STRENGTHENING MALAYSIA'S WATER RESOURCE MANAGEMENT

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Dato' Sri Ir. Hj. Zulkefli Hassan, the Director General of the Department of Irrigation & Drainage or Jabatan Pengairan dan Saliran (JPS), reveals some in-depth plans to better manage our water resources as well as to mitigate the occurrences of floods in the country as part of integrated efforts to achieve "Water Security Is National Security".

It is indeed ironical that while some parts of Malaysia experience flooding, other areas are hit, at the same time, by drought that forces the imposition of water rationing.

Addressing this issue has become a priority for the Department of Irrigation & Drainage or Jabatan Pengairan dan Saliran (JPS), the government department that manages and regulates the country's water resources. On a bigger scale, JPS is moving towards achieving water security and sustainability. According to its Director General, Dato' Sri Ir. Hj. Zulkefli Hassan, ensuring water security will contribute towards national security.

In this exclusive interview, he shares with *JURUTERA* the means to achieve water security and sustainability, as well as the importance of having the various states adopt the new Water Resources Act proposed by JPS and the establishment of a new national entity in a bold move to integrate and fortify the management of the country's water resources.

This move is guided by the Government's 2050 National Transformation (TN50) roadmap for Malaysia to become "a top 20 country in the world by 2050", with clear-cut economic, social, cultural and environmental targets which it aims to achieve by 2050.

Q. In December 2014, the east coast states of Kelantan, Terengganu and Pahang were hit by extraordinary floods, resulting in the evacuation of some 400,000 people. What were the main causes of the flood?

Dato' Sri Ir. Hj. Zulkefli: The floods in 2014 have been recorded as the worst flood disaster in the country. Several states, especially Kelantan, Pahang and Terengganu, were seriously affected. This was caused mainly by the north-east monsoon which brought big amounts of rain for days. The water saturated the ground and took time to recede. The rain fell for more than 10 days over wide areas of Kelantan, Terengganu and Pahang, especially at the cornerstone of the three states above Gunung Gagau, which recorded over 1,000mm of rain during this period.

More than 400,000 victims were displaced. The floods cost the nation over RM2 billion in infrastructure damages and billions more in property damages, compensation and productivity losses.

Another reason was the effect of tidal seawater. Flooding occurred when high tide and heavy rainfall happened at the same time. As a result, it took the drainage systems, whether natural rivers or drainage trenches, a long time to drain the water into the sea.

There were also several other factors which contributed to the floods. Debris and rubbish in the drainage systems blocked the runoff flow and, as a result, the level of water in the drainage systems rose and flooded the surrounding areas. The existing drainage system was also unable to accommodate the increase in runoff due to heavy rainfall as water poured down in high intensity within a short time.

Q. Does JPS have an overall master plan to mitigate flood in the affected states? What are the main projects to be implemented to address this issue in Kelantan, Terengganu and Pahang and what is the cost involved?

Dato' Sri Ir. Hj. Zulkefli: One of the efforts taken by JPS is through the implementation of development projects in which 70% of the total allocation approved under the 11th Malaysia Plan for JPS will focus on the preparation and implementation of flood mitigation plans.

Through the Ministry of Natural Resources and Environment, JPS has also applied for a development expenditure budget of RM36 billion to develop a total solution and a long-term flood mitigation plan, including the construction of flood gates and walls. These are expected to reduce the risks of flooding over the next 20 years and the cost will be justified by having fewer flood risks across the country.

Several flood mitigation projects have been done and more will be implemented. About 50,236 residents within an area of 28.5 sq. km. in the city of Kota Bharu, are protected from flood through the implementation of the Sungai Kelantan Flood Mitigation Plan (Phase 1).

Part of Kampung Laut jetty in Kelantan collapsed when flood hit the state in 2014

JPS uses Selehong Watergate to control water flow during floods in Tumpat, Kelantan.

Under the 11th Malaysia Plan, RM572 million was approved for projects under the Integrated River Basin Development Project (IRBDP) for Sungai Kelantan, which began in 2016. It is expected to be completed in 2020. This programme has three main objectives: Flood Mitigation Plan for Kelantan, Living River and Stormwater Management.

RM300 million has also been allocated for IRBDP for Sungai Golok to cover the flood mitigation works through bund construction as well as the upgrading of the drainage system and construction of the control gate structure.

In Terengganu, a total of RM15 million was allocated for the upgrading of the existing flood drainage system, the construction of log boom/trap and bunds as well as beautification of the river corridor, which were completed in September 2016. RM300 million also has been approved for IRBDP for Sungai Kemaman to construct the proposed floodway, river bund, river improvement works and stormwater management. Four new projects have also been approved under the 2nd Rolling Plan, which includes three proposals under the Flood Mitigation Project in various areas: Gong Kiat Flood Mitigation Project, Guntung Luar Flood Mitigation Project and Kuala Terengganu (UMT) Flood Mitigation Project.

The Federal Government also allocated RM527 million for the flood mitigation programme in Pahang under the

IRBDP for Sg. Kuantan. This will overcome the frequency of flooding and improve the water quality in Kuantan and the surrounding areas. The approval of that provision includes RM445 million for the Kuantan City Flood Mitigation Plan. Also allocated are RM32 million for Living River and RM50 million for Stormwater purposes.

Q. What are the obstacles that JPS faces in its efforts to resolve flooding issues in the country?

Dato' Sri Ir. Hj. Zulkefli: There is growing recognition that flood disasters have been adversely affecting the sustainability of development and that flood issues need to be addressed in the context of Integrated Water Resources Management (IWRM) concept by an Integrated River Basin Management (IRBM) approach especially in flood management.

IWRM is a process that promotes the co-ordinated development and management of water, land and related resources in order to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

IRBM is the process of co-ordinating conservation, management and development of water, land and related resources across sectors within a given river basin, in order to maximise the economic and social benefits derived from water resources in an equitable manner while preserving and, where necessary, restoring freshwater ecosystems.

As to why we have yet to solve the flooding issues, we must first determine the types of flooding. Our obligation is to mitigate monsoonal river floods (excess flood flow overtopping river banks). Providing structural measures is expensive and has certain protection limits (known as Average Recurrence Interval or ARI). Besides, regular and proper inspection and maintenance of surface and sub-surface drainage seem to be a significant long-term financial investment to prevent the occurrence of flash floods. The yearly budget for inspection and maintenance will not be compromised so as to sustain the proper function of the drainage system and the river.

Furthermore, the human factor also plays an important part when we talk about the causes of flooding. Bad habits such as the indiscriminate dumping of rubbish and other solid wastes or the conversion of crucial flood plains and swamps into housing and other types of developments as well as the uncontrolled development of water catchment areas, will inevitably result in floods, sooner or later.

Q. Apart from physical projects, does JPS plan to develop comprehensive early warning and flood forecasting systems so that people can be better prepared?

Dato' Sri Ir. Hj. Zulkefli: We cannot avoid floods totally but we can minimise its impact. The public must understand that man can only do so much to provide protection from floods. If a storm of an unusually huge intensity is expected, one that is beyond the protection level that a flood mitigation project can offer, the only solution is evacuation if we are to minimise losses and damage to property.

As a way forward, JPS has taken the initiative for a better system to give an earlier warning to the public and related agencies. Currently in the development stage, the system is expected to be fully operational in Kelantan, Pahang and Terengganu next year (2018). The Flood Warning Forecasting Project or Projek Ramalan dan Amaran Banjir Negara (PRAB) was approved by the Government in the 11th Malaysia Plan.

The projects will improve the lead time of warning from the current six hours to two days before flooding occurs. The forecast will show catastrophic flooding characteristics which are beyond the current river capacity. This flood forecasting and warning programme complements structural measures in case of an upcoming massive storm that the structures cannot cope with.

Q. Has global climate change influenced flooding trends in Malaysia?

Dato' Sri Ir. Hj. Zulkefli: Floods can be categorised into flash floods and monsoon floods. Climate change has also contributed to the uncertainty of flood intensities and extreme circumstances of a weather phenomenon. Flooding can occur due to various factors such as heavy rainfall, high tide, obstruction in drainage systems, shallow river problems and unusual water flow due to heavy rain as well as mudslides that may occur as a result of the change in land use. The duration of a flood and the time needed for the flood waters to recede, depend on the condition of the river or the surrounding topography. This may take several hours or days.

Q. There were incidences when certain parts of the country were hit by floods while simultaneously, other areas experienced water shortage and water rationing. Why does this happen and how can we address the issue?

Dato' Sri Ir. Hj. Zulkefli: We have seen changes in rainfall pattern and trends particularly in cities, perhaps due to the "urban heat island" effect. These can also be seen in rural areas where changes in land use may affect the hydrological cycle dynamics which translate to frequency and intensity of rains possibly moving away from water catchment areas. If this is true, it will affect the availability of water and other aspects of water security as a result of low rainfall in some catchment areas affecting water storage.

In the National Water Resources Council (NWRC), we are proposed to apply non-structural measures as an alternative to structural measures. Mitigation and non-structural measures tend to be potentially more efficient as these offer more sustainable and long-term solutions to water-related problems. These measures should be enhanced, particularly to ensure future sustainability.

Non-structural measures involve the use of knowledge, and the practice or agreement to reduce risks and impacts, in particular through policies and laws as well as raising public awareness through training and education. As far as water sustainability is concerned, non-structural measures in water management deal with the compliance and enforcement of the relevant Acts and guidelines such as the Urban Stormwater Management Manual (MSMA).

Groundwater can also be one of our water resources but it shall remain an alternative resource as the country has abundant surface water all year round. In order to sustain the quantity of groundwater, the hydrological groundwater recharge process must be done. This recharge is the primary mechanism for aquifer replenishment which ensures future sources of groundwater for commercial and residential use as well as to maintain future water resources sustainability.

The NWRC has agreed to the following measures concerning water resources issues:

- Groundwater exploration as a source of raw water for treatment plants during period of drought.
- Inter Basin Water Transfer to assist states facing water stress.
- Implementation of National Water Balance Study (NAWABS) as a management tool for water resource assessment.

Q. In the 11th Malaysia Plan, JPS was given an allocation to develop NAWABS. Can you explain how this system will help the country manage its water resources?

Dato' Sri Ir. Hj. Zulkefli: In order to strengthen our water resources security, a holistic approach has been taken through the development of NAWABS, which will serve as a Decision Management Support System in water resources management. NAWABS will be used as the management tool for earlier forecasts and warnings anticipated during the water crisis/dry period. It will be the centre for decision-making for flood and drought management in the country.

The water balance model and Decision Management Support System (DMSS) cover seven major river basins: Kedah, Muda, Bernam, Melaka, Klang, Kelantan and Batang Saribas (Sarawak). The model will provide Water Resource Forecast two months in advance and issue warnings two weeks in advance to water managers in each basin.

The model outputs are Water Accounting, Water Alternative, Water Availability, Water Prioritisation and Demand Management Options, Water Allocation, Water Storing and Releasing during High and Low Flows, Water Quality (salinity, sediment transport and turbidity), Water Resources Index (WRI), Drought Index (DI) and Water Auditing.

Q. What are the challenges we face in ensuring water security for consumers?

Dato' Sri Ir. Hj. Zulkefli: Malaysia has to face the consequences of heavy rainfalls that often result in floods. It is not surprising that, on average, there are some 150 flood events of various severities every year. There were some big ones but most were local flash floods that lasted less than a day.

On the other hand, different parts of the country may also experience drought every year. These dry episodes are also part of the natural weather cycle and are prevalent in some parts of the country such as Perlis and the northern part of Kedah. These areas exhibit climatic characteristics similar to that of southern Thailand which has a distinct dry spell. Drought has a longer onset period but its effects are longer and can be devastating. Many developed countries in the temperate zone are more concerned over the impact of drought rather than flood.

Three other main aspects that influence the sustainability of water resources management are water quality, pollution and the characteristics of usage. In 2015, the Department of Environment monitored 477 rivers. Of these, 276 rivers (58%) were found clean, 168 rivers (35%) slightly polluted and 33 rivers (7%), polluted. Most of the polluted rivers are in urban areas with a high pollution load originating from multiple sources such as wastewater plants, industries and commercial premises, as well as a small base flow volume due to the large percentage of paved areas.

Excessive use of water for paddy irrigation is another cause for concern. Farmers lack awareness of water conservation and major paddy schemes show an irrigation efficiency of less than 50%. This issue needs to be addressed as irrigation is the biggest user of water resources in the country. Even a small saving from this section will translate into a big saving of water resources for other uses.

Q. The responsibility of managing the country's water resources rests with JPS. What is its vision to effectively regulate and manage water resources to achieve a more sustainable development with minimum impact to the environment?

Dato' Sri Ir. Hj. Zulkefli: As mentioned earlier, we have proposed, in the NWRC, to apply non-structural measures as an alternative to structural measures. I have also touched on the Urban Stormwater Management Manual (MSMA), which is actually about controlling the runoff from development through a control-at-source approach as opposed to the rapid-disposal approach. Land use changes from rural to urban industrial areas cause local runoff impacts on receiving water flow, quality and ecology.

A potential and preferred approach to stormwater management is the storage-oriented approach. This

One for the album after the interview with JURUTERA. (From left) Captain (R) Ir. Haji Anuar bin Haji Yahya, JPS Director of Coastal Zone Management Division, IEM Council Member and Co-opted Committee Member of Water Resources Technical Division (WRTD) of IEM, Ir. Dr Wong Wai Sam, Chairman of WRTD, IEM, Dato' Sri Ir. Hj. Zulkefli bin Hassan, JPS Director General, Ir. Elias Saidin, IEM Vice President (2016/2018), IEM Council Member and Committee Member of WRTD and Dato' Ir. Hj. Azmi bin Hj. Ismail, JPS Director of Corporate Division.

provides for the temporary storage of stormwater runoff at or near its point of origin, with subsequent slow release to the downstream stormwater system or receiving water (detention) or infiltration into the surrounding soil (retention). Detention and retention facilities can reduce the frequency and extent of downstream flooding.

As far as water resources are concerned, only 15% of our surface runoff is stored while 85% flows unregulated into the sea. What we must do is to increase the storage from 15% to 50%. This will reduce surface runoff and peak discharge into the rivers, hence reducing the risks of flood. Storing water also can be an alternative solution to water scarcity during the drought.

This is one of the solutions to vary our water sources. Others include inter/intra basin water transfer, groundwater exploration, increased water storage capacity, underground storage of water, tapping rainwater and constructing low head barrage.

More importantly, we need a legal enforcement "vehicle" to cover all aspects of managing our water resources. In this regard, we have proposed a new Water Resources Act, which will be tabled in Parliament in November, 2017. It will cover all water-related laws and will serve as the road map to strengthen water resource management in the country. It is a comprehensive Act which, once implemented with the support and commitment of the state governments, will ensure several crucial key steps to create uniformity in our approach in managing water resources. This will also make us more focused on the main job of managing national water resources.

We need a strong commitment from all stakeholders, especially state governments and their co-operation. For this, we have gone round to all the various states to explain the importance of working together and accepting the proposed Act. In this case, I will ensure that all JPS State Directors will persuade and give some advice particularly to state governments to accept the new Act.

JPS has also proposed to the Government the establishment of a new identity to integrate and fortify the management of the country's water resources and to move the agenda of achieving water security. This encompasses human safety, economic security, food security, hydro-power security and the resilience to deal with the impact of climate change. The name and other details for this new identity are still being finalised.

Its formation is a bold move under the Malaysian Government's 2050 National Transformation (TN50) roadmap to become "a top 20 country in the world by 2050", with clear-cut economic, social, cultural and environmental targets.

Q. In the global context, flood defence has dominated flood management in the past decades and recently, scientists are promoting "Flood Resilience" and "Flood Adaptation" as the preferred concepts in managing flood. Where does Malaysia stand currently and do you think we are ready for it?

Dato' Sri Ir. Hj. Zulkefli: Malaysia has been applying the concept of Living With Flood in terms of agreeing with the promoted approach of Flood Resilience and Flood Adaptation. Living With Flood is one of the Integrated Flood Management approaches for effective and efficient flood mitigation management. It uses flood plains efficiently as well as minimises damage to property and the loss of life through the following principles:

- Employ a basin approach.
- Treat floods as part of the water cycle.
- Integrate land and water management.
- Adopt a mix of strategies based on risk management approaches.
- Enable co-operation between different agencies.
- Ensure a participatory approach.

Q. Flood Management Budget Appraisal is a systematic process adopted by most developed countries. For instance, the United Kingdom has applied Flood and Coastal Defence Appraisal Guidance FCDPG3. This is a transparent system that justifies the worthiness of the flood budget spending in accordance with the cost-benefit scores based on the merits of economic, social and environmental factors. What appraisal system has JPS adopted? Will it be an efficient method to help us achieve developed nation status?

Dato' Sri Ir. Hj. Zulkefli: On 24 November, 2009, the National Development Planning Committee (NDPC) decided that Value Management must be implemented in Federal Government Projects that are worth RM50 million and above.

The Value Management process includes the process of Value Assessment on the concept design of the project, which will be led by the Economic Planning Unit. It is then followed by Value Engineering laboratory in order to optimise costs, alternatives and to determine the best method of implementation. This is to maximise value for money, improve the effectiveness of the project and finalise the design based on the scope of the project. ■