# CHAPTER 10

# STUDY FINDINGS

The Department of Drainage and Irrigation (DID) has planned to implement “Projek Pembangunan Lembangan Sungai Bersepadu Sungai Kemaman, Kemaman, Terengganu” to prevent devastating flood affecting the town of Chukai in the district of Kemaman. The Chukai is the second largest town in the State of Terengganu; an administrative and commercial town and also petroleum gas-based centre in the District of Kemaman. The inhabitants of the Chukai town suffered frequent flooding due to lack of comprehensive flood mitigations and drainage infrastructures. This resulted in a lot of hardship and economic losses to the inhabitants, commercial and industrial premises including loss of property values. The recurring flood is an obstacle to develop the Chukai town further though it has potential to develop as one of the major industrial hubs in the region due to presence of gas and oil field facilities.

The flood problem existed since very long time and this was mainly due to housing and industrial development in the Sg Kemaman flood plain consisting mainly of peat and mangrove swamp forests. The seasonal flood was naturally mitigated to some extent by peat and mangrove swamps. The flood water retained by peat swamps and released to the surface and underground hydrological system slowly.

The extend, intensity and duration of flood increased year by year due to land uses changes in the watershed which included logging, clearing and fragmentation of forests in the upstream catchment area for large scale plantations. Meanwhile in the lowland flood plain consisting of extensive peat and mangrove swamp forests which used to retain excessive water during the monsoon periods were drained,

cleared, degraded and fragmented affecting their natural flood mitigation potential and capacity. In addition, increased urban and industrial development at the flood plain had decreased infiltration efficienty, increased surface runoff, erosion and sedimentation coupled with increased solid wastes which affected drainage flow, and also river carrying capacity to the downstream. This is further exacerbated due to climatic changes which altered rain fall pattern and other calamities which increased the flood problems during the monsoon periods.

For many years, Government had tried to address the persistent and damaging flood woes by constructing several new drains, straightening rivers and implementing other infrastructure to solve or rather mitigate flood problems particularly at the Chukai town but such efforts did not solve the flood problem due to inadequate capacity of the infrastructures to keep up with the pace of rapid development within the basin.

Therefore, a comprehensive flood mitigation infrastructure is mandatory for the Chukai town. Consequently, several options and alternatives were considered before deciding on the current project scope including its components and design criteria. All those criteria are considered over several years of studies, however the implementation were made sectoral or piecemeal basis due to lack of sufficient budget. However, as the problems are persisting and recurring with more severe flood costing both material and financial losses to private and public sectors year after year, the Government of Malaysia has decided to implement comprehensive flood mitigations at least to protect the Chukai town first before resolving entire flood woes in the Sg Kemaman basin.

In conjunction with this, in the RMK 11 an allocation of RM 300.00 million has been approved for implementation of the Pembangunan Lembangan Sungai Bersepadu (PLSB) of Sg. Kemaman. The amount allocated will be used to implement major components of the various flood mitigation options proposed in the detailed engineering designs carried out in the year 2003 (JPS, 2003). Nevertheless, JPS has selected some key components from the proposals, and improved further to the current situation upon taking into consideration of issues related to conservation of peat swamp forest and other socio-economic issues including fireflies colonies, for implementation as first comprehensive step to prevent flood at the Chukai town.

The objective of the proposed project is to protect the Chukai town from recurring and devastating flood by constructing floodway to divert peak flow from Sg Kemaman to Binjai swamp and Tasik Bungkus. The excessive water from Tasik Bungkus will be released into Sg. Bungkus/Sg. Chukai in a regulated manner. In addition, three long bunds will be constructed almost protecting entire Chukai town on its northern and southern boundaries. The northern bund is known as Binjai Bund and the southern bunds known as Sg Kemaman bunds which will be built on both banks of Sg. Kemaman. In addition, two flood retention ponds will be constructed closer to Sg Kemaman flood prone areas to further mitigate the flood at Chukai town. A “U” shaped perimeter bunds will be built around Tasik Bungkus to protect nearby human settlement and also Jalan Ibok close to Tasik Bungkus and also about 500 m Guild Bund will be constructed inside the Tasik Bungkus to control sediment input to Sg Bungkus and Sg Chukai.

The proposed project is classified as a Prescribed Activity of Section 34A of the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 under sub-categories defined in terms of project size (as area) and capacity (quantum) while others are not defined by any unit of measures. The proposed project falls under prescribed activity 3(b) of the Second Schedule and activity 15(b) of the First Schedule of the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015.

Meanwhile, the proposed project area covers wider and multiple land uses. Though the project in terms of scale of construction may not be large but the project cover larger area involving massive land clearing and earthwork activities particularly in the existing forest reserves, wetlands and densely populated urban area affecting physical, biological and human environment significantly. There are many environmentally sensitive receptors are located within and vicinity of the project boundary.

The implementation of the project would involve a number of development activities and these activities would spread over the pre-construction, construction and operation phases of the project which would induce both positive and negative impacts on the environment. As a precursor to the impact assessment exercise, the **Chapter 5** covers detail description of the project and various principal project activities identified to ascertain extent the development process will interact with

environmental resources, as well as with general state of the environment in the vicinity of the project site. The aim is to highlight specific activities that may have an impact on the existing environment so that appropriate mitigation and abatement measures can be instituted. The most significant activities during construction phase of the project are vegetation clearance, excavation for floodway, transportation of large amount of biomass and unsuitable materials to disposal sites and transportation of large amount of earth materials to build the bunds

Prior to assessment of impacts of project implementation on environment, the EIA study has attempted to assess existing environment, both primary and secondary sources in the project area on wide spectrum of environmental components relevant to the project and project boundary. Though all the physical, biological and human environmental sectors are covered in detail but the most important among them are geology, geo-hydrology, surface hydrology, water quality, forestry, ecology, biodiversity and socio-economic components. In addition, baseline data was also collected on air quality, noise and vibration within the project boundary.

Though the project implementation would cause environmental impacts on wide spectrum of environmental components. The extent and degree of the impacts are the only things that vary from project to project. Several factors determine the extent of the impacts, such as land use sensitivity, sensitive receivers (physical, biological, and human environment), scale and size of the development area, regional impacts, long term environmental impacts and socio-economic implications. Any potential significant impact on the aforesaid sites as a result of the construction and operation of the project will be evaluated. The environmental impacts which are considered to be ‘most significant’ have been discussed in detail in the **Chapter 7: Evaluation of Impacts**.

The vegetation clearing at the initiate stage of the project development would generate large quantity of biomass which has to be disposed in the approved dump sites without burying or burning within the project site. The contractor need to dispose at the approved dump site far from the project site for disposal of the biomass. This would also cause land traffic, noise, vibration and air quality impacts. Another most significant impact will be the forest fragmentation due to construction of floodway until Tasik Bungkus which cause permanent loss of forest and flora

along floodway corridor. The excavation and earthwork activities would cause soil erosion and sedimentation to water ways, increase traffic, affect public and workers' health and safety, and deteriorate air quality and noise in the region. Some of the major impacts are assessed quantitatively wherever possible and others qualitatively.

During the operation phase of the project, large amount of floodwater will be diverted from one hydrological system to another system including Binjai swamp, Tasik Bungkus, Sg. Bungkus and finally to Sg. Chukai, though such flood dispersion is already occurring without floodway but in different scale. Flood diversion would significantly affect hydrology, water quality and aquatic ecology of receiving system though it designed 50 ARI. During the operation phase of the project, the "most significant impacts" would be issues related to surface hydrology due to sudden surge of additional water to the system which would in turn affect water quality in terms of suspended solids, sediments and nutrients. Some of these most significant impacts are also assessed quantitatively including river hydrology, water quality particularly salinity, and also issues related to fireflies.

Though potential environmental impacts are predicted, there exist effective measures both technological and administrative, which can adequately address the issues posed by the development and implementation of the project. These concerns will be given due consideration with the recommendation of appropriate mitigation measures that satisfy all the relevant government authorities and public concern. As pointed out in **Chapters 8**, most potential significant impacts can be mitigated using the appropriate methods, management strategies and construction practices. However, there are certain impacts are permanent and cannot be mitigated. Some of them are permanent loss of forest reserve including its flora and to some extend fauna along the floodway corridor; and also functional values of wetlands for long term survival of the existing forest reserves. The most significant impact which cannot be mitigated required serious consideration and monitoring mechanism which related to sudden surge of flood water to Binjai swamp, Tasik Bungkus, Sg. Bungkus and finally to Sg. Chukai. Though the system is already facing floodwater in large quantity seasonally but the proposed floodway and Binjai Bund would redirect the excessive flood water north of Chukai town. There is a

possibility of more intensive and extensive flood than now outside the bunds which require serious consideration from the authorities.

Such sudden surge of large quantity of floodwater would bring along significant amount of suspended solids, sediments and nutrients to the receiving system, which in turn would affect ecology and biodiversity of the receiving system. There is a possibility that due to slow sedimentation, the Tasik Bungkus wetland could turn into dry land, which in turn alter ecological balance and species composition. More importantly it may lose flood mitigation function due to sedimentation and changes in water quality and ecology. Similar situation would possibly occur at Binjai swamp as well. Though additional water from Tasik Bungkus would reduce the increased salinity as result Sg. Chukai bypasses and channelization project that presumably affected fishery and fireflies, the problem would possibly remain same due to increase in suspended solids, silt and sediment in different form.

Meanwhile comprehensive Environmental Management Plan (EMP) has been prepared and provided in **Chapter 9** which include LDP2M2 for mitigation of significant impact both during construction and operation phases of the project. The contractor of the project would have to prepare site specific EMP during construction phase of the project which include detailed Erosion and Sediment Plan (ESCP), LDP2M2, Traffic Management Plan (TMP), and Best Management Practices (BMP) approved by the relevant authorities before implementation of the project. The contractor would have to implement various environmental monitoring programmes to determine the effectiveness of the mitigating measures adopted, and to monitor the changes (adverse or otherwise) to the surrounding physical, chemical, biological and human environments. The monitoring programmes outlined in the EMP should cover all stages of the project; from site investigation, site clearing and earthworks, construction and operation phases of the project. Even though the mitigation measures suggested in the EIA are expected to reduce the impacts but monitoring of the impacts has to be carried out at certain critical areas and times in order to ensure that these measures are working effectively. The project management should utilise the monitoring data to check for compliance and also as an indicator of the effectiveness of pollution control measures. Remedial measures should be taken in the event of non-compliance.