-2005) with an allocation of RM2.7 billion. It is estimated that the cost for future river improvement and flood mitigation works for the next 15 years will amount to some RM17 billion.

Structural measures are actually engineering methods which include the following:

- Flood Control Dams

These dams are constructed to retain flood water in order to protect areas downstream of the dams. Construction of storage dams solely for flood control purposes is generally economically not viable and such dams are frequently utilised for other purposes such as water supply. In addition, dams constructed for hydro-electric purposes also have a portion of their capacity allocated for flood detention. Among the dams specially constructed for flood mitigation are Batu Dam, Semberong Dam, Bekok Dam and Macap Dam while irrigation dams include Muda Dam, Pedu Dam, Timah Tasoh Dam, Bukit Merah Dam and Beris Dam. Hydro-electric dams built by Tenaga Nasional Berhad include Kenyir Dam, Bersia Dam, Kenering Dam, Temenggong Dam and Sultan Abu Bakar Dam. The Klang Gates Dam is an example of a dam built for water supply but also serves as a flood mitigation dam.

- Canalisation and Related Works

Canalisation works include the widening and deepening of channels as well as lining the banks and beds of the channels. They also include the replacement of undersized structures such as bridges. These works are necessary as the original channels have become undersized as a result of the increase in flood flows caused by development.

- Bunding of Rivers

Bunding of rivers prevents overtopping and flooding of the lowlying adjacent areas. This option may give rise to problems of internal drainage as a result of the bunding. Bunding an urban area introduces a high flood damage potential as any occurrence of flooding as a result of flood water overtopping or breaching the bund would be very damaging.

- Storage Ponds of Flood Attenuation

Ponds such as disused mining pools can be used for flood storage. The objective is to divert the flood water through such ponds and thus regulate the outflow so that the flood peaks are attenuated. This strategy has been used in the case of Batu/Jinjang Pond Project in Kuala Lumpur where excess flood water is diverted from Sg. Gombak to Batu Pond for temporary storage and from Sg. Keroh to Jinjang Pond. Water in the pond will be released slowly back to the river after the flood flow has subsided.

- Poldering (Ring Bund)

Poldering is the provision of a ring bund surrounding the area to be protected. This is normally carried out for an area which has high damage potential but for which the cost on overall basin-wide protection would be prohibitive. It includes the provision of internal drainage for the area to be protected and the evacuation of flood water by pumping during periods of high river flows. The present strategy of using structural flood control measures such as the above has proven effective in controlling floods and is usually the only option available for built-up areas. However, structural measures usually incorporate “hard” engineering measures that result in bigger channels conveying high flows at high velocities. These measures incur high costs as well as require substantial land reserves for the channel.

- Flood Diversion Channel or Tunnel

Certain river stretches especially in major city centres, due to intensive development along both river banks, can no longer be widened or deepened to accommodate the increasing flood discharges through the city. Under such circumstances, excess flood water has to be retained upstream in storage ponds or diverted downstream through a flood diversion channel or tunnel. This is being implemented in Kuala Lumpur where the Stormwater Management and Road Tunnel (SMART) Project has become a viable and innovative solution. The SMART system when completed will alleviate flooding in the Kuala Lumpur city centre by diverting large volumes of flood water from entering the city centre. The tunnel is designed to incorporate a stormwater channel and a motorway for dual purposes. The motorway section of the tunnel is expected to ease traffic congestion at the southern gateway to KL City near Sungai Besi. This concept is believed to be the first of its kind in the world. Non-structural measures are

employed more for preventing floods from occurring and with the aim of minimising losses due to flooding. These measures are broadly aimed at reducing the flood magnitude through the management of catchment conditions as well as reducing the flood damage.

Aside from structural measures, non-structural measures relate to planning and practice and can comprise the following:

- Integrated River Basin Management (IRBM)

Under the concept of Integrated River Basin Management, the whole river basin is planned in an integrated manner and all factors are taken into consideration when a certain development plan is proposed. Factors like zoning for river corridors, riparian areas, natural flood plain, conservation of wetlands, storage ponds etc. will be taken into consideration when preparing flood management plans. The concept of IRBM has been incorporated into and will be implemented starting in the 8th Malaysia Plan.

- Preparation of Guidelines and Design Standards

Suitable guidelines and design standards have been prepared, specifying clear requirements, both physical as well as technical, for rivers and their reserves, as well as flood mitigation and urban drainage projects. These guidelines and design standards if followed strictly by the public and private sectors will help to minimise the occurrence of floods. The Department of Drainage and Irrigation has published more than 20 Hydrological Procedures as well as the Urban Drainage Planning and Design Procedure No. 1 for use as reference materials and guidelines by all planners, consultants and other Government agencies throughout the country. Recently in the year 2000, a new Urban Stormwater Management Manual (MASMA) has been published by DID. The Manual has obtained Cabinet approval for implementation commencing 1 January 2001 and is to be complied with by all local authorities and the public and private sectors. The Manual provides control-at source measures and recommendations on flood fighting by utilising detention/retention, infiltration and purification processes. This will

result in a more harmonious urban environment thereby enhancing the aesthetic value of the surroundings as well as property values.

- Resettlement of Population

One positive measure to reduce damage potential as well as loss of life in flood-prone areas where floods would not be significantly reduced by structural measures is to resettle the population. Since 1971, 1672 families and 2715 families have been resettled in the States of Kelantan and Pahang respectively.

- Flood Proofing

This measure consists of implementation of protective works to prevent the entry of flood water into individual houses and specific places, for example, by bunding a building with a wall so that the floor is not submerged during a flood thereby reducing flood damage. In flood-prone cities like Kuala Lumpur and Penang, entrances to basement car parks should incorporate some flood proofing measures.

4.3 Integrated River Basin Management (IRBM)

River basin studies has been conducted in Malaysia with the objective is to draw up appropriate flood maps and also feasible projects for the respective basin areas in order that their development is properly managed and also that water resources management including flood control measures is effective and well-controlled. These studies recommend the optional flood control planning and design criteria for the respective basins. Generally, socio–economic considerations for the basin will dominate the design criteria. Since 1972, a number of river basin studies have been carried out for rivers where major flood problems exist. The objective of these studies is to draw up master plans for water resources development, and measures for flood mitigation form an important component. To date, more than 26 river basin studies have been completed, including Kuala Lumpur (1974 & 2002), Pahang River (1974), Kelantan River (1978 & 1989), Terengganu River (1978), Limbang River (1978), Kinabatangan River (1982), Samarahan River (1983), Batu Pahat River (1984), Johor River (1985), Golok River (1985), Besut River (1988), Klang River

(1978,1989 & 1994), Menggatal, Sabah (1999), Miri Flood Diversion (2000), Linggi (2000), Selangor River (2000), and Bernam (2001). Realising the need for a long-term water resources development strategy and master plan, the Government has carried out a National Water Resources Study (1982) to develop a comprehensive and coordinated water resources development programme for the country. The study has formulated a long-term plan for flood mitigation works in various flood-prone areas of the country. This includes improvement of 850 km of river channels, construction of 12 multi-purpose dams, 82 km of flood bypass, 12 ring bunds around urban centres, and resettlement of about 10,000 people in flood-prone areas. The whole plan was estimated to cost RM2.55 billion (1982 estimate) over a period of 20 years and will provide protection to some 1.8 million people. (However the cost for future flood mitigation works is now estimated to be in the region of RM17 billion for the next 15 years and the estimated number of people affected by flooding has now risen to 4.817 million.) A number of studies have also been carried out with the aim of alleviating flooding problems in various locations in the country. These include the Cukai Flood Mitigation Study, Lower Perak Flood Mitigation Study and the Kangar Flood Mitigation Study as well as drainage master plan studies for the towns of Butterworth and Bukit Mertajam, Kuala Lumpur, Alor Setar, Sandakan/Tawau/Kota Kinabalu, Bintulu, Johor Bahru, Kelang and Port Kelang, Seremban, Melaka, Kuantan, Kota Bharu, Kuala Terengganu, Port Dickson, Raub, Kerteh, Teluk Intan, Penang, Langkawi, Batu Pahat, Sungai Petani, Kuching, Ipoh and the Multimedia Super Corridor (MSC).

However, an effective management of water resources requires full participation form the various stakeholders and a holistic approach. An appropriate institutional framework, a clear policy and strategic and effective implementation of plans are required to alleviate some of the current difficulties. Integrated River Basin Management (IRBM) was introduced which defined as “the coordinated management of resources in natural environment (air, water, land, flora, fauna) based on river basin as a geographical unit, with the objective of balancing man’s need with necessary of conserving resources to ensure their sustainability. RBM is geared towards integrating and coordinating policies, programmes and practices. It addresses water and river related issues. It requires improved professional capability and increased financial, legislative, managerial and political capacity. In essence, it is about bringing nature back to rivers and implementing all the key elements. Low participation from NGOs and local communities was the main problem

identified which hinders the progress of implementing the Integrated Water Resources Management (IWRM). As a result, it has led to some negative impacts in the area such as the unsustainable utilisation, the management of water resources, and the decreased level of water quality (United Nations, 2004). The main causes which contributed to the problem were identified in the study and these include the following: i) Lack of legal requirement ii) Low level of awareness among decision maker ii) Political interference.

4.4 Flood Forecasting And Warning System

The provision of a flood forecasting and warning system is an important, practical and low-cost measure to minimise flood losses. Flood forecasts given early will enable people living in flood-prone areas to be warned so that they can evacuate themselves and their belongings before the arrival of the flood. This can considerably reduce flood loss and damage and above all the loss of human lives. Following the 1971 flood, telemetric forecasting systems have been installed in the major river basins namely Kelantan, Pahang, Perak, Sadong, Kinabatangan, Klang, Terengganu, Besut, Dungun, and Johor which are susceptible to major floods from time to time. A similar system was recently installed in the Muar river basin in Johor and more are being planned for another 20 river systems. VHF flood forecasting systems have been established in smaller basins. In river basins which are subjected to flash floods, little lead time is available for effective warning. Therefore flood warning sirens, which automatically trigger once the flood level reaches a critical point have been installed at strategic locations along certain urban rivers to alert the local residents of impending floods with the aim of minimising flood damage. Since 1980, flood warning boards have been erected in the major river systems. Levels marked on these warning boards are correlated to the levels at the observation point and they enable the residents of the villages to assess for themselves what the situation would be like in their areas, upon receiving information on the water level through radio broadcasts, village heads and/or police. In recent years, a web-based information system on flood warning and flood information can be readily obtained through http://infobanjir.moa.my.

The Malaysian government's Department of Irrigation and Drainage (DID) provides a new National Flood Forecasting and Warning System (NaFFWS) service to the public. The objective

of NaFFWS is to develop and maintain an effective and efficient integrated flood forecasting and river monitoring system (iFFRM), with flood warning dissemination, using national network data, telemetry data, radar data and rainfall forecasts. This iFFRM tool is designed to enable effective decision support by DID. Ultimately, the NaFFWS will represent all of the key river basins, however, systems for each of the rivers are being implemented in groups. The first system have been developed for Sungai Muar, on the west coast of Malaysia, which became operational in 2014. Since then, a system for Sungai Kedah, on the west coast, has been implemented and three east coast rivers (Sg Kelantan, Sg Terengganu and Sg Pahang) have been started, all with support from HR Wallingford's UK and Malaysian-based experts.

The components of the NaFFWS are fully automated systems driven by a combination of live, telemetered gauged data from DID's own InfoBanjir database, spatial rainfall radar data, and numerical weather prediction rainfall forecasts from the Malaysian Meteorological Department. Typically, automatic hourly simulations are carried out to forecast water levels and flows in the river channels, and to map the flood inundation process within the flood plains. The results are used to inform and warn DID staff, so that they can take immediate action to provide an effective and proactive emergency response. Results are also passed to DID web pages, and to dedicated smartphone applications, enabling forecasts to be disseminated more widely. A parallel analytical modelling network can take over the forecasting role should the primary systems fail. Ongoing structural measures for flood mitigation are captured through a flexible modelling approach that can incorporate model updates to reflect real changes in the catchments, complementing the structural measures being implemented by DID and ensuring a sustainable flood warning solution with long term benefits.

Figure 3: National Flood Forecasting and Warning System

Flood Forecasting and Warning System Management for this phases is based on the Standard Operating Procedure as determined by the NSC to agencies like Department of Irrigation and Drainage (DID), Public Works Departments (JKR), Department of Meteorology and Local Authorities includes two steps, namely, structured and unstructured. Structural measures adopted in Malaysia are like dams and dykes to control flood flows. Meanwhile, non-structural measures is such as land use planning and flood forecasting and warning systems to mitigate the effects of floods (Chan, 2012; Khalid and Shafiai, 2015). This two steps measures was implemented to reduce the danger of flooding and will reduce a greater hazard to people in the flood plain. The agencies involved in disaster management of unstructured is the Malaysian Meteorological Department (JMM), JKR and DID (MKN, 2012). Flood warning systems in major rivers that often suffer severe flood disaster has been reviewed in 1971. Until 2009, DID has placed about 335 telemetric rain gauges and 208 water level stations telemetric around 40 river basins to get real-time for monitoring floods. In addition, at the observation center, 400 river gauges are available with manual flooding and more than 250 stations have been established siren by the responsibilities agencies (JPS, 2013).

Real-time information on rain and water levels also have been issued from online via the website Info-Flood and can be accessed directly by government officials and the public. In addition, the short message system is also provided to warn employees of related government agencies such

as the Police, the Army, the JMM, Civil Defense Department, the Department, and National Security Division in the Prime Minister and other agencies involved (JPS, 2013). The Meteorological Department has also provided a weather forecast web site to facilitate public access to current weather conditions at the same times. Malaysia also has introduced "Manual Saliran Mesra Alam" in 2001 to be used as a tool in integrated flood management (Chan, 2012; Musa et al., 2013). In contrast, an example of which is seen nonstructural methods are effective flood forecasting and warning system (JPS, 2013). The methods used for the management of flood disclosed before it has been shown that Malaysia has certainly had an initiative to reduce the impact of floods on human health and life at risk areas. Referring to Sahu, (2006) [7], SMS is an effective alert or notification system which can be used to distribute the information to all people and functional to resilience disaster. Besides that, the people can obtain the accurate information about the rainfall and water level through on-line via infobanjir webpage. This system is effective as early flood warnings dissemination to the public. The flood forecasting and warning systems have been installed at the DID telemetric rainfall stations, telemetric water level stations, manual stick gauges, flood warning boards, flood sirens, real time flood forecasting and warning systems in nine river basins.

Recently, in May 2017, a Malaysia/UK collaboration project involving public-private partnership is focussed on developing an Earth and Sea Observation System (EASOS) which can serve as a platform for tackling environmental problems including flood monitoring and forecasting. The system is expected to be able to provide flood prediction up to 7 days in advance using weather and climate data. The foundation of the work based on satellite enhanced flood modelling capability together with specialist teams of weather and flood forecasting experts. The 18 month project began in December 2016 and the trial run is expected to be completed by May 2018.

5 PERMANENT FLOOD CONTROL COMMISSION

The Permanent Flood Control Commission was established by a Cabinet decision on 21 December 1971 to study short-term measures to prevent the occurrence of floods and long-term measures for flood mitigation. The Commission, in its first sitting, drew up the following terms of reference: (a) To take measures for flood control and to reduce the occurrence of floods; (b) In the event of floods, to minimise damage and loss to life and property. The main objective of the Flood Commission is prevention rather than cure. Since its inception, the Commission's

recommendations of projects for flood control have been made with the overall view of meeting the objectives of the New Economic Policy of eradicating poverty and restructuring society. The Commission was chaired by the Minister of Agriculture with the Drainage and Irrigation Department (DID) acting as the Secretariat. In 2004, the Cabinet placed the DID under the newly formed Ministry of Natural Resources and Environment; and the chairmanship of the Commission was transferred.

From the period between 1971 to 2000 (30 years) and 2001 to 2005 (5 years), a total more than RM 1.6 billion and RM 1.7 billion, respectively, had been spent on structural flood mitigation measures. Under the Ninth Malaysia Plan (2006-2010), the allocation for structural flood control works escalated to RM 3.834 billion. It was then estimated that the cost of future river improvement and flood mitigation works for the next 15 years (until 2025) would amount to more than RM 17 billion.

In January 2001 the Cabinet approved the Urban Stormwater Management Manual (MSMA), published by DID in 2000, to be implemented and complied by all local authorities, public and private development projects. The MSMA includes both structural and non-structural measures to reduce urban flooding. The approach is for control at-source measures. Other recommendations on flood control are by means of detention and retention, infiltration and purification process, including erosion and sedimentation controls. The quality and quantity of the runoff from developing areas should be maintained to be the same as pre-development condition.

6 FLOOD DISASTER RELIEF MACHINERY

Flood management activities will involve various agencies throughout the entire flood lifecycle; from mitigation to recovery phases. All of these agencies will have its own roles and responsibilities that need to be properly defined by good governance structure. Governance in general refers to the actors, processes and policy tools that steer the development of society. It outlines the ways in which government interacts with society to reach mutually acceptable decisions in solving a problem. Governance in disaster management determines how the process

of managing a disaster is implemented, since most responses, and portfolio of responses, depend on governance mechanisms, such as policies, practices and procedures. Interactions among all the actors in the governance structure is to share and coordinate information in ensuring proper disaster responses are received by the people affected by flood. The flood disaster machinery was established with the objective of co-ordinating relief operations at the federal, state and district levels so that assistance can be provided to flood victims in an orderly and effective manner.

In 1972 the Natural Disaster Relief Committee has been established by the Government. The Natural Disaster Relief Committee responsible in coordinating relief operations and is headed by the Minister of Information with its secretariat at the National Security Council. The committee is empowered, among other things, to declare any district, state or even the whole nation to be in a state of disaster so as to be eligible for getting financial assistance from the Federal Government for remedial works in addition to the allocation of funds under the operation budget. Members of this Committee include government departments/agencies and social organizations which provide shelter, rescue and food supplies in case of disaster. The Committee will meet at least once a year to ensure that its machinery will run smoothly normally before the northeast monsoon.

Previously, the National Security Council (NSC) identified the governance structure responsible in coordinating disaster management activities by establishing the Disaster Management and Relief Committee (DMRC). It had the major aim of coordinating disasters at three different levels, namely: Districts, States and Federal. The main functions of the DMRC includes, but not limited to formulating policies and strategies, to coordinate resource from all disaster agencies involved and establishing a recovery systems for the community to return to its normalcy. It clear stated in Directive no. 20 that agencies involved in flood lifecycle will be responsible for its own implementation and execution of roles and activities. On the other hand, Badruddin (2012) highlighted the determining factors of disaster management preparedness which are the level of understanding (knowledge) and practice of Directive No.20. He found that the staff of the Disaster Management and Relief Committee (DMRC) have a good knowledge and practice of Directive 20 and this will help to promote disaster preparedness in almost all districts specifically his study is in Kedah. In ensuring all these agencies execute their roles, a clear governance structure that

includes roles, tasks and activities is required for all different levels of governance and management in Flood Manangement.

Directive 20 provide guidance in managing disaster, including flood, where the mechanism of FM is to regulate the disaster based on the three levels of disaster. The complexity and size of the disaster will determine which level the disaster will be placed, together with the responsible DMRC agencies. In a case of a flood, once a report on flood is made, through public, media or Police Control Centre, the RMP will immediately when to the area to evaluate the level of flood that happen, based on the three levels described above. Depending on the level, the relevant RMP personnel will open the Event Control Post (ECP) and acts as a commander according to the level identified. Disaster Operation Commander (DOC) will coordinate all actions taken by the Rescue and Relief Agencies, in searching and rescuing operations and giving emergency aids to flood victims. Disaster Management Committee will be activated according to the identified disaster level, for coordinating, controlling and operationalizing the search and rescue activities. DOC will report to Disaster Operation Control Centre (DOCC) from time to time to get assistance. The task of the DMRC was to coordinate flood relief operations at national, state and district levels with a view to prevent loss of human lives and to reduce flood damage.

NSC also had developed an Emergency Control Centre (ECC) that acts as a central command and control facility to manage any public threats or emergency. It is responsible for carrying out the activities for the entire phases of disaster: mitigation, preparedness, response and rehabilitation that functions at a strategic and tactical level in an emergency situation. In order to implement and achieve the ECC objective, a National Disaster Management System (NDMS) is built. This system able to support the disaster management at a federal level by providing information management that includes data analysis, historical data, activity monitoring and action status. The system also will include geospatial data, contributed from eleven ministries and government agencies. NSC as the ECC owner will head the information gathering for geospatial with the help of three technical agencies including Malaysian Center for Geospatial Data Infrastructure (MaCGDI), Malaysia Map and Measure Department and Malaysia Remote Sensing Agency.

Based on the Operation Procedure No. 29 published by National Security Council, the Department of Irrigation and Drainage Malaysia (DID) is one of the committee member and the organizational of flood relief and operation. Subsequently, DID published Circular No. 2/2003 "Guidelines for Management of Flood Disaster during Monsoon Season and Flash Floods" which to coordinate the preparation of flood operation at federal, state and district levels. DID also create official postal for public to execute their program. Figure 2 shows the website of the official portal of DID.

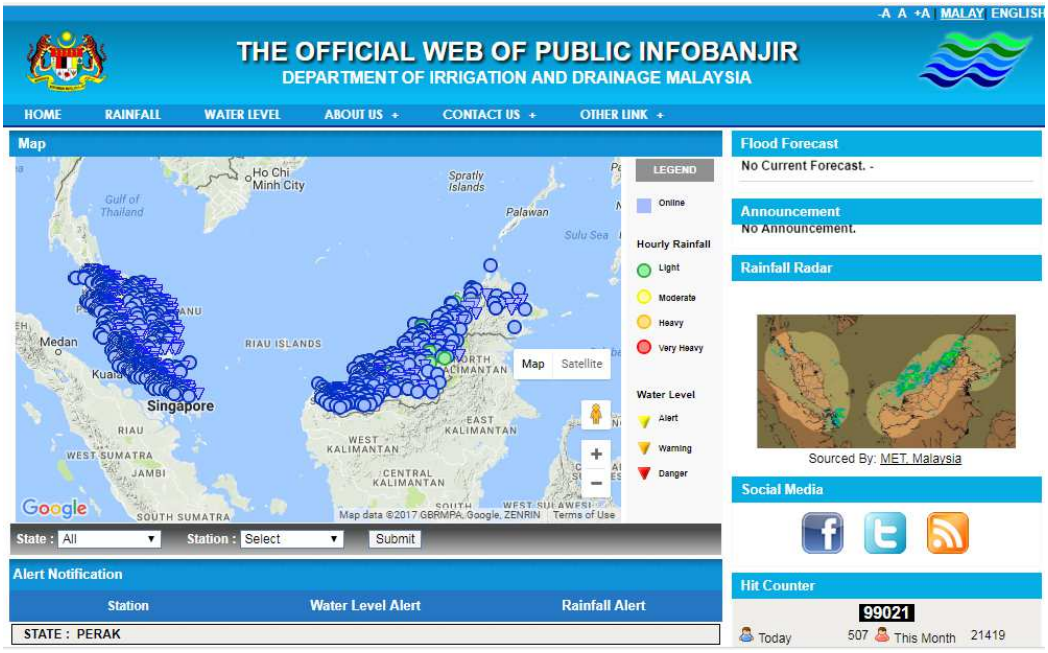

Figure 2: Official Website of Public Inforbanjir.

The DID is engaged in the procedures under the flood relief mechanism beginning from close monitoring of the flood situation when the river stage reaches the "alert" level at the flood warning station. The relevant flood control centres that the flood relief mechanism shall be activated in certain level of river will be advised by DID. The respective state DID office should conduct the flood forecast operation using the real time telemetric data and river forecasting computer models during the flood season. The National Security Division and the national and state control centre for flood relief and operation will be activated immediately the moment the river water stage is over the normal level.

However, in December 2015, subsequent to the large scale flood event in several East Coast States at the end of 2014, the government announced the setting up of the National Disaster Management Agency (NADMA) to coordinate government agencies in tackling all disasters. The Deputy Prime Minister, Datuk Seri Dr Ahmad Zahid Hamidi said, in making the announcement, that NADMA, was set up to ensure all assistance to flood victims were channeled more effectively and orderly. It would start its operation for the first time in the 2015 flood season. NADMA is set up manage and coordinate efforts against disasters in the country, together with disaster management related agencies, such as the Malaysian Armed Forces, police, Malaysian Civil Defence Department, Fire and Rescue Department, Rela, Social Welfare Department. The core functions of NADMA are i. Planning and Preparedness, ii. Operation Activities, and iii. Post Disaster Management. The vision of NADMA is to act as the national focal point in disaster management and preparedness. Its mission is to ensure safety and welfare of the public through fostering cooperation with various parties as one team to build and enhance capabilities and preparedness in disaster management. The new Agency is expected to use existing disaster management mecanisms while it is in the process of improving procedures in line with global best practices.

7 ISSUES AND CHALLENGES IN DISASTER MANGEMENT

Based on past experience in disaster management in Malaysia, several issues may be highlighted where improved approaches and procedures may be implemented. Some of these are:

- Poor Disaster Relief Management at the Evacuation Center

  A natural disaster occurs when an extreme geological, meteorological, or hydrological event exceeds the ability of a community to cope with that event. The purpose of a humanitarian relief is to provide the appropriate emergency supplies to people affected by natural and man-made disasters to minimize human suffering and death. The distribution system used in humanitarian relief operations may depend on each situation's. The problems that arise during of disaster relief operations may differ depending on the various factors, such as the type, impact, and location of the disaster occurs, and local conditions in the regions affected (Balcik et al., 2008). The need of disaster relief, humanitarian aid provided during disasters is expected

to continue and increase as the number and impact of natural disasters increased (Shazwani Shafiai and Mohamad Sukeri Khalid, 2016). They also quoted that Thomas and Koczak (2005) addressed that the inability of humanitarian relief organizations to properly scale capacity to face of increasing needs on that time, although has led to a generalized scarcity of resources and the intense pressure to improve operational efficiency of disaster relief efforts (Shazwani Shafiai and Mohamad Sukeri Khalid, 2016). The humanitarian relief organizations today has resources thinly stretched among the simultaneous operations in different theatres around the world. In addition, increasingly demanding donors pressing for better results and data demonstrating impact of aid to those in need has subjected relief organizations to greater scrutiny, leading to further pressure toward operational transparency and results orientation. At this point, the victim is transferred to evacuation centers that have been established by the government. Therefore, at this stage, they expect help from the government to reduce the suffering and the burden faced by the victim. Mohd Zulhafiz et al. (2013) stated that there are issues that arise in the distribution of disaster relief and improper evacuation centers lead to conflict in evacuation centres. This include the irregular, inadequate and slow assistance provided to victims. Issues and problems have caused conflict in there. In addition, Mohd Zulhafiz et al. (2013) also revealed that there has been significant dissatisfaction with management is not systematically implemented by the JKM, MKN and the District Office because lack of rescue equipment and an evacuation center do not comfort for the victims. Mohd Zulhafiz et al. (2013) also stated that the flood relief center are insufficient in food supply, lack of understanding between the victims, overcrowded and insufficient and unsuitable infrastructure and equipment at the center make the conflict exist. They also found that the evacuation center is not properly managed and maintained by the responsibilities agency and the center is not ready for using during flooding disaster. Because of that, the perception and complaints of the victim should be taken by the government in order to serve as a guide for improving the distribution of aid operations in the future.

- Lack of the Utilities and Slow Recovery Policy

Nevertheless, lack of the utilities during the flooding is the one of the important issues were list out by previous researchers. According to Mohd Zulhafiz et al. (2013), all the victims

agreed that the all utilities at evacuation center is not maintained and properly managed. Because of that, it is not suitable for the victim as a place to stay for a long time until temporary or permanent house are built. After disaster, the recovery is the most important phases to help victims build a new life and decrease their suffering after destruction by disaster. Lindel (2011) suggested three has three distinct disaster recoveries but has the interrelated meanings. First, it is a goal that involves the restoration of normal community activities that were disrupted by disaster impacts in most of people's minds, exactly as they were before the disaster struck. Second, it is a phase in emergency management cycle that begins with the stabilization of disaster conditions and ends when the community has returned to its normal routines. Third, it is a process by which the community achieves the goal of returning to the normal routines. The recovery process involves both activities that were planned before disaster impact and those that were improvised after the disaster impact.

According to Badri et al. (2006), the formation of post-disaster policy is more important as the victims urgently need help from the government to provide temporary and implement disaster recovery measures for improving the welfare and victims quality of life after a disaster. Before that Chan in 1995 urged that resettlement after floods should be evaluated in order to be implemented for future improvements in his review of policy support after the disaster in Malaysia. There are still shortcomings in terms of misunderstanding in implementing policies enacted by the government led to disaster management becomes ineffective despite the Directive No. 20 has been tabled. This is because in was not clearly established the type of placement will be given to the victims and this has led to the restoration project need to be discussed by the higher authorities and its requires a long-time due. Because of that, the victims need to stay at the evacuation center or stay at their relative houses for a long time. This situation makes them not comfortable and will affected their quality of life.

- The Attitude of Flood Victims and Lack of Community Involvement

The attitudes of flood victims during the flooding events are mostly change because of flood impact. They will pressure and perceived negative attitude like selfish and just thinking about their own necessity. Roosli and O'Brien (2011) found that the negative attitudes of flood

victims make the relief management facing more difficulties when the victims expect government will give the relief on time. The relief management staff may not adequate while when the number of victims continue to increase may cause the flood relief exercise not well executed. Based on that finding, it can see that the educating community is very important to face disaster events in the future including floods. Disaster educated community especially victims will change their attitudes to be more rational and can considerate with others at evacuation centers in that situation. Social scientists already suggested that future actions involving the community should not only consider community involvement in the planning and formulation of policies but to ensure that a person realize their human potential and would make the implementation of a more comprehensive assistance in policy or programs planning and implementation (Godschalk et al., 2003; Love and Vallance, 2013; Vallance, S. (2011), Brookman, 2015). But in Malaysia, communities there no mechanism to contribute the ideas directly on these issues because the government will take the actions based on policies developed in order for the policy to be implemented. On the hand, too, many communities expect the government to take all the necessary action and do not become pro-active in disaster preparedness.

- Bottom-up Approach

Previous researchers propose that in the future research needs to use bottom-up theory to identify the effectiveness of aid during and after the stage from the perspective of the victims themselves. Involving community in disaster management will reduce the government burden and the community can contribute to help the victims. Top-down approach cannot be used in flood relief management in Malaysia because it not given the successful implementation in holistic manner (Roosli and O'Brien (2011); Chan (2012). Furthermore, strategies, instruments, and measures of flood protection and prevention seem insufficient to reduce risks and prevent damage. Floods not only lead to damage, but it also motivates societal and political change. This will lead to opportunity in change of governance structure surrounding flood management.

At the Stakeholder Forum For Incorporating Climate Resilience In The National Water Resources Policy Action Plans, 27-28 October 2014, organised by MyWP with DID with support by MyCWP, some of the challenges highlighted by officers in the Flood Management Division of the DID were:

- Floodplains are continuously being developed,
- Residents/stakeholder have high expectations and less tolerance towards flooding,
- Structural flood management costs are rising, and
- Non-structural approach has not been weell accepted (IFM, IWRM).

In developing climate change resilience towards flood risks, the aim was to control and reduce the occurrence of floods, reduce damage and losses, as well as to protect life and prevent property damage. Among the approaches being adopted are:

- Advocate the concept of Living with Flood and incorporate Integrated Flood Management (IFM) in development plans,
- Adopt Best Management Practices/Plans, and
- Stakeholder Engagement.

8 INSTITUTIONAL ISSUES

Malaysia is a federation of states where legislative powers are held at both the federal and state level. Due to the distribution of powers under the Constitution, the various aspects of flood and drought management are planned and managed on a sectoral basis with various government institutions at both federal and state levels being involved. For example, domestic and industrial water supply is a state responsibility and thus is managed by the states through their respective Water Supply Departments, while the generation of hydro-electric power is a federal responsibility and is managed by the Ministry of Energy, Water and Communications. For flood control, the matter is more complicated, as irrigation and drainage, including flood control, is a concurrent

responsibility (both Federal and State government have their roles) and is managed by the Department of Irrigation and Drainage operating at both state and federal levels.

Land development control which will affect urban stormwater and flood management, is managed by the Town and Country Planning Department, while local urban drainage regulations are managed by the Department of Local Government at the State level. The problem is due to the historical development of the administrative system where the various water-related government agencies are focused on different and limited aspects of water management, both excess water (flood) and water shortage (drought). This has resulted in gaps and overlaps in the jurisdiction of the various agencies.

In recognition of these issue, in 1998, after the serious water shortage crisis of 1997-98, a National Water Resources Council (NWRC) was established. The intent was to have a more effective and integrated water resources management, including better flood and drought management. This Council is chaired by the Prime Minister with members comprising all State Chief Ministers and a number of Federal Ministers. It is intended to be a high level policy formulating body on integrated water resources management. The secretariat to this council is the DID. Partly as a result of the water resources issues and related environmental problems, the Ministry of Natural Resources and Environment was formed on 27 March 2004.

9 CLIMATE CHANGE CONSIDERATIONS

The National Hydraulic Research Institute of Malaysia (NAHRIM) together with California Hydrologic Research Laboratory (CHRL) has developed a dynamic down-scaled Regional Hydro-Climate Model for Peninsular Malaysia (RegHCM-PM) of 9km resolution in order to assess the impacts of climate change on local rainfall patterns. The model is capable of generating climate and hydrological projections up to 2050. Model assessments were made for Peninsular Malaysia in 2006 (NAHRIM, 2006). A similar model for Sabah and Sarawak has also been developed in 2010 (NAHRIM, 2010a). The impact of climate change on sea level was also assessed (NAHRIM, 2010b). The potential changes in atmospheric and hydrologic conditions were assessed with

rainfall changes of between +5% to +10% of cuurent values. Monthly river flow were forecasted to vary from +11% to +43% for flood flows and -31 to -93% for low flows (GWPSEA, 2010). The Malaysia Meteorological Department also modelled climate change impacts on Malaysian climate and forecasted changes of from -19% to +15% of 1990-1999 annual rainfall (GWPSEA, 2010).

The range of uncertainty in future rainfall and river flows are an indicator of the seriousness ofclimate change for Malaysia. Where droughts were previously infrequent, the models forecast the possibility of previously unrecorded periods of prolonged drought as well of greater intensity and duration of rainfall. The much greater flood flows are also expected to occur more frequently.

Although Malaysia frequently experiences flood, the occurrence of drought is less frequent but becoming an issue in the past two decades, as an issue of growing population and climate change. The growth in population and the extensive industrialization, together with intensification of agricultural activities in line with the country's policy to make agriculture the third engine of growth for the economy places a strain on public water supply as there is a continuously increasing water demand. Water stress occurs in certain regions of the country where the demand has exceeded the carrying capacity of the river basins. Another important factor is the decreasing quality of water available and used for public water supply.

Based on DID, almost all the water used in this country is extracted from surface water sources with ground water contributing only about 3 %. Although the annual rainfall is very high (3,000 mm average) there are large variations both in time and in space, and river flows are prone to large fluctuations as well. Hence prolonged dry periods can easily affect its freshwater supply. This has led to drought occurrences in the past, related to climate forcing factors. One example is that in 1997/98 which was an El Nino related drought. This caused extensive impact to the environment, economic and social activities of the whole nation. In some parts of the country such as Selangor, Sarawak and Sabah, the prolonged drought resulted in a lowering of the ground water table especially in peat areas, and consequently cases of extensive forest fires. From the DID hydrological data, Malaysia has a highr chance to experience drought between January until August. Thus, during this time, dams are carefully regulated so that the water will be made

available throughout the dry months. Unfortunately, drought forecasting technologies has not been well developed yet for Malaysia.

To assist in forecasting and assessment, NAHRIM has developed a data portal on hydroclimate, at (http://www.futurehydroclimate.nahrim.gov.my/), in order to provide timely information to the government, consultants and researchers for developing new projects on climate change scenarios.

In terms of Malaysia's Intended Nationally Determined Contribution (INDC), the focus is on GHG emission reduction, as Malaysia intends to reduce its greenhouse gas (GHG) emissions intensity of GDP by 45% by 2030 relative to the emissions intensity of GDP in 2005. The sectors most relevant for flood and drought is land use, land use change and forestry. However, the assumptions and methodological processes for this component (for non-forested land) has still to be determined. Nevertheless, since the Tenth Malaysia Plan (2011-2015), the government has focussed on sustainable growth and introducing mitigation strategies to reduce emissions of GHG. In the forestry sector, the two major initiatives launched to ensure sustainable forest management and use of natural resources, were the Central Forest Spine (CFS) and Heart of Borneo (HOB). The government continued in its focus in green growth in the Eleventh Malaysia Plan (2016-2020) for sustainability and resilience. The actions include strengthening enabling environment for green growth, adoption of sustainable consumption and production, conserving natural resources and strengthening resilience against climate change and natural disasters. However the government also identified some issues and barriers which have to be overcome:

Flood Risks have especially been mention in the INDC. It was recognised that seasonal monsoon floods have resulted in an average annual direct loss amounting to RM915 million. It noted that in the past decade, rainfall intensity had increased leading to more severe monsoonal floods. Urban areas were also becoming more prone to flash floods due to this increased intensity. In 2014, the extreme floods resulted in damage to public infrastructure amounting to RM2.9 billion. Adaptation resilience efforts needs to be increased through development Plans. From 2004 to 2014, Malaysia has invested over RM 9.3 billion on flood mitigation. Flood mitigation programmes and strengthening of disaster risk management and resilience of infrastructure are to be further enhanced in the Eleventh Malaysia Plan and beyond.

In terms of drought management, Water Security is another component addressed in the INDC. Since over 97% of the water supply is derived from surface water in rivers and reservoirs, thus management of these vital water catchment areas is crucial to ensure a reliable source of water supply. A Review of the National Water Resources Study (2000-2050) was completed in 2011, and a National Water Resources Policy was formulated in 2012. Inter-basin water transfer projects are considered as one option to supplement water traditional supply water to certain areas. These expensive infrastructure investments are necessary under a future climate regime. In the Eleventh Malaysia Plan, strengthening of the regulatory framework of the water services industry, expansion of the water supply network and treatment capacity infrastructure and increasing the efficiency of water supply services are also given attention.

The INDC statement recognised that climate-related disasters are already posing huge challenges to the public disaster management systems. Ensuring clean water supply and optimal sewerage services are particularly difficult during disasters such as flooding, as experienced during the extreme year-end floods that affect several states, which can give rise to food and water-borne diseases.

10 SWOT ANALYSIS RESULTS

A SWOT analysis of the water governance and management system in the country is given below. This analysis was carried 2016 by the Malaysia Country Water Pertnership and formed formed part of the GWP-SEA Rapid Country Level Analysis.

Based on the SWOT analysis, three main needs for support were idenified. These were:

i. Increased capacity and capability in developing a multi-stakeholder platform in order to bring the many different agencies together to identify common interests and objectives in holistic water resources management. This includes working on key projects in an integrated manner.

ii. Provide funding support and develop knowledge and capacity for engaging in community and public participation for water resources management. There needs to be a distributed leadership network of trainers and facilitators, including peer to peer training to engage the community. Currently the agencies responsible for water management are technical and engineering departments. Staff normally is skewed to the engineering profession with almost no staff with backgrounds in societal engagement.

iii. Human resource development in using and implementing latest technological systems for water resources monitoring, evaluation and reporting at a national scale, e.g., flood and drought modelling, warning systems, and water-related disaster management.

Strengths	**Weaknesses**
What kind of resources and capacities are available within the water governance and management system that can facilitate the achievement of the water connected development objectives at country level? 1. Existence of Government Federal and State level agencies specifically related for water and water utilities management - National Water Council, Department of Irrigation and Drainage; Public Water Supply Departments; Wastewater Department 2. Existence of Government Corporations (e.g. LUAS), Government-Linked Corporations and private water utility companies (eg. SYABAS) 3. Existence of National Water Resources Policy, Climate Change Policy, legal instrument on water utilities and	*What kind of resources and capacities are lacking within the water governance and management system, or which internal situations and developments negatively affect the country's water management performance, thereby hindering the achievement of the water connected development objectives?* 1. Too many different agencies and regulations managing water from different aspects with each agency having its own KPIs and objectives. In addition the differentiation between Federal and State government jurisdiction over land and natural resources complicates matters. 2. Public apathy towards participation, with the attitude that Government will provide everything. Only small number of experts

Commission on Water Supply Services (SPAN). There is a proposal for the establishment of a National Water Resources Act. 4. Existence of mandated Public Consultation platform - Forum Air Malaysia	working in community and public participation engagement. 3. Insufficient resources for public capacity building and engagement due to limited funding from internal resources 4. Insufficient funding for development of sophisticated technological systems for water resources monitoring, evaluation and reporting at a national scale.
Opportunities	**Threats**
Which facts and developments– such as sectoral policies, new sources of funding, level of community awareness, transboundary collaboration, partnerships, expert networks, resource centres, capacity-building institutions, technical innovations, innovative financing etc. – could help facilitate the achievement of the water connected development objectives? 1. NGOs able to participate in government-led public participation programmes 2. Government agency support for NGO capacity building activities in water management 3. Government funding on flood disaster management allocated after 2015 big flood on east coast of Peninsular Malaysia - this involved funding to NGOs and Academia. 4. Climate change and green funds present a potential source of funding for initiating projects on water and natural resources management for national climate change adaptation plans.	*Which facts and developments – such as general political and social developments, economic recession, climatic variance, urban migration, food insecurity, transboundary conflict, sectoral interests, etc. – could jeopardise the achievement of the water connected development objectives?* 1. Drop in global oil prices affected the economy and, in turn, social development projects. 2. Climate change uncertainties likely to resulted in economic losses in future due to extended droughts and extreme floods. 3. Water security issues due to climate change also affect food security especially of the staple food of rice. 4. Considered as a newly developed country, Malaysia loses out in international aid and support compared to lesser developed countries in the region. Thus, in some cases due to aid given to developing countries, they become more advanced in building capacity in certain water resource management areas due to international support and expertise given.

	For example capacity building and in development of catchment management plans, community participation enhancement, climate change adaptation planning and management, disaster management.

11 GAP ANALYSIS TABLE

Based on the GWP strategic goals and outcome challenges, and considering the regional goals in Southeat Asia, a gap analysis is carried out for the goals most relevant for flood and drought management in Malaysia. The results are presented in tables in Appendix 1 for the three Goals.

12 SUMMARY

Education and public awareness, coordination among governmental and non-governmental agencies, effective stakeholder participation, and early warning systems are key components of preparedness planning. Flood emergency response can be defined as the implementation of pre-planned activities during flooding to reduce the adverse impacts to the population and material values and infrastructure. It can be differentiated from post-flood recovery and rebuilding. During this stage, the effectiveness of the preparatory work is conducted during the pre-flood season which validated. The post-flood recovery and reconstruction phase creates opportunities as well as challenges for development projects in make sure that post-flood recovery and rebuilding can to eliminate the possibility of future flood. It also provides the opportunity to move vulnerable activities away from risk areas and introduce flood-proof infrastructures during rebuilding. Managing flood problems in Malaysia could result in other unintended results. Therefore due care needs to be taken into account when proposing solutions. There are several main causes of flooding in Malaysia which include loss of water storage, increased runoff due to urbanization, inadequate

drainage systemd, localized continuous heavy rainfall, tidal backwater and inadequate river capacity. Some are man-induced and some are natural conditions.

In respect of flooding, the government has taken positive steps by establishing NADMA, the Permanent Flood Control Commission, setting up of the flood forecasting and warning system, carrying out of river basin studies and preparation of drainage master plan for major towns, and implement of structural and non-structural measuremes such as through MSMA. The Department of Irrigation and Drainage Malaysia (DID) plays an important role as it is responsible for providing flood forecasting and warning services to the public. A pre-emptive approach to flood disaster response is still under development and needs to be given due attention. Similarly, although dry spells are still infrequent events, there is a need to develop forecasting for potential prolonged drought occurrences and educating the public on water demand management. A more concerted and extensive inclusion of communities in disaster preparedness management will be important is reducing the subsequent impacts on them in both flood and drought situations.

APPENDIX 1 – GAP ANALYSIS TABLES

STRATEGIC GOAL 1: Catalyse Change in Policies and Practices

Goal	Current Achievement	Gaps	Causes	Solutions
#OC1 Malaysia, incorporate water security in their IWRM and climate related policies and plans as well as in national development policies and plans	Malaysia has a National Water Resources Council. In 2012, Malaysia initiated a Malaysia Water Resources Management (MyWRM) Forum as a biennial program. The next MyWRM Forum will be held in 2018. Malaysia has a National Water Resources Policy (NWRP) in 2012. The action plans will take into consideration the National Policy on Climate Change of Malaysia. Academy of Sciences Malaysia (ASM) has instituted Stakeholder Forums on inter-sector water demand management. MyCWP has been collaborating in these forums.	Policy needs to be translated into Action Plans. Action plans are mostly focussed on structural measures which can be easily quatified in financial terms.	Societal changes are often difficult to measure and occurr over a longer period of time. Much of society perceive that government should take the action instead of themselves. There is no clear mechanism on how community can engage on disaster management issues.	Advocate that Action |Plans have a component related to society/community awareness and education, as well as community engagement and participation over a longer period of time, not only in the project phase but also in operational phase. Community flood/drought preparedness training can be one of the themes.
OC # 2 Malaysia develop "no regrets" financing strategies for water security, climate resilience	The National Water Services Commission shall be implementing a Non Revenue Water Action Plan to reduce	The actions to be taken are from the government side. Public financing of water	Public perception is that water is a right and should not have high charge rates. This	Education of the public on the real value of water, especially in times of abundant water is important to increase potential

Goal	Current Achievement	Gaps	Causes	Solutions
and development strategies in respective countries and presented for funding.	NRW from 38% to 25% by 2020.	services through water charges are difficult to do.	affects the political scenarion for financing strategies.	for being able to place a reasonable price for water supply.
OC # 3 Malaysia implement pilots and demonstration projects on integrated drought management and integrated flood management programmes	The Integrated Flood Management (IFM) programmes with community stakeholders on flood response management is being organised annually. There is a WACDEP project on community training for flood preparedness completed 2016. There is another small WACDEP demonstration project on community-level rainfall harvesting.	Training is only implemented ad hoc based on financing and sponsorship availability. At present the project proponents are discussing replication for another community.	Lack of financing for further expansion of the projects. Need to develop relationships with local authorities to generate greater interest	Work with the relevant agencies, such as DID and local authorities, to do a Training of Trainers course for community-level flood preparedness. In addition, MyCWP can offer training and capacity building for the region on IFM based on Malaysia's success on the existing programmes (e.g. SMART Tunnel) and demonstration projects.
OC # 7 Malaysia will facilitate agreement or commitment to enhance water security for transboundary basins (Golok basin with Thailand)	Malaysia and Thailand have formed Committees on bilateral cooperation for Golok River Basin focusing on water and ecosystem as well as basin management.	Communication is at the national level between the two countries is is dependent on financial resources by the agencies involved	Imbalance in the status of development in the two regions on either side of the river. Less motivation unless there are some specific issues to be tackled. Financial constraints.	This is dependent on the priority of the two countries and agencies. The issue of flood and drought risk, in the transboundary river basin, may increase the priority for further collaborative projects to be done.

STRATEGIC GOAL 2: Generate and Communicate Knowledge

Goal	Current Achievement	Gaps	Causes	Solutions
OC # 1 Malaysia has a system of monitoring and reporting for water resources and operational by 2016 (in collaboration with UN Water).	The National IWRM Information Repository System has been established and launched officially in 2012. In 2014 and subsequent years, the framework will be regularly strengthened.	Currently the National IWRM Information Repository System is not used widely by general public, mostly only by water engineers	Although the website is launched, the general public is still unaware if it.	Greater publicity and also training on application for flood and drought forecasting is important.
OC # 2 Stakeholders gain improved political awareness and commitment to deliver water security with demonstrable follow-up commitments and actions.	MyCWP participate in facilitating technical seminars and public awareness programmes which conducted together with stakeholders in different locations around the country in conjunction with the national level World Water Day and World Rivers Day. MyCWP partners have developed a youth and community-based river appreciation and monitoring programme called “River Rangers” which is being implemented at the state level.	Traing and projects are small scale and need to be implemented on a wider scale through out the country	Insufficient financial resources and limited human resources to conduct training on flood and drought management especially at community level .	Conduct training of trainers workshop in collaboration with local authoritiesand key government agencies to spread the practice. Gender perspectives and involvement of youth should also be included in these courses.

STRATEGIC GOAL 3: Strengthen Partnerships

Goal	Current Achievement	Gaps	Causes	Solutions
OC #1 RWP network establishes a robust monitoring framework and associated reporting mechanism with regular reporting on outcomes.	MyCWP uses the GWP framework. The numbers given are sometimes estimate and there may be misunderstanding of the indicators.	It is difficult to provide the numbers for indicators used in the framework and relate to project outcomes.	Lack of knowledge and understanding on how to measure the indicators.	Training on the definition and interpretation of indicators and measures in the implementation of the framework. Also on how to link the project outcomes to the indicators.
OC # 4 CWPs access new and diverse funding sources and increase overall funding to double that provided through GWPO.	MyCWP collaborates with partners in conducting activities where partners provide in-kind contribution and /or actual funding. Most are government agencies / higher education institutions	Only a few private companie are approached for funding/sponsorship of activities but in difficult economic times, the contibution is mostly in kind.	Lack of experience, time, understanding for sourcing, proposing to private and international funders. Lack of motivation, since normally easiest to obtain funding in kind from government agencies.	Need full-time personnel experienced in sourcing for such funding. Need training on writing proposalas and 'selling' the CWP benefits to sponsors. Survey on the types of topics/themes Sponsors/Partner representatives are interested to sponsor and attend.

References

Badri, S.A. A. Asgary, A.F. Eftekhari, and J. Levy (2006), Post-Disaster Resettlement, Development and Change: A Case Study of the 1990 Manjil Earthquake in Iran. Disasters 30 (4), 451-468. PubMed:17100753, DOI:10.1111/j.0361-3666.2006.00332.x

Balcik, B., Beamon, B., & Smilowitz, K. (2008). Last mile distribution in humanitarian relief. Journal of intelligent transportation systems, 12(2)., pp. 51-63. doi: 10.1080/15472450802023329.

Brookman, Ryan M. (2015). Effect of Community Involvement on Disaster Relief. Global Honors Theses. Paper 29. http://digitalcommons.tacoma.uw.edu/cgi/viewcontent.cgi?article=1028&context=gh_theses

Chan, N. W. (2012), Impacts of Disasters and Disasters Risk Management in Malaysia: The Case of Floods. In Sawada, Y. and S. Oum (eds.), *Economic and Welfare Impacts of Disasters in East Asia and Policy Responses*. ERIA Research Project Report 2011-8, Jakarta: ERIA. pp.503-551.

Diya, S.G., M.B. Gasim, M.E. Toriman, and M.G. Abdullahi (2014), Floods in Malaysia, Historical Reviews, Causes, Effects and Mitigations Approach. International Journal of Interdisciplinary Research and Innovations, 2 (4), 59-65.

Godschalk, David. R., Brody, S. and Burby, R. (2003). Public Participation in Natural Hazard Mitigation Policy Formation: Challenges for Comprehensive Planning. Journal of Environmental Planning and Management, 46(5), 733-754, September 20013.

GWPSEA (2010), Status of Climate Change Management in Southeast Asia, Interim Report. Country Water Partnership Reports. http://www.gwp.org/globalassets/global/gwp-sea_files/gwpsea_climate-change-report.pdf

Hussaini, H.A. (2007), Flood and Drought Management in Malaysia. Keynote Speech delivered on 21 June 2007. Kuala Lumpur: Ministry of Natural Resources and Environment. http://www.met.gov.my/web/metmalaysia/publications/reports/presentationpaper/2007/socioeconomicimpactsofextremeweatherandclimatechange/presentation/185155/Keynote%20Lecture%202.doc.

Khairilmizal, S; Hussin, M F; Hussain, A R; Jusoh, Mohamad Huzaimy Sulaiman, Ahmad Asari. 2016. Implementation of Disaster Management Policy in Malaysia and Its Compliance Towards International Disaster Management Framework. Information. Koganei 19.8A (Aug 2016): 3301-3306.

Kong Y.Y., N. A. B. Bahrun, and Ooi Y. K. (2010), A Study On The Urban Flooding. Universiti Malaysia Pahang. Unpublished report.
https://group8a03ykooi.wikispaces.com/file/view/FINAL%2BREPORT.docx

Lindell, Michael K, 2011, 'Disaster studies', *Sociopedia.isa*, DOI: 10.1177/205684601111
Suzanne Vallance (2011). Early Disaster Recovery: A Guide for Communities. Australasian Journal of Disaster and trauma Studies. Volume 2011-2. 19-25.

Mohd Zulhafiz, S., Salfarina, A.G., Mohd Nazri, S., Abd Malik, A.A. (2013), Konflik di Pusat Pemindahan Banjir: Kajian Kes di Daerah Padang Terap, Kedah. Malaysia Journal of Society and Space 9(1), 69-78.

Musa, S.M., Chan, N.W., Ku Mahamud, K.R., Karim, A., Zaini, M. (2013), Faktor Polisi dan Tindakan Pengurusan Banjir Dalam Mempengaruhi Keberkesanan Pelaksanaan Manual Saliran Mesra Alam (MSMA). In: Prosiding Seminar Serantau ke-2 Prosiding Seminar Serantau ke-2 Pengurusan Persekitaran di Alam Melayu, 6-7 Mei 2013, Provinsi Riau, Indonesia .

NAHRIM (2006), Study of the Impact of Climate Change on the Hydrologic Regime and Water Resources of Peninsular Malaysia. NAHRIM, Ministry of Natural Resources and Environment, Malaysia.

NAHRIM (2010a), Study of the Impact of Climate Change on the Hydrologic Regime and Water Resources of Sabah and Sarawak. NAHRIM, Ministry of Natural Resources and Environment, Malaysia.

NAHRIM (2010b),The Study of The Impact Of Climate Change on Sea Level Rise in Malaysia. NAHRIM, Ministry of Natural Resources and Environment, Malaysia.

Roosli, R., O'Brien, G. (2011), Social learning in managing disasters in Malaysia. Disaster Prevention and Management: An International Journal, 20(4), 386-397.

Robert Love, and Suzanne Vallance (2013). The role of communities in post-disaster recovery planning: A Diamond Harbour case study. Lincoln Planning Review, 5(1-2) (2013) 3-9.

Shakirah, A., J. L. Mm Sidek, B. Hidayah, Nazirul M.Z., M. Jajarmizadeh, F.C. Ros, and Z.A. Roseli, (2016). A Review on Flood Events for Kelantan River Watershed in Malaysia for Last Decade (2001-

2010). IOP Conf. Ser.: Earth Environ. Sci. 32, 012070. (http://iopscience.iop.org/1755-1315/32/1/012070)

Shazwani Shafiai and Mohamad Sukeri Khalid (2016). Examining of issues on flood disaster management in Malaysia. International review of Management and Marketing. 6(S7), 51-56.