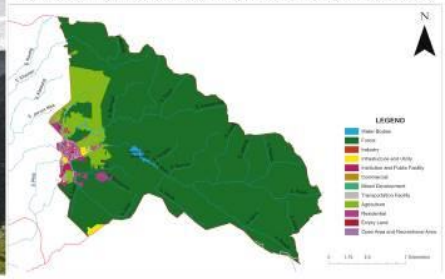
PERAK

UPPER KINTA BASIN MANAGEMENT STRATEGY

DECEMBER 2020

LANDUSE OF UPSTREAM OF UPPER KINTA BASIN



Jabatan Pengairan dan Saliran Perak

Global Environment Centre

YAYASAN HASANAH
A foundation of Khazanah Nasional

UNDP

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UPPER KINTA BASIN MANAGEMENT STRATEGY

DECEMBER 2020

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EXECUTIVE SUMMARY

The Upper Kinta Basin (UKB) in Perak covers about 31,470 ha above Ipoh city in Perak. The Kinta River which flows from Gunung Korbu in Ulu Kinta at an altitude of around 2000 m above the sea level is 110 km long with the catchment area of 2,540 km². The Kinta River is an important water supply source to Ipoh inhabitants and its surrounding areas. In managing water catchment and riverine biodiversity, there is always negative impact from slope erosion and sedimentation. The Upper Kinta Basin (UKB) in Perak State are no exception to this problem. Meanwhile, managing riverine biodiversity and safeguarding water resources requires partnerships with multiple stakeholders ranging from government agencies, private sector, landowners, beneficiaries, local communities, civil society, and the general public.

Integrated Management of Kinta River Basin for community and ecosystem services through active community and stakeholder participation is a project initiated in 2018 by Global Environment Centre (GEC) and Yayasan Hasanah with key support from Department of Irrigation and Drainage, Perak, Ipoh City Council, Department of Environment, Perak, Perak Forestry Department and Orang Asli Welfare Department (JAKOA). The project aspires to bring together the governing agencies, local communities, and private sectors in a bottom-up integrated approach to managing and conserving the forest and rivers in the Mukim Hulu Kinta (MHK) which UKB is part of this. This project through its first objective to develop the Upper Kinta Basin Management Strategy (UKBMaS). The project brought together government agencies, local communities, and private sector in a bottom-up integrated approach to managing and conserving the forests and rivers in the Upper Kinta Basin and to streamline the forest and riverine habitat conservation into development planning and policies. The development of the UKBMaS has also been supported by the UNDP-GEF Supported ptoject on mainstreaming Biodiversity into river management. This project financed a biodiversity assessment of the Upper Kinta Basin as well as supported the development of a specific Strategy on Mainstreaming Biodiversity into River Management in UKB which is summarized in the main strategy and included as a separate Annex (Annex 2).

UKBMaS was developed with key agencies of UKB through series of workshops and post workshop follow up. UKBMaS mainly developed as key reference to conserve UKB that offers key ecosystem services to all. Although there were various plans, there has never been a strategy to tie all of the key stakeholders to protect UKB on a holistic and integrated manner especially involving the communities including Orang Asli communities.

So the project is highlighting and closing the gaps that identified within existing plans which means UKBMaS can be used as sub-set of existing plans to conserve UKB. Besides this, the strategy also highlights local issues with related action plans especially on UKB which agencies and other immediately can infuse these elements into their job scope.The UKBMaS is made up of four main goals, 23 strategies and 45 KPIs. The finalized strategy serves as living document with expectation action plans implemented by agencies and subject to revision as well as enhancement in future if needed.

CHAPTER 1: INTRODUCTION

1.1 Background

Integrated Management of Kinta River Basin for community and ecosystem services through active community and stakeholder participation is a project initiated by Global Environment Centre (GEC) and Yayasan Hasanah with key support from Department of Irrigation and Drainage, Perak, Ipoh City Council, Department of Environment, Perak, Perak Forestry Department and Orang Asli Welfare Department (JAKOA). The project aspires to bring together the governing agencies, local communities, and private sectors in a bottom-up integrated approach to managing and conserving the forest and rivers in the Mukim Hulu Kinta (MHK) and to streamline the forest and riverine habitat conservation into development planning and policies. In this project, the local community is seen as a critical component of managing water resources as a soft-path management instrument.

The prime interest of the project is the Upper Kinta Basin (UKB) in Perak. The Kinta River, which forms the Kinta Valley, is bounded by the Main Range to the east and the Keledang Range to the west. The Kinta river which flows from Gunung Korbu in Ulu Kinta at an altitude of around 2000 m above the sea level is 110 km long with the catchment area of 2,540 km2. The Kinta River is an important water supply source to Ipoh inhabitants and its surrounding areas. The river basin has high biodiversity and is rapidly urbanizing. The state capital visions itself as a sustainable, dynamic, and excellent city by 2020. However, just as other fast-paced developing cities in Malaysia, it is a constant battle balancing urban growth, economic development, and protecting environmentally sensitive areas. A basin-wide approach is an appropriate unit for integrated management. A basin-level perspective allows addressing the linkages between water resources management and the management of land and other related resources effectively. The importance of water resource conservation should be recognized at the highest level of decision-making as well as at the grassroots level through top-down and bottom-up approaches.

This project through its first objective to develop the Upper Kinta Basin Management Strategy (UKBMaS). The strategy will support the Perak State Structural Plan 2040 (Rancangan Struktur Negeri Perak 2040, RSN) under the Planning Policy item 23: Strengthening/empowering the role of community in caring for the environment. The strategy developed will also be linked to the Central Forest Spine

(CFS) initiative as well. Moreover, the project also supports Malaysia's efforts in achieving the 2030 sustainable development goals (SDGs) which six out of the 17 SDGs goals are partially linked within the framework of the UKBMaS, which are:

- SDG 6 - Ensure availability and sustainable management of water and sanitation for all

- SDG 8 - Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

- SDG 11- Make cities and human settlements inclusive, safe, resilient and sustainable

- SDG 12 - Ensure sustainable consumption and production patterns

- SDG 13 - Take urgent action to combat climate change and its impacts

- SDG 15 - Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Under the project objective 2, a number of activities are being implemented to encourage responsible river basin usage, water consumption and waste management through community engagement inline with Integrated River Basin Management (IRBM) concept. This supports the SDG 6 targets to improve water quality by reducing pollution, increase water-use efficiency, implement Integrated Water Resources Management (IWRM), and to protect and restore water-related ecosystems by 2030. The proposed activities will be focusing on supporting and strengthening the participation of local communities in improving water and sanitation management. Similarly, under SDG 11 and 12, the target for education environmental impacts will be focusing on efficient use of natural resources and waste management including chemicals and food.

The public awareness programmes have been designed to incorporate the SDG 12 and 13 by aiming to ensure that all stakeholders especially community have the relevant information and awareness on the sustainable development and lifestyles in harmony with nature. It also works to improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and

early warning too. This project also intends to encourage entrepreneurship and job creation as well alternative livelihood through supporting the Orang Asli community to establish small-scale nursery as part of tree planting initiative, providing small-scale skill training and supporting the community-based initiatives such as hiking tour guiding and nature-based tourism. This is inline with SDG 8 goal, where one of the key implementations is to devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products by 2030. Finally, the UKBMaS initiatives at the state-level, supports the SDG 15 targets which includes to promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally, and secondly to integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts by 2020.

1.2 Project area

The overall project focuses on the upstream portion of the Kinta River (hereafter referred to as Mukim Hulu Kinta, MHK). The Mukim Hulu Kinta covers an approximate area of 69,736 hectares (PLAN Perak, 2017) , encompasses Chemor to the north, Lahat to the south, and other major towns such as Ipoh, Tanjung Rambutan, Jelapang, Tambun and Ulu Kinta. This area lies entirely in Mukim (sub district) Ulu Kinta in the Kinta district. The Ulu Kinta sub district is divided into Chemor, Ipoh, Lahat, and Tanjung Rambutan, administered by the Pejabat Daerah dan Tanah Ipoh. The project area is within the local authoritative administration of the Majlis Bandaraya Ipoh (MBI).

For the purpose of this project, the MHK area was sub-divided into three main zones to facilitate project planning, designing and implementation as shown in Figure 1.1. The zones, identified as upstream (UKB), midstream, and downstream, represent the different regions of the Upper Kinta River that is within the project area.

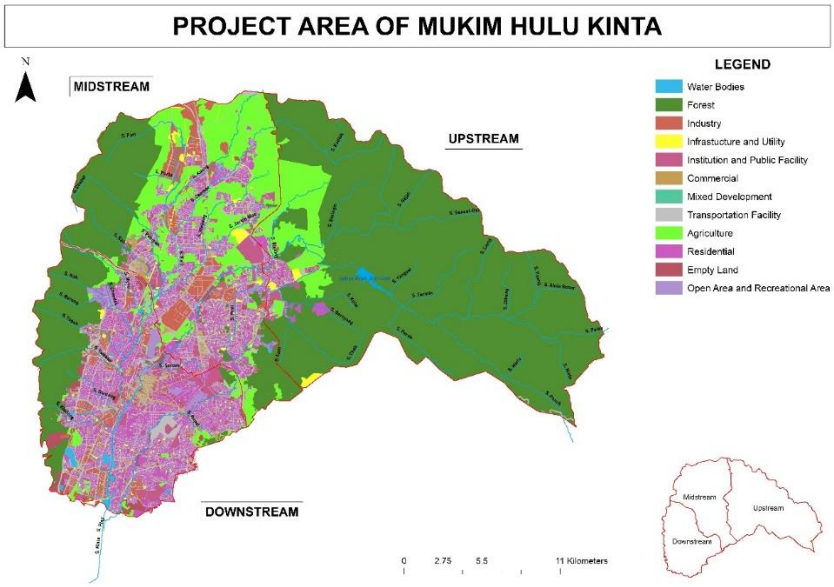


Figure 1.1 MHK Project Area

i. **Upstream (UKB)**: Represents the upper portion of the Kinta River, to the east of the project area. The topography is hilly and mountainous with elevation ranging from approximately 175 m above sea level (masl) to the highest peak at Yong Belar Mountain on the Main Range, at 2181 metres above sea levell , .

ii. **Midstream**: Represents the middle portion of the upper Kinta River, which includes a portion of the Pari and Pinji basin. The midstream section begins from the towns fringing the green areas in upstream, namely Chemor, Tanjung Rambutan, and Ulu Kinta, towards the North-South Expressway that bisects MHK. The elevation in the valley ranges from approximately 50 masl at the Kinta River bank, to Peninjau Mountain 1058 masl on the Keledang Range to the west, and 938 masl at Juang Mountain to the east2,3.

iii. **Downstream**: Represents the lower portion of the upper Kinta River, where Ipoh town is located. The Kinta River separates Ipoh old town and new town. The topography of the downstream zone is generally higher on the range to the west, gradually decreasing towards the floodplain, and then slightly increases to the east. The elevation ranges from approximately 808 masl at the peak of Keledang Mountain to 30 masl near the Kinta River bank at the MHK boundary.

However for Management strategy, the project area only covers the Upper Kinta Basin (UKB), upstream portion of the Mukim Hulu Kinta reviewed under the study. .

1.3 Scope of Management Strategy

The target area for this strategy is Upper Kinta Basin (UKB). It functions as a primary water catchment area and habitat for key flora and fauna. This strategy covers conservation and preservation of targeted area through key stakeholders. Key stakeholders such as government agencies (Forestry Dept., Drainage & Irrigation Dept.), orang Asli communities, local communities, and private agencies. The strategy outlines forest conservation, water resource protection, Orang Asli community empowerment and multistakeholder coordination as key goals identified under this strategy. The strategies include description and key action plans beside the key performance indicators (KPI) that can be measured and monitored for each goals.

1.4 Rationale of strategy

UKBMaS mainly developed as key reference to conserve UKB that offers key ecosystem services to all. Although there are various plans, there never been a strategy to tie all of the key stakeholders to protect UKB on a holistic and integrated manner especially involving the communities including Orang Asli communities. So the project is highlighting and closing the gaps that identified within existing plans which means UKBMaS can be used as sub-set of existing plans to conserve UKB. Besides this, the strategy also highlights local issues with related action plans especially on UKB which agencies and other immediately can infuse these elements into their job scope. The finalized strategy aimed to be endorse and adopted by Perak State Government through related agencies and proposed action plans implemented at grassroots with active participation from communities.

- **Goal:**

    1. Serve as main guidance and reference for stakeholders especially government agencies, as well the communities and private sectors to plan and implement respective activities that lead to conserved Upstream of Upper Kinta Basin (UKB).

- **Expected outputs:**

  1. Clear goals, strategies and action plans defined on UKB protection & management

  2. UKB Management strategy been adopted by state and relevant stakeholders

- **Expected outcomes:**

  1. Guidance document for all stakeholders

  2. Better protection of Upper Kinta Basin through UKBMaS

1.5 Approaches and Methodology

UKBMaS developed jointly with inputs from key stakeholders such as government agencies, Orang Asli communities, local communities and private stakeholders. Series of consultation through individual and joint meetings and workshops. UKBMaS covers 6 chapters:

Chapter 1: Introduction

This section describes about background, project area, scope of strategies and approaches and methodologies used to develop UKBMaS

Chapter 2: Upper Kinta Basin (UKB)

This section describes geography, climate, water bodies, flora, fauna and other key components of UKB. Land uses also covered within this section.

Chapter 3: UKB management issues

This section describes issues that related to forest, catchment management, and stakeholders within UKB. Issues here also covered review of existing plans and strategies that related to UKB.

Chapter 4: Proposed strategic management plans

This section focuses on the proposed aim of strategies as well the strategies and action plan and stakeholders. Main four (4) goals of UKBMaS are:

1) To protect forest and biodiversity
2) To protect and improve water resources
3) To enhance sustainable livelihood and welfare of orang asli communities
4) To enhance multi-stakeholder coordination & management

Chapter 5: Implementing the strategy

This section describes roles of stakeholders relating to implementation of UKBMaS. The resources needed also highlighted in this section.

Chapter 6: KPI

This section covers KPIs measured for each goals respective to strategies. Monitoring methods, reporting tools, and feedback mechanism are also covered within this section.

CHAPTER 2: UPPER KINTA BASIN

2.1 Area

Although Mukim Hulu Kinta (MHK) is focused for implementation of overall project activities, strategy will be focusing only Upper Kinta Basin (UKB). UKB covering the upper portion, including the source of the Kinta River. It includes the Kinta Permanent Forest Reserve which makes UKB mainly (73.8%) covered by forests. Besides this, UKB also host Sultan Azlan Shah Dam that provides water supply to Kinta District including Ipoh city, the capital of Perak. Hence, the strategy developed is aiming on ensuring long-term water supply for the beneficiaries as well as conserving the forest as water source and habitat for flora and fauna as well the interest of Orang Asli.

Upper Kinta Basin Management Strategy (UKBMaS) will be focusing Orang Asli, the local guardians of this area, who are living here and depends on local resources for their livelihood. Besides Orang Asli as beneficiaries, government stakeholders also focused as key implementers of planned framework to sustain long terms water supply and other ecosystem services offered by catchment. Beside that, other stakeholders such as private agencies, NGOS and local community outside focus area also given scope and importance under this strategy as holistic involvement will ensure extra protection.

Figure 2.1 shows the UKB area that covered by this strategy.

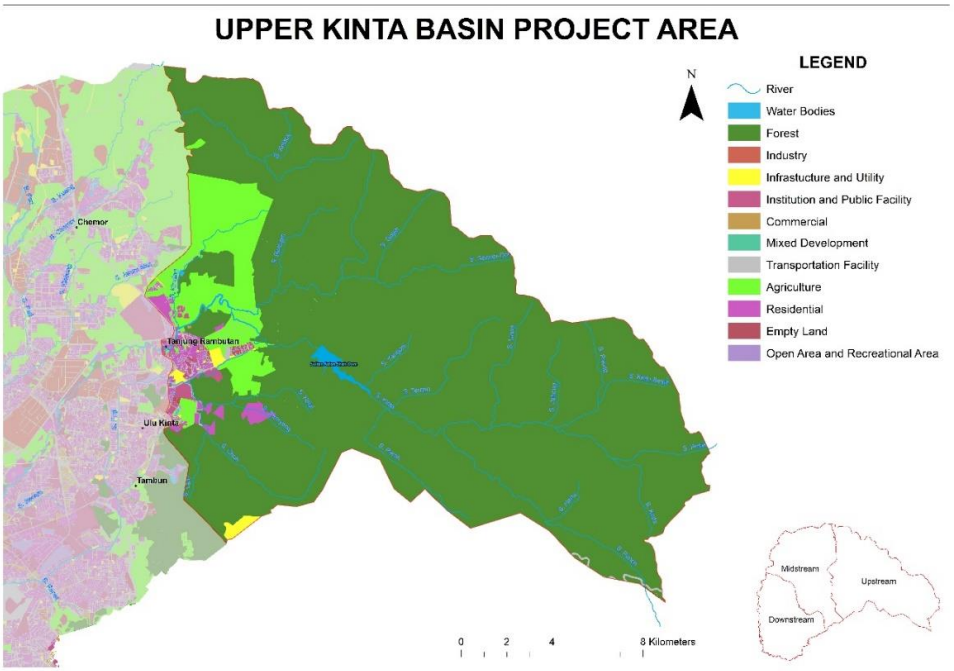


Figure 2.1 UKB Area

2.2 Climate

The project site experiences abundance sunshine and typical equatorial climate, humid with high temperature all year round. The mean annual humidity ranges from 63% to 99% with the lowest usually recorded in February and the highest usually recorded between October to November. In general, the climate within UKB is hot and wet with the seasons relatively defined as tabulated in **Table 2.1**. The daily temperature generally varies between 23°C and 32°C, where low air temperature occurs from December to January and the highest air temperature usually occurs from April to May. The annual rainfall ranges between 2,000 mm to 2,400 mm.

Table 2.1 The annual seasonal climate period within the project area

Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
North–East Monsoon			Transitional period			South-West Monsoon			Transitional period		

This area is sheltered from the Northeast monsoon, hence receives limited rain during this season. In contrast, the Southwest monsoon, from May to July, accumulates moderate rainfall. The peak of rainfall occurs from April to May and August to October during the transition period between the monsoons. Major floods generally occur

between the months of July to December. In some events, occasional spills over the mountain range during the Northeast monsoon cause floods in November and December.

2.3 Geology and Soil Type

UKB is located in the Western Tin Belt of Peninsular Malaysia and composed of Devonian sedimentary rocks of limestone. The floodplain soils range from well-drained levee soils to poorly drained heavy clays and peat soils in very poorly drained areas. Most soils are suitable for a wide range of crops. The terrain is flat to gently undulating has a general alluvial landscape that is underlain by unconsolidated to semi-consolidated sediments of variable thicknesses deposited during the Quaternary age in a variety of environmental settings. The mountain ranges are entirely of sedimentary rocks, mainly of fine-grained sandstone with interbedded shales, mudstones and minor siltstones probably of Carbo-Permian Age.

As reported in Integrated River Basin Management (IRBM) Sg Perak Study 2010, both rock of granitic and sedimentary origin are found and about half of the Kinta catchment is made up of riverine alluvial deposits. The soil suitability evaluation indicated that about 37% of the soils are suitable for perennial crops such as plantation crops and fruits and suitable or moderately suitable for medium and short term crops because of slope factors. In this basin, a large portion of land (58,000 ha) are ex–mining soils and are deemed as problem soil. The elevation profile of the Kinta catchment has indicated about 20,115 ha have elevation above 1,000 metres above sea level (masl).

2.4 Land Cover

The topography is hilly and mountainous in the UKB (**Figure 2.2**) with elevation ranging from approximately 175 masl to the highest peak at Yong Belar Mountain on the Main Range, at 2181 masl.

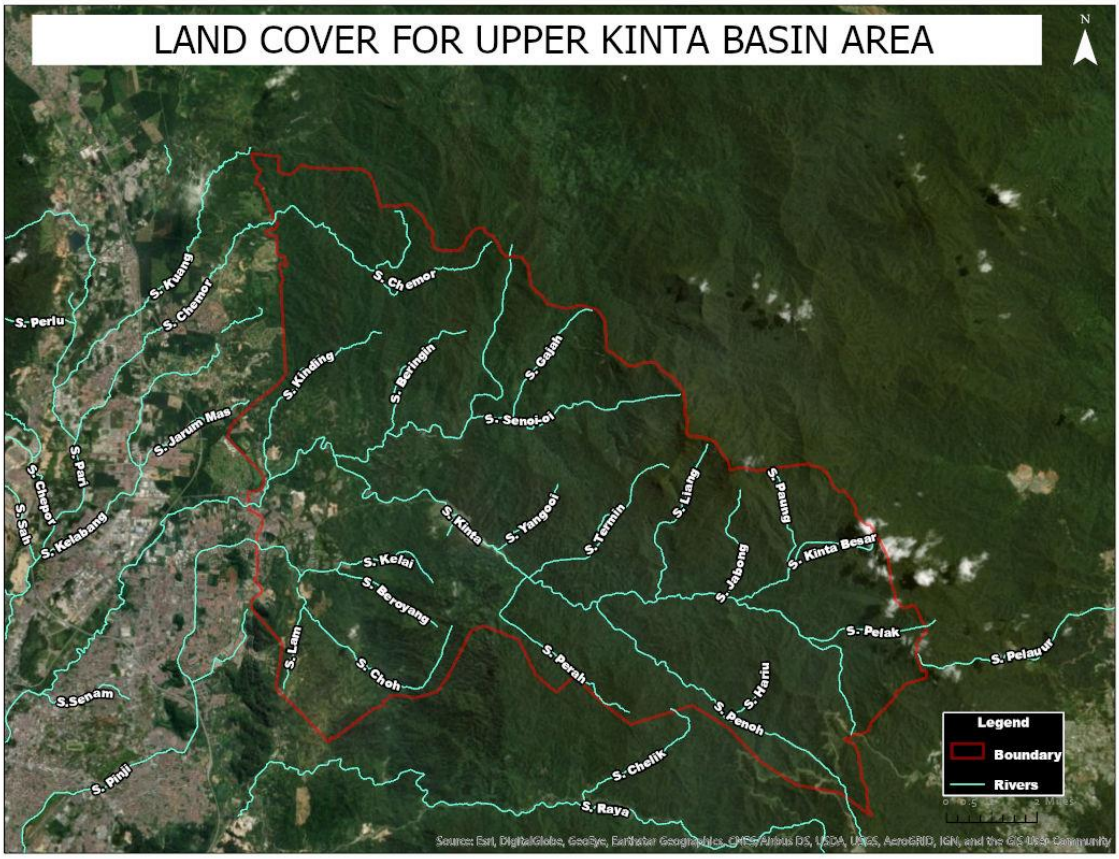


Figure 2.2 Land cover of UKB (year 2018)

. The UKB catchment is mainly forested and is the catchment of the Sultan Azlan Shah Dam (**Figure 2.3**) which provides the main water supply for Ipoh City. The forest area at Upper Kinta (within the dam catchment) is classified as water catchment reserve.

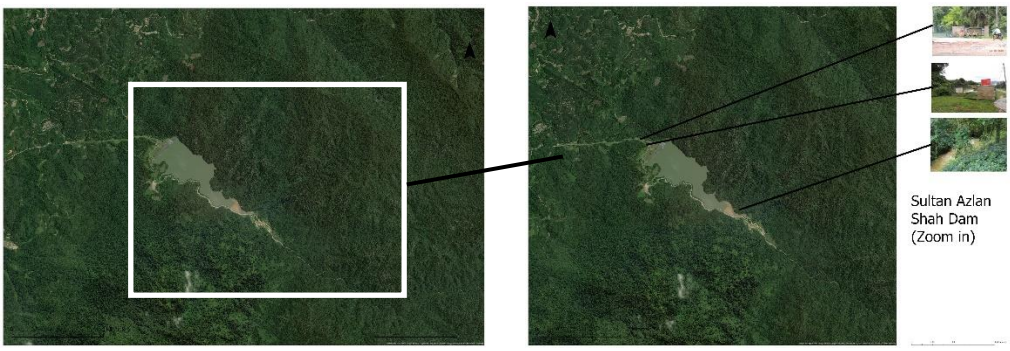


Figure 2.3: Surrounding area of Sultan Azlan Shah Dam

It consists of lowland forest and hill dipterocarp forests in higher altitudes. Hutan Simpanan Kekal Bukit Kinta covers an area of 67,459 hectares (**Figure 2.4**). The highest point is in Gunung Korbu which more than 3000 masl.

Figure 2.4 Location of Hutan Simpanan Kekal Bukit Kinta (GPS: 4.668226, 101.194542) (Note: Bright Blue line represent boundary)

2.5 Biodiversity

The rivers, in the Kinta Valley are also rich source of freshwater fish like Kelah (*Tor* spp.), Toman, Temoleh (*Probarbus* spp.), Sebarau (*Hampala macrolepidota*), which are popular sport fishing species.

The local population of the Upper portion of Sg Kinta (above Tg Rambutan) include many Orang Asli of the Semai group who are still dependent on the forest and aquatic ecosystems along the river for fish, prawns and forest products including rattan, beeswax, camphor and edible swiftlet nests.

Forest

Hutan Simpanan Kekal Bukit Kinta covers an area of 67,621.65 hectares gazetted as a permanent forest reserve (6158) on 29th August 1930. Hutan Lipur Simpanan Kekal Bukit Kinta were classified as secondary forest as most of the virgin or primary logs were harvested earlier to 2007 (JPNP, 2013). According to Wyatt-Smith (1963), the area is categorized as lowland dipterocarp forest, an inland forest formation that rises to about 300 m above sea level and is dominated by *Dipterocarpaceae* family. This forest covers dam vicinity and the forest cover along the community settlement, consist various stages of maturity, patches of shifting cultivation area, several patches of orchards i.e., tapioca, durian, cocoa, cempedak, banana, rambutan and petai, small scale rubber and palm oil.

Flora

Nearby Sg Termin flowing from Sultan Azlan Shah Dam, there are several timber species such as *Shorea leprosul*, *Durio* sp., *Fagraea fragrans* and *Cinnamomum porrectum*. *Shorea leprosul* is the most common of the six species of *Shorea* recorded in the lowland dipterocarp forest within upstream of Upper Kinta Basin. No rare or endemic species of plant were recorded within the lower elevation portions of the forest by Stone (1981, 1982); only in an area at the elevation of more than 1200 masl (montane oak forest) rare and endemic plants are likely to be encountered (Stone, 1982) (In addition, according to Birdlife International (2013), two parasitic plants belonging to the family Rafflesiaceae was recorded in Hutan Simpan Bukit Kinta, *Rafflesia cantleyi* and *Rhizanthes lowii*. The pitcher plants such as *Nepenthes gracilis* also found in the forest.

Herbaceous such as Simpoh Gajah (*Dillenia grandifolia*), Simpoh Air (*Dillenia suffruticosa),* Putat (*Barringtonia racemose),* Saga Daun Tumpul *(Adenanthera pavonina).* Gelenggang *(Cassia alata),* Shrub *(Sterculia),* Sekoyak *(Bauhinia integrifolia),* Orkid Buluh *(Arundina graminifolia), Etlingera spp.* are also available in the upstream of Upper Kinta Basin. Mengkuang *(Pandanus spp.)* is one of the plants present near to water bodies. Tembusu *(Fagraea fragrans),* Jambu *(Syzygium malaccense*), Terap Nasi *(Artocarpus elasticus),* Balik Angin *(Mallotus macrostachyus)* are some of the tree species present in the upstream forested area.

Fauna

Mammals such as Long-tailed Macaque (*Macaca fascicularis*) and Plantain Squirrel (*Callosciurus notatus*) are present within the Hutan Simpan Bukit Kinta. According to the EIA Report (1998), other mammals which are commonly found are Wild Boar (*Sus scrofa*), Pig Tailed Macaque (*Macaca nemesterina*), Banded Leaf Monkey (*Presbytis femoralis*), Dusky Leaf Monkey (*Trachypithecus obscurus*), White Handed Gibbon (*Hylobates lar*), Cream-colored Giant Squirrel (*Ratufa affinis*), Malayan Civet (*Viverra tangalunga*), Lesser Mousedeer (*Tragulus kanchil*), Sambar Deer (*Rusa unicolor*), Barking Deer (*Muntiacus muntjak*), Long-tailed Giant Rat (*Leopoldamys sabanus*) and Smooth Otter (*Lutrogale perspicillata*). Reptiles such as *Calotes emma, Calotes versicolor, Bronchocela cristatella, Varanus salvator, Draco quinquefasciatus, Eutropis multifasciata, Ansonia longidigita* are also available here.

Some of the birds found in Kinta Nature Park are also present within the upstream area as birds are mobile and Kinta Nature Park is located close to Upper Kinta Basin. According to Malaysian Nature Society (MNS), some 150 species of birds have recorded in Kinta Nature Park. According to PERHILITAN (2010), the most abundant mammals species recorded in Hutan Simpan Bukit Kinta, are bats with 34 species recorded.

As a water catchment area UKB water bodies attracts many butterflies, moth and other insects to live near it or even in it. A rare species of butterfly, Rajah Brooke's Birdwing (*Trogonoptera brookiana*) is found in abundance within the upstream area. Arthropods such as *Nephila pilipes* can be found within the upstream area. Other than that, Jacintha Eggfly (*Hypolimnas bolina*) and Common Tiger (*Danaus genutia*) also present in this area.

2.5.1 Species of Conservation Significance

Species of biodiversity can be considered to be of conservation significance on a local, national, regional or global scale. In most instances it is suffice to classify species according to the IUCN (The World Conservation Union) Global Threat Criteria. To develop these criteria, IUCN taxonomic experts review and assess all available information pertaining to species under review, and based upon this, accord each a Global Threat Category. In basic terms these Threat Criteria divide assessed species into nine categories (IUCN, 2019):

1. **Not Evaluated (NE)**, when the species has not yet been assessed.
2. **Data Deficient (DD)**, when there is insufficient data to review and assess the status of a species or population.
3. **Least Concern (LC)**, when a species is unlikely to become extinct in the near future.
4. **Near Threatened (NT)**, when the species is close to being at high risk of extinction in the near future.
5. **Vulnerable (VU)**, when the species meets one of the 5 red list criteria and thus considered to be at high risk of unnatural (human-caused) extinction without further human intervention.
6. **Endangered (EN)**, when the species is at a very high risk of extinction in the wild, and meets any of criteria A to E for Endangered.
7. **Critically Endangered (CR)**, when the population is in a particularly and extremely critical state.
8. **Extinct in the Wild (EW)**, when it survives only in captivity, cultivation and/or outside native range, as presumed after exhaustive surveys.
9. **Extinct (EX)**, when it is beyond reasonable doubt that the species is no longer extant.

Species that are considered to be Near Threatened, Vulnerable, Endangered and Critically Endangered globally, are nearly always is a high threat category at the local, national and regional scale, therefore the IUCN Threat Criteria provide a good assessment of the conservation significance of an area and the biodiversity it supports.

The tropical forest ecosystems of the UKB support a wealth of biodiversity of global conservation significance. These include iconic and endemic animal species such as:

a) Malayan Tiger (*Panthera tigris jacksoni*), classified by IUCN as Critically Endangered (CR), with a global population of less than 250 animals, which is found only in the Thai-Malay peninsula.
b) Malayan Tapir (*Tapirus indicus), classified by IUCN as Endangered (EN), with less than 2,500 mature individuals in the population.*
c) *Plain pouched Hornbill (Rhyticeros subruficollis), classified by IUCN as Vulnerable (VU), with a global population of less than 7,000 individuals within a restricted range and decreasing forest habitats in the Thai-Malay peninsula.*

According to Jabatan Perlindungan Hidupan Liar Dan Taman Negara, Semenanjung Malaysia (PERHILITAN) in Red List of Mammals for Peninsula Malaysia

(PERHILITAN, 2010), members of Felidae family such as Golden Cat (*Pardofelis temminckii*), Leopard (*Panthera pardus*), Malayan Tiger (*Panthera tigris*), Marbled Cat (*Pardofelis marmorata*) and Leopard Cat (*Prinailurus bengalensis*) were recorded until the year 2000 within the Hutan Simpan Bukit Kinta area. All member of Felidae family classified as Totally Protected Species under the new Wildlife Conservation Act 2010. Other mammals recorded by PERHILITAN (2010) within the Hutan Simpan Bukit Kinta area are Asian Elephant (*Elephas maximus*), Malayan Tapir (*Tapirus indicus*), Sumatran Rhinoceros (*Dicerorhinus sumatraensis*), Malayan Gaur (*Bos gaurus*), Serow (*Capricornis sumatrensis*), Dhole (*Cuon alpinus*), Sun Bear (*Helarctos malayanus*), Porcupine (*Hystrix brachyura*) and Scaly Anteater (*Manis javanica*). All these animals have been listed under Second Schedule, Totally Protected Species, under the new Wildlife Conservation Act 2010. Chestnut-bellied Malkoha (*Phaenicophaeus sumatranus*) categorised as Near Threatened under current IUCN Red List also can be found in UKB.

2.5.2 Species of Economic Significance

Timber from Dipterocarpus and Shorea species is the main source for timber industry in Malaysia. According to the EIA report by Perak Water Board in 1998, a total 27 species of trees of commercial importance have been recorded and as one moves further upstream, the occurrence are more frequent.

Non-timber Forest product such as petai (*Parkia speciosa*), rattan (*Calamus* sp.), bamboo, durian (*Durio* sp.), Tongkat Ali (*Eurycoma longifolia*) are sources of income for the villagers. Nearby rivers also as source of fish supplies for the villagers.

2.6 Water Bodies

The water bodies at UKB are reported to be 94 units in total (231 ha) (**Figure 2.5**). Although water bodies are with minimal percentage in UKB compared to overall MHK area, impacts of human activities such as agriculture, development, industrial activity and so on have greater impacts on them due to deposition and transportation of pollutants.

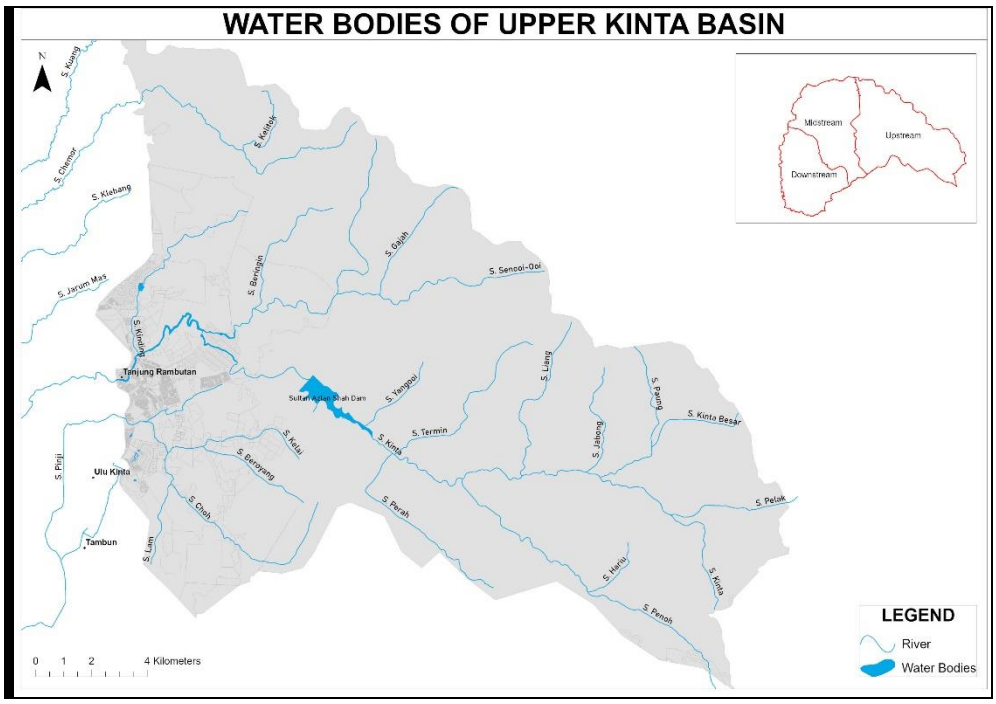


Figure 2.5 Water bodies of UKB

A total of 21 rivers and 71 small lake/ponds were identified within UKB (Table 2.2). Others referring to unidentified patches of water log within UKB. It is difficult to categorize them into existing types of water bodies, hence, they were grouped within others.

Table 2.2 Breakdown of waterbodies in UKB

Water Bodies	**Upstream**	
	Unit	**Area (ha)**
River	21	55
Lake/Pond	71	8
Recreational Lake	0	0
Dam	1	103
Others	1	1
Mining/Ex-mining Pond	0	0
Total	94	231

2.6.1 Hydrology

Based on Sg. Perak IRBM Report, 2010, water flow for Sg Kinta at Weir G, the Q100 is computed to be 847 m^3/s using frequency analysis. The Q100 was estimated to be 490 m^3/s in the study titled "Perancangan Terperinci Projek Tebatan Banjir Sg Kinta" by JPS in year 2002. The remarkable increase in Q100 is mainly due to two recent high storm events which occurred in October 2008 (746 m^3/s) and January 2009 (767 m^3/s). The increase in peak flow could also be attributed to continuous land development activities which have resulted in higher flood flow. It is interesting to note that the Q100 of 847 m^3/s under this 2010 study is close to the Q100 of 809 m^3/s derived using the rainfall–runoff model in the Sg Kinta Study for 2020 land use scenario[1]. **Table 2.3** shows the low flow analysis for Sg. Kinta.

Table 2.3 Low flow analysis for Sg. Kinta

No	Station ID	Station Name	River Basin	Ca($km^{2)}$	Data Period	5 yr m^3/s (MLD)		50 yr m^3/s (MLD)	
						1-day	7-day	1-day	7-day
1	4611463	Sg Kinta at Tg Rambutan	Sg Kinta	246	1962 – 2007	0.78 (68)	1.00 (87)	0.27 (23)	0.41 (35)
2	4310401	Sg Kinta at Weir G at Tg Tualang	Sg Kinta	1,700	1977 – 2009	12.50 (1,080)	13.52 (1,168)	6.58 (569)	7.07 (611)
3	4511468	Sg Raia at Keramat Pulai	Sg Kinta	192	1978 – 1999	0.80 (69)	1.05 (91)	0.30 (26)	0.43 (37)
4	4410461	Sg Kinta at Batu Gajah	Sg Kinta	1,054	1962 – 1984	3.41 (294)	3.97 (342)	2.10 (181)	2.78 (240)

Source: Sg. Perak IRBM Report, 2010

[1] Sg Perak IRBM Report, 2010

2.6.2 River systems

Kinta River is one of the main tributaries of Perak River, flows through UKB from Mount Korbu at Ulu Kinta, Tanjung Rambutan to Perak River at Cenderong. Its main function is for water supply as well supporting other ecosystem services. **Table 2.4** shows the list of rivers that found within UKB. There are total of 21 rivers listed within UKB.

Table 2.4 Rivers within UKB

No.	River
1.	Sg. Kinta
2.	Sg. Kinta Besar
3.	Sg. Pelak
4.	Sg. Hariu
5.	Sg. Paung
6.	Sg. Jabong
7.	Sg. Liang
8.	Sg. Penoh
9.	Sg. Perah
10.	Sg. Termin
11.	Sg. Yangooi
12.	Sg. Senooi-Ooi
13.	Sg. Gajah
14.	Sg. Beringin
15.	Sg. Chemor
16.	Sg. Kelitok
17.	Sg. Kinding
18.	Sg. Kelai
19.	Sg. Beroyang
20.	Sg. Lam
21.	Sg. Choh

Among these rivers, Sg Kinta is the main river that carrying water as well as pollutants to downstream flowing through Sultan Azlan Shah Dam. Any impacts to tributaries will

have major effect on this main river. Sg. Senooi-Ooi is flowing through Orang Asli villagers, which their discharge or activities will pose, threat to this river. On the other hand, Sg. Choh and Sg. Chemor are two rivers that are located within mixed development areas.

2.7 Human Use and Demographics

UKB provides many services for its stakeholders and beneficiaries: Orang Asli, local communities, private players and so on. Consumption for survival, health and wellbeing, livelihood and economic activities as well the development that grow alongside population lead to impacts on natural resources especially within UKB.

2.7.1 Population

The population density of Kinta district is 432 persons per square kilometer. **Figure 2.6** shows the communities in UKB. It is mainly made up of Orang Asli and local community in Tanjung Rambutan area.

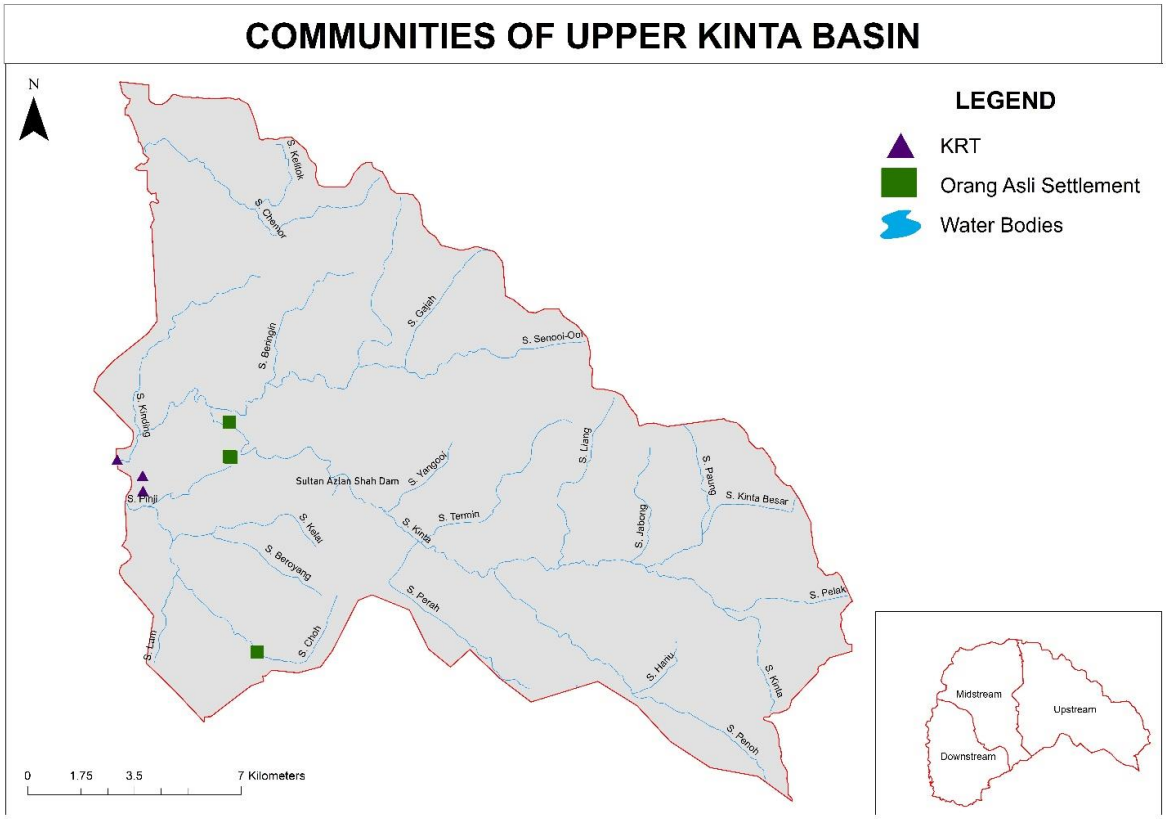


Figure 2.6 Communities in UKB

There are six Orang Asli villages; Kg. Chadak, Kg. Makmur, Kg. Sg Suloh, Kg. Tonngang, Kg. Sg. Baduk and Kg. Sg. Choh within UKB (**Table 2.5**). Kg Makmur is made up of five villages that were relocated during the construction of the Sultan Azlan Shah Dam.

Table 2.5 Orang Asli Community within UKB

Village name	Number of residents	Average household
Kg. Chadak	474	4
Kg. Makmur	625	2
Kg. Sg Suloh	167	3
Kg. Sg. Choh	163	3
Kg. Tonggang	372	4
Kg. Sg. Baduk	125	3
Total	1,926	

Kg. Chadak and Kg. Makmur are located near to each other along Kinta River flowing into Sultan Azlan Shah Dam. On the other hand, Kg. Sg. Suluh is located along the sub-basin of Seno-oi River. Kg. Sg. Choh is located nearby Sg. Choh, the tributataries of Sg. Kinta. Kampung Sg. Chadak is located in Ulu Kinta, Perak. The old location of the village was behind the PGA Camp and was move to new location because of the construction of the Camp in 1960s. The village consists of 434 people and has about 78 houses. The people are from Temiar Tribe of Senoi Group with 90% of the people are Muslim while the other 10% are animism.

Kampung Sg. Suloh was built along sub-basin of Sungai Seno-oi in 1978 with more than 200 people. The village now consists of 146 people with 43 families. About 90% of the people are Muslim while the rest are animism. The people are from Temiar Group and the speak Temiar and Malay language.

Some of the initial discussion and consultation with the Orang Asli communities indicate the followings:

- Kampung Chadak is the only village that is located directly along the main Kinta River.

- Kampung Makmur, Kampung Sg. Suloh and Kampung Tonggang are situated within sub-basin of Senoi-oi River.

- The Kampung Chadak community cannot use the Kinta River flowing adjacent to the village for their water supply or fishing activities due to high siltation effect.

- Kampung Chadak's drinking water supply comes from another tributary known as Tongyang River. Whereas drinking water for Kampung Makmur is from Senoi-oi River and Kampung Sg. Suloh from Suloh River.

Sg Raya Basin is adjacent basin to Upper Kinta Basin. There are some Orang Asli villages located within Sg Raya basin as well. Kg Pawong, Kg Jantung Baru, and Kg Chiduk are some of the Orang Asli villages situated there. Although these Orang Asli villages located outside from the basin, these community groups can play key role in preserving eroded sides especially near Km44-46 Simpang Pulai highway, due to their nearest settlement to incident area.

Besides Orang Asli villages, local communities in Tanjung Rambutan is also key beneficiary in UKB. The local communities within UKB are located in Tanjung Rambutan Town consists of Tmn Sri Tanjung KRT, Tmn Indah KRT and Tanjung Rambutan KRT. The estimated total population of UKB in 2010 was 653,838 with a population density of approximately 938 persons per squared kilometres. Approximately 6,840 people live within Tanjung Rambutan (**Table 2.6**). Majority of the population in Tanjung Rambutan are Malay (47.6%), followed by Indian (36.5%), Chinese (13.2%) and others (0.54%). Non Malaysian Citizen made up 2.2% of the approximate population within Tanjung Rambutan.

Table 2.6 Population by Ethic Group in Tanjung Rambutan UKB

Area	Bumiputera			Chinese	Indian	Others	Total	Non-Malaysian Citizen	Total
	Malay	Other	Total						
Tg.Rambutan	3,254	19	**3,273**	902	2,494	18	**6,687**	153	**6,840**

- Source: Dept of Statistic, 2010

2.7.2 Land uses

The total area of Upper Kinta Basin (UKB) is 31,470 ha. Overall the largest land use type is forest, which covers about 85.3% (26,841 ha). Second largest is agriculture covering an area of 2418 ha, followed by institution and public facility (1210 ha) and residential (405 ha) (**Figure 2.7**). Water bodies within UKB only covers about 7.5% from overall water bodies of MHK. Other land use include Infrastructure and utility (156 ha), commercial (9 ha), transportation facility (275 ha), empty land (61 ha), open area and recreational area (31 ha) (**Table 2.7**).

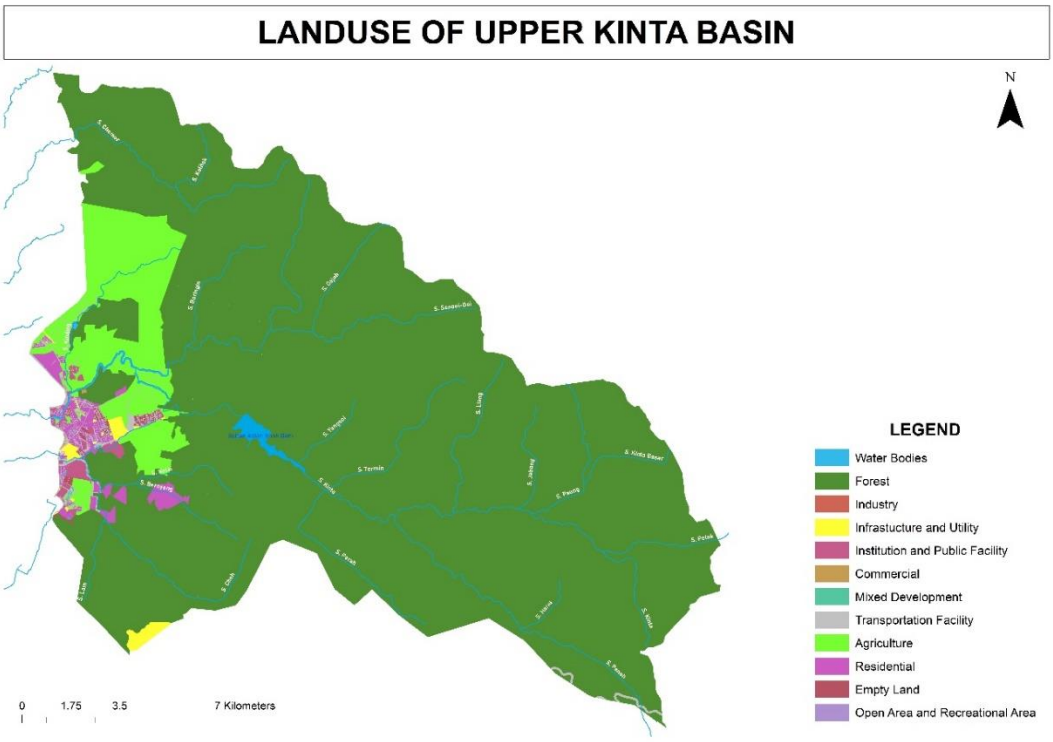


Figure 2.7 Land use of UKB

Table 2.7 Breakdown of land uses in UKB

Type of Land Use	Unit	Area (ha)	% of land area
Water Bodies	77	64	0.20
Forest	1	26,841	85.29
Industry	0	0	0
Infrastructure and Utility	132	156	0.50
Institutions and Public Facility	83	1,210	3.84
Commercial	238	9	0.029
Mixed Development	0	0	0
Roads	20	275	0.87
Agriculture	1240	2418	7.68
Residential	4169	405	1.29
Empty Land	2206	61	0.19
Open Area and Recreational Area	146	31	0.10
Total	**8311**	**31470**	**100**

i) <u>Forest</u>

Within the forested area, Bukit Kinta is on the main range known as Environmentally Sensitive Area (ESA) in Perak where Hutan Simpan Kekal Bukit Kinta covers most the forest land uses. This forest reserve is managed by Perak State Forestry Department through Kinta Forest Office. High conservation value (HCV) species are found in the UKB area such as the Resak abdulrahman (*Vatica abdulrahmaniana*), Balau Putih (*Shorea lumutensis*)and Gerutu Pasir Daun Besar *(Parashorea globosa)*. Besides this, UKB also host Taman Eko-Rimba Ulu Kinta (9.22 hectares) aimed for recreational and educational activities while conserving the forest. **Figure 2.8** shows the forest land of UKB.

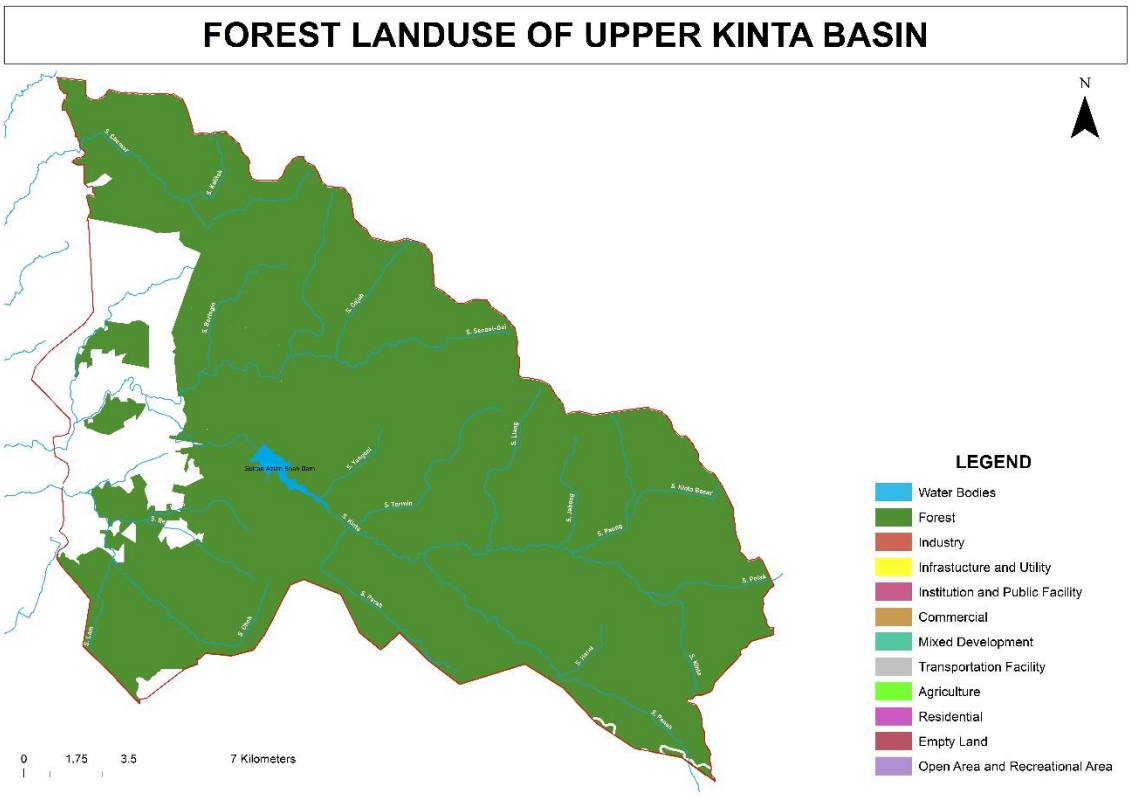


Figure 2.8 Forest land use of UKB

ii) Agriculture

The agriculture activities covers around 8% of total UKB land use area (**Figure 2.9**). Main agricultural activities includes the fruit farms, rubber plantations, coconut trees plantations, palm oil plantations, mixed agriculture and others.

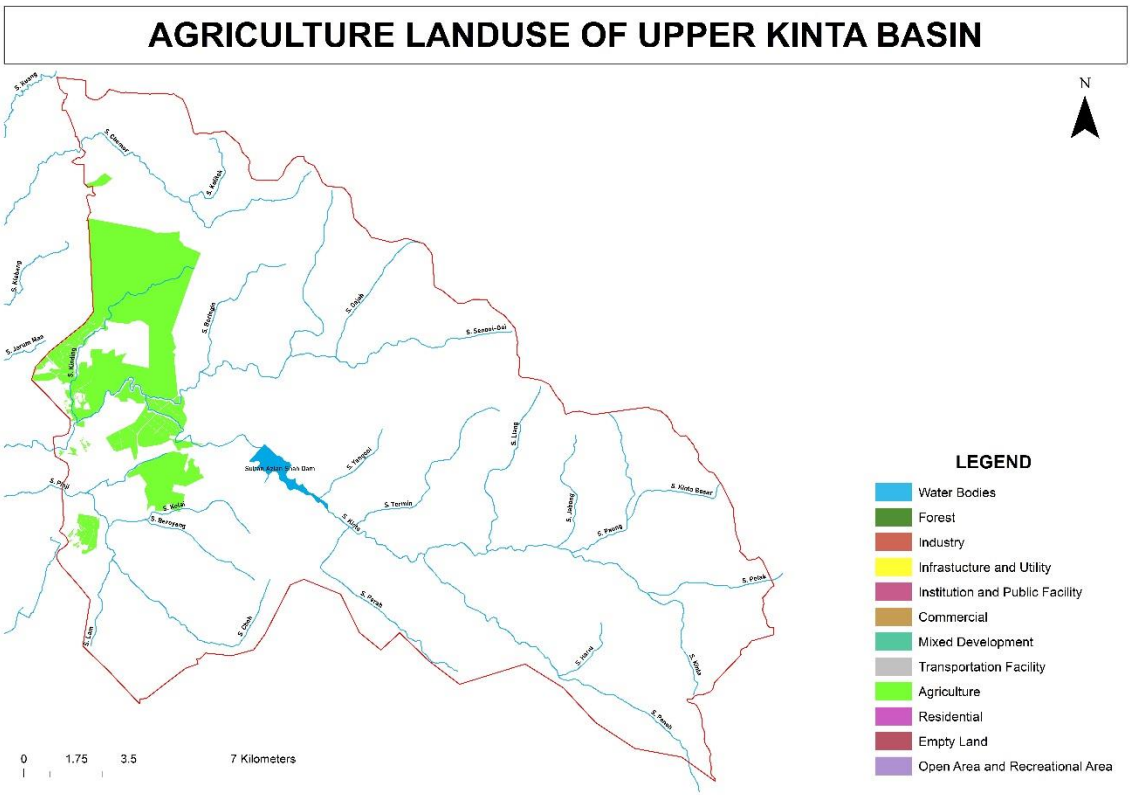


Figure 2.9 Agriculture land use of UKB

2.7.3 Transportation

UKB includes almost main 20 roads with area of 275 ha. Second East–West Highway (Malay: Lebuhraya Timur–Barat Kedua), also known as Simpang Pulai–Kuala Berang Highway, Federal Route 185 and Federal Route 36, is a highway crossing through UKB linking Simpang Pulai in Perak to Kuala Jeneris in Terengganu. It overlaps with Federal Route 8 Federal Route 8 between Gua Musang and Sungai Relau. It is notorious for its many sharp corners which increase the risk of road accidents. Besides this, erosion happening since development of this highway that has cause major threat to water supply through sedimentation in Sultan Azlan Shah Dam.

2.7.4 Socio cultural uses

The population of the Upper Sg Kinta (above Tg Rambutan) include many Orang Asli of the Semai group who are still dependent on the forest and aquatic ecosystems along the river. The Upper Kinta valley is also the source of water supply for Ipoh City through the Kinta Dam (Empangan Sultan Azlan Shah) and the Ulu Kinta Water Treatment Plant as well as Sg Kinta Water Treatment Plant.

The rapid development in the Ulu Kinta valley has led to depletion of natural resources and caused significant impacts on the water supply and socio-economy of the local community. Some parts of the river ecosystem have degraded and this may lead to possibility of economically important fish species to be vanished from the river as a result of river pollution and habitat loss. Such development activities also impacting the natural resources in the area which also provide the supplementary livelihood for the Orang Asli.

Besides this, there are facilities observed in Orang Asli villages. Kampung Sg. Chadak has several facilities built in the village. The "Dewan Orang Ramai" was built and now used by the villagers to have any meetings and any program. A kindergarten is also built for the kids in the village and also from nearby Kampung Sg. Suloh. A football field is also built in the village next to futsal arena. Other facility in the village is a bridge that connects the village with town.

Table 2.8 showed the facilities used for social-cultural activities. Most of the Orang Asli community have community hall except for Kg. Sg. Suloh. Early education like pre-school are available in Kg. Chadak and Kg. Makmur.

Table 2.8: Facilities within Kg. Orang Asli

Village name	Public facility				Utilities	
	Community hall	Primary school	Pre-school	Prayer room	Water	Electric
Kg. Chadak	Yes	No	Yes	Yes	Gravity	Yes
Kg. Makmur	Yes	No	Yes	Yes	Gravity	Yes
Kg. Sg Suloh	No	No	No	Yes	Gravity	Yes
Kg. Sg. Choh	Yes	No	No	Yes	Gravity	Yes

CHAPTER 3: UKB MANAGEMENT ISSUES

3.1 Stakeholders in UKB

The complex and dynamic nature of the UKB issues requires flexible and transparent decision making that embraces a diversity of knowledge and values. In order to achieve the UKB Management Strategies (UKBMaS) objectives, participation of all key stakeholders are required for the implementation of the plan. Combination of regulation and incentives from the Government as well the voluntary adaptation of good management practices by the other stakeholders are required for sustainable management. Active participation involving stakeholders from the different area of expertise and interest are vital as to achieve the UKB Management StrategiesUKBMaS desired intention. The stakeholders include Government agencies from Federal, State and local level, Orang Asli communities, local communities, private sector stakeholders and academic research community and civil society. The stakeholders include people who will impacted by the UKB Management Strategies and possibly affect the UKBMaS. The stakeholder must possess information, knowledge, skill and resources crucial to the implementation of UKBMaS and control the relevant implementation instruments. The stakeholders need to support and adopt the UKBMaS to ensure its successful implementation.

3.1.1 Government Agencies – State and Federal Levels

The federal government adopts the principle of separation of powers under Article 127 of the Federal Constitution and has three main pillar; executive, legislature and judiciary. The state governments in Malaysia also have their respective executive and legislative bodies. Each state has its own constitution that runs the law of state that are not covered by the federal government as long the legislation is not prohibited by the Constitution. The Federal government passed a set of laws that are the Environmental Quality Act 1974, the Protection of Wildlife Act 1972 Act 76, the National Forestry Act 1984, the National Parks Act 1980, and the Town and Country planning Act 1976, which helps in protecting as well as conserving healthy water catchment area. The problem is the environmental laws and policy in Malaysia do not give direct impact to the respective issues. This is because there is overlapping powers and jurisdiction between Federal and State in managing UKB. Table 3.1 shows the list of government agencies comprising both Federal and State responsible for UKB management.

Table 3.1 List of identified stakeholders from government agencies.

Federal Government	State Government
Ministry of Water, Land and Natural Resources (KATS)	Perak State Government (Exco for Education, Science, Environment, Green Technology and Information & other related Excos)
Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC)	Department of Irrigation and Drainage (DID) Perak
Department of Irrigation and Drainage Malaysia (JPS)	Department of Town and Country Planning Perak (PLANMalaysia@Perak)
Department of Environment (DOE)	Department of Environment (DOE) Perak
Department of Mineral and Geoscience Malaysia (JMG)	Perak State Forestry Department
Department of Survey and Mapping Malaysia (JUPEM)	Perak State Education Department (SED)
Public Works Department (JKR)	Department of Orang Asli Development
	Perak State Office of Land and Mines
	Perak State Agricultural Development Corporation
	Department of Fisheries Perak
	Department of Mineral and Geoscience Perak
	Perak Water Board (LAP)
	Perak Economic Planning Unit (UPEN)
	Perak State Health Department
	Perak State National Solid Waste Management Department (NSWMD).

From the constitutional perspective, the responsibilities over the environmental issues in UKB cannot be precisely divided between federal and state governments as some are over lapping issues which sometime fall under concurrent list. The environmental issues could only be dealt through a concurrent jurisdiction. The responsibility for the protection and conserving the UKB is by Perak state as the state authorities are in better position to monitor the violations and nearest to the source of environmental problems. Environmental issues in UKB should be assigned to the Concurrent Legislative List that would encourage better federal-state joint efforts and cooperation. **Table 3.2** shows the list of agencies and their respective jurisdiction.

Table 3.2 Jurisdiction power of agencies *

No.	Agency	Jurisdiction
1.	Ministry of Water, Land and Natural Resources (KATS)	• Control the water distribution and supply through WSIA 2006
2.	Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC)	• Overlook river water quality through EQA 1974 • Ensure implementation of EIA order 2015
3.	Department of Irrigation and Drainage Malaysia (JPS)	• Oversees water quantity, water allocation and flood control
4.	Department of Environment (DOE)	• Oversees river water quality
5.	Department of Mineral and Geoscience Malaysia (JMG)	• Oversees ground water usage and extraction
6.	Department of Survey and Mapping Malaysia (JUPEM)	• Oversees mapping and satellite data repository
7.	Public Works Department (JKR)	• Oversees road development and maintenance works
8.	Department of Irrigation and Drainage (DID) Perak	• Oversees water quantity, water allocation and flood control in Perak State
9.	Department of Irrigation and Drainage Kinta/Batang Padang	• Oversees water quantity, water allocation and flood control in Kinta District
10.	Department of Town and Country Planning, Perak	• Plan and advise state on its development through National Physical Plan
11.	DOE Perak	• Oversees river water quality in Perak State
12.	Perak State Forestry Department	• Oversees forest reserve and economic forest in Perak
13.	Kinta Manjung District Forestry Office	• Oversees forest reserve and economic forest in Kinta District

14.	Department of Orang Asli Development, Perak	• Oversees welfare of Orang Asli communities
15.	Perak State Office of Land and Mines	• Oversees approval for development and any other activities in Perak
16.	Department of Fisheries Perak	• Oversees fish monitoring, aquaculture and biosecurity of Perak
17.	Department of Mineral and Geoscience Perak	• Oversees ground water in Perak
18.	Perak Water Board (LAP)	• Oversees water supply and treatment in Perak
19.	Perak Economic Planning Unit (UPEN)	• Oversees economic activities in Perak
20.	Ipoh City Hall (MBI)	• Local council that manages Ipoh city
21.	Kinta Land and District Office	• Oversees approval for development and any other activities in Kinta District
22.	Perak State Health Department	• Oversees health and safety in Perak state
23.	Perak State National Solid Waste Management (NSWMD)	• Manages solid waste in Perak state through appointed concessionaires

*as per 2019

The obvious gaps between the water pollution that arise out of Sultan Azlan Shah dam construction and the Simpang Pulai highways are federal subjects while encroachment of Ulu Kinta forest reserve, agricultural activity, rivers, land use and sanitation are state subjects might endanger the environment of the Perak state or even the country. Similarly, the sources of the Kinta river pollution are varied. Rivers are polluted also by siltation caused by deforestation to open lands for agricultural activities. Possible agricultural discharges of fertilizers contents high nutrients value during raining season and improper sanitation by the communities at the upstream of Ulu Kinta Basin possessed to be two major sources of water pollution. Following the UKB water catchment area, most of the environmental problem occurred within the area closely related to land, agriculture, farming, water and forests that

are state matters. State and local authorities are also in a better position to identify the environmental problems and to monitor situations in the particular areas. They are the frontline agencies to which the public would turn to ask help and guidance. Due to close proximity between the source of environmental problems and the state and local government agencies, enforcement measure would be more effective. State government through their local agencies are in better position to identify the problems and to monitor the situation.

However, due to lacks of the resources, states most of the time are not in a position to effectively deal with the environmental issues. Dealing with water pollution and many other environmental issues require adequate work force, finance, monitoring equipment and technical expertise that exceeds the financial resources of the state. Insufficient funds, lack of work force and technical expertise are the major constraint in the effective management of the environment. This due to state have limited sources of revenue as the important sources of state revenue are from the lands, mine and forest. So, therefore most of the state policies biased towards economic consideration rather than environmental concerns. The revenue derived from the sale of timber are used to finance other development projects and state expenditures. Hence, the role of forests in protecting the environment conserving the water and providing a safe habitat for the wild animals is given less priority. The state fear that the requirements for a sustainable forest management and other environmental and ecological restrictions on logging companies will result in lower revenue for the state.

Environmental issues do not stop at single river but usually across many rivers and basins, and sometime have a nation-wide implications. For instance, clearing UKB water catchment areas would pose threat to water supplies in midstream and downstream at Ipoh town and discharge into Perak River may affect water quality or sedimentation in the Perak River. Besides that, both federal and state governments should make efforts based on their respective abilities to achieve common goals. Federal efforts should not displace state efforts to protect the environment but should guide them to exercise their powers more effectively.

3.1.2 Orang Asli communities

The Orang Asli community is particularly at risk as to dam construction and water resources related engineering strategies because they occupy remote and topographically hilly area and their settlements and foraging forests are within water catchment areas. So as main stakeholders, Orang Asli are the direct beneficiary of the UKB. Proactive engagement will

help these communities to develop a sense of protecting the UKB and becoming the long-term strategic partners for UKBMaS implementation. The willingness and the capacity of the community to support work on the environment will ensure the improved environmental outcomes and a sustainable future.

UKB has six Orang Asli villages; Kg. Chadak, Kg. Makmur, Kg. Tonggang, Kg. Sg Suluh, Kg. Sg. Choh and Kg. Sg. Baduk . All these villages are located along either Kinta River or Seno-oi River. Jabatan Kemajuan Orang Asli Malaysia (JAKOA) Batu Gajah manages all the villages under Rancangan Penempatan Semula Orang Asli Ulu Kinta. The easiest village to access is Kampung Chadak and Kampung Tonggang. Kampung Sg Suloh is about 2 km away from Kg Chadak and the access road started from Kg Chadak. Kampung Sg Suloh can also be accessed from Kampung Tonggang via 2km road. Kampung Makmur located about 4km away from Kg Chadak on winding hilly road. (refer to Chapter 2)

The Kampung Chadak is the only village located directly along the main Kinta River and unfortunately, the Kampung Chadak community cannot use the Kinta River for their water supply or fishing activities due to high siltation effect. Therefore, the Kampung Chadak's drinking water source comes from another tributary known as Tongyang River.

A total of 2418 ha of land use for agriculture activities reported at the UKB. Most of the Orang Asli lands at the respective kampong used for palm oil plantation. High usage of fertilizers on the agricultural activities could cause the excess fertilizer ends at the river during raining season and altered the river water quality. The issues arise as the drinking water supply comes from the tributaries within this agricultural areas. This might cause harm to the villagers using the river as a main source of water supply to them.

Improper sanitation among the Orang Asli communities is still an issue to be tackled. Even though JAKOA is already taking care of the wellbeing and facilities of the Orang Asli communities, some still prefer open defecation. Improper defecation practices or sanitation caused harmful effect to water bodies. Even though Orang Asli community already have built in toilet within their house over the years, behavior change effort may still be needed to promote the use of the inhouse toilets. The average monthly income of the Orang Asli communities of doing odds jobs is roughly around RM 500.00 only. Therefore an alternative livelihood that uses environmental friendly practices will boost their motivation to safeguard UKB.

3.1.3 Other local communities

The local communities are within the upstream of Upper Kinta Basin is the community at Tanjung Rambutan. Approximately 9 hectares of the areaare used for the commercial purposes at the UKB.

The main issues within the Tanjung Rambutan vicinity are the sullage water from the wet market at Tanjung Rambutan town flow into the river (**Figure 3.1**). Even though there are waste treatment plant within the wet market area, currently the plant is not functioning. Therefore, the sullage water is directly flow into the river without any treatment.

Figure 3.1 Sullage and solid waste from Tanjung Rambutan Wet Market

Solid waste dumping at open places and adjacent to river was observed around Tanjung Rambutan area (**Figure 3.2**). This action leads to abundance of rubbish end up into the river and reduce aesthetic value of river.

Figure 3.2 Solid waste dumped at Jalan Bunga Raya, Taman Chong Kwee, Tanjung Rambutan

3.1.4 Private Sector Stakeholders

At UKB, highland farming is also being carried out. Agroto Business (M) Sdn Bhd is carrying out farming in the upper catchment. Besides these, there are other farming businesses also observed which may be expanded in near future. Agroto Business (M) Sdn Bhd are among the private stakeholders that plays key role in preserving the UKB especially ensuring clean raw water for Sultan Azlan Shah Dam. There are other key private sectors within UKB; Lafarge Cement Quarry in Chemor and Sunway City. Lafarge Industries is also is a key private stakeholder that can be roped in for conservation of UKB. Sunway Property through Sunway City Ipoh (SCI) is capable to bring economic boom to Ipoh and Perak. Hence, their location within UKB is also making them as key private player to conserve UKB.

3.1.5 Academic Research Community and Civil Society

Besides communities and private stakeholders, there are research communities mainly universities, think tank also located within UKB. Table 3.3 shows the list of universities and colleges within UKB. Besides universities, Institute Darul Ridzuan (IDR), state think tank also located within UKB. There are other civil societies such as Persatuan Aktivitis Sahabat Alam (KUASA) and Koperasi Alam Hijau Perak Berhad (KOHIJAU), who working for environmental preservation also located within UKB.

Table 3.3 Universities and colleges within UKB

No.	University/College
1	Taj International College
2	Maxwell College
3	Open University Malaysia
4	Universiti Kuala Lumpur Royal College of Medicine Perak (UniKL RCMP)
5	Kolej Teknologi Perak
6	Wawasan Open University, Perak
7	Olympia College, Ipoh
8	QUEST International University Perak
9	PIA College

3.2 Forestry and Forest Management Issues

The source of Kinta River originates from Mount Korbu. Mount Korbu, which is the highest mountain within the Titiwangsa range, is managed by the Perak Forestry Department. Mount Korbu is vegetated with upper montane forests and dipterocarp forest that is also the water catchment forest for the Kinta River. A 19,445ha of Bukit Kinta is gazetted as Water Catchment Forest with the remaining 3951ha is still in the process to be gazetted (RPH Perak, 2016-2020). Beside that 132.49 hectares (Compartment 161) within Bukit Kinta Forest Reserve is listed as Virgin Forest Reserve (VFR). VFR is the forest reserve that cannot be disturbed and filled with plants especially forest that that have unique elements that reserved for research. The main aim of Virgin Forest Reserve classification is to represent the types of forest in Peninsular Malaysia, especially those that have unique elements for scientific purpose, so that it can be preserved and managed sustainably. Compartment 161 within Bukit Kinta Forest Reserve is classified as Virgin Forest Reserve on 1962 and known for hill dipterocarp –Montane Oak. Unfortunately, Bukit Kinta Forest Reserve is not one among the 8 areas in Perak identified for High Conservation Value Forest Reserve (HCVF) (RPH Perak, 2016-2020).

3.2.1 Recreational Activity Management

The Ulu Kinta Wildlife Forest (Taman Eko Rimba Ulu Kinta) which is 9.22 ha being used for recreational and research activities. It is located 12 km from Ipoh City via Ipoh Road - Tanjung Rambutan within the Bukit Kinta Forest Reserve. However, the recreational area is being rundown and lately has not been fully utilised. It is proposed for a Nature Tourism Planning Using River Based Resources and Recreational Assessment to be developed to look into reviving the existing recreational forest area.

3.2.2 Orang Asli land and resource use rights

The rights of the Orang Asli over their traditional lands are minimally protected by the Aboriginal Peoples Act, 1954. This Act provides for the establishment of Orang Asli areas and reserves. **Figure 3.3** is a flowchart on the articles available to protect the Orang Asli's right.

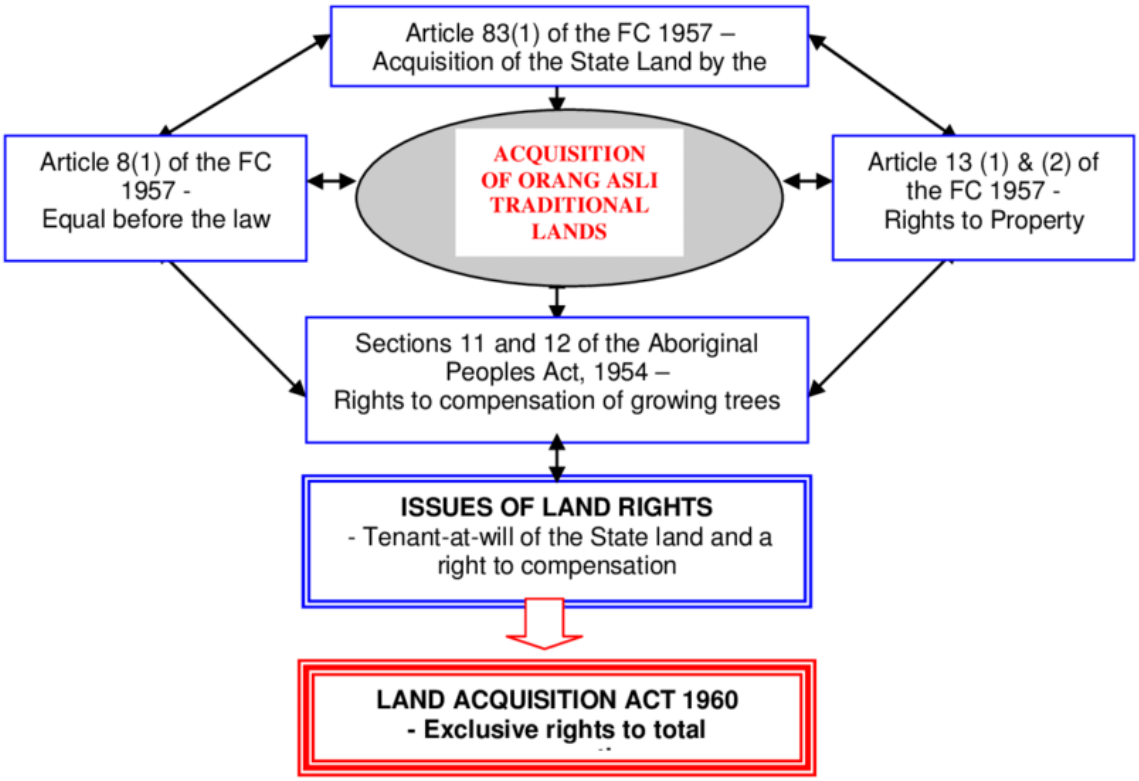


Figure 3.3 Acquisitions of orang Asli land and the resource use right [2]

[2] Alias, Anuar & Kamaruzzaman, Syahrul Nizam & Daud, Md. (2010). Traditional lands acquisition and compensation: The perceptions of the affected Aborigin in Malaysia. International journal of physical sciences.

Section 11 – 'Compensation on alienation of State land upon which fruit or rubber trees are growing: (1) …then such compensation shall be paid to that aboriginal community as shall appear to the State Authority to be just; (2) any compensation payable under subsection (1) may be paid in accordance with section 12'; and

Section 12 – 'Compensation: …..any aboriginal area or aboriginal reserve granted to any aborigines or aboriginal community is revoked wholly or in part, the State Authority may grant compensation therefore and may pay such compensation to the persons entitled…..'. Any compensation pursuant to Sections 11 and 12 of the Aboriginal Peoples Act, 1954 is at the discretion of the authorities. There is no fixed guideline. The compensation payable to the Orang Asli pursuant to Sections 11 and 12 is only for the loss of growing trees and buildings.

Some of theissues faced by the Orang Aslin on the land and resource use rights, which need to be addressed. This includes:

(i) The lack of protection under the law of Orang Asli land rights and interests,
(ii) Compensation as required by the existing laws only provides for payment for growing trees and affected buildings; there is no compensation for the loss of traditional lands,
(iii) The amount of compensation is at the discretion of the authorities, which results in disparities among the state governments.
(iv) Compensation based on common law (court cases) is beyond the existing laws and regulations that are being implemented (Sagong Tasi, 2002; Adong Kuwau, 1997)

Awareness and skill need to be emphasized among the Orang Asli communities to protect themselves from the manipulators and in safeguarding their rights. Most of them are not aware the extent of the impact of their action to the nature and being brainwashed by the compensation given to handover their land and rights in the name of development and immediate monetary source.

3.3 Water and Catchment Management Issues

Sultan Azlan Shah Dam was built in 2007 with the aim of increasing the water supply in Kinta Valley to 639 million litres per day in order to meet the water demand until 2020. It is the main water source within Kinta Valley with catchment area of 146 km2 with storage capacity of 29,550 ML. The raw water from the upstream of Ulu Kinta River were then, treated in the Ulu Kinta Water Treatment Plant. The water supply production from the Ulu Kinta Water Treatment Plant is monitored by Ministry of Health with samples analysed by Chemistry Department and overseen by the National Water Services Commission (SPAN), as the industry regulator. The Ulu Kinta water treatment plant started its operations with the capacity of producing 91,000 m^3/day of treated water and upgraded to 136,000 cubic m^3/day by Metropolitan Utilities Corporation Sdn Bhd (MUC). **Figure 3.4** illustrates the location of the Sultan Azlan Shah Dam, Ulu Kinta Water Treatment Plant, Sg Kinta Water Treatment Plant and the stilling Pond.

Figure 3.4 Location of the Dam and the WTP

3.3.1 Status of the Catchment

Hutan Simpan Kekal Bukit Kinta covers an area of 67,459.47 ha and gazette as permanent forest reserve. The Kinta River that flows from Gunung Korbu is 110 km long with the catchment area of 2,540 km^2. The Kinta River is the main water source of the municipal water pipeline to the urban and peri-urban areas. Lembaga Air Perak (LAP) operates the Sultan Azlan Shah dam and the two water treatment facilities; the Sungai Kinta Water Treatment Plant (WTP) and Ulu Kinta WTP. These two WTPs are the only dam regulated in

the Kinta district. The Sungai Kinta WTP is the second largest WTP in the district with a design capacity of 227 millions litres per day (MLD) whereas and Ulu Kinta WTP is designed with capacity of 136 MLD. Sultan Azlan Shah Dam is the first in the country that adopted the roller compacted concrete construction technique and was the last phase of the Greater Ipoh Water Supply II Scheme under LAP. The dam can produce 639 million litres of water per day and was constructed in order to raise the water supply of Perak by 25% from 136 million litres daily (MLD) to 639 MLD to cater for 350,000 consumers by 2020. The Kinta water supply is within the LAP Centre Zone with the coverage area of 1,933 km^2 for 276,000; 40,435 and 32,984 domestic customers respectively within Ipoh, Kampar and Batu Gajah. **Table 3.4** shows the annual data on the catchment of Sultan Azlan Shah Dam and the treatment plants, was extracted from the LAP annual report. The data covers for overall Perak Water Supply. The findings from the data available until 2017 indicted that the production as well as consumption of the raw water increases when the demand increases (growth in the population). However problem will arise when the clean water supply deteriorated due to the impact of pollution.

Table 3.4 Annual Data on the Perak Water Supply and its Catchment

Data	**2013**	**2014**	**2017**
Area of Perak State	21,005 KM^2	21,005 KM^2	21,022 KM^2
Population	2,440,869	2,459,900	2,496,400
i. Number of Registered Customers	714,751	731,798	773,349
ii. Domestic Customers	625,218	639,649	676,619
iii. Commercial Industries and others	89,533	92,149	96,730
Water Catchment Area	11,098 KM^2	11,098 KM^2	11,098
Number of Dams	2	2	2
Total Raw Water Abstracted From Present Intake	438,144,421 M^3/Year	451,435,454 M^3/Year	No data
Main Source of Raw Water	Perak River	Perak River	Perak River

Perak River	(40%)	(40%)	(40%)
Number of Treatment Plants	46	46	44
Designed Capacity of Treatment Plants	1,793	1,793	1,887
Number of Water Reservoirs	169	169	No data
Number of Water towers	198	198	No data
Daily Supply of Treated Water	1,200	1,252	1,314
Daily Water Consumption	835	875	908
Non-Revenue Water	30.4%	30.5%	30.9%
Length of Pipes	11,234 KM	11,325 KM	11,614 KM

3.3.2 Pollution - Potential Sources and Impacts

Upstream activities have a direct impact on river and deteriorating the quality of the raw water at the Sultan Azlan Shah Dam.

As mention earlier, the Sungai Kinta River basin system has six (6) main tributaries as Termin, Changor, Penoh, Sempak, Tamong and Liang River. However there are more than 12 secondary sub-tributaries and 13 tertiary sub-tributaries flowing from Mount Korbu and the Ulu Kinta Water Catchment Forest Reserve (**Figure 3.5**). The contributing factor for high sedimentation at the upper Kinta River is originates from one of these tributaries. As illustrated in **Figure 3.6,** all the identified tributaries are located deep inside the forest reserve area, further from other land use activities.

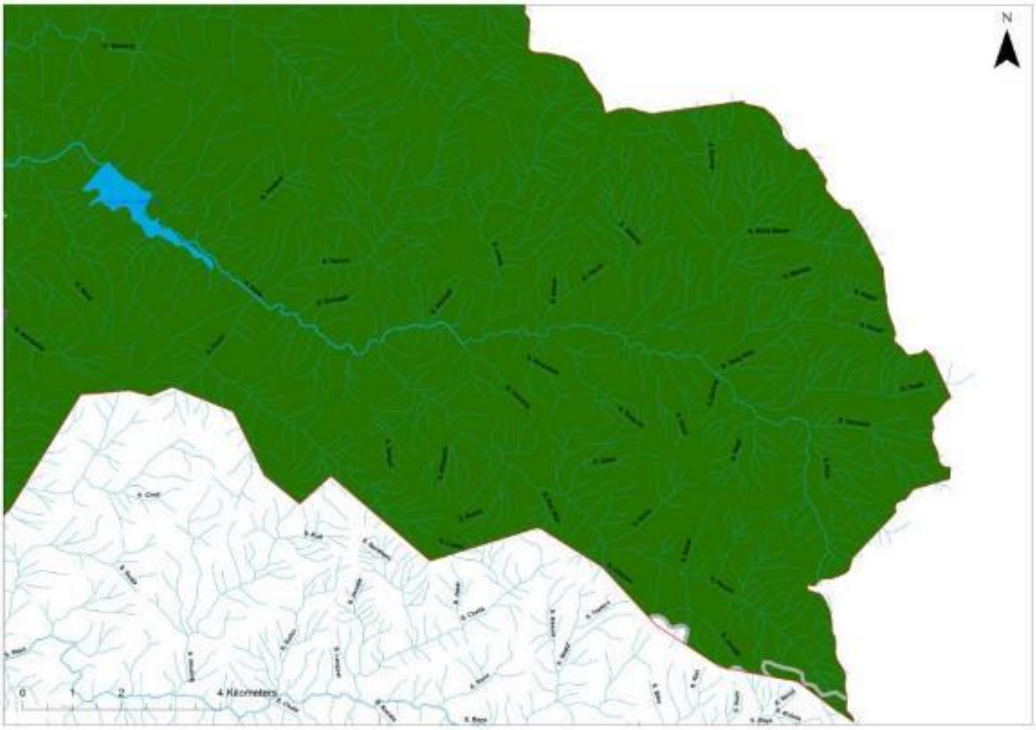


Figure 3.5 Tributaries located inside the green sketch inside the forest reserve area as informed by The Perak Forestry Department

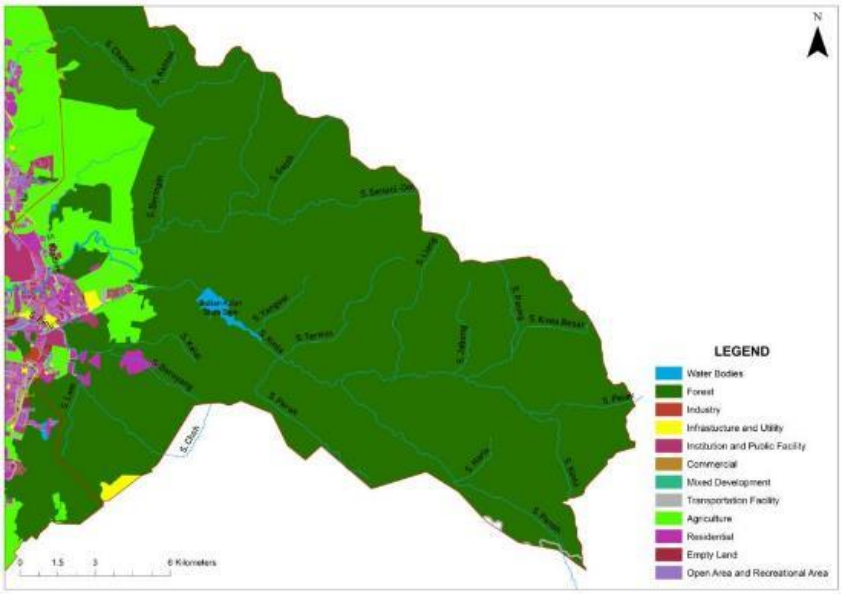


Figure 3.6 Kinta River main and sub-tributaries forming the water catchment of Upper Kinta Basin

As classified as forest reserve and water catchment forest area, no development, logging or any form of activities can take place within this area. Moreover the catchment of Kinta River

above the water intake weir is steep and mountainous. The ridge along the head of the catchment forms part of the watershed of the main range (Titiwangsa Range). From the satellite image, no large scale land use activities or landslide detected at or near the majority of the main or sub tributaries (**Figure 3.7**).

Figure 3.7 Satellite map of Upper Kinta Basin (year 2018)

However when the image was focused more towards the tributary closest to the Simpang Pulai-CH Route A181, erosion and some landslide issues can be noticed as shown below **(Figure 3.8).**

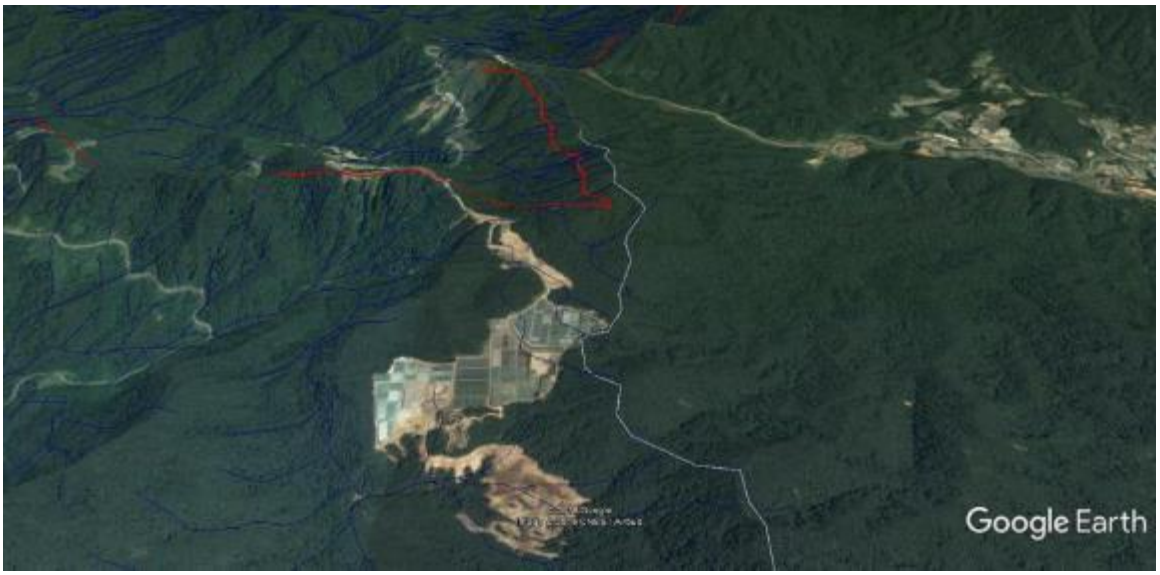


Figure 3.8 Satellite map indicating land clearance and landslides (year 2018)

A site visit was conducted along the Simpang Pulai-CH Route A181 on 9 October 2018 to locate the number of landslide occurred at the range as well as to identify the route to access the tributary that have caused the massive erosion. The image below **(Figure 3.9)** shows some of the land opening and landslides along the route.

Figure 3.9 Landslide and the clearance along the route through the UKB

The major landslide detected at Km 44-46 were identified and verified as the main cause of the high sedimentation of the alluvium at the Sultan Azlan Shah Dam. The contributing factor significant to the landslide is known as the northern earth flow, movement of the plates of the Gunung Pass. The area affected is the western hillside of the Gunung Pass ridge; where the eroded landslides were washed down to the Penoh River during heavy downpour. The deeply-incised Penoh River is located 600 m below into the valley densely forested and generally steeper than 30°, leading down from the Gunung Pass which has an elevation of 1587 m above the sea level. Satellite image**, Figure 3.10** shows the location of the landslide and the sub-tributaries flowing from the ridge going down to Penoh River whereas **Figure 3.11** shows the water catchment area, location of the highway and the Sultan Azlan Shah Dam on the google map.

Figure 3.10 Satellite image and drone photo of the landslide and the erosion ending up into the Penoh River feeding into the Kinta River (Sultan Azlan Shah Dam) as in November 2018

Figure 3.11 Water catchment area, location of the highway and the Sultan Azlan Shah Dam on the google map.

In terms of the UKB, one of the key issues is hill cutting and erosion, which can lead to sedimentation of the river channel and siltation of the water supply dam. The followings were found to be the key sources of siltation in the upstream area:

(1) Large amounts of sediment eroded from the Simpang Pulai - Cameron highway route especially at Km44-46 and carried to the dam via Penoh River.

The landslide at km 44-46 Simpang Pulai to Cameron Highland started in 2003 following hillside excavation at the terrain along the highway which starting 1997. According to the study conducted by Andres Malone Ltd in 2007, movement occurred at roadside when the slope was cut during the roadworks (**Figure 3.12**). The slope was cut back to a flatter angle but due to the persistent instability, more extensive slope flattening was undertaken in response until the works reached the ridgeline, 200 m to 260 m above the road. This lead to the gross movements, which occurred in the cut in September 2013 (**Figure 3.13**) with the formation of a main scarp and associated disruption and the displaced mass, has since moved continuously. This is later known as the Northern Earthflow where the main scarp of the failure extends to the north into unexcavated ground in the more weathered part of the slope where natural hillside valley existed and has now extended to road level.

Figure 3.12 Slope cutting along highway route (extracted from the Landslide Study at CH23+800 Simpang Pulai – Lojing Highway Malaysia Report submitted by Andres Malone Ltd (May 2007

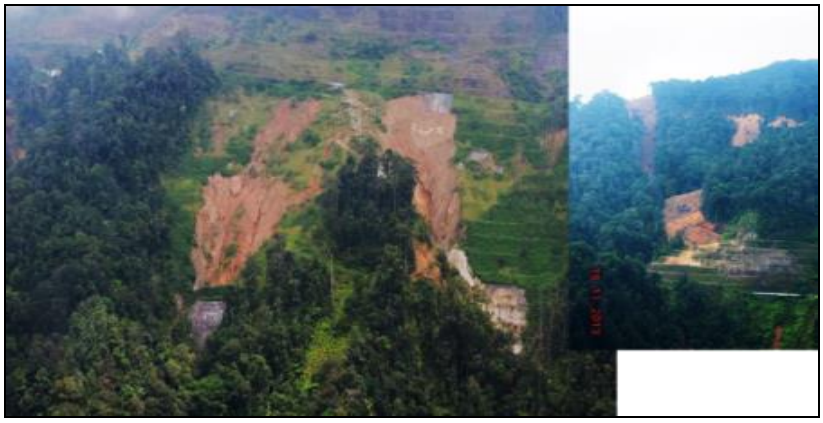


Figure 3.13 Erosion at slope as of 2013 (extracted from GEC - IDR Report - 2014)

The Malaysian Public Works Department (PWD) Kuala Lumpur has classified the landside at Section 44 (Km44) and Section 46 (Km46) of Simpang Pulai-Lojing Road (FT185) as a critical area.

Figure 3.14 Status of the landslide area along Simpang Pulai-Cameron Highland as of November 2018

Figure 3.14 shows the stretch of the Simpang Pulai – Cameron Highland CH44 landslide area as of November 2018. In order to mitigate the continuous impact of the landslide, the federal government allocated RM34 million to repair two slopes along the Simpang Pulai-Kampung Raja road leading to Cameron Highlands in 2015-2017. Two (2) companies were appointed to carry out the slope strengthening works at Km44 (JJM Integrated Sdn Bhd) and Km46 (Jati Estetika Sdn Bhd). The project at Km44 focused on a piled embankment to withstand erosion (**Figure 3.15**). Reinforced concrete landslide shed was built to enable any landslip to slide over the shed and fall beyond it. This would protect road users. The shed will also acts as a retaining wall[3].

Figure 3.15 Mitigation measures – piled embankment undertaken to reduce the impact of landslide

Although mitigation measures were undertaken to address the issue, continuous slope failure keeps on taking place as highlighted in **Figure 3.16**. This is caused by multiple geological factors and complex. The structure of the rocks along the slopes is unstable and weak because due to weathering, structure and geology. In addition to landslides along the Simpang Pulai – Cameron Highland stretch, two other incident happened this year (2018), i.e. mudflow as the retaining wall collapse due to continuous rain sent a river of mud flowing down the hillslope[4]

[3] https://www.malaymail.com/s/907623/rm34m-to-repair-cameron-highlands-slopes

[4] https://www.thestar.com.my/news/nation/2018/09/28/dept-simpang-pulaicamerons-road-safe/#GohoStBQDcyvsA5F.99flowing

and six orang asli houses were destroyed after earth fissures measuring 1.2m wide at Kampung Pawong, near Simpang Pulai[5].

Landslide in 2017 (31 January 2017[6])

Landslide in 2016 (16 July 2016[7])

Mud flood in 2018 (26 September 2018)

Figure 3.16 Examples of landslides during the last two years (2017 & 2018)

Because of the continuous erosion of the highway slope large amounts of sediment are washed downstream choking the bed of the Penoh River and being washed downstream to the dam (**Figure 3.17**).

[5] https://www.thestar.com.my/news/nation/2018/10/24/earth-fissures-damage-six-orang-asli-houses-near-simpang-pulai/#h7LGv3uwV8BoRi1W.99

[6] http://english.astroawani.com/malaysia-videos/laluan-simpang-pulai-cameron-highlands-selamat-digunakan-141363

http://english.astroawani.com/malaysia-videos/laluan-simpang-pulai-cameron-highland-selamat-digunakan-120257

[7] http://www.utusan.com.my/berita/nasional/jalan-simpang-pulai-cameron-highlands-selamat-digunakan-1.354061

Figure 3.17 The sediment in the bed of the Penoh River in November 2018 below the eroding highway slope

The images captured in April 2019 by LAP as in **Figure 3.18** does not show any improvement with the condition of the site where sedimentation were washed down to the dam as indicated in **Figure 3.19**.

Figure 3.18 Condition of the landslide at Simpang Pulai – Cameron Highland Highway in 2019

Figure 3.19 Sediment condition at the Sultan Azlan Shah Dam

(2) Highland Agriculture/Agro Tourism project in Ulu Kinta/Sg Raya catchment Perak

Land opening at the highland for agro-tourism also contributes to significant siltation and high sedimentation which ends up in the dam. During the early 2013 study, the development of agriculture (Agrotourism) (Collecting, Processing and Packaging Center by Agroto Business (M) Sdn Bhd Agroto) on Lot PT24507, and the road and vegetable farm on PT 245072 Mukim Ulu Kinta, PT23157 Mukim Sg Raya was causing a lot of issues and contributed to the sediment runoff to the dam as in **Figure 3.20**. Although during the November 2018 site visit, it was observed that the project area is has been largely revegetated; however a small landslide was observed. The drainage of storm water from the uphill to the downhill where the water flows through or absorbed by the ground was identified as the contributing factor and need to be addressed to avoid unforeseen landslides in future. **Figure 3.21** shows the 2018 condition of the site. The images indicates the mitigation undertaken and current landslide issues within the site (**Figure 3.22**)

Figure 3.20 Dumping of the soils along the slope and incomplete discharge point into the slope towards the water catchment area in 2013

Figure 3.21 The site in November 2018 after mitigation being undertaken

Figure 3.22 Two patches of slope erosion on either side of the Agroto Sdn Bhd store which shows the flow of the water from the drainage from the agro tourism site flowing contributing to slope erosion in the Kinta Catchment

During the 2019 site visit, land opening was observed and some activities were seen focusing on the agro farming and agro tourism at an upper portion of the site (at GPS coordinate 4.601013; 101.345473 – **Figure 3.23**). This land clearing is in the adjacent Raya River catchment which also is classified in the National Physical Plan as an Environmentally Sensitive Area (ESA) Class 1 as it is a proposed dam catchment and it needs to be totally protected. High sedimentation during this project period will end up into the catchment. In addition to land clearance, once the site is ready for agro farming and tourism, there are possible that issues related to pesticide and fungicide will pose direct threat to the water body. Runoff from both the Agroto Business (M) Sdn Bhd and the upcoming of agro farming and agro tourism at (GPS coordinate 4.601013; 101.345473) will end up into the Kinta River.

Figure 3.23 Current land clearance activities for agro tourism within adjacent Raya River catchment area (linked to access road on main Penoh/Kinta River catchment)

As mention earlier, one of the main concerns of the pollution source at upstream area relies mainly of the agro farming and tourism at the hilly slopes. The usage of fertilizers for the vegetables and plants in the farm will eventually end up into the catchment in form of runoff as no holding pond noticed there to stop the fertilizers from entering the water bodies

(3) Small scale land development

There are three (3) Orang Asli settlements; Kampong Pawong, Kampung Chiduk and Kampung Jantung Baru along the river stretch downhill from the landslide stretch (but in the adjacent catchment of Raya River) which will be affected significantly from the activities upstream (**Figure 3.24**). The settlements are located very near to the river as they community depend mainly on the river and the natural resources for their livelihood. Moreover, Orang Asli also has orchard and small land opening for agriculture for livelihood.

Figure 3.24 Kampong Pawong, Kampung Chiduk and Kampung Jantung Baru settlement and the land use within the settlement

The plantation and orchard belonging to the Orang Asli upstream of the Sultan Azlan Shah Dam were also highlighted as the possible contributing factor if no proper mitigation taken or monitor accordingly. **Figure 3.25** shows some of the Orang Asli's durian orchard and oil palm as well the rubber plantation at the upstream.

Figure 3.25 The plantation area within the Orang Asli settlement

(4) Other activities in the UKB

In addition, land clearing activities for development also identified to contributes to the pollution. Development near to Markas Comondo 69 at Jalan A182, Ulu Kinta was recorded to have silt discharged into the nearest stream (**Figure 3.26**). Besides land clearing activity, accumulation of solid waste also observed to be dumped at that area (**Figure 3.27**)

Figure 3.26 Land clearing activity near Markas Comando 69

Figure 3.27 Solid waste dumping at water bodies near to Markas Comando 69

Besides this, land clearing for agriculture at Choh River upstream and river bank erosion at Pinji River were also observed (**Figure 3.28 & Figure 3.29**) which possibly can impact the water body.

Figure 3.28 Land clearing activities for agriculture, Choh River

Figure 3.29 River bank erosion at Pinji River

The overall observation shows that UKB is mainly polluted by sedimentation from land clearing and development activities. Besides that, solid waste dumping into water bodies also detected.

3.3.3 Impacts of pollution on water supply

A review paper in 2018, 'Impact of land uses on water quality in Malaysia'[8] indicated that human activity have a significant influence on the acceleration or deceleration of pollution rate at the source. In addition, the review finding supports that higher percentages of land use associated with human activities and economic development in watersheds are often interrelated with high concentrations of water pollutants, while undeveloped areas such as natural forest areas are linked with good water quality. Moreover, the review from Razali, 2018[9] highlighted that according to Malaysia Islands and Highlands Development Guideline, any forestlands situated 1000 m above the sea level are classified as reserved forest or catchment forestland. Thus, any land clearing is prohibited, as it is an environmentally sensitive area (Tan and Mokhtar 2011). Moreover, high altitude results in higher rate of chemical loss from soil erosion into the river (Saadati et al. 2012) and cultivation on steep slopes areas triggered soil erosion (Lantican et al. 2003). In addition, agriculture practices done in fragile highlands area especially in steep slopes tend to cause an on and off farms pollution toward the environment (Barrow et al. 2009).

The secondary data obtained with the support of the baseline water quality result highlighted sedimentation as significant pollution influencing the water supply and key problem faced by Sultan Azlan Shah Dam. **Figure 3.30** highlights the turbidity reading recorded during the baseline study, to compare the level of turbidity before dam (UK1) and after dam (Sungai Kinta WTP, SK and Ulu Kinta WTP, UK).The finding indicates that high turbidity already been recorded even before the dam. Although all the readings within recommended raw water quality, it can be worsened during heavy rainfall if preventive measures not been adopted.

[8] Camara, M., Jamil, N.R. & Abdullah, A.F.B. Ecol Process (2019) 8: 10. https://doi.org/10.1186/s13717-019-0164-x

[9] Razali, A., Syed Ismail, S.N., Awang, S. et al. Land use change in highland area and its impact on river water quality: a review of case studies in Malaysia. Ecol Process 7, 19 (2018) doi:10.1186/s13717-018-0126-8

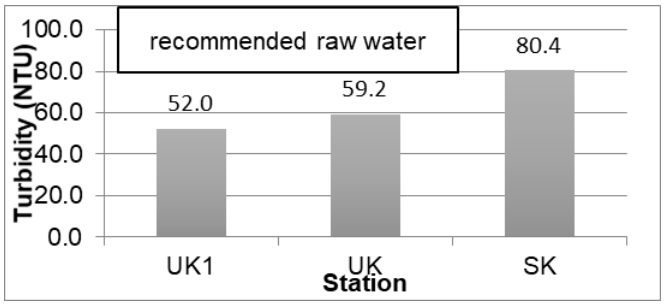


Figure 3.30 Turbidity level before and after dam

LAP together with Ministry of Health with the support of the Chemistry Department conduct chemical, microbiological and heavy metal test **(Table 3.5)** to monitor the river water quality. LAP data (**Table 3.6)** shows that the treated water supplied to the customers were within limit designed under the Quality Assurance Programme (QAP) for 2018.

Table 3.5 Parameters monitored by LAP for the Treated Water from the WTP

Chemical Parameter (Group 1)		Chemical Parameter (Group 2)	
No	Parameter	No	Parameter
1	Turbidity	1	Total Dissolved Solids
2	Color	2	Alkalinity
3	pH	3	Hardness
4	Chlorine	4	Conductivity
Micro bacteria		5	Chloride
No	Parameter	6	Ammonia
1	Fecal Coliform (E.Coli)	7	Nitrate
2	Total Coliform	8	Iron
Heavy Metal (Group 3)		9	Fluoride
No	Parameter	10	Aluminium
1	Lead	11	Manganese
2	Copper		
3	Zinc		
4	Uranium		
5	Mercury		

Table 3.6 Summary of the Water Quality Compliance as per QAP until November 2018

Water Quality Compliance as per QAP till November 2018														
E.Coli & Chlorine Residue (QAP < 0.05)			E.Coli (QAP < 0.15)			Turbidity (QAP < 2.00)			Chlorine Residue (QAP < 1.85)			Aluminium (QAP < 10.20)		
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
8884	0	0.00%	8908	0	0.00%	8981	12	0.13%	8968	0	0.00%	1614	95	5.89%

A = No of Samples
B = Non Compliance
C = % of non-Compliance

The data of 2018 results indicates that the breaching of the standard is on the turbidity was recorded at 0.13% whereas for aluminium at 6%. Higher aluminium content in finished/treated water can be due the use of aluminium salts as coagulants in water treatment. This was referred from the background Document form WHO Guidelines for drinking water Quality. In addition, Aluminium is released into the environment mainly by natural processes. Factors influence Aluminium mobility and subsequent transport within the environment includes chemical speciation, hydrological flow paths, soil–water interactions, and the composition of the underlying geological materials.

3.3.4 Impacts of pollution on biodiversity

Bukit Kinta Forest Reserve lies in central east Perak state, between Banjaran Bintang to the west and Banjaran Titiwangsa to the east. Its topography is hilly and mountainous. Limestone hills rise from its lower western flank and its highest peaks include Gunung Korbu (2,138 m above sea level), the second highest mountain in the peninsula. Bukit Kinta's natural vegetation include lowland and hill dipterocarp forest with typical Shorea and Dipterocarps tree species. Montane oak/laurel and ericaceous (mossy) forests were found on the upper slopes and higher peaks. Bukit Kinta Forest Reserve is the basin of many important rivers in

Perak, including Sungai Kinta, Sungai Kampar and Sungai Raia. Bukit Kinta Forest Reserve has several sites where the rare parasitic plants belonging to the family Rafflesiaceae were found, including *Rafflesia cantleyi* and *Rhizanthes lowii*. Many endemic plants grow on the limestone hills in the area.

The limestone hills harbour many endemic mollusks.

i. **Globally threatened mammals (IUCN, 2002):**

Endangered: Tiger *Panthera tigris, Malayan Tapir Tapirus indicus; VULNERABLE: Gaur Bos gaurus, Clouded Leopard Neofelis nebulosa, Serow Capricornis sumatraensis, Pig-tailed Macaque Macaca nemestrina;*

Near threatened*: Siamang Symphalangus syndactylus, White-handed Gibbon Hylobates lar, Long-tailed Macaque M. fascicularis, Banded Leaf-Monkey Presbytis melalophos*

ii. **Globally threatened plants (IUCN, 2002):**

Lower risk/conservation dependent: *Ilex grandiflora*[10]

Some of the possible threats to the key biodiversity at Bukit Kinta includes infrastructure development, highland highway, tourism development, poaching and collecting, noise, air and light pollution, soil erosion, presence of alien exotic species, conversion to oil palm and rubber, horticulture, agriculture, pesticide/chemical pollution, logging, rising temperature, as well as sedimentation . Disturbed forest cover is prone to be washed off especially during heavy rainfall, causing mud flood, turning the river turbid and silted. This not only polluted the rivers and threatened the water supply but also have significant impact on the wildlife.

Encroachment of forest for road construction and highland agriculture has exposed the land and leads toward landslides and erosion. Splash erosion and surface erosion washes off sediments into the rivers, causing water pollution and shallowing of riverbeds. Uncontrolled logging destroys the water catchment area and affects the water temperature. Destructions of the forest cover/trees eliminated the thermal cover rising the water temperature and pH level

[10] BirdLife International (2019) Important Bird Areas factsheet: Central Titiwangsa Range. Downloaded from http://www.birdlife.org on 06/11/2019.

that will have significant impact of the food web. This will disrupt the aquatic ecosystem especially the microbenthic invertebrates, and the primary food supply for the fishes, reducing the survival rate of the fishes.

3.3.5 Sedimentation and Siltation

The two main issues faced by the LAP at Sultan Azlan Shah Dam, Ulu Kinta Water Treatment Plant and Sg Kinta Water Treatment Plants are due the sedimentation and limited water stored during the dry season. The observed sedimentation; alluvium is made up of a variety of materials, including fine particles of silt and clay and larger particles of sand and gravel. This area is an active erosion environment because of the erodible material in the stream and check dams[11]. Check dams are commonly used to stabilize sedimentation, reduce the water velocity, limit catchment erosion impact, and increase the reservoir storage capacity of a dam.

The additional process of pre-sedimentation via excavation of the sedimentation carried out to keep water storage in the dam at the recommended level. Three (3) check dams were constructed (**Figure 3.31**) before the Sultan Azlan Shah Dam by the LAP to control sedimentation as marked in **Figure 3.32** to excavate the silt ending up into the treatment facilities.

[11] LAP, 2014

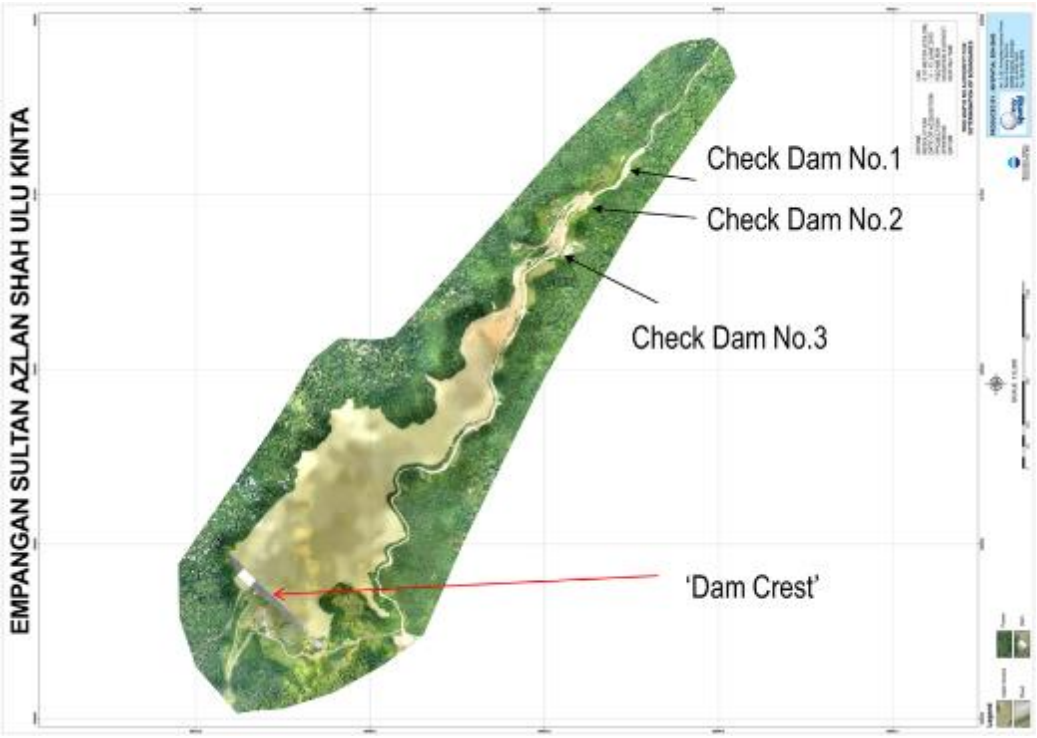


Figure 3.31 Check Dam within the Sultan Azlan Shah Dam[12]

Figure 3.32 Google map of the dam which indicates the location of the check Dam

[12] Pembentangan LAP pada 14 April 2019 - Bekalan Air Minuman Bagi Ipoh Serta Cabarannya

Excavation of the silt carried out by the contractor assigned by LAP (**Figure 3.33)**. For this, LAP had spent close to RM24mil for the last 10 years (2007-2017) as indicated in Excavation of the silt by LAP were carried out according to the need (**Table 3.7**) , if more sediments were observed and in rainy weather, the amount of silt accumulated are more compared to dry weather, excavation will be carried out. **Figure 3.34** shows the amount of sediment excavated annually from the check dams from 2007 to 2018 as provided by LAP.

Table 3.7 Accumulated amount of Silt excavated from the dam and the cost spent by LAP (2007-2017)

No	Year	Total Amount excavated(m^3)	Jumlah Pembayaran (RM)
1	2007	93,268	602,000.00
2	2008	149,476	1,968,000.00
3	2009	117,604	1,668,000.00
4	2010	96,290	1,175,718.00
5	2011	78,272	1,718,000.00
6	2012	181,335	2,213,360.00
7	2013	227,312	2,988,000.00
8	2014	120,715	1,880,000.00
9.	2015	227,513	2,500,163.00
10.	2016	203,394	2,811,056.00
11.	2017	351,767	4,318,023.00
	Total	**1,846,946 m3**	**RM23,842,320.00**

Figure 3.33 Images captured inside the Sultan Azlan Shah Dam, where the excavation is carried out

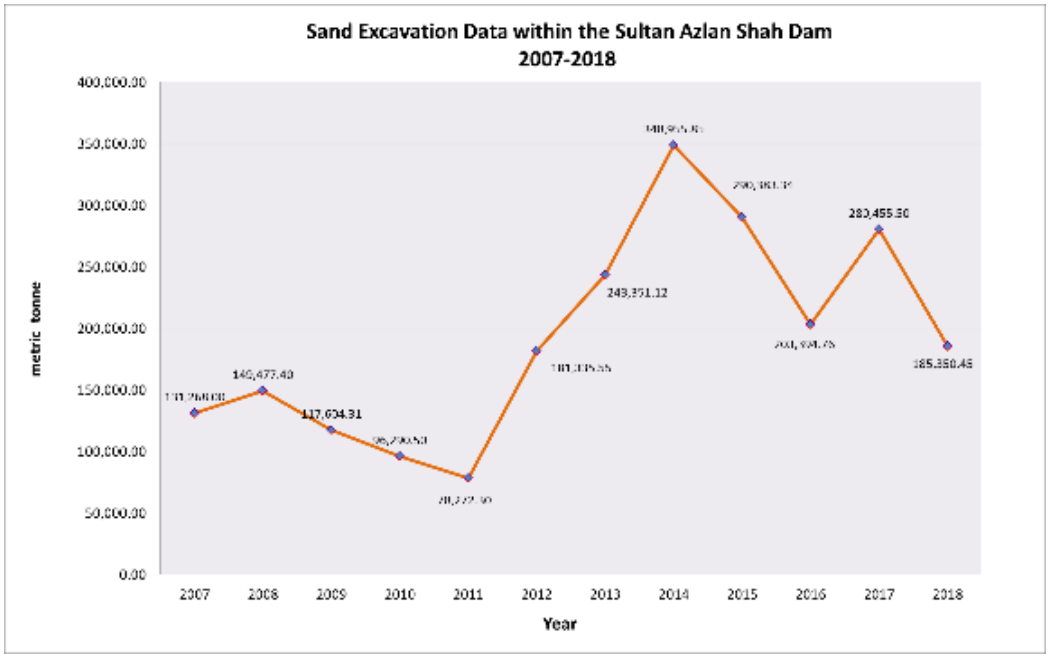


Figure 3.34 Amount of sediment excavated annually from check dams (source: LAP)

It is also noted that the water is turbid with high content of total suspended solid at the excavation site and towards the downstream of the catchment area due to the followings:

(1) Water naturally erodes sediment from the bed and banks of rivers (source) and transports it downstream through the catchment, depositing it in areas of 'lower energy' e.g. where the flow is slower and areas of land are flatter
(2) Most of the silt and sediments settles beneath the river surface when the water movement were still or less current and when excavation is carried out the disturbed site triggers the silts to be washed down

The actual process of sediment deposition is unique to every reservoir and is impossible to predict accurately. In general, the coarser, heavier sediments, the gravel and sand, tend to settle out at the upper end of reservoir, forming a "backwater" delta, which gradually advances toward the dam. The lighter sediments, the silt and clay, tend to be deposited nearer the dam. Study of the effectiveness of the check dam indicates that 72% of sand and gravel; aggregate were accumulated at the Check Dam with the remaining 28% ending up into the dam. LAP built a pre-sediment tank at the water treatment plant (**Figure 3.35**) at the cost of RM28 million to reduce the impact on the sedimentation in shortening the lifespan of the dam.

Figure 3.35 Pre-Sediment Tank of Sultan Azlan Shah Dam

3.3.6 Economics of Water Supply

A. Non-Revenue Water (NRW)

NRW is water that has been produced and is "lost" before it reaches the customer. Reasons for losses include leaks, theft or meter inaccuracies. High levels of NRW are detrimental to the financial viability of water operators because NRW is equivalent to revenue loss. The present level of NRW in the state is 30% (overall). The data shared by LAP (**Table 3.8**) shows that for there was fluctuation on the NRW from 2005 to 2018 with the lowest (30%) were recorded in 2018. The state is yet to achieve the target of 25% as of 2018. However, detailed data for the Sultan Azlan Shah Dam and its WTP is not available to further the discussion on the economics of water supply section. Overall, LAP managed to provide treated water to the contumers. So far there are no water severe supply shortage (**Table 3.9**)

Table 3.8 Tabulated data on the Production, Usage and the NRW for Perak 2005 -2018

Year	Production (m³/tahun)	Usage (m³/tahun)	NRW ((m³/tahun)	Percentage of NRW (%)
2005	348,654,709	241,785,734	106,868,975	30.7%
2006	334,807,366	234,324,518	100,482,848	30.2%
2007	355,393,294	248,871,207	106,522,087	30.0%
2008	369,166,978	255,258,885	113,908,093	30.9%
2009	379,179,399	263,472,446	115,706,953	30.5%
2010	394,543,250	278,375,794	116,167,456	29.4%
2011	404,755,724	281,832,860	122,922,864	30.4%
2012	422,726,669	295,381,928	127,344,741	30.1%
2013	438,144,421	304,892,625	133,251,796	30.4%
2014	450,618,102	313,257,378	137,360,724	30.5%
2015	459,806,182	320,642,827	139,163,355	30.3%
2016	483,502,817	336,186,700	147,316,117	30.5%
2017	482,737,696	333,592,035	149,145,661	30.9%
2018	486,526,020	340,367,975	146,158,045	30.0%

Table 3.9 Water Supply and Consumption of Treated Water

	2016 (m^3/year)		**2017 (m^3/year)**	
District	Supply of Treated Water	Consumption of Treated Water	Supply of Treated Water	Consumption of Treated Water
Batang Padang	38,122,242	25,440,080	39,579,323	25,370,931
Hilir Perak	37,329,245	24,089,426	37,813,221	24,228,198
Total for "Wilayah Selatan"	75,451,487	49,529,506	77,392,544	49,599,129
Kinta	177,261,421	132,940,176	173,820,700	130,376,311
Jumlah Wilayah Tengah I	177,261,421	132,940,176	173,820,700	130,376,311

B. Water supply for Future

Sultan Azlan Shah Dam built in 2007 with the aim of increasing the water supply in Kinta Valley to 639 million litres per day in order to meet the water demand until 2020. Perak will not face water shortage issues anytime soon as the supply from the Sg Perak is sufficient

C. Potential Impacts of Climate Crisis on Water Supply

NAHRIM projected that the climate remains slightly drier in Peninsular Malaysia except during the pre-monsoon months of September to October towards the end of 21st century when the projected increment of mean precipitation exceeds ~15% especially over the western coastal and southern region of Malaysia. **Figure 3.36** shows the predicted changes in the climate for Malaysia.

Seven (7) vulnerable sectors (and sub-committees) were identified to be effected due to climate crisis:

- Agriculture (Malaysia Agriculture Research & Development Institute)
- Forestry (Forestry Department of Peninsular Malaysia)
- Biodiversity (Forest Research Institute of Malaysia)
- Water resources (NAHRIM)
- Coastal and marine resources (Department of Irrigation & Drainage)
- Public health (Institute of Medical Research)
- Energy (Centre for Green Energy)

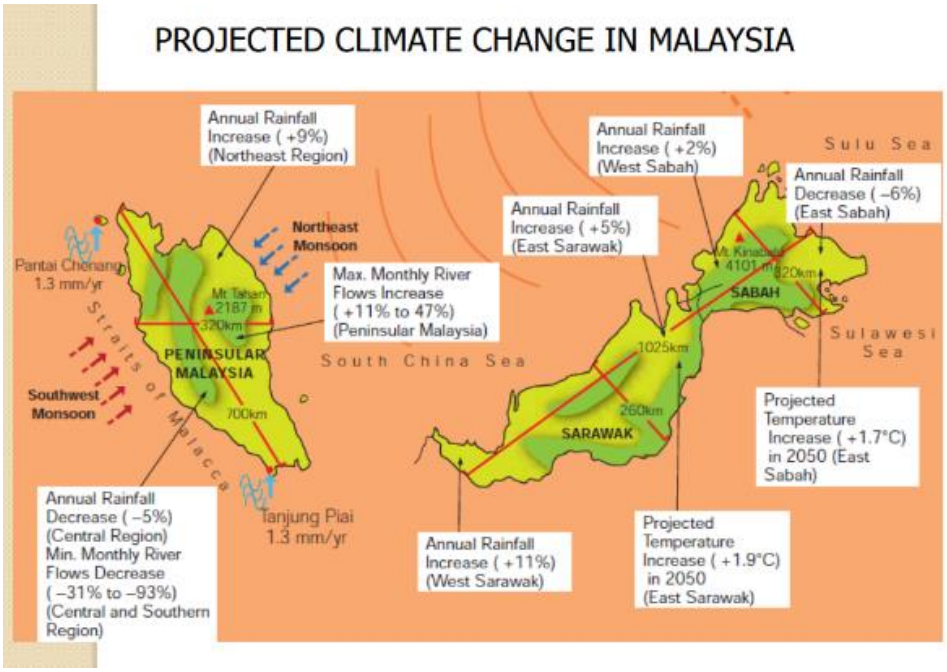


Figure 3.36 Projected Climate Change in Malaysia

D. Community Development Needs for Orang Asli Communities

Currently the Orang Asli community sometime facing potable water supply problems both in quantity as well the quality. Below are some of the issues faced by them (**Table 3.10**):

Table 3.10 Issues at Orang Asli Community's Village

Village	Houses (unit)	Population	Water source	Issues
Kampung Sungai Choh (Batin Adi a/l Usop)	35	177	Sungai Pinji	Mini dam wall and based structure damage. Water quality (sedimentation), quantity and low pressure .
Kampung Sungai Suluh (Batin Pandak Salim Bin Pandak)	➢ 24	169	Sungai Senoi-oi	Water quality & quantity within their mini dam Piping system from mini dam to houses issue (leaking and low pressure) No water storage tank.
Kampung Kulim dan Kampung Bakuk (Kampung Makmur) Encik Derama a/l Itam	28 (14:14)	188 (79:109)	Sungai Senoi-oi	Sharing the water tank with Kg Bakuk. Limited volume storage both the tank and mini dam. Sedimentation Leakages
Kampung Jambu (pecahan Kampung Makmur)	18 Encik Derama a/l Itam	132	Sungai Senoi-oi	
Kampung Dollah (pecahan Kampung Makmur) (Encik Ajid Bin Ramlee)	28	198	Sungai Senoi-oi	Fiber water tank leakage and damage Paip leakage.
Kampung Chadak (Encik Anjang Bin Alang)	50	453	Sungai Senoi-oi	No water tank Water quality esp raining seasons Water quantity during dry seasons..

Figure 3.37 Development at Orang Asli Settlements

3.4 Existing plans and strategies

UKBMaS also takes account on existing plans developed by both Federal or State government. Structural and conservation plans related to UKB reviewed which strategies drawn in UKBMaS in line with those plans and aimed to close the gaps based on previous plans.

3.4.1 Overall plan

There are two key plans which are structural plans reviewed here. They are Ipoh Local Plan 2020 and Perak State Structural Planning 2040.

a) Ipoh Local Plan 2020 (Rancangan Tempatan Ipoh 2020)

The Ipoh Local Plan 2020 divided the areas under its administration into eight planning blocks (PB) for more accurate and systematic development planning and control of land use. A part of PB 3, PB 4, PB 5 and whole PB 8 of Ipoh Local Plan 2020 involved in UKB management strategies. Three thrust of the Ipoh Local Plan 2020 involved in development of UKB Management Strategies. The thrusts are as follows:

1. **Thrust 1: Township and Sustainable Resources (Perbandaran dan Sumberjaya Mampan)**

Sustainable land use development approaches are important to guide and control future land use development patterns to withstand development pressures and to ensure the protection and conservation of the environment. Overall, eight development strategies designed based on Thrust 1. For UKB Management Strategies, strategy 2, 5, and 6 are applicable and stated below:

i. Optimize usage of land and streamline the land use structure (Mengoptimumkan penggunaan tanah dan memperkemaskan struktur guna tanah)

This developmental strategy will reduce the pressure on greenfield areas for new land use and encourage infill development in the abandoned and worn out downtown areas. Through this strategy more economical land use and infill development will be focused at Pekan Chemor (PB 5), Tanjung Rambutan (PB 4), and Tambun (PB 3).

ii. Management of Environmental quality based on the concepts of integrated 'pollution prevention' and 'environmental planning' *(Pengurusan kualiti alam sekitar berdasarkan konsep 'pencegahan pencemaran' dan 'perancangan alam sekitar' bersepadu)*

Two out of three actions planned under this developmental strategy applicable to UKB management strategies.

- ✓ Water quality management to improve the quality of the Kinta river, Pari river and Pinji river.
- ✓ Bukit Kinta Forest Reserve and Saiong Kledang Forest Reserve must be maintained to function as a green lung as a part of air quality management.
- ✓

iii. Management of Environmental Sensitive Areas (KSAS) and implementation of development controls to conserve natural resources and protect against disaster risk (Pengurusan Kawasan Sensitif Alam Sekitar (KSAS)) dan pelaksanaan kawalan pembangunan untuk memelihara sumber semulajadi dan melindungi dari risiko bencana)

UKB management strategies can be in line with three out of four conservation actions planned under this developmental strategy.

- ✓ Proposing existing forest areas such as Bukit Kinta Forest Reserve and Kledang Saiong Forest Reserve for conservation as a Level II Environmental Sensitive Areas where no agricultural and land development activities allowed, but only small scale well monitored logging activities.
- ✓ Preservation and conservation of highlands and steep slopes to reduce disaster risk, mostly within Bukit Kinta Forest Reserve. Permission will be given only to low impact activities such as ecotourism, research and education. Activities such as agriculture and development are not permitted.
- ✓ Preservation of the Kinta dam and conservation of the water catchment area KSAS water bodies within the area are Kinta dam and Water acquisition point catchment areas (Sungai Kinta, Sungai Senoi, Sungai Tapah dan Sungai Kinding). Permission will be given only to low impact activities such as ecotourism, research and education. Activities such as agriculture, development and logging are not permitted. Ex-mining ponds only will be developed after considering the development strategies, infrastructure and utility sectors and flood mitigation purposes.

2. Thrust 2: Integrated Economic Development *(Pembangunan Ekonomi Bersepadu)*

Economic expansion and diversification especially in the industrial, tourism and services sectors able to ensure sustainable and balanced economic growth. Four out of eight strategies (strategy 4, 5, 7 and 8) formed based on Thrust 2 applicable to UKB Management Strategies.

i. **Developing high quality, viable and competitive tourism destinations and tourism products to diversify economic resources** *(Membangunkan destinasi pelancongan dan produk pelancongan yang berkualiti, berdaya maju dan berdaya saing bagi mempelbagaikan sumber ekonomi)*

Existing tourism resources including reserve forest areas, traditional village settlements, indigenous settlements, heritage areas and limestone hills. With these resources, the area has the potential to be developed as a tourism product to attract more tourists to Ipoh city.

- ✓ Proposal for ecotourism development at Bukit Kinta Forest Reserve and limestone hills.
- ✓ Proposal for homestay tourism development at Kampung Chadak (Orang Asli settlements) nearby Bukit Kinta Forest Reserve
- ✓ Development of tourism products at Kinta River riverbank areas stretched for 28 Km from Tanjung Rambutan to Pengkalan. Proposal for committed development known as Kinta Riverfront turns Ipoh as a garden city

ii. **Preservation of Class II agricultural and agricultural land outside the development area (Pengekalan kawasan agropelancongan dan kawasan tanah pertanian Kelas II yang berada di luar kawasan pembangunan)**

Existing agricultural area planting limau tambun around Ampang and Tambun area proposed to be maintained. Existing agricultural areas around Kledang Saiong Forest Reserve and Bukit Kinta Forest Reserve proposed to be maintained due to their role as buffer zone to conserve the existing forest reserve.

iii. Maintaining rural areas and upgrading infrastructure to create a more quality and resilient living environment (Pengekalan kawasan petempatan desa dan menaik

taraf kemudahan infrastruktur bagi mewujudkan persekitaran hidup yang lebih berkualiti dan berdaya tinggi)

iv. Enhancing the economy of the villagers through involvement in the tourism and rural Industry sectors (Meningkatkan ekonomi penduduk desa melalui penglibatan dalam sektor pelancongan dan Industri desa)

- ✓ Increasing involvement of local communities in the development of tourism sector: ecotourism products
- ✓ Homestay program introduced at Kg. Ulu Chepor, Orang Asli settlements at Kg. Chadak dan Gugusan Manjoi.
- ✓ Proposal for improvement of productivity of village settlement area through clusters of rural industries

3. Thrust 4: Wellbeing of Community *(Komuniti Sejahtera)*

Wellbeing of a community starts with sustainable township. Sustainable township refer to a comfortable, healthy and safe living, residency and working environment. Nine development strategies formed based on Thrust 4 with Strategy 5, 7, 8, and 9 applicable for UKB management strategies. The strategies are as follows:

i. Recreational and landscape development for people from all walks of life *(Pembangunan rekreasi dan landskap untuk semua lapisan masyarakat)*

Proposal for recreation and landscape for Kinta river : involves three rivers (Sungai Kinta, Sungai Pari and Sungai Pinji)

ii. Implement a sustainable integrated water management program and maintenance of integrated drainage systems *(Melaksanakan program pengurusan air larian dan penyelenggaraan sistem perparitan bersepadu secara mampan)*

Involves catchment areas of Sungai Pari (289 km square) Sungai Kinta (179.3 km square) and Sungai Pinji (77.8 km square)

- ✓ Proposal for preparation of river and drain inventory
- ✓ Proposal for development of integrated urban drainage system
- ✓ Proposal for ecological treatment and cleaning of runway waters

iii. Manage sustainable solid waste disposal systems and sewerage systems to improve environmental quality *(Menguruskan sistem pembuangan sisa pepejal dan sistem pembentungan secara mampan ke arah meningkatkan kualiti alam sekitar)*

- ✓ Proposal for sewage system and sewage treatment facility
- ✓ Improves the Solid waste management system : opening new landfill base at Papan, Hulu Johan in Kinta district

iv. Increase the level of provision of comprehensive, efficient and high-tech utility facilities (Meningkatkan tahap penyediaan kemudahan utiliti yang mencukupi secara menyeluruh, efisien dan berteknologi tinggi)

- ✓ Proposal for development of water plant: Proposal for new water plant at Ulu Kinta with capacity of 227 million liter water per day
- ✓ Proposal for recycle rain water for non-potable usageg

b) Perak State Structural Planning 2040 *(Rancangan Struktur Negeri Perak 2040)*

Perak State Structural Planning (RSN) 2040 contains written statements describing the policies and state-level strategic proposals regarding development and use of land in urban and rural areas in Perak. **Table 3.11** and **Table 3.12** shows the details of this plan.

Table 3.11 Thrust in Perak RSN 2040

Thrust	Planning Policy (RSA)		Implementation strategies (SP)	
	Total	Applicable for UKB	Total	Applicable for UKB
Thrust 1: Maintaining Sustainable Environment and Well-Being Communities *(Pemeliharaan Persekitaran Mampan dan Komuniti Sejahtera)*	5	2	21	3
Thrust 2: Increase the added value and economic productivity based on local and natural resources *(Peningkatan Nilai Tambah dan Produtiviti Ekonomi Berasaskan Sumber Tempatan dan Semula Jadi)*	11	3	28	6
Thrust 3: Provision of high accessibility and efficient infrastructure *(Penyediaan Kemudahsampaian Tinggi dan Infrastruktur Efisien)*	4	1	15	3
Thrust 4: Honoring the Natural Treasures and the Perak State Heritage *(Memartabatkan Khazanah Semula Jadi dan Warisan Negeri Perak)*	4	4	6	6

Table 3.12 Planning policy in Perak RSN 2040

RSA	SP
RSA 2: Planning a balanced land use development between economic development and environmental well-being *(Merancang pembangunan guna tanah seimbang antara pembangunan ekonomi dan kesejahteraan alam sekitar)*	• SP 2.2: Developing land use and municipal activities using the concept of smart growth • SP 2.3: Integrated Plan development and control physical development towards a more balanced development of economic and environmental interests
RSA 4: Preserve the character and identity of the Perak countryside *(Memelihara karakter dan identiti kawasan desa Negeri Perak)*	• SP 4.2: Announcing the Orang Asli lands and settlements
RSA 6: Increasing Competitiveness and Resilience in the Growth of Selected Economic sectors of the Perak State Economy *(Meningkatkan Daya Saing dan Daya Tahan Pertumbuhan Sektor Terpilih Ekonomi Negeri Perak)*	SP 6.3: Strengthening Economic Capacity Project to Increase the income of B40 Group _ Create strategic partnership between government agencies, private companies/sectors and NGO with focus on increasing CSR activities

RSA 7: Empowering the Perak State Tourism Sector as a National Tourism Destination *(Memperkasakan Sektor Pelancongan Negeri Perak Sebagai Destinasi Pelancongan Utama Negara)*	• SP 7.1: Making the Tourism Industry a Major Contributor to the State Economy _ community based tourism products. • SP 7.2: Provide Perak State Tourism Master Plan with Theme of Nature and Heritage Tourism Destinations _ Develop eco-tourism meeting international standards with preserving forest reserve and coastal areas from large-scale development & sustainably diversify nature-based tourism activities. • SP 7.3: Developing the Perak River as a Perak State Tourism Icon_ Provide a comprehensive Perak River Development Plan in terms of physical, social, economic and management development • SP 7.6: Developing Integrated Tourism Products and promoting widespread
RSA 12: Developing the mineral sector on a sustainable basis as one of the main economic bases of Perak State *(Memajukan sektor mineral secara lestari sebagai salah satu asas ekonomi utama Negeri Perak)*	• SP 12.1: Increase the mineral-based industries added value in a controlled manner_ Conducting the mineral extraction activities by following the rules to minimize pollution effect to the environment/preserving the ex-mining ponds as water reservoirs

RSA 20: Enhance the Effectiveness of Infrastructure Systems and Emphasize Green Technology Practices to Support Perak State Development *(Meningkatkan Keberkesanan Sistem Infrastruktur dan Menekankan Amalan Teknologi Hijau Bagi Menyokong Pembangunan Negeri Perak)*	• SP 20.1: Developing and Managing Water Resources in an Integrated and Sustainable manner • SP 20.5: Utilize the sewage treatment plants suitable for local condition and emphasize on the control of water quality pollution • SP 20.6: Providing integrated solid waste management and scheduled waste with technology-based waste treatment system and focus on pollution control
RSA 21: Conserving KSAS and biodiversity to ensure continuity towards sustainable environment *(Penjagaan KSAS dan Biodiversiti Bagi Memastikan Kesinambungan ke Arah Alam Sekitar Mampan)*	• SP 21.1: Ensure 50 percent of the State of Perak Maintained as a forest area • SP 21.2: Raising and improving the protection status of biodiversity and state heritage resources • SP 21.3: Preserve and conserve environmental sensitive areas (KSAS) and biodiversity
RSA 22: Holistic and Effective Environmental Quality Improvement *(Peningkatan Kualiti Alam Sekitar Secara Holistik dan Efektif)*	• SP 22.1: Increase the level of Environmental Quality

○ RSA 23: Empowering the role of communities in the conservation of the environment *(Pemerkasaan Peranan Komuniti Dalam Penjagaan Alam Sekitar)*	SP 23.1: Strengthening Management of the Environment and Biodiversity by the Community
○ RSA 24: Effective Disaster Risk Management To Ensure Safety *(Pengurusan Risiko Bencana Yang Efektif Bagi Menjamin Keselamatan)*	SP 24.1: Empowering comprehensive Disaster Risk Management

3.4.2 Forestry Management Plan

Perak Forestry State Department have its own management plan, better known as 'Rancangan Pengurusan Hutan Negeri Perak 2016-2025 (RPH Perak)'. RPH Perak served as reference document to plan and manage forest reserve in Perak. There are 4 focus elements and 7 objectives to achieve within this RPH which makes this RPH differs from 10 year planning before this. The four focus areas are:

a) Optimal deforestation based on the Annual Cut Control (CTT) *(Hutan pengusahahasilan secara optimum berlandaskan Catuan Tebangan Tahunan (CTT) yang telah diterapkan)*;
b) Protected forests to meet the requirements of the National Forest Policy 1978 (Amendment 1992) and the National Biodiversity Policy 1998 in accordance with the intention of the State Government *(Hutan perlindungan dimantapkan bagi memenuhi keperluan Dasar Perhutanan Negara 1978 (Pindaan 1992) dan Dasar Biodiversiti Kebangsaan 1998 seiring dengan hasrat Kerajaan Negeri*);
c) The application of value-added elements to the function of forest classification, in particular, enhances ecotourism through new strategies *(Penerapan elemen nilai tambah ke atas fungsi pengkelasan hutan terutamanya mempergiatkan ekopelancongan menerusi strategi baru)*
d) Extensive exploration of new economic potentials from forest resources such as' Payment for Ecosystem Services (PES) *((Penjelajahan secara meluas terhadap*

potensi penjanaan ekonomi baru dari sumber hutan seperti 'Pembayaran Perkhidmatan Ekosistem (PES))

RPH Perak 2016-2025 have seven objectives to be achieved:

a) Forest resource management through the implementation of the Sustainable Forest Management (SFM) concept which covers all aspects of biodiversity conservation to the extraction and production of exported timber products overseas *(Pengurusan sumber hutan melalui pelaksanaan konsep Sustainable Forest Management (SFM) yang merangkumi semua aspek daripada pemeliharaan biodiversity sehingga pengusahasilan dan pengeluaran produk kayu yang dieksport ke luar negara).*

b) *Development of forest resources through the implementation of conservation and conservation activities to ensure sustainable and sustainable value added of forest resources in the future* (Pembangunan sumber hutan melalui perlaksanaan aktiviti pemeliharaan dan pemuliharaan bagi menjamin bekalan sumber hutan secara berkekalan dan mempunyai nilai tambah di masa hadapan).

c) Community forestry through providing exposure, facilities and benefits to the community through social forestry programs to promote forestry education and publicity services to enhance community understanding and dissemination of information on various forest benefits. *(Perhutanan masyarakat menerusi memberi pendedahan, kemudahan dan faedah kepada masyarakat melalui program perhutanan sosial bagi menggalakkan pendidikan dalam perhutanan dan perkhidmatan publisiti bagi meningkatkan kefahaman masyarakat dan sebaran maklumat terhadap pelbagai faedah hutan).*

d) Preservation of biodiversity of flora and fauna for the purpose of preserving the environment through education and research programs.*(Pemeliharaan biodiversiti flora dan fauna bagi tujuan menjaga kestabilan alam sekitar menerusi program-program pendidikan dan penyelidikan).*

e) *Human resource development through the provision of training programs to department personnel to ensure trained workforce in the forestry sector as well as providing relevant infrastructure facilities to support the forestry sector* (Pembangunan tenaga manusia menerusi pemantapan program-program latihan kepada kakitangan jabatan bagi menjamin tenaga kerja terlatih di sector perhutanan di

samping menyediakan kemudahan infrastruktur berkaitan bagi menyokong sector perhutanan)

f) *Use of the latest technology in accordance with environmental requirements for the conservation, management and utilization of forest resources* (Pengunaan teknologi terkini yang bersesuaian dengan keperluan alam sekitar bagi pemeliharaan, pengurusan dan penggunaan sumber hutan).
g) *Increase contribution to economic growth and job opportunities through new forestry sector wealth* (Meningkatkan sumbangan kepada penjanaan ekonomi dan peluang pekerjaan melalui kekayaan baru sektor perhutanan).

RPH Perak 2016-2025 also have particular focus on social forestry that enhance alternative livelihood for communities. Four core areas focused for social forestry are:

a) Community awareness programmes
b) Conservation and rehabilitation programmes
c) Restoration and landscape re-greening programmes
d) Eco-tourism programs

Social forestry component takes account of involvement of local communities, JKKK, NGOs and other tourism related companies to not only boost economic gains for local people but become identity for state as well. So, RPH Perak 2016-2025 do welcome involvement of local communities and NGOs for forest conservation and preservation as well.

3.4.3 Conservation Plan

3.4.3.1 Local conservation Plan for protected areas

Kinta Valley Geopark declared as National Geopark by His Royal Highness the Sultan of Perak Sultan Nazrin Muizzuddin Shah on 25th October 2018. The 1,952ha Lembah Kinta Geopark area, encompassing the Kinta and Kampar districts was gazetted as a National Geopark and currently are under the management and observation of the Perak State Parks Corporation. The Lembah Kinta Geopark area, rich in geological, biological and historical heritage under the supervision of the corporation, will also be promoted as an icon for ecotourism, marine tourism and geotourism destinations. This makes Kinta Valley the country's second national geopark after the Langkawi's Unesco Global Geopark (northern state of Kedah). There is 18 geo-sites located in area, which includes Gunung Lang, Tambun

Cave, Naga Mas Cave, Tempurung Cave, Gunung Korbu, Jeram River, Hutan Lipur Ulu Kinta, Sungai Salu Waterfall and a few more. Expedition and assessment is going on to study these sites especially Gunung Korbu. Hence, declaration of National Geo Park adds local conservation plan for Upper Kinta Basin and further details will be known after the expedition as well as assessment findings.

3.4.3.2 Central Forest Spine (CFS) Strategy

The Central Forest Spine (CFS) of Peninsular Malaysia, composed of four (4) main forest complexes, is an important natural landscape of Malaysia, supplying up to 90% of the population's water supply, alleviation of flood risks, regulation of climate; and supply of resources, products and services, such as ecotourism. The National Physical Plan (NPP) identified forest fragmentation as a major threat to the conservation and maintenance of biodiversity and recognizes that conserving forest lands would be integral as it is important to secure mutual co-existence and benefit for development and conservation (NPP, 2005). Optimizing the use of land in the country and that the multifunctional role of the forest lands should be enhanced through the recognition of the CFS and programmes to create linkages and corridors to the more isolated reserves.

In essence, connecting these fragmented forests recognizing the importance in securing connectivity of the fragmented forests, the Malaysian government, through the Federal Town and Country Planning Department, has therefore embarked on a master plan study whose objective is to re-establish, maintain or restore connectivity in places where it is already lost within the central forest spine of Peninsular Malaysia (Federal Department of Town and Country Planning Peninsular Malaysia). The CFS master plan was jointly tabled to the Cabinet for adoption by the Ministry of Natural Resources and Environment (NRE) and Ministry of Housing and Local Government in 2011. The CFS Master Plan was approved by the National Physical Planning Council (NPPC) on 13 August 2010 and endorsed by the Malaysian Cabinet on 1st April 2011.The Cabinet appointed NRE as the main implementing agency, supported by the Forestry Department (FD) and Department of Wildlife and National Parks (DWNP). To assist NRE in the implementation of the CFS Master Plan, A CFS Steering Committee was formed comprising representatives from state governments, agencies and NGOs.

The CFS was defined as the backbone of Peninsular Malaysia's environmentally sensitive area network, comprises four (4) major forest complexes in the National Physical Plan. In addition the CFS is a core feature of Malaysia's commitments to international conventions i.e. United Nations Convention on Biological Diversity and United Nations Framework Convention on Climate Change, both of which we are a signatory to. The CFS is also important in supporting Malaysia's national policies such as the 11th Malaysia Plan, *Transformasi Nasional 2050* (TN50), the National Policy on Climate Change, National Environment Policy and the National Policy on Biological Diversity 2016-2025. The CFS Master Plan takes a far-sighted objective of re-establishing, maintaining and enhancing connectivity between the most significant/important remaining areas of forests in Peninsular Malaysia.

The ultimate goal is to ensure the conservation of the entire range of species found in our forests, as well as maintain the host of ecological processes taking place within it. An additional objective would be to create "stepping stones" to increase habitat connectivity for some but not all species. For this purpose, "ecological linkages" are identified in areas where it is important to establish connectivity, in order to form the CFS. A total of 37 ecological linkages (i.e., 17 Primary Linkages [PL] and 20 Secondary Linkages [SL]) were distinguished with specific emphasis needs. The Primary Linkages is crucial to re-establish forest connectivity in order to achieve the main CFS link. These areas are inevitably located between the most important blocks of forests; usually in narrow stretches where non-forest land use is still minimal. The primary linkages are important corridors for large mammals which use these areas to move from one forest to another. Primary linkages take the form of linear corridors, i.e. unbroken stretches of forested habitats connecting forest islands.

Secondary Linkages are complementary to primary linkages. They are identified in areas where it is unfeasible to create a primary linkage (e.g. due to vast areas of non-forested land or long distances between forests, or high human population), but it is still important to maintain some level of connectivity (albeit weaker) between forests. Secondary linkages are usually used by small animals, birds and insects. They are also beneficial to plants through pollination and seed dispersal. Secondary linkages take the form of stepping stones, i.e. patches of suitable habitats, and are usually designed to follow river corridors.

The four major forests within CFS1 and CFS2 are, *Banjaran Titiwangsa-Banjaran Bintang-Banjaran Nakawan*, *Taman Negara-Banjaran Timur*, South East Pahang, Chini and Bera Wetlands, and Endau Rompin Park-Kluang Wildlife Reserves. The CFS1 covers northern Peninsular Malaysia, stretching from the state of Kedah on the West until Terengganu in the East, i.e. states of Kedah, Perak, Kelantan, Terengganu and Pahang together with adjoining southern Thailand (i.e. transboundary linkages) encompasses an area of about 3 million hectares. The CFS2 encompasses an area of about 2.3 million hectares covers the southern part of Peninsular Malaysia central forest spine within the four states of Pahang, Johor, Negeri Sembilan and Selangor. Although UKB is not part of the CFS 1 or 2 linkages, it is still with a key part of the CFS as it is a potential area where the north-south linkage of the CFS is disrupted by the Simpang Pulai to Cameron Highland Highway. Without the maintenance of the integrity of this forest, the movement of wildlife along the main range will be disrupted. The CFS has already been significantly disrupted by the Cameron Highlands to Gua Musang road and the associated large scale agriculture and plantation development. Without proper maintenance of the UKB forests, the CFS integrity may be compromised. **Figure 3.38** shows the CFS (PL and SL Linkages) together with the project site.

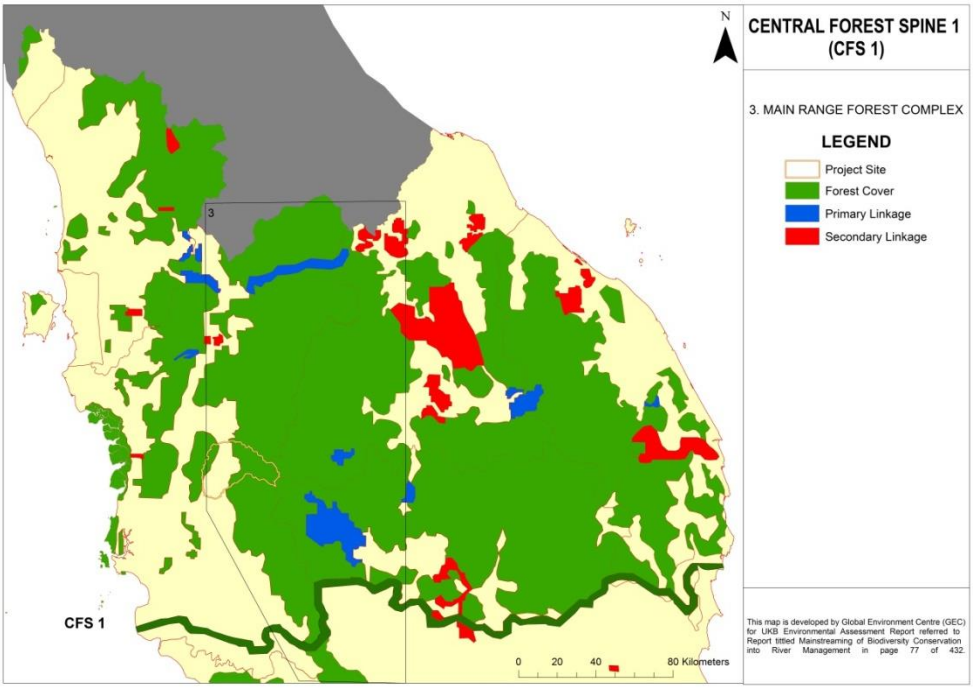


Figure 3.38 CFS and the neighboring UKB site

Over the years, when the CFS was developed and implemented, the effectiveness of the CFS is yet to be projected as a successful case story. It is observed that the main focus of the CFS was to connect the habitat to enable the wildlife to move around the fragmented forests within Peninsular Malaysia. This was proposed to ensure the wildlife is protected from the rapid developments in Malaysia over the decade. Some of the significant challenges highlighted in the report include the following:

- As land resources are a state matter, the management and utilization of forests as well as implementation of development projects, remain under each state's jurisdiction.

- Many of the linkages are under-maintained due to lack in the commitment from the state governments, poor enforcement as well as insufficient resources/ department/person to implement the CFS.

- The findings from various NGOs that are working on the conservation efforts along the CFS linkages indicate that the effectiveness of the CFS is long-term and the implementation plans need the support of various stakeholders.

- SMART stakeholder partnership and support is required to ensure the implementation is significant to achieve its goal and to overcome the issues identifies.

- Some of the issues identified needs immediate action i.e. conversion of the primary forests into monoculture plantation or, forestland being leased out by the state government for logging and also a conversion for infrastructure development.

- Funding is critical to successful of the implement the CFS Master Plan. As component of many initiatives undertaken by the government, where with limited resources the outcome of the CFS is not widely emphasis or published.

Malaysian forests are divided into two different land categories; Permanent Reserved Forests (PRF); and Non-PRF (comprises of State land Forests and Alienated Forests). The PRF is legally secured and gazetted in accordance with the National Forestry Act, 1984 and managed under the Sustainable Forest Management (SFM) system for the benefit of present and future generations.

According to the keynote presented by Director-General of Forestry Department of Peninsular Malaysia during the conference on Perak's Central Forest Spine on 19 February 2013, a total of 14.39 million ha of PRFs have been gazetted in Malaysia. Of this total, 4.8 million ha are in Peninsular Malaysia. For the purpose of management, PRFs are further classified into two major management purposes, namely Production Forest; and Protection Forest. Production Forest is established for the purpose of supply in perpetuity which can be economically produced and marketable.

Meanwhile, the Protection Forest is established for conservation purposes that were further refined into eleven multiple values of forest or forest functional classes as stipulated under Section 10 (1) of the National Forestry Act (1984). These forest functional classes are : Soil Protection Forest; Soil Reclamation Forest; Flood Control Forest; Water Catchment Forest; Forest sanctuary for wildlife; Virgin Jungle Reserved Forest; Amenity Forest; Education Forest; Research Forest; Forest for Federal purposes; and State Park.

Although water is emphasized under the Malaysian forest classification as Water Catchment Forest (PRF) and water resource management is being highlighted as one of the component of CFS, the importance of the water resource/catchment areas are not treated as primary need. While the Forestry department focuses on protecting the Forest Reserves for future sustainable and resource, the CFS has been focused on wildlife protection. Most of the environmentalist and the project proponent emphasized on the need of the forest as habitat for the wildlife for the conservation of Malayan Tigers and Elephant in addition to other wildlife which is low in the number due to the rapid forest clearance and logging. Although the locals and civil societies emphasized on the wildlife protection, the state government on the other hand, depends on the logging as one of main state revenue. Malaysia forests are rich with first-class timber which upon harvesting benefits the state revenue. The Perak State Government has been unable to stop timber harvesting as it will result in the loss of the revenue needed to provide services to the people and forest management in Perak. Although the Permanent Reserve Forests (PRFs) are protected under the National Forestry Act 1984 under the jurisdiction of the state forestry department; the state government has the power to excise PRFs by degazetting them. Cutting for timber production in PRFs ("timber production forest under sustained yield"), and the excision of PRFs from the state warrants replacement with another similarly-sized piece of land ("State Authority to replace land excised from permanent reserved forest") by the state is permissible. **Figure 3.39** shows the Primary

linkages of CFS, where Bukit Kinta was one of the nearest sites to the Upper Kinta Basin Site (between SL3 and PL3).

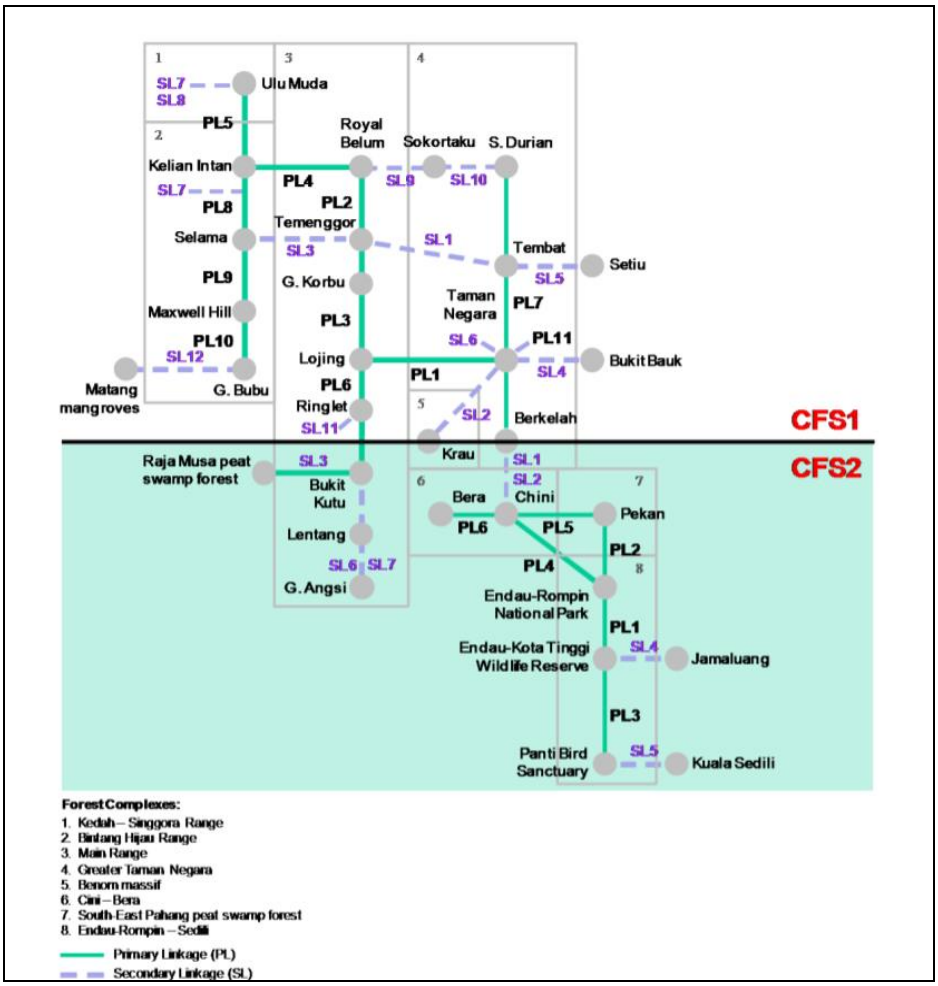


Figure 3.39 Ecological linkages in Perak border

As Perak is one of the states with highest forest cover and valuable trees, logging has been carried out in a large-scale manner by licensed concessionaires by the state government.. Wildlife hunting and poaching run parallel with logging. When there is an area open for logging, the wildlife within the area was hunted down for its precious resources. Although water catchment area and river corridor were included in the CFS masterplan, it was listed as secondary. It is proposed for water catchment to be emphasized as the main component of CFS masterplan. As our drinking water and supply originates mainly from rivers (97%), the forest is needed as the catchment area. A fragmented forest without catchment is not sufficient for water storage or supply. A combined water store is required and the forest patches forming the linkages need to be gazetted as protected forest area (water catchment patches). The definition of water catchment need to be revised and its significant impact, if

the resources not protected need to be emphasized to all stakeholders. The state governments need to be briefed and enlighten on the impact of forest destruction to their water supply. Water Supply is important not only for domestic usages but also for agriculture and industrialization. The current approaches have silenced the importance of CFS for water resource protection. As the feedback and commitment or feedback from the stakeholders may differ and committed approach can be proposed or implemented if the benefit of CFS highlighted differently, the UKB project will be inline and supportive of this.

From the review of the CFS masterplan, almost all the water catchment area was not highlighted as part of the CFS or only emphasized under CFS Secondary linkages. Secondary linkages are to support the primary linkages; in this case, river corridor management is a secondary issue to be addressed, after the linkages for the large mammals are connected. Commonsense, shows the mammals need water to survive and if water is treated as secondary issue, the objective of the linkages to create the pathway for the mammals, stop logging to create habitat and stop illegal hunting and poaching will not be materialized. On the other hand, when a forest is being gazetted, it is being protected from all form of illegal logging, hunting and poaching where the living organisms are contained within its protected area. It is proposed for all the relevant agencies, that are working on the CFS Primary linkages also to look closely into the water catchment area which was addressed as secondary linkages or those not part of the CFS for long-term resource protection. Long-term water resource protection plan is needed to ensure the water catchment area being protected, and this can only take place through the support of various stakeholders. Each stakeholder as State Economic Planning Unit (EPU), LAP, DID, State Forest Department, JAKOA, IDR and other states as well as federal agencies, need to look into long term goal. It is also important that the agencies work in hand via SMART Partnership in working together within their capacity to support each other in protecting the Bukit Kinta Forest Reserve and the Upper Kinta Basin.

Currently for Ulu Kinta Basin, there is no specific CFS corridors identified. However, this river can play a major role in connecting areas namely from Cameron Highlands (Pahang) and Kinta (Perak). Since CFS approach focus on landscape management and effectiveness for wildlife roaming areas which requires larger and wider areas especially for tiger and elephant, it is recommended that ideally, 6 ecological corridors from 3 states namely Pahang, Kelantan and Perak are focused. For Pahang, there are 2 corridors namely PL1 which connects Sg Yu

FR, Tanum FR, Jelai FR and Taman Negara Merapoh at Lipis Disctrict; and PL6 which connects Jelai FR, Lemoi FR and Bukit Bujang FR at Cameron Highlands District. For Kelantan, there is one corridor identified as PL3 which connects Lojing FR, Sg Brok FR and Sg Betis FR at Gua Musang District. For Perak, there are 3 corridors namely PL10 which connects Larut Matang and Bubu Area; SL11 connects Bujang Melaka FR and Kinta area; and SL12 connects Larut Matang area. Therefore, if these corridors are established and functioned accordingly, wildlife has a wide areas from the central main range located from Taman Negara Merapoh towards mangroves areas in Larut Matang (western site of Peninsular Malaysia). However, since Ulu Kinta Basin is located at Perak State only, another option is to focus within Perak only. Therefore, 3 mentioned corridors are recommended in order for wildlife to roam from Cameron Highlands to Matang mangroves.

According to CFS Master Plan, there are 8 general guidelines that can be implemented for establishing and maintaining the ecological linkages namely:

a. General guidelines for Animal Crossing
b. Guidelines for Human-Widllife Conflict
c. Anti-poaching guidelines
d. Eco-tourism guidlines
e. Guidelines for Settlement and Village Development in Ecological Corridor
f. Guidelines for Sustainable Agricultural Management Practices in Plantations
g. Guidelines for Forestry and Reforestation in Ecological Corridor
h. River Reserve guidelines in Ecological Corridor

As for Ulu Kinta Basin, all guidelines are recommended to be integrated into the management plan. Besides this, public awareness will have a significant role in pressuring the government to emphasize on the water catchment area protection. If the public is aware on the impact of the forest destruction on their water supply, the voice of people might create a platform for the state government to relook into their revenue plans. Payments for ecosystem services (PES), also known as payments for environmental services (or benefits), are incentives offered to users like farmers or landowners in exchange for managing their land to provide some sort of ecological service. PES should be enforced to industrial or corporate players which are benefiting by extracting the water resources Those farmers and agro farming activities along the water catchment area as well as the development of TNB

National Gridline, Highway cutting through the forest also need to be charged with PES to enable conservation and rehabilitation efforts can be undertaken by the state government. The CFS masterplan is currently under review and it is likely that the management of water catchments within the CFS will be given increased attention.

3.4.4 Kinta IRBM

Currently there is no specific report on Kinta IRBM. However there are some information on this basin coved within Sg Perak IRBM study. The study has been completed by G&P Professionals Sdn Bhd and its Associates for JPS Malaysia in Dec 2010.The main aim of the Sg Perak IRBM Study is to establish a balance between the natural functions of the river and the developed aspects of the system. Hence, the framework for the IRBM Plan for Sg Perak encompasses the holistic approach to water resources management in order to meet the following objectives:

(i) Ensure clean water;

(ii) Ensure sufficient water;

(iii) Reduce flood risk;

(iv) Enhance environmental conservation.

Overall the report covers land use, engineering aspects, environment, stakeholder participation and GIS and data management. However, the study did’t developed any strategy.

CHAPTER 4: PROPOSED MANAGEMENT STRATEGY

4.1 Goal 1: To sustainably manage biodiversity in the Upper Kinta Basin (UKB)

4.1.1 Scope

The scope of this goal is to include all gazetted Forest Reserves and other forest areas within the UKB.

4.1.2 Objectives

The main objectives are

i) To conserve forests and related biodiversity in the Upper Kinta Basin (UKB)

ii) To reduce the sedimentation of water courses and water bodies and prevent downstream pollution in the UKB.

4.1.3 Strategies

Strategy	Details
Strategy 1.1	Delineation of Catchment Forest Boundaries and restriction of access
Strategy 1.2	Promoting Linkages with the Central Forest Spine (CFS) Initiative and enhance protection of environmentally sensitive areas (ESA/KSAS)
Strategy 1.3	Promoting Sustainable Eco-tourism in Upstream UKB
Strategy 1.4	Promoting Forest Stewardship by Orang Asli Communities and local communities
Strategy 1.5	Assessment and monitoring of biodiversity and conservation issues
Strategy 1.6	Rehabilitation of degraded forest and riverine areas
Strategy 1.7	Support sustainable development of Kinta Geopark
Strategy 1.8	Mainstreaming biodiversity into river management

Strategy 1.1: Delineation of Catchment Forest Boundaries and restriction of access

Description

Most of the Forests in the upstream of the Upper Kinta Basin are gazetted as water catchment forest except for a small area degazetted for the Agroto Agriculture project. The water catchment needs to be clearly delineated and marked; and action to be taken against any activities encroaching into the catchment.

Action plans

a) Identify and map UKB boundary (including district, council, forest reserve, Geopark, water catchment) and identify requirements for each jurisdict
b) Enhance Boundary marking for water catchment forest boundaries
c) Installation of signboards (Agency or District office)
d) Control of access through permit system (Forestry/LAP/ etc)
e) Control extractive use/hunting
f) Guidelines on any access and activities

Lead Organization (s)

- Perak State Forestry Department

Supporting Organization (s):

- State Park Corporation
- Mineral and Geoscience Department
- Ipoh City Council
- Kinta District and Land Office
- Perak Water Board
- Department of Survey and Mapping Malaysia

Timeframe

Short term and ongoing

Strategy 1.2: Promoting Linkages with the Central Forest Spine (CFS) Initiative and enhance protection of environmentally sensitive areas (ESA/KSAS)

The Central Forest Spine (CFS) links all the forest in the main range of Peninsular Malaysia. The forests of the UKB are an important part of the CFS. The Simpan Pulai to Cameron Highlands Highway forms a barrier to wildlife movement and also facilitates actions that negatively impacting the UKB. Linkage need to be established with the CFS initiative in terms of coordinating forest and wildlife conservation actions in adjacent areas and sub-catchment, e.g Sg Raya Catchment to the south.

Action plans

a) Document issues in UKB relevant to CFS
b) Provide input to CFS masterplan (CFS Perak management plan –FRIM) review process
c) Wildlife management plan (addressing human wildlife conflicts)
d) Adopt *Garispanduan Pengurusan KSAS dan Garispanduan Tanah Tinggi*
e) Determine flora and fauna diversity

Lead Organization (s)

- Perak State Exco on Health, Science, Environment and Green Technology
- PLAN Malaysia
- Perak State Forestry Department
- Departmentof Wildlife and national parks

Supporting Organization (s)

- Perak State Economic Planning Unit
- NGO
- FRIM
- Perak State Park Corporation

Timeframe

- Medium (2-5 years)

Strategy 1.3: Promoting Sustainable Eco-tourism in Upstream UKB

Description

The forests of the upstream of the UKB provide an ideal resource for low-impact, outdoor adventure and sports such as:

a) Mountain trekking to the summit of Gunung Korbu, Peninsular Malaysia's second highest peak,
b) Forest survival and camping expeditions,
c) Bird and animal watching, such as sites where congregations of butterflies such as the spectacular Rajah Brooke's Birdwing come to gather minerals,
d) Visits to known sites for *Rafflesia* when in bloom, etc,
e) Water recreation options, and
f) Community based chalets

Development of such activities, as an alternative income generator for Orang Asli and local communities, and to promote the conservation and protection of the area, will need sensitivity and innovation to prevent disturbance to natural phenomena and desirable features, pollution and littering and other disturbances. Training of local Orang Asli as certified nature guides will be an integral part of this strategy.

Action plans

a) Undertake assessment of potential ecotourism options in UKB
b) Improve facilities for ecotourism including trails, rest spots, camping sites or homestays
c) Train and certify orang asli/local people to be local guides and require use of local guides for treking

d) Promotion to tour operators and public
e) Ask visitors to document their visits and share observations in designated platform esp social media
f) Local product development

Lead Organization (s)

- Perak State Forestry Department
- Ministry of Tourism, Arts and Culture Malaysia (MOTAC)
- Department of Orang Asli Development (JAKOA)

Supporting Organization (s)

- NGO
- Perak State Economic Planning Unit
- Eco-tourism private agencies
- Orang Asli association

Timeframe

- Medium to long term (2-10 years)

Strategy 1.4: Promoting Forest Stewardship by Orang Asli Communities and local communities

Description

Throughout the upper UKB, Orang Asli (OA) communities are the best placed stakeholders to provide stewardship and protection for forestry resources, as they are on the "frontliner" with regard to access (legal and illegal), forest resource use and exploitation (legal and illegal) and conservation of forest and water resources. The promotion of Forest Stewardship by OA

communities can be implemented through innovative programmes and schemes that utilize their local knowledge, skill and intrinsic understanding of the forest ecosystem.

Action plans

a) Development of a network of Orang Asli Rangers or Friends of UKB as an early warning system against illegal forest encroachment, resource extraction, pollution events, etc.
b) Training for community rangers
c) Provision of basic equipment
d) Develop "Community Conservation Area" CCA
e) Appoint OA as "assistant" forest ranger

Lead Organization (s)

- Perak State Forestry Department

Supporting Organization (s)

- Department of Orang Asli Development (JAKOA)
- Perak State Economic Planning Unit
- Department of Irrigation and Drainage (DID) Perak
- NGOs
- Orang Asli Associations

Timeframe

- Medium to long (2-10 years)

Strategy 1.5: Assess and monitor biodiversity and conservation issues

Description

Very few surveys have been undertaken of biodiversity in the UKB. It is important that proper assessments and monitoring are carried out.

Action plans

a) Wildlife surveys
b) Botanical surveys
c) Identification of conservation issues
d) Map geology features (GeoPark)
e) Assess historical and cultural features
f) Identify and map human wildlife conflict areas

Lead Organization (s)

- Perak State Forestry Department
- Departmentof Wildlife and national parks
- Department of Irrigation and Drainage (DID) Perak

Supporting Organization (s)

- Universities
- Research centres

Timeframe

- medium to long (2-10 years)

Strategy 1.6: Rehabilitation of degraded forest and riverine areas

Description

Degraded areas of forest should be rehabilitated by removing the root cause of degradation and facilitating natural recovery or undertaking active replanting with suitable species. A number of rivers/streams in the catchment have been degraded through high levels of siltation. Provided action is taken to addres the erosion problem, the river stretches that have been impacted can be rehabilitated by removal of the silt and reintroduction of appropriate riverine vegetation.

Action plans

a) Identification of priority degraded forest and riverine habitats in catchment.
b) Selection of sites, species and techniques for active rehabilitation
c) Establish trial rehabilitation sites with engagement of local orang asli communities
d) Scale up rehabilitation measures
e) Monitor and maintain rehabilitated sites

Lead Organization (s)

- Perak State Forestry Department
- Department of Wildlife and National Parks
- Department of Irrigation and Drainage (DID) Perak

Supporting Organization (s)

- FRIM
- Perak Water Board
- Orang Asli Associations

Timeframe

Medium to long (2-10 years)

Strategy 1.7: Support sustainable development of Kinta Geopark

Description

UKB located within recently declared Kinta Georpak. Being Geopark, it comes with certain restrictions as well as new laws/regulations that can give both positive and negative impacts for overall management of UKB. Hence, concept of sustainable development need to be infused in establishment of geopark and also for any future activities within geopark.

Action plans

a) Assessment and masterplan development
b) Development/repair of trails and access points
c) Development of brochures and promotional materials
d) Further monitoring and assessment through expeditions

Lead Organization (s)

- Perak State Exco on Health, Science, Environment and Green Technology
- Perak State Parks Corporation

Supporting Organization (s)

- Mineral and Geoscience Department
- Ministry of Tourism, Arts and Culture Malaysia (MOTAC)
- Perak State Forestry Department
- Tourism Association
- Universities

Timeframe

- Medium to long (2-10 years)

Strategy 1.8: Mainstreaming biodiversity into river management

Description

UKB is very important for biodiversity conservation with large number of endangerted plants and animals. biodiversity conservation needs to be mainstreamed into the work of different agencies responsible for management of the catchment including the forests, highway, reservoir, rivers and conservation areas.

Action plans

a) To rehabilitate the eroded highway slopes and river banks within UKB
b) To maintain and enhance riverine biodiversity richness within UKB
c) To empower all stakeholders to protect and conserve riverine biodiversity through holistic Communication, Education and Public Awareness (CEPA)

Lead Organization (s)

- Perak State Forestry Department

Supporting Organization (s)

- Ministry of Energy and Natural Resources
- Department of Wildlife and National Parks
- Department of Irrigation and Drainage (DID) Perak
- Perak State Parks Corporation
- Perak Water board
- Public Works Department
- Fishery Department
- Universities

Timeframe

- Medium to long (2-10 years)

Refer to Annex 2, titled 'Strategy on Mainstreaming Biodiversity into River Management in UKB' developed by UNDP-GEF5 project on Mainstreaming Biodiversity into River Management for further details.

4.2 Goal 2: To protect and improve rivers and water resources in UKB

4.2.1 Scope

The scope of this goal is to include all streams, rivers and other water bodies in the UKB and to protect associated water resources.

4.2.2 Objectives

The main objectives are

i) To conserve streams, rivers and other water bodies in the upstream of the Upper Kinta Basin (UKB)
ii) To enhance water quality in the Sultan Azlan Shah Reservor and maintain and enhance long term water supply for Ipoh City and adjacent areas.

4.2.3 Strategies

Strategy	Details
Strategy 2.1	Assess and quantify the Pollutant Sources in UKB
Strategy 2.2	Undertake immediate measures to address slope erosion along highway
Strategy 2.3	Enhance siltation control and desilting measures at Sultan Azlan Shah Reservoir
Strategy 2.4	Review and upgrade as necessary the water treatment system at Sultan Azlan Shah Reservoir
Strategy 2.5	Improve water quality and recreation sites downstream of the Dam

Strategy 2.6	Enhance Monitoring of Water Quality and flow in UKB
Strategy 2.7	Undertake an outreach programme to UKB water consumers to inform them of the importance of protection/monitoring of UKB for water supply

Strategy 2.1: Assess and quantify the Pollutant Sources in UKB

Description

The Environmental assessment of the UKB identified that the most important pollution source was the landslides and land clearing associated with the Simpang Pulai to Cameron Highland highway together with agricultural land development in the upper catchment. There is a need to undertake a detailed assessment and mapping of the eroded slopes and prioritise slopes for treatment. Mechanism to address landslides and erosion also need to be implemented in all type of upstream activities.

Action plans

a) Mapping of eroding slopes and categorization according to severity of erosion and possible mitigation measures.
b) Review effectiveness of current erosion control measures.
c) Establishment of monitoring programme on slope erosion and landslides.
d) Assess silt loading of rivers and streams downstream of eroding slopes
e) Conduct risk assessment

Lead Organization (s)

- Department of Environment (DOE)
- Department of Irrigation and Drainage (DID) Perak
- Perak State Forestry Department

Supporting Organization (s)

- Perak Water Board
- National Water Service Commission (SPAN)
- Perak State Economy Planning Unit
- Department of Environment (DOE)

Timeframe

- Short (1-2 years)

Strategy 2.2 Undertake immediate measures to address slope erosion along highway

Description

Whilst maintenance work has been ongoing along the highwat for more than 15 years, the focus has been stabilizing the slope above the highway to prevent landsides and rockfalls and not on stabilising the slope below the highway to prevent erosion to the river. Major work is needed in the short to medium term to stablise the slope below the highway and prevent continuous silting of the water reservoir.

Action plans

a) Design and implement erosion control measures on the slopes below the highway to reduce siltation to the rivers and reservoir.
b) Public Work Department of (PWD) Perak to request erosion mitigation design from Federal PWD.
c) Establish pilot plots for bio-enginering approach and PWD to monitor together.
d) Establish Slope Watch Program run by Orang Asli (OA) and public who monitor slopes especially on Simpang Pulai Highway stretch for signs of landslides and report to

authorities, conduct simple maintenance of slopes, such as clearing of overgrowth in drains.

e) Initiate community based bio-engineering activities as part of immediate mitigation like bamboo planting
    a. Help community especially OA to setup nursery
    b. Plant bamboo and other species to stablise erosion prone slopes.

Lead Organization (s)

- Perak State Exco on Health, Science, Environment and Green Technology
- Slope Engineering Division, Public Works Department
- Department of Irrigation and Drainage (DID) Perak
- Department of Environment (DOE)
- Perak Water Board

Supporting Organization (s)

- Malaysian Highway Authority
- Department of Orang Asli Development (JAKOA)
- Orang Asli Communities living near erosion sites
- Researchers working on soil bio-engineering approaches.

Timeframe

- Short to Medium (1-5 years)

Strategy 2.3: Enhance siltation control and desilting measures at Sultan Azlan Shah Reservoir and upstream areas

Description

LAP has established silt traps immediately upstream of the Sultan Azlan Shah Reservoir, but these have so far not proven effective in stopping the siltation reach the reservoir. Desilting work has regularly been carried out but large amounts of silt are still accumulating. Additional silt traps should be established further upstream including at the base of the eroded slopes to trap the sediment closer to source and reduce the impact on the river system.

Action plans

a) Assess experience and lessons learned from current silt traps at reservoir and take measures to enhance their effectiveness and operation and maintenance.
b) Introduce silt curtains and other measures to reduce likelihood of silt reaching the reservoir.
c) Assess potential options to establish silt traps closer to the eroding slopes.
d) Undertake additional measures in line with assessments

Lead Organization (s)

- Department of Irrigation and Drainage (DID) Perak
- Department of Environment (DOE)
- Perak Water Board

Supporting Organization (s)

- Perak Public Works Department
- National Water Service Commission (SPAN)

- Department of Irrigation and Drainage (DID) Perak

Timeframe

- Short to medium (1-5 years)

Strategy 2.4: Review and upgrade as necessary the water treatment system at Sultan Azlan Shah Reservoir

Description

The water treatment plant below the Sultan Azlan Shah Reservoir is significantly negatively impacted by the pollution of the reservoir. When it was first established the water quality was almost Class I, but following the regular and severe siltation the source water quality has deteriorated leading to higher water treatment costs and occasional shutdowns.

Action plans

a) Review operation and effectiveness of the water treatment plant
b) Identify and implement enhancements as needed to ensure long term and sustainable water supply.

Lead Organization (s)

- Perak Water Board
- National Water Service Commission (SPAN)

Supporting Organization (s)

- Perak Public Works Department
- Malaysian Highway Authority
- Department of the Environment (DOE)
- Department of Irrigation and Drainage (DID) Perak

Timeframe

- Short term (1-2 years)

Strategy 2.5 Improve water quality and recreation sites downstream of the Dam

Description

There are a number of sites along the Kinta River below the Dam which are of significance for recreation. However in recent years the high levels of silt discharged by the dam have had a negative impacton these sites. In association with measures to address erosion and enhance the water quality in the river system, measures should also be taken to improve water quality and rehabiliate the recreation sites downstream of the dam.

Action plans

a) Ulu Kinta water catchment area reviewed again and regazetted
b) Conduct rapid assessment on nature and use of recreation sites downstream of the Sultan Azlan Shah Dam
c) Recommend actions to enhance and rehabiliate the sites
d) Implement measures to rehabliate the sites together with local stakeholders.
e) Strengthen laws on river buffer zones

Lead Organization (s)

- Department of Irrigation and Drainage (DID) Perak
- Perak State Forestry Department

Supporting Organization (s):

- Ministry of Tourism, Arts and Culture Malaysia (MOTAC)

- Perak Water Board
- Ipoh City Hall
- PLAN Perak
- Department of Orang Asli Development (JAKOA)

Timeframe

- Medium to long term (2-10 years)

Strategy 2.6: Enhance Monitoring of Water Quality and flow in UKB

Description

In order to track the progress made in enhancing the water quality of the UKB, it is important to establish a long term realtime water quality monitoring system to include rivers above the dam (with and without erosion problems) as well as the reservoir and downstream rivers. In addition it is important to track the quality of the intake water of the water treatment plant and well as the treated water.

Action plans

a) Establish realtime water monitoring station at strategic location upsteam and downstream from the reservoir and within the reservoir.
b) Continuous monitoring of intake and teated water quality for water treatment plant
c) Sharing of monitoring data among relevant/respective agencies
d) Sharing data on intake water quality and treated water quality with public as part of Public Outreach Programme

Lead Organization (s)

- Department of Irrigation and Drainage (DID) Perak

- Department of Environment (DOE)

Supporting Organization (s)

- Ministry of Health (KKM)
- Perak Water Board
- National Water Service Commission
- NGOs
- Communities

Timeframe

- Continuous (1-10 years)

Strategy 2.7: Undertake an outreach programme to UKB water consumers to inform them of the importance of protection/monitoring of UKB for water supply

Description:

Most consumers in Ipoh are unaware of the source of their water and the impact of the Simpang Pulai - Cameron Highliands Highway on the water source. They are also unaware of the importance of catchment protection and monitoring to maintaining the security of their water supply. An outreach programme needs to be undertaken to inform the consumers of the nature and risk to their water supply. They need to be aware of the impact of the pollution to human health and the risks to long term supply e.g., the impact of land clearing on the water quality as well climate change on the quantity and quality of water. The importance of clean river for social, recreational as well spiritual functions should be also included. The outreach should be supported by LAP and SPAN and undertaken by state agencies and NGOs.

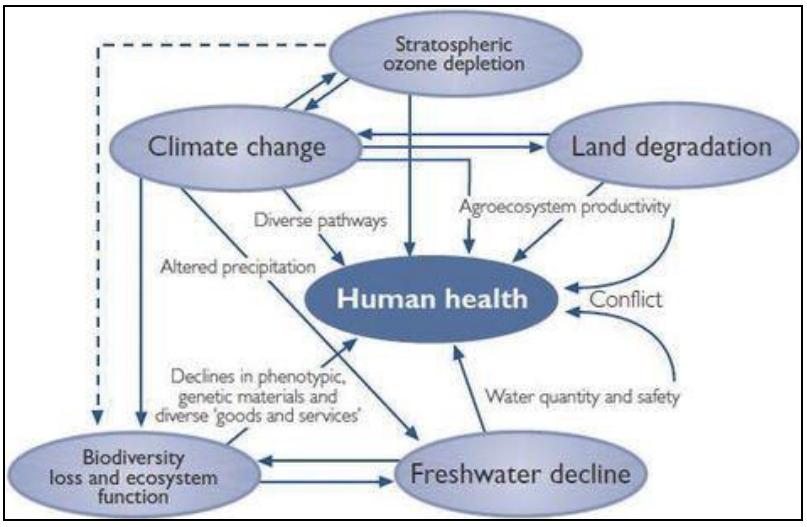


Figure 4.1 Impact of water pollution to Human Health

Action plans

a) Develop outreach campaign on UKB water resources and supply in partnership with relevant stakeholders
b) Develop and promote to consumers their river address that emphasizes on the river, water intake and treatment plant connectivity
c) Include information on water bills related to water source and river address
d) Conduct pre-post public outreach programme study related to water source during any programmes

Lead Organization (s):

- Perak State Exco on Health, Science, Environment and Green Technology
- Perak Water Board
- Department of Irrigation and Drainage (DID) Perak
- Department of Environment (DOE)

Supporting Organization (s):

- Perak State Economy Planning Unit
- National Water Sevice Commission
- NGOs
- Rukun Tetangga
- MPKKK

Timeframe

- Medium term (2-5 years)

4.3 Goal 3: To enhance sustainable livelihood and welfare of Orang Asli communities in the Upper Kinta Basin (UKB)

4.3.1 Scope

The scope of this goal is to ensure the livelihood and welfare of the Orang Asli community living in the UKB is enhanced and sustainable. (Skop matlamat ini adalah bagi memastikan kelestarian kehidupan dan kebajikan komuniti Orang Asli yang tinggal dalam kawasan Lembangan Hulu Kinta bertambah baik dan mampan).

4.3.2 Objectives

The main objectives are:

i) To empower the Orang Asli (OA) on the sustainable alternative livelihood

ii) To enhance the welfare of OA community as part of UKB Management Plan

4.3.3 Strategies

Strategy	Details
Strategy 3.1	Develop Alternative Sustainable Livelihoods for Orang Asli Communities in UKB
Strategy 3.2	Enhance safe water supply and sanitation for Orang Asli Communities in UKB
Strategy 3.3	Enhance welfare for Orang Asli communities in UKB
Strategy 3.4	Enhance promotion and marketing of Products from orang Asli Communities in UKB

Strategy 3.1 Develop Alternative Sustainable Livelihoods for Orang Asli Communities in UKB

Description

Developing alternative livelihoods is an effective step in making investments to encourage community involvement in target areas to support the implementation of a project especially those related to sustainable environmental management. This concept is also introduced to encourage sustainable use of natural resources and at the same time able to preserve biodiversity diversity and balance ecosystems more sustainably. Through this strategy, it is also part of the support for several Sustainable Development Goals (SDGs) such as SDGs 6 and 15 which emphasize sustainable water and forest management and SDG 1 to eradicate poverty. In addition, this concept can also help in reducing dependence on one resource which can reduce the threat to the environment. For example, through sustainable farming activities, it can reduce the opening of land for agricultural or plantation purposes in an area which at the same time can curb the problem of erosion and pollution of water bodies. Therefore, this strategy is very important in supporting the reduction of local problems and issues such as soil erosion, deforestation and water pollution. Minimal land or area use in implementing this strategy can indeed reduce the impact and negative impact on the surrounding area which in turn can support the main goal of the project to preserve the forest and river habitat in the Upper Kinta River Basin as well as reduce the dependence of local communities on one source of income only and reducing the poverty gap rate. This is also part of the support for the implementation of the JAKOA Strategic Plan 2016-2020 for Focus 4 which is to increase the income of the Orang Asli community through sustainable economic activities.

Action Plans

a) Eco-tourism
b) Eco-trails construction
c) Honey bee farming and production
d) Natural fish spa
e) Forest resource based nature craft products

f) OA as tour guides
g) Outdoor recreational space creation

Leading Organization (s)

- Department of Orang Asli Development (JAKOA)
- Ministry of Tourism, Arts and Culture Malaysia (MOTAC)

Supporting Orgnizations

- Department of Irrigation and Drainage (DID) Perak
- Perak State Forestry Department
- Perak State Economy Planning Unit
- Private tour companies
- NGOs
- Orang Asli community association

Timeframe

- Medium to Long (1-10 years)

Strategy 3.2: Enhance safe water supply and sanitation for Orang Asli Communities in UKB

Description

Water is the main source of life for humans, animals, plants and other organisms to survive. Therefore, water resource management is important to ensure the sustainability of ecosystems and life, especially in the sustainability of community life and the environment. In UKB, Orang Asli received their source of water supply directly from the river or a source which does not or does go through minor treatment process. Therefore, JAKOA through the JAKOA Strategic Plan 2016-2020 has emphasized and will implement treated water supply projects in

Orang Asli villages under Focus 2, namely infrastructure facilities. This effort is to provide clean and treated water supply so that the standard of health and quality of life of the community in Orang Asli villages can be improved.

In UKB, uncertain climatic conditions have caused some areas to experience water supply disruptions at certain times besides having issue of river sedimentation. Besides water supply, sanitation is a way to prevent human contact from waste hazards so that the level of health is always maintained. Dangers caused by inefficient sanitation management may be physical, microbiological and chemical agents for a related disease. Waste that can cause health problems consists of human or animal faeces, domestic wastewater (sewage, urine, bath or laundry waste) as well as solid waste, and agricultural waste.Therefore, appropriate action plans should be implemented to ensure that the Orang Asli community can enjoy a better and cleaner source of water supply and sanitation management system to ensure the well-being of life as other communities. This can also support the Sustainable Development Goals (SDG 6). Therefore, this strategic implementation is very important in an effort to ensure the sustainability of the UKB area through the active involvement of the Orang Asli community.

Action Plans

a) Forest Monitoring Training
b) Water and river water quality monitoring
c) Sanitation management

Leading Organization (s)

- Department of Orang Asli Development (JAKOA)
- Perak Water Board
- Northern Regional Water Service Commission (SPAN)
- Perak State Health Department

Supporting Organization

- Perak State Forestry Department
- Agriculture Department
- National Solid Waste Department
- NGO

Timeframe

- Short to Medium (1-5 years)

Strategy 3.3: Enhance welfare for Orang Asli communities in UKB

Description

It is common understanding that the Department of Orang Asli Development (JAKOA) is the only agency responsible for the welfare of the Orang Asli community. Therefore, all efforts to improve and welfare the Orang Asli community are on the shoulders of JAKOA. The government is always taking steps that are deemed necessary to upgrade and empower JAKOA so that this agency is more effective in carrying out the responsibility of developing, upgrading and safeguarding the interests of the Orang Asli community. However, this cannot be achieved without the involvement and support of other stakeholders as well as the Orang Asli community itself.

There are 7 main focuses in the JAKOA Strategic Plan 2016-2020 which indeed takes into account and emphasizes the welfare aspects of the Orang Asli community from land administration matters, infrastructure facilities, human capital and youth skills, sustainable economy, arts, culture and heritage, social security networks and service delivery system. This shows that there is still a significant gap in the welfare of the Orang Asli community and needs improvement for their sustainable livelihood in the future. Apart from that, efforts to

improve the level of education among Orang Asli students are still the main agenda of the government and are being actively implemented with the cooperation of various parties through the addition of educational infrastructure and the implementation of awareness campaigns on the importance of education.

A total of six Orang Asli villages were identified to be in the Ulu Kinta area, namely Kampung Chadak, Kampung Sungai Suluh, Kampung Sungai Choh, Kampung Makmur, Kampung Sungai Baduk and Kampung Tonggang. All these villages are located along the Kinta River and the Seno-oi River. Most of the residents in this village area are made up of the Temiar and Semai tribes.

The terrain condition is identified as an influence on the provision of public facilities such as school facilities for each village. This has been a contributing factor for school dropout issues among Orang Asli children. However, the introduction of transport services to school facilitated Orang Asli children daily commute to nearby school. Apart from that, the hilly geographical area has also made it difficult for the Orang Asli community to get other services such as clinics, hospitals and so on. This clearly shows that the welfare of the Orang Asli needs to be improved so that their lives are secure and sustainable.

Action plans

a) Empowerment and education programs
b) Health and Environmental Monitoring
c) Infrastructure support

Leading Organization (s)

- Department of Orang Asli Development (JAKOA)

Supporting Organization

- Perak State Education Department
- Perak Water Board
- Perak State Health Department
- NGO
- Corporate
- Local communities

Timeframe

- Medium (2-5 years)

Strategy 3.4 Enhance promotion and marketing of Products from orang Asli Communities in UKB

Description

A community product is any product produced by the community either in the form of cultural, traditional or necessity resulting from a process that relies solely or partly on hand skills, crops, care and so on. Among the community products are such as handicrafts that have artistic and aesthetic value, bee/kelulut honey as a current need in health care and cooking, natural fish spa as an application of eco-tourism concept and others. These products require a better promotion and marketing injection to ensure their sustainability and gaining good acceptance from the entire community, tourists and consumers. Therefore, cooperation between agencies, departments and organizations within the UKB area is important as a mechanism in promoting and marketing products from the Orang Asli community.

Action plans

a) Establish business opportunities / hubs to promote and market Orang Asli products
b) Creating the best business models and mechanisms.
c) Promote as a tourism product

Leading Organization (s)

- Department of Orang Asli Development (JAKOA)
- Ministry of Tourism, Arts and Culture Malaysia (MOTAC)

Supporting Organization

- Agriculture department
- Perak Fishery Department
- Corporate
- NGO
- Local communities

Timeframe

- Medium to Long (2-10 years)

4.4 Goal 4: To enhance multi-stakeholder coordination & management

4.4.1 Scope

The scope of this goal is to include all stakeholders in a common platform to manage UKB as currently it is being done based on respective jurisdiction power of agencies. This scenario brings into grey areas, hence lead to improper management. Hence, this goal will focus holistic management for better UKB.

4.4.2 Objective

The main objectives are:

i) To setup the multi-agency coordination and sustainable mechanism of stakeholder participation
ii) To ensure the UKBMaS as way forward and adopted and accepted by all stakeholders.

4.4.3 Strategies

Strategy	Details
Strategy 4.1	Implement Effective Inter-Agency Coordination for Sustainable Manangement of UKB
Strategy 4.2	Building Effective Mechanisms for Stakeholder Participation
Strategy 4.3	Promote effective Outreach, Monitoring and Reporting (OMR) Mechanisms
Strategy 4.4	Promote the inclusion of UKBMaS in future local planning decision-making
Strategy 4.5	Establish a financing mechanism for UKBMaS

Strategy 4.1: Implement Effective Inter-Agency Coordination for Sustainable Management of UKB.

Description

UKB is being impacted by various sources of pollution. Runoff from highway, highland farming, improper sanitation and expanding development activities are found to be main sources of pollution. All these impacts will be worsen during rain events as high amount of pollutants can be transported following gradient in a quicker time. It is difficult for a clean up or sediment removal from upstream as it is within forest which will consume high cost and lot of man power if need to do. So, prevention/precaution is better than anything. Since, there are different agencies having respective juridiction to manage UKB, it is vital for them to be under one umbrella for effective improvement in management as well as outputs can be translate into improving river water quality, biodiversity and so on. Inter-agency coordination need to be carried out to maintain sustainable UKB. There are lot of framework already developed and tested at other states to protect particular river basin or catchment. Integrated River Basin Mangement (IRBM) is among good framework developed but successful implementation is yet to been seen. However, the concepts and mechanism of IRBM can be adopted for UKB management and can be customized to suit local level. IRBM is a framework but still need to adopt existing plans both at federal, state and local levels.

Action plans

Establish UKB Integrated Catchment Management (ICM) committee. The committee should be consists of both state and federal agencies as well the local authorities. Besides government agencies, selected private players and NGOS should be included to have check and balance system. The committee is proposed to be headed by the Menteri Besar or State Secretary of Perak.

- Effective mechanism for inter-agency coordination need to set up. This includes status update meeting, reporting through common platform (website and other digital platform) and monthly/quarterly review.

- Enhance existing/newly established State level environment committee chaired by Perak MB
- Invite other stakeholder like private stakeholders and communities to be part of committee
- Appoint special committee/taskforce in each government agencies for them to be trained first and to replicate planned initiaitves within their respective departments

Lead Organization (s)

- Perak State Exco on Health, Science, Environment and Green Technology

Supporting Organization (s)

- All the agencies
- Corporate
- Private
- Local communities
- Orang Asli community associations

Timeframe

- Short term and ongoing (1-5 years)

Strategy 4.2: Building Effective Mechanisms for Stakeholder Participation

Description

The UKBMaS adoption, implementation and execution arrangements should focus on maintaining strong collaboration and cooperation, and avoid duplication of effort, among the stakeholders. To support the formal management committee set up at higher level, there is need for an effective mechanism for stakeholders to participate at all levels to support action to conserve UKB. Engagement and support from stakeholders including private sectors, Orang Asli communities,local communities and public is critical to ensure that plans and programmes planned by UKB ICM committee to succeed at grassroots level. In addition, NGOs are also key players as they have greater flexibility to initiate activities and raise funds.

A lot of integrated framework always stuck at top level which makes bottom-up approach to fail. Stakeholder participation is important as it leads to informed decision-making as stakeholders often possess a wealth of information, which can benefit water resource management. Their consensus at the early stages of planning and development projects can reduce the likelihood of conflicts which can harm the implementation and success of such projects. There is a need to get more public participation in river basin management activities at the local level at sub basin. This is necessary to increase public awareness and education about the importance of their role in minimising the pollution of rivers and the long term environmental sustainability of rivers and also the use of water resources. Effective participation will ensure good governance, democracy and avoid decentralization.

Action plans

a) Establish or strengthen existing river basin stakeholder coalitions in the UKB consisting of organizations or individuals who are interested in the well-being of the respective river sub-basins in UKB. The main functions of each river sub-basin coalition is as follows:

- Identify key problems or required actions in the sub-basin and provide input to basin committees
- Support the government in the implementation of plans and programmes for each river sub-basin
- Establish community or stakeholder based river monitoring activities
- Monitor and provide assessments of activities implemented
- Ensure the dissemination of relevant information among members, the general public and private sector, and NGOs
- Create better awareness and mutual understanding
- Ensure that the interest of all stakeholders are adequately represented
- Develop consensus on issues and actions to be taken

b) Carry out activities more towards interactive, recreation and fun learning. River protection, monitoring, clean up, restoration and educational games are some of the interesting learning activities can be planned and implemented.

Lead Organization (s):

- Perak State Exco on Health, Science, Environment and Green Technology

Supporting Organization (s):

- All the agencies
- Corporate
- Private
- Local communities
- Orang Asli community associations

Timeframe

- Short term and ongoing (1-5 years)

Strategy 4.3: Promote effective Outreach, Monitoring and Reporting (OMR) Mechanisms

Description:

Outreach activities are vital for effective participation of stakeholders. Outreach activities can be in form of awareness and knowledge as well involve practical sessions such as river monitoring and river clean ups or restoration. Outreach activities aimed to instill care and concern towards catchment and river basin. While agencies and NGOs can be the outreach agents, communities and private stakeholders can function as players. Through outreach, they should be able to monitor both good and bad issues happening within their respective basin or catchment. Monitoring alone is not enough as the issues will be kept within observers. It needs right platform for reporters or whistle blowers to address the issues they highlight or observe. Reporting need to be forwarded to right agencies and feedback on report from agencies are also important for outreach, monitoring and reporting (OMR) mechanism to sustained for long term.

Action plan

a) Agencies to have common reporting mechanism for UKB. Existing reporting mechanism by agencies combined together under one framework so that all relevant stakeholders can take decision based on holistic data, not a single data.
b) State level reporting mechanism (web/mobile application)
c) Establish sub-committee for issues identification and reporting. These reports to be compiled and discussed at higher level meeting (e.g. state environment exco committee)
d) Use alternative effective reporting mechanism by stakeholders. Reporting mechanism using stakeholders especially local communities will ease the problem of immediate/realtime identification of issues. Reporting mechanism can be linked both local communities and stakeholders especially agencies. **Figure 4.2** shows the mechanism of Citizen Eye App in mobile version used in River of Life Public Outreach Programme Phase 5 (ROLPOP5)

e) Visibility – community and public as well as tourists need to be exposed on the issues, status, action and reporing mechanism.

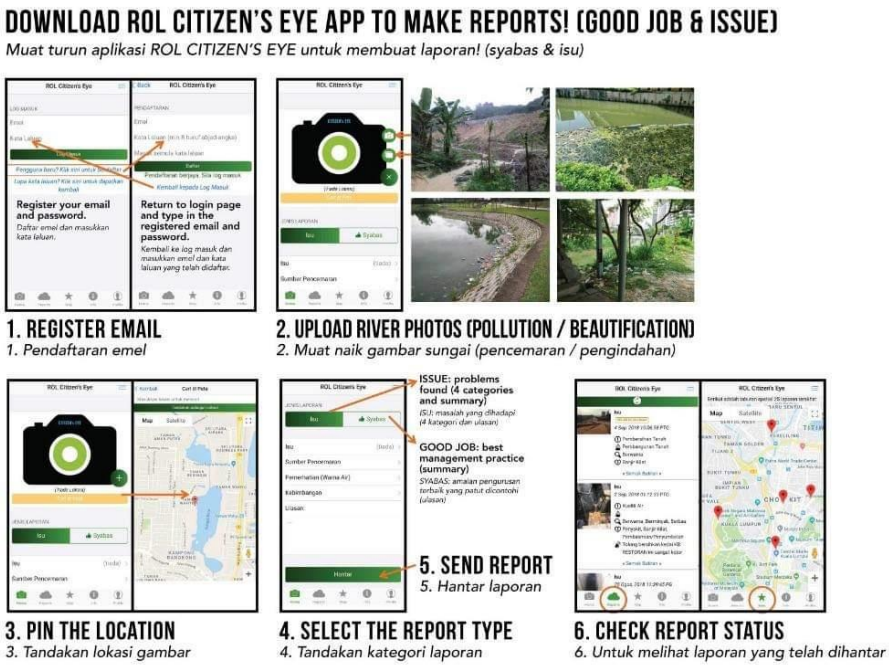


Figure 4.2 Citizen Eye App used for River of Life Public Outreach Programme Phase 5 (ROLPO5)

Lead Organization (s)

- Perak State Exco on Health, Science, Environment and Green Technology

Supporting Organization (s)

- All the agencies
- Corporate
- Private
- Local communities
- Orang Asli community associations

Timeframe

- Short term and ongoing (1-5 years)

Strategy 4.4 Promote the inclusion of UKBMaS in future local planning decision-making

Description

Developed UKBMaS need to be ensure to be operational and most importantly should not be overlapping with other existing plans. It should compliment the existing plans and fills up the gaps identified during review. The strategy is also should be feasible and ready for immediate adoption by stakeholders. Federal to local planning need to consider UKBMAS for their future planning

Action plans

a) Promote UKBMaS for adoption by stakeholders. Stakeholders' inputs need to be taken in account and further revision need to be carried out for successful implementation by relevant agencies.
b) Develop promotional materials in multi laungages to cater the need on local stakeholders including the tourists
c) Road show for UKBMaS to be made public so that everyone including public know the plan which can infuse their individual actions. A lot of plans and strategies kept most of the time within government circles only, making difficult access for private and public as well as NGOs to initiate any conservation action.
d) Promote the inclusion of UKBMaS in future revisions of
    - National Physical plan
    - Kinta District local plan
    - Rancangan Tempatan Majis Bandaraya Ipoh 2030
    - CFS Master Plan
    - Perak Structure Plan
    - Perak Forest management plan
    - Peak Water Board Business plan
e) Enhance classification of UKB as Environmentally Sensitive Area
f) Submit report on issues to National Water Council

Lead Organization (s)

- Perak State Exco on Health, Science, Environment and Green Technology
- PLAN Perak

Supporting Organization (s)

- All the agencies
- Corporate
- Private
- Local communities
- Orang Asli community associations

Timeframe

- Medium-term (5 -10 years)

Strategy 4.5 Establish a financing mechanism for UKBMaS

Description

In order to implement the management strategy for UKB, it will be necessary to secure funding from multiple sources including government agencies, private sector (CSR funds) and/or through user and polluter pay mechanisms or Payment for Ecosystem Services (PES).

Action plan

a) Idenfify the resource needed to implement the strategy
b) Identify potential funding sources including government, private sector and other including international funders
c) Incorporate funding into requests from Malaysia plan
    - Funding from both federal and state
d) Establish user pay schemes such as allocating portion of water tariffs or Payment for Ecosystem Services (PES).

- Infuse in water bills and tariff increase based on usage (domestic, commercial and industrial)
- Fixed amount (no percentage)

e) Establish polluter pay schemes – such as charge to relevant agency or road users for cost of erosion control

Lead Organization (s)

- Perak State Exco on Health, Science, Environment and Green Technology
- Perak State Economy Planning Unit

Supporting Organization (s)

- Ministry of Water, Land and Natural Resources (KATS)
- Other State Agencies
- Private & Corporate
- NGOs
- Communities

Timeframe

- Medium (5-10 years)

CHAPTER 5: IMPLEMENTING THE STRATEGY

5.1 Institutional arrangements - outlining responsibilities and integration

For effective implementation of UKBMaS, institutional organization is important and vital. **Table 5.1** shows the list of institutions that are key for UKBMaS implementation.

Table 5.1 Institutional list for UKBMaS implementation

No.	Agency*	Type of institution
1.	Ministry of Water, Land and Natural Resources (KATS)	Federal government
2.	Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC)	Federal government
3.	Department of Irrigation and Drainage (DID) Malaysia	Federal government
4.	Department of Environment (DOE) Malaysia	Federal government
5.	Department of Mineral and Geoscience Malaysia (JMG)	Federal government
6.	Department of Survey and Mapping Malaysia (JUPEM)	Federal government
7.	Public Works Department (PWD)	Federal government
8.	National Water Services Commission (SPAN)	Federal Government
9.	Perak State Government (Exco for Education, Science, Environment, Green Technology and Information & other related Excos)	State government
10.	Department of Irrigation and Drainage (DID) Perak	State government
11.	Department of Town and Country Planning Perak (PLANMalaysia@Perak)	State government
12.	Department of Environment (DOE) Perak	State government
13.	Perak State Forestry Department	State government
14.	Perak State Education Department (SED)	State government
15.	Department of Orang Asli Development	State government
16.	Perak State Office of Land and Mines	State government
17.	Perak State Agricultural Development Corporation	State government
18.	Department of Fisheries Perak	State government
19.	Department of Mineral and Geoscience Perak	State government
20.	Perak Water Board (LAP)	State government
21.	Perak Economic Planning Unit (UPEN)	State government
22.	Perak State Health Department	State government
23.	Perak State National Solid Waste Management Department (NSWMD).	State government
24.	Kinta Manjung District Forestry Office	Local government
25.	Ipoh City Hall	Local government
26.	Kinta Land and District Office	Local government

27.	Department of Irrigation and Drainage Kinta/Batang Padang	Local government
28.	Agroto Business (M) Sdn Bhd	Private sector
29.	Lafarge Cement Malaysia	Private sector
30.	Sunway City Ipoh	Private sector
31.	Global Environment Centre (GEC)	NGO
32.	Malaysian Nature Society (MNC)	NGO
33.	Ipoh City Watch (ICW)	NGO
34.	Orang Asli communities in UUKB	Communities
35.	Local communities in Tanjung Rambutan & Ipoh	Communities

- * **As per Dec 2019**

The stakeholders mentioned above have been identified as key stakeholders within the UKB and potentially playing very important role in implementing UKBMaS sustainably . They need to be integrated together under one framework so that all are able to work together to achieve common goals.

5.2 The Role of Stakeholders

Once relevant stakeholders are identified, specific task and role in implementing UKBMaS for each of them need to be developed and agreed upon. Their proposed roles were drafted based on their existing jurisdiction. **Table 5.2** shows the list of stakeholders and their role relating to four (4) goals in UKBMaS.

Table 5.2 Roles of stakeholders relating to UKBMaS goals

No.	Agency	Related UKBMaS goal				Role
		G1:To protect forest and biodiversity	G2:To protect and improve water resources	G3:To enhance sustainable livelihood and welfare of orang asli communities	G4:To enhance multi-stakeholder coordination & management	
1.	Ministry of Water, Land and Natural Resources (KATS)	√	√		√	• Coordinator at federal level for water, land, forest and natural resources.
2.	Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC)	√	√		√	• Coordinator at federal level for environment and climate change.
3.	Department of Irrigation and Drainage (DID) Malaysia		√		√	• Lead agency for river resource management
4.	Department of Environment (DOE) Malaysia	√	√		√	• Lead agency for monitoring water quality
5.	Department of Mineral and Geoscience Malaysia (JMG)	√	√	√	√	• Lead agency for groundwater assessment and approval for extraction
6.	Department of Survey and Mapping Malaysia (JUPEM)	√	√		√	• Assist in planning and boundaries setting

7.	Public Works Department (PWD)	√	√		√	• Lead agency to control pollution from roads/highways and related activities within its jurisdiction
8.	National Water Services Commission (SPAN)		√		√	• Lead national Agency to oversee water resource services
9.	Perak State Government (Exco for Education, Science, Environment, Green Technology and Information & other related Excos)	√	√	√	√	• Head committee for UKBMaS :UKB Integrated Catchment Managementm(ICM) committee
10.	Department of Irrigation and Drainage (DID) Perak	√	√	√	√	• Lead agency for river management in Perak state
11.	Department of Town and Country Planning Perak (PLANMalaysia@Perak)	√	√		√	• Lead agency for planning in Perak state
12.	Department of Environment (DOE) Perak	√	√	√	√	• Monitor river water quality and environmental safeguards for large-scale developments in Perak state
13.	Perak State Forestry Department	√	√	√	√	• Lead agency for forest protection in Perak state
14.	Perak State Education Department (SED)	√	√	√	√	• Agency that can be integrated for outreach
15.	Department of Orang Asli Development		√	√	√	• Lead agency that oversees welfare and activities of Orang Asli
16.	Perak State Office of Land and Mines	√	√	√	√	• Lead agency for approval of development and land ownership

17.	Department of Fisheries Perak	√	√	√	√	• Lead agency for planning and approving fisheries and its related businesses in state
18.	Department of Mineral and Geoscience Perak	√			√	• Document mineral and geosciences in state with promotion of conservation
19.	Perak Water Board (LAP)	√	√	√	√	• Lead agency for providing water supply for the state
20.	Perak Economic Planning Unit (UPEN)	√	√	√	√	• Planning and approval for economic and development activities in state
21.	Perak State Health Department			√	√	• Agency that monitors drinking water quality and health of residents in state
22.	Perak State National Solid Waste Management Department (NSWMD).			√	√	• Agency that manages solid waste in state
23.	Kinta Manjung District Forestry Office	√		√	√	• Direct agency that monitors forest management in UUKB
24.	Ipoh City Hall		√		√	• Lead agency to manage solid waste and drainage in Ipoh town
25.	Kinta Land and District Office	√	√	√	√	• Lead agency that plans and approve developments in Kinta district
26.	Department of Irrigation and Drainage Kinta/Batang Padang		√	√	√	• Lead agency to monitor water resources within Kinta district

27.	Agroto Business (M) Sdn Bhd	√	√	√	√	• Company developing portion of catchment that needs to ensure sustainable agrofarming
28.	Lafarge Cement Malaysia	√	√		√	• Player that needs to ensure sustainable quarrying and processing
29.	Sunway City Ipoh	√	√		√	• Player that undertake sustainable development in Ipoh City
30.	Global Environment Centre (GEC)	√	√	√	√	• NGO that works with all stakeholders to realize successful UKBMaS
31.	Malaysian Nature Society (MNC)	√	√	√	√	• NGO that works with all stakeholders to realize successful UKBMaS
32.	Ipoh City Watch (ICW)	√	√	√	√	• NGO that works with all stakeholders to realize successful UKBMaS
33.	Orang Asli communities in UUKB	√	√	√	√	• Lead community group that monitors forest in UKB
34.	Local communities in Tanjung Rambutan & Ipoh		√	√	√	• Lead community group that helps Orang Asli to ensure continuous water supply while practicing sustainable water consumption

5.3 Institutional Arrangements

Institutional arrangement for UKBMaS implementation as per Figure 5.1. Chief Minister proposed to chair the state environmental committee which UKBMaS implementation can be reported, monitored and reviewed . Besides government agencies, grassroots voices also proposed to be taken in account by giving one seat for representative from coalition of NGOs, local communities and private agencies.

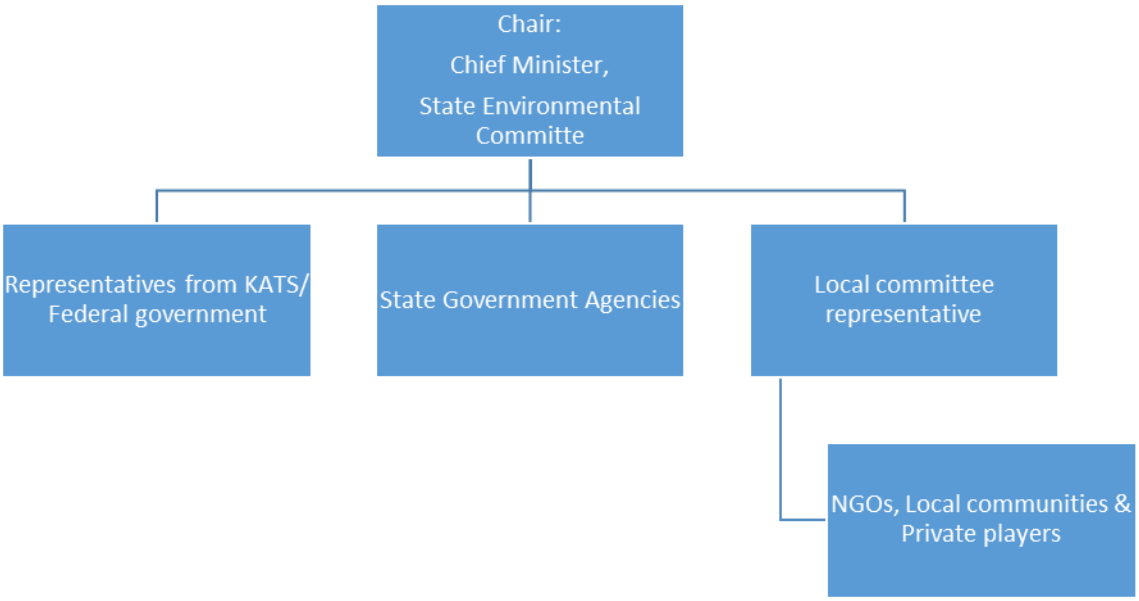


Figure 5.1 UKBMaS institutional arrangement

5.4 Resources and support for Implementation

There need to be proper resources and support for successful implementation of UKBMaS. Table 5.3 shows the potential resources and support needed for UKBMaS implementation.

Table 5.3 Resources and support for UKBMaS implementation

NO.	Resources	Support
1.	Human resources	• Allocate personnel from existing agencies • Additional budget for personnel from state and federal governments • Involve local communities for monitoring
2.	Logistic arrangement such as vehicles, information centre etc.	• Explore unused and unoccupied buildings/facilities • Additional budget from state and federal government
3.	Digital technology (Website. Mobile application etc.)	• Agencies to agree for one common platform • Either Federal/State government takes lead on setting up this mechanism
4.	Monitoring tools and facilities	• Allocation for new purchase and maintenance from relevant agencies • Repair and use existing ones that can be used
5.	Capacity building programmes & initiatives	• Agencies to support continuous capacity building programmes for key personnel involved in UKBMaS
6.	Open access platform for data repository and reference	• Either state/federal government lead on setting up the open access for stakeholders to refer progress of UKBMAS
7.	Funding for implementation of the strategy	• Federal allocations (RMK12 etc) • State agency allocations • User pay/polluter pay schemes • Payment for Ecosystem Services • Private sector contributions

CHAPTER 6: KEY PERFORMANCE INDICATORS

6.1 Introduction

This section covers Key Performance Indicators (KPI) for the goals outlined in UKBMaS. KPI drawn based on respective strategies and proposed action plan under respective goals. Monitoring methods through stakeholders: either agencies or communities emphasized for easier adoption, implementation and monitoring. Reporting mechanisms also described within this section.

6.2 Scope

KPI mainly drawn based on strategies highlighted in each goal in chapter 4. KPIs will be in line with goal's measurable outcomes in long term. KPIs set follows SMART concept that stands for Specific, Measurable, Attainable, Relevant and Time-bound.

6.3 Key Performance Indicators (KPIs)

Overall a total of 45 KPIs proposed to be monitored. Table **6.1** shows the breakdown of KPIs for strategies under each goal.

Table 6.1 Number of KPIs for each goals

Goal	Number of strategies	Number of KPIs
1	7	14
2	7	14
3	4	8
4	5	9
Total	23	45

6.3.1 KPIs for Goal 1: To sustainably manage biodiversity in the Upper Kinta Basin (UKB)

Table 6.2 shows the proposed 14 KPIs for Goal 1.

Table 6.2 Proposed KPIs for Goal 1

Strategy	KPIs	Monitoring Methods	Leading Stakeholders	Reporting Mechanism/ Tool
Delineation of Catchment Forest Boundaries and restriction of access	• Percentage of delineation carried out • Number of access restriction • Rate of annual changes in catchment forest boundaries	• On site survey • Geographical Information System (GIS) • Satellite Survey • Maps	• Perak State Forestry Department	• Updated maps • Field report • Annual report

Promoting Linkages with the Central Forest Spine (CFS) Initiative and enhance protection of environmentally sensitive areas (ESA/KSAS)	• Inclusion of UKB within CFS as linkage • Provision of ESA Class for UKB	• CFS report • Satellite Survey • Maps	• Perak State Exco on Health, Science, Environment and Green Technology • Federal Department of Town and Country Planning (PLAN) • Perak State Forestry Department • Perak State Wildlife Department	• CFS Masterplan
Promoting Sustainable Eco-tourism in Upstream UKB	• Percentage of involvement of Orang Asli in Mount Korbu tourism • Number of Orang Asli benefiting directly esp generating alternative income	• Log/Record book • Survey	• Perak State Forestry Department • Ministry of Tourism, Arts and Culture Malaysia (MOTAC) • Department of Orang Asli Development (JAKOA)	• Report • Committee meetings

Promoting Forest Stewardship by Orang Asli Communities and local communities	• Number of Training to empower the communities • Numbers of OA/local community forest stewardess	• Stakeholders record • Forest monitoring • Field survey	• Perak State Forestry Department	• Training report • Reporting to agencies • Web portal • Mobile application
Rehabilitation of degraded forest and riverine areas	• Percentage of rehabilitated degraded forest areas • Percentage of rehabilitated degraded riverine areas	• Field survey • Rehabilitation activity monitoring	• Perak State Forestry Department • Department of Wildlife and national parks • Department of Irrigation and Drainage (DID) Perak	• Report • Improvement assessment • Audit
Support sustainable development of Kinta Geopark	• Number of activities carried out annually relating to Kinta Geopark	• Activity monitoring • Participation of stakeholders in activities	• Perak State Exco on Health, Science, Environment and Green Technology • Perak State Parks Corporation	• Report

Mainstreaming biodiversity into river management	• Number of activities carried out in UKB with this concept • Improvement rate in riverine biodiversity	• Field survey/expedition • Biodiversity monitoring & reporting	• Department of Irrigation and Drainage (DID) Perak • Perak State Forestry Department • Department of Wildlife and national parks • Public Works Department • Perak Water Board	• Report • Improvement assessment • Audit

6.3.2 KPI for Goal 2: To protect and improve rivers and water resources in UKB.

Table 6.3 shows the proposed 13 KPIs for Goal 2.

Table 6.3 Proposed KPIs for Goal 2

Strategy	KPIs	Monitoring Methods	Leading Stakeholders	Reporting Mechanism/ Tool
Assess and quantify the Pollutant Sources in UKB	• Number of monitoring by communities • Annual pollution source inventory in UKB by agencies	• Pollution monitoring • Field survey	• Department of Environment (DOE) Malaysia • Department of Irrigation and Drainage (DID) Perak • Perak State Forestry Department	• Centralized web portal • Centralized mobile application

Undertake immediate measures to address slope erosion along highway	• Checklist on slope risk categories along the highway • Number of hard-engineering measures to address slope erosion • Number of bio-engineering measures to address slope erosion	• Impact monitoring • Slope survey & monitoring • Biodiversity survey & monitoring	• Perak State Exco on Health, Science, Environment and Green Technology • Slope Engineering Division, Public Works Department (JKR) • Department of Irrigation and Drainage (DID) Perak • Department of Environment (DOE) Malaysia • Perak Water Board	• Web portal • Citizen science reporting • Annual report
Enhance siltation control and desilting measures at Sultan Azlan Shah Reservoir	• Annual rate of reduction in siltation	• Sediment trap monitoring • Check dam monitoring • Water quality monitoring	• Department of Irrigation and Drainage (DID) Perak	• Reports • Audit

		(Biological & Physicochemical)	• Department of Environment (DOE) Malaysia • Perak Water Board	• Citizen science reporting
Review and upgrade as necessary the water treatment system at Sultan Azlan Shah Reservoir	• Percentage of compliance of water quality to drinking water quality standards • Ability of supply potable water as per demand	• Public feedback/complaints • Log book record on water supply disruption • Field survey	• Perak Water Board • National Water Service Commission (SPAN)	• LAS report • Web portal • Mobile application
Improve water quality and recreation sites downstream of the Dam	• Water quality target setting based on beneficial usage for recreation site • Number of beneficiaries from recreational sites at downstream	• Public participation • Fishing activity monitoring • Recreation activity monitoring	• Department of Irrigation and Drainage (DID) Perak • Perak State Forestry Department	• Report • Committee meetings

Enhance Monitoring of Water Quality and flow in UKB	• Frequency of water quality and flow monitoring • Improved water quality within UKB	• Water quality monitoring • River Hydrology study • Rainfall monitoring • DID's Automatic Monitoring stations	• Department of Irrigation and Drainage (DID) Perak • Department of Environment (DOE)	• Environmental Quality Report • Citizen science reporting
Undertake an outreach programme to UKB water consumers to inform them of the importance of protection/monitoring of UKB for water supply	• Number of outreach programmes carried out annually • Number of initiatives carried out annually by targeted groups	• Consultation • Trainings/workshops • Roadshows • Initiatives	• Perak State Exco on Health, Science, Environment and Green Technology • Perak Water Board • Department of Irrigation and Drainage (DID) Perak • Department of Environment (DOE)	• Report • Survey • Committee meetings

6.3.3 KPI for Goal 3: To enhance sustainable livelihood and welfare of Orang Asli communities in the Upper Kinta Basin (UKB)

Table 6.4 shows the proposed 6 KPIs for Goal 3.

Table 6.4 Proposed KPIs for Goal 3

Strategy	KPIs	Monitoring Methods	Monitoring Stakeholders	Reporting Mechanism/ Tool
Develop Alternative Sustainable Livelihoods for Orang Asli Communities in UKB	• Number of alternative livelihoods developed • Number of Orang Asli benefitting from alternative sustainable livelihood	• Demographic survey • Initiative report	• Department of Orang Asli Development (JAKOA) • Ministry of Tourism, Arts and Culture Malaysia (MOTAC)	• Report

Enhance safe water supply and sanitation for Orang Asli Communities in UKB	• Percentage of clean (improved) water supply for Orang Asli • Percentage of improved sanitation for Orang Asli	• Field survey • Infrastructure support • Beneficiaries' inventory	• Department of Orang Asli Development (JAKOA) • Perak Water Board • Northern Regional Water Service Commission (SPAN) • Perak State Health Department	• Compliance report • Environmental Quality Report • Audit
Enhance welfare for Orang Asli communities in UKB	• Number of welfare initiatives • Percentage of improved welfare for Orang Asli	• Field survey • Infrastructure support • Beneficiaries' inventory	• Department of Orang Asli Development (JAKOA)	• Report • Audit
Enhance promotion and marketing of Products from orang Asli Communities in UKB	• Number of promotion/marketing products	• Demographics survey • Beneficiaries' inventory	• Department of Orang Asli Development (JAKOA)	• Report • Audit

	• Number of Orang Asli benefitting from marketing & selling		• Ministry of Tourism, Arts and Culture Malaysia (MOTAC)	

6.3.4 KPI for Goal 4: To enhance multi-stakeholder coordination & management

Table 6.5 shows the proposed 9 KPIs for Goal 4.

Table 6.5 Proposed KPIs for Goal 4

Strategy	KPIs	Monitoring Methods	Monitoring Stakeholders	Reporting Mechanism/ Tool
Implement Effective Inter-Agency Coordination for Sustainable Management of UKB	• Establishment of state level environmental protection and monitoring committee • Number of environmental related	• Committee meetings • Activity updates	• Perak State Exco on Health, Science, Environment and Green Technology	• Meeting report • UKBMaS adoption reporting

	stakeholders in committee			
Building Effective Mechanisms for Stakeholder Participation	• Effective Mechanism developed and used • Number of stakeholders implementing UKBMaS	• Activity monitoring • Initiatives monitoring	• Perak State Exco on Health, Science, Environment and Green Technology • All the agencies	• Committee meeting • Centralized web portal for UKBMaS
Promote effective Outreach, Monitoring and Reporting (OMR) Mechanisms	• % of monitoring activities carried out under UKBMaS • % of issues reporting by target groups • Rate of feedback	• Pollution reporting • Complaints • Feedback mechanism	• Perak State Exco on Health, Science, Environment and Green Technology • All the agencies	• Committee meeting • Citizen Eye mobile application
Promote the inclusion of UKBMaS in future local planning decision-making	• Number of UKB action/strategies adopted in local/state plan	• Strategy • Initiatives monitoring	• Perak State Exco on Health, Science, Environment and Green Technology • PLAN Perak • All the agencies	• Local town plan • State plan • Committee meeting

Establish financing mechanism for catchment protection and monitoring	• Establishment Sustainable financing options for UKBMaS	• Monetary benefits • CapEx & OpeX	• Perak State Exco on Health, Science, Environment and Green Technology • Perak State Economy Planning Unit •	• State budget committee meetings • Audit • Financial reporting

ANNEX 1 : PROPOSED ACTION PLAN FOR ORANG ASLI COMMUNITY IN HULU KINTA RIVER BASIN (*CADANGAN PELAN TINDAKAN KOMUNITI ORANG ASLI KAWASAN LEMBANGAN HULU KINTA*)

(PEMBANGUNAN EKOPELANCONGAN DAN PENGUSAHAAN TAPAK SEMAIAN)

Disediakan oleh:

Global Environment Centre

YAYASAN HASANAH
A foundation of Khazanah Nasional

Disokong oleh:

PERAK

PERHUTANAN

JAKOA
JABATAN KEMAJUAN ORANG ASLI

- 1.0 PENGENALAN PROJEK

Sebagai usaha dalam memastikan kelestarian kawasan hutan dan sumber bekalan air terutamanya dalam kawasan Lembangan Hulu Kinta, pelbagai usaha boleh dilaksanakan dengan kerjasama semua pihak termasuklah komuniti tempatan. Penglibatan komuniti tempatan kini menjadi salah satu tonggak utama dalam memastikan sesuatu usaha berjaya dilaksanakan. Dalam usaha memastikan kelestarian kawasan Lembangan Hulu Kinta, penglibatan komuniti Orang Asli dilihat amat signifikan sebagai mata dan telinga kepada agensi atau jabatan kerajaan terutama dalam memantau dan melaporkan setiap permasalahan atau isu yang terdapat di persekitaran mereka. Sebagai contoh, sebarang kegiatan atau kejadian seperti hakisan, pembukaan tanah, pembalakan haram dan pencemaran sungai boleh dilaporkan oleh komuniti Orang Asli kepada agensi atau jabatan yang bertanggungjawab. Ini memudahkan kerja-kerja agensi dan jabatan untuk bertindak secara lebih efektif dan cepat dalam menangani masalah dan isu-isu tersebut.

Selain daripada itu, bagi memastikan usaha-usaha ini dapat dilaksanakan dengan berkesan dan berjaya, konsep seperti penerapan dan perlaksanaan sesuatu inisiatif juga dilihat amat berkesan. Melalui penerapan dan penubuhan inisiatif seperti ekopelancongan dan pengusahaan tapak semaian komuniti, dilihat sebagai satu langkah yang produktif dalam memastikan penglibatan aktif kumpulan sasaran seperti komuniti Orang Asli. Hal ini kerana, melalui konsep ini komuniti akan secara langsung memperoleh manfaat dan berupaya menjadi sumber pendapatan kepada mereka disamping mengekalkan kelestarian kawasan hutan dan persekitarannya.

Namun begitu, sokongan dan kerjasama daripada agensi serta jabatan seperti Jabatan Perhutanan Negeri Perak, Jabatan Pengairan dan Saliran Negeri Perak dan Jabatan Kemajuan Orang Asli Negeri Perak adalah penting dalam memastikan penglibatan komuniti Orang Asli ini dapat dilihat sebagai suatu inisiatif yang berjaya dan menjadi perintis bagi Negeri Perak.

- 2.0 LATAR BELAKANG

Sebanyak 4 projek yang berlainan dibawah perlaksanaan GEC akan menyokong projek pembangunan ekopelancongan serta pengusahaan tapak semaian. Projek-projek tersebut adalah:

a) Projek Pengurusan Bersepadu Lembangan Hulu Kinta

Projek Pengurusan Bersepadu Lembangan Sungai Hulu Kinta bagi komuniti dan perkhidmatan ekosistem melalui penglibatan aktif komuniti dan pihak berkepentingan adalah sebuah inisiatif dibawah Global Environment Centre (GEC) dengan kerjasama Yayasan Hasanah (YH) yang dilaksanakan bermula tahun 2018 sehingga pertengahan tahun 2021. Matlamat projek ini adalah untuk memelihara hutan dan habitat sungai di Lembangan Sungai Hulu Kinta bagi menyokong inisiatif pelan induk *Central Forest Spine* (CFS) melalui perkongsian sektor rentas dan pemerkasaan komuniti.

Objektif bagi mencapai matlamat projek ini adalah terbahagi kepada dua objektif utama iaitu:

i. Untuk membangunkan dan mengadaptasi strategi pengurusan hutan dan sumber air di Lembangan Sungai Hulu Kinta.
ii. Untuk mewujudkan program penglibatan masyarakat untuk menangani isu-isu mengenai pengurusan hutan dan perlindungan sungai.

b) Projek Pemerkasaan Komuniti Orang Asli Dalam Pemuliharaan Sumber Semulajadi dan Kelangsungan Hidup

Projek Pemerkasaan Komuniti Orang Asli Dalam Pemuliharaan Sumber Semulajadi dan Kelangsungan Hidup adalah sebuah inisiatif dibawah Global Environment Centre (GEC) dengan kerjasama *United Nation Development Programme* (UNDP) yang dilaksanakan bermula 2020 sehingga pertengahan tahun 2021. Matlamat projek ini adalah untuk memperkasakan komuniti Orang Asli di Malaysia dalam pemuliharaan sumber semulajadi dan kelangsungan kehidupan melalui mitigasi hakisan, perlindungan dan rehabilitasi kawasan hutan, sungai serta tanah gambut.

Objektif bagi mencapai matlamat projek ini adalah terbahagi kepada empat objektif utama iaitu:

i. Menyokong kehidupan Orang Asli dan rehabilitasi kawasan tanah gambut di Pekan, Pahang.

ii. Memperkasa komuniti Orang Asli dalam tindakan melindungi kawasan tadahan hutan dan sumber air di Lembangan Hulu Kinta, Perak.

iii. Memperkasa dalam rehabilitasi kawasan hutan paya bakau dan menambahbaik kelangsungan hidup oleh Sahabat Hutan Gambut Kuala Langat Utara, Selangor.

iv. Menyediakan kemudahan pembangunan kapasiti Orang Asli melalui latihan dan pertukaran maklumat.

c) Projek Mengarusperdanakan Pemuliharaan Kepelbagaian Biologi dalam Pengurusan Sungai

Projek Mengarusperdanakan Pemuliharaan Kepelbagaian Biologi dalam Pengurusan Sungai adalah sebuah inisiatif dibawah Global Environment Centre (GEC) dengan kerjasama Global Environment Facility (GEF) Phase 5, dan United Nation Development Programme (UNDP) yang dilaksanakan bermula Januari 2020 hingga Disember 2020. Matlamat projek ini adalah untuk menyumbang kepada pemuliharaan dan pemanfaatan kepelbagaian biologi secara mampan dalam pengurusan sungai di Malaysia.

Objektif bagi mencapai matlamat projek ini adalah terbahagi kepada dua objektif utama iaitu:

i. Untuk meningkatkan keupayaan institusi dan teknikal bagi pemuliharaan kepelbagaian biodiversiti sungai di kalangan pihak berkepentingan utama.

ii. Menubuhkan tapak perintis dan demonstrasi bagi mempromosikan penyepaduan pemuliharaan kepelbagaian biodiversiti sungai ke dalam pengurusan sungai.

d) Projek Memperkasakan Kelangsungan Hidup Komuniti Di Lembangan Hulu Kinta sebagai Sebahagian Daripada Strategi Pasca Pandemik Covid-19.

Projek Memperkasakan Kelangsungan Hidup Komuniti Di Lembangan Hulu Kinta sebagai Sebahagian Daripada Strategi Pasca Pandemik Covid-19 adalah sebuah inisiatif dibawah Global Environment Centre (GEC) dengan kerjasama Yayasan Hasanah (YH) yang dilaksanakan bermula Jun 2020 sehingga April 2021. Matlamat program ini adalah bagi menyokong kelangsungan hidup komuniti termasuk menyediakan peluang pekerjaan pasca tempoh Perintah Kawalan Pergerakan (PKP) bagi menjana pendapatan, sokongan peningkatan sosio-ekonomi dan kesihatan mental dalam kalangan komuniti terutamanya komuniti Orang Asli dalam kawasan Lembangan Hulu Kinta.

Objektif bagi mencapai matlamat projek ini adalah:

i. Untuk meningkatkan dan mewujudkan sumber alternatif segera bagi kelangsungan hidup dalam kalangan komuniti Orang Asli yang berada dalam Lembangan Hulu Kinta.
ii. Untuk meningkatkan dan mewujudkan sumber alternative bagi kelangsungan hidup dalam kalangan komuniti bandar dan pinggir bandar yang berada dalam Lembangan Hulu Kinta.
iii. Untuk mewujudkan sinergi antara komuniti bandar/ pinggir bandar dengan komuniti Orang Asli berkaitan aktiviti-aktiviti ekonomi berasaskan alam sekitar.

Dalam memastikan projek-projek ini dapat dilaksanakan dengan berjaya, GEC dengan kerjasama semua jabatan seperti Jabatan Pengairan dan Saliran Negeri Perak, Jabatan Perhutanan Negeri Perak, Jabatan Kemajuan Orang Asli Negeri Perak, Majlis Bandaraya Ipoh dan lain-lain telah menubuhkan satu Jawatankuasa Kerja Projek (PWG) bagi memantau dan menyelaras setiap perlaksanaan aktiviti dan program sepertimana yang dirancang.

3.0 OBJEKTIF PELAN PERANCANGAN

Rancangan Pengurusan Hutan Negeri Perak 2016-2025 (RPH Perak 2016-2025) dihasilkan oleh Jabatan Perhutanan Negeri Perak (JPNPk) dan dijadikan dokumen rujukan asas untuk merancang dan mengurus hutan simpan kekal secara berkekalan di negeri Perak. Dalam RPH ini, Program Perhutanan Sosial (PPS) adalah merupakan program tumpuan utama yang melibatkan peluasan skop aktiviti bersesuaian dengan peranannya sebagai ejen pemangkin dalam meningkatkan taraf hidup di kalangan masyarakat kampung, orang asli, dan badan bukan kerajaan (NGOs). Empat (4) modul utama menjadi teras kepada PPS ini adalah program kesedaran bersama masyarakat, program pemeliharaan dan konservasi, program

restorasi serta penghijauan semula landskap dan program ekopelancongan.. RPH Perak 2016-2025 juga mensasarkan untuk membentuk sekurang-kurangnya satu (1) model (perintis) bagi PPS di Semenanjung Malaysia dan menjadi produk penting bagi Negeri Perak.

Selain itu, 'Upper Kinta Basin Management Strategy' (UKBMaS) merupakan sebuah strategi yang telah dibentuk dengan input daripada pelbagai agensi kerajaan termasuk Jabatan Perhutanan Negeri Perak. Empat matlamat utama telah digariskan dalam UKBMaS. Matlamat ketiga adalah "Untuk menambahbaik kelestarian kehidupan dan kebajikan komuniti orang asli di Lembangan Hulu Kinta". Empat strategi telah dibentuk di bawah matlamat ketiga seperti berikut:

1.0 Membangunkan mata pencarian alternatif yang mampan untuk komuniti Orang Asli di UKB
2.0 Menambahbaik sumber bekalan air bersih dan pengurusan sanitasi untuk komuniti Orang Asli di UKB
3.0 Menambahbaik kebajikan komuniti orang asli di UKB
4.0 Meningkatkan promosi dan pemasaran Produk dari Komuniti Orang Asli di UKB

Seiring dengan RPH 2016-2025 dan UKBMaS, pelan perancangan pembangunan ekopelancongan dan pengusahan tapak semaian dirancang bagi kesejahteraan Hulu Kinta. Kawasan ini juga merupakan antara tapak geosite di bawah *Kinta Valley's Geopark*. Inisiatif ini bukan sahaja akan membantu sebagai pendapatan sampingan bagi komuniti terutamanya komuniti Orang Asli,malahan, akan menyediakan sumber tenaga bagi penjagaan lembangan sungai Hulu Kinta.

• 4.0 GLOBAL ENVIRONMENT CENTRE

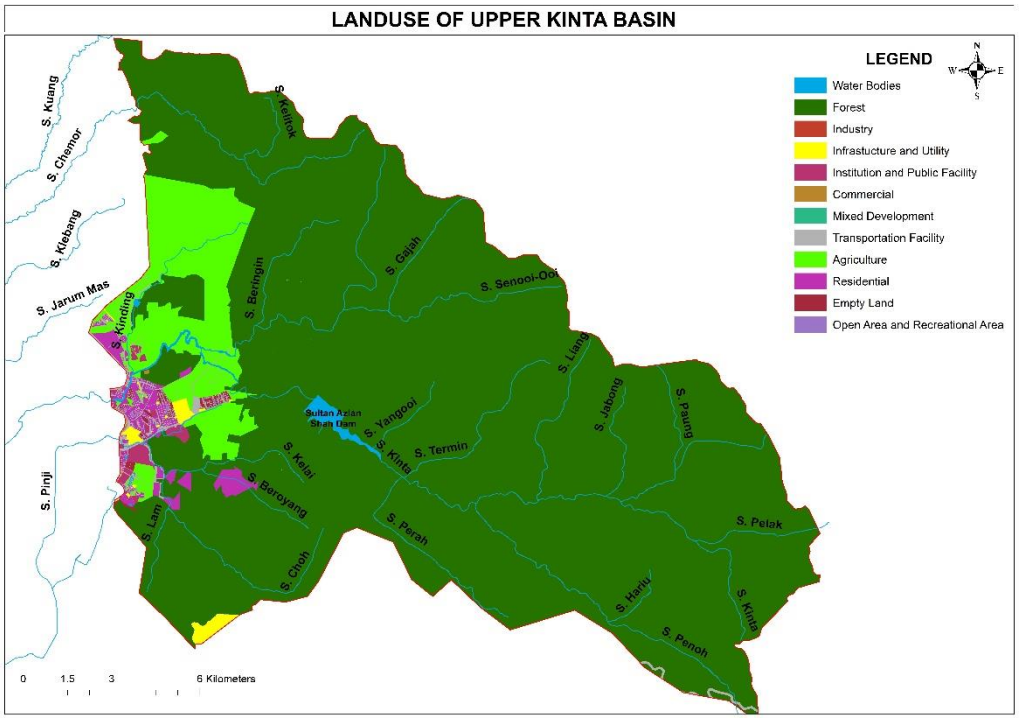
Global Environment Centre (GEC) telah ditubuhkan pada tahun 1998 untuk mengendalikan isu alam sekitar yang mempunyai kepentingan untuk global. GEC didaftarkan sebagai Organisasi Bukan Berkeuntungan (NGO) yang berfungsi secara serantau dan antarabangsa secara langsung dan melalui rakan strategik serta pihak berkepentingan. GEC juga menyokong pertukaran maklumat dan pembinaan kapasiti serta melaksanakan projek-projek strategik khususnya di negara-negara membangun.

Misi utama GEC adalah menyokong perlindungan alam sekitar dan penggunaan sumber alam mampan untuk memenuhi keperluan tempatan, serantau dan global melalui perkongsian strategik dengan masyarakat dan organisasi yang sama matlamat.

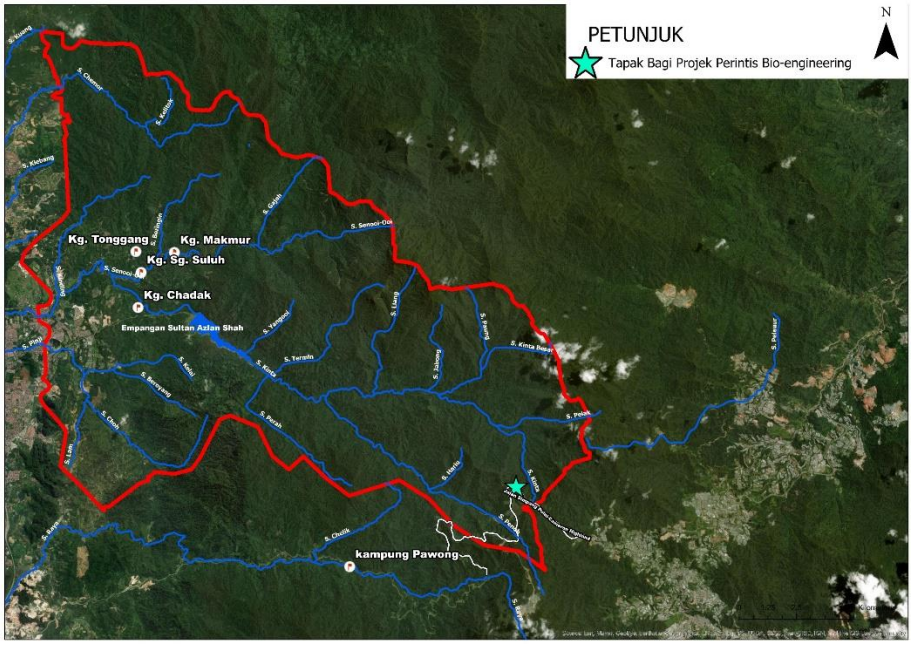
Bagi negeri Perak, GEC telah memulakan projek berkaitan pengurusan sumber air sejak tahun 2012 dibawah projek 'WATER' iaitu *Working Actively Through Education and Rehabilitation.* Projek W.A.T.E.R. di Perak telah berjaya melatih pelbagai kumpulan sasaran seperti komuniti tempatan, institusi pendidikan, premis perniagaan dan agensi kerajaan dalam pengurusan lembangan sungai secara bersepadu.

- 5.0 KAWASAN PROJEK

Cadangan kawasan projek adalah sekitar perkampungan Orang Asli dalam Lembangan Hulu Kinta (UKB) sepertimana ditunjuk dalam gambar peta dibawah.



Gambar 1: Keseluruhan kawasan Lembangan Hulu Kinta



Gambar 2: Kawasan perkampungan Orang Asli (OA)

- 6.0 CADANGAN PIHAK BERKEPENTINGAN

Pihak berkepentingan yang relevan adalah penting bagi perlaksanaan perancangan ini kerana pihak berkepentingan yang berbeza memberikan khidmat dan tanggungjawab khusus serta pengaruh yang berlainan mengikut bidang masing-masing. Senarai pihak berkepentingan yang relevan yang berpotensi dalam menyokong perlaksanaan perancangan ini adalah seperti berikut:

i. Jabatan Perhutanan Negeri Perak (JPNPk)
ii. Jabatan Pengairan dan Saliran (JPS) Negeri Perak
iii. Jabatan Kemajuan Orang Asli (JAKOA) Negeri Perak
iv. Jabatan Mineral dan Geosains (JMG) Malaysia Negeri Perak
v. Perbadanan Taman Negeri Perak
vi. Pejabat Kementerian Pelancongan, Seni dan Budaya Malaysia Negeri Perak
vii. Jabatan Perhilitan Negeri Perak
viii. Lain-lain agensi dan jabatan mengikut keperluan semasa.

- 7.0 PERLAKSANAAN PROJEK
- 7.1 Aktiviti Utama
- 7.1.1 Penubuhan Jawatankuasa Perlaksana Projek (JPP)

Penubuhan Jawatankuasa Perlaksanan Projek (JPP) adalah penting dalam memastikan sesuatu projek dapat dilaksanakan dengan baik dan berjalan lancar mengikut perancangan. Oleh itu beberapa agensi dan jabatan yang berkepentingan perlu dikenalpasti dan dilibatkan dalam jawatankuasa ini. Tujuan JPP ini ditubuhkan adalah untuk memberikan bimbingan, nasihat, perancangan, sokongan dan pemantauan terhadap perancangan yang akan dilaksanakan. Tambahan lagi, peranan agensi dan jabatan juga adalah penting dalam pemilikan projek yang selari dengan matlamat setiap agensi dan jabatan terutamanya yang berkaitan dengan konsep ekopelancongan.

Jawatan	**Agensi/ Jabatan**
Pengerusi JPP	Jabatan Perhutanan Negeri Perak
Sekretariat 1	Jabatan Kemajuan Orang Asli (JAKOA) Negeri Perak
Sekretariat 2	Jabatan Pengairan dan Saliran (JPS) Negeri Perak Global Environment Centre (GEC)
Ahli	Jabatan Mineral dan Geosains (JMG) Malaysia Negeri Perak
Ahi	Pejabat Kementerian Pelancongan, Seni dan Budaya Malaysia Negeri Perak
Ahli	Jabatan Perhilitan Negeri Perak
Ahli	Perbadanan Taman Negeri Perak

- 7.1.2 Inisiatif Ekopelancongan

Ekopelancongan adalah perjalanan dan lawatan yang bertanggungjawab terhadap alam sekitar ke kawasan bersifat semula jadi untuk menikmati dan menyedari akan sifat semula jadi (termasuk sifat-sifat kebudayaan kini dan lalu) yang menggalakkan pemuliharaan alam

sekitar dan memberikan kesan yang minima serta membolehkan penglibatan secara aktif masyarakat tempatan di dalam aktiviti sosio ekonomi.

Oleh itu, Pelan Perancangan Pembangunan Ekopelancongan di Perkampungan Orang Asli Hulu Kinta ini dibangunkan untuk merancang serta melaksanakan aktiviti-aktiviti yang boleh mewujudkan suasana ekopelancongan yang mana berpotensi dibangunkan dikawasan tersebut mengikut keunikan dan tarikan yang sedia ada. Melalui perlaksanaannya, diharap dapat memberikan manfaat yang maksima terhadap sosio ekonomi komuniti setempat terutamanya komuniti Orang Asli sebagai peneraju dan pelaksana.

Selain itu, pelan ini juga akan mengambil kira dan mementingkan aspek-aspek pemuliharaan alam sekitar terutamanya perlindungan sumber air dan hutan sebagai kunci keberkesanan pembangunan ekopelancongan di sesuatu kawasan yang dibangunkan.

Objektif perlaksanaan pembangunan ekopelancongan bagi komuniti Orang Asli di Hulu Kinta adalah:

- Untuk melibat dan memperkasakan Orang Asli dalam pengurusan sumber semula jadi secara lestari terutamanya dalam pengurusan hutan dan perlindungan sungai.
- Untuk mempromosikan potensi ekopelancongan sedia ada dikawasan komuniti Orang Asli Hulu Kinta secara lestari.
- Untuk membantu masyarakat Orang Asli dalam meningkatkan kualiti kehidupan dan sosio-ekonomi setempat.
- Untuk menjalinkan kerjasama pintar antara masyarakat Orang Asli, pelancong dan agensi serta jabatan dalam pemuliharaan alam sekitar.

7.1.2.1 Penubuhan Kumpulan Jurupandu Alam Semula Jadi Masyarakat Orang Asli

Jurupandu Alam Semula Jadi adalah seseorang yang bertanggungjawab untuk memaklum, mendidik dan membawa pelancong ke sesuatu kawasan fokus kepada pengetahuan alam sekitar dan pemuliharaannya serta memberi kesan minima kepada persekitaran disamping menggalakkan tindakan positif dalam pengurusan lestari alam sekitar. Melalui pelan perancangan ini, sekurang-kurangnya satu kumpulan jurupandu alam semula jadi yang fokus lebih kepada Malim Gunung bagi pendakian ke Gunung Korbu akan diperkenalkan dalam kalangan komuniti Orang Asli. Tujuannya adalah untuk menggalakkan penggunaan khidmat komuniti tempatan dalam pendakian ke Gunung Korbu sebagai usaha membantu penambahbaikan sosio ekonomi mereka yang secara tidak langsung dapat mengurangkan kesan pencemaran kepada alam sekitar atau kawasan pendakian. Kumpulan ini akan dilatih untuk mahir dalam pelbagai aspek termasuklah sebagai mata dan telinga dalam pemantauan hutan melalui kursus-kursus yang akan dianjurkan secara bersama dengan pihak berkepentingan yang lain.

Sebagai permulaan kepada inisiatif ini, ia akan dimulakan dengan 2 buah perkampungan yang telah dikenalpasti iaitu:

i) Perkampungan Orang Asli Kampung Makmur
ii) Perkampungan Orang Asli Kampung Sungai Suluh

- 7.1.2.2 Penubuhan Kawasan Rekreasi

Kawasan rekreasi yang dirancang diperkenalkan adalah berkonsepkan eko dan hijau yang mempunyai kesan minima kepada sesuatu kawasan. Penubuhan kawasan rekreasi iaitu berkonsepkan mini chalet atau rumah hutan ditepian sungai atau kawasan berkelah yang seakan perkampungan Orang Asli sememangnya mempunyai daya tarikan dan mampu memberikan keuntungan kepada sosio ekonomi komuniti setempat. Konsep yang menampilkan ciri ringkas masyarakat Orang Asli seperti chalet/ pondok yang diperbuat daripada buluh, pokok bertam dan rotan sememangnya mempunyai nilai estetika yang tinggi dan unik untuk diketengahkan. Selain itu, sebagai pelengkap kepada konsep ekopelancongan yang diperkenalkan, komuniti tempatan juga boleh menyediakan perkhidmatan aktiviti-aktiviti yang menarik kepada pengunjung seperti persembahan kebudayaan, tarian sewang, aktiviti menyumpit, demo aktiviti pemburuan dan sebagainya. Penubuhan Pusat Jualan produk komuniti juga akan membantu dalam meningkatkan lagi sosio ekonomi bagi komuniti Orang Asli. Diharapkan kawasan ini juga akan menjadi kawasan persinggahan bagi pendaki-pendaki ke Gunung Korbu dan Bukit Batu Suluh untuk menikmati sumber alam yang tersedia ada. Melalui konsep ini, ianya secara tidak langsung dapat memberikan kesedaran kepada semua pihak berkenaan kepentingan penjagaan sumber alam terutamanya hutan dan sungai yang merupakan keperluan penting dalam kehidupan manusia termasuk flora dan fauna.

Selain daripada itu, beberapa kawasan juga telah dikenalpasti mempunyai daya tarikan dan berpotensi untuk dibangunkan sebagai kawasan santuari kerana persekitaran sungainya yang cantik serta mampu memberikan ketenangan kepada pengguna atau pelancong. Mengambil contoh konsep ekopelancongan di Kampung Luanti Sabah yang memperkenalkan sistem tagal dan menyediakan tarikan santuari kelah yang mana pelancong mempunyai peluang bermain dengan ikan kelah.

Sebagai permulaan kepada inisiatif ini, ia akan dimulakan dengan 2 buah perkampungan yang telah dikenalpasti iaitu:

i) Perkampungan Orang Asli Kampung Suluh
ii) Perkampungan Orang Asli Kampung Makmur

Gambar 3: Contoh chalet di perkampungan Orang Asli di Kuala Mu

Gambar 4: Contoh konsep chalet daripada sumber alam

Gambar 5: Cadangan kawasan yang akan dibangunkan dengan konsep kawasan rekreasi

- 7.1.3 Tapak Semaian Komuniti

Tapak semaian bermaksud suatu kawasan atau tapak yang dimajukan untuk menyemai atau membiak benih atau menanam anak pokok dan dibesarkan pada satu jangka masa yang sesuai. Objektif utama penubuhan tapak semaian ini adalah untuk menghasilkan bahan tanaman yang berkualiti bagi memenuhi keperluan dan permintaan serta untuk menggunakan anak pokok yang disemai dalam mengurus kawasan hutan Lembangan Hulu Kinta terutamanya digunakan dalam aktiviti penanaman pokok. Cadangan pokok yang akan disemai adalah terdiri daripada spesis buluh dan pokok tepian sungai yang boleh berfungsi sebagai pencegah hakisan.

Sebagai permulaan kepada inisiatif ini, ia akan dimulakan dengan 3 buah perkampungan yang telah dikenalpasti iaitu:

i) Perkampungan Orang Asli Kampung Tonggang.
ii) Perkampungan Orang Asli Kampung Makmur.
iii) Perkampungan Orang Asli Kampung Pawong.

Selain itu, tapak semaian ini juga akan dipromosikan sebagai kawasan tumpuan bagi ekopelancongan yang mana konsep pendidikan dan kesedaran akan diterapkan. Produk hasil daripada buluh dan sumber hutan juga akan dipamerkan serta dijual di tapak semaian ini sebagai tarikan tambahan. Selain daripada itu, aktiviti penanaman pokok juga boleh disediakan kepada pelancong, orang awam, atau organisasi yang berminat sebagai usaha memupuk kesedaran dalam kalangan mereka dan sebagai punca pendapatan kepada komuniti dalam memastikan kelestarian inisiatif yang dilaksanakan. Tambahan lagi, mana-mana pihak juga mempunyai peluang untuk menyumbang anak-anak pokok bagi ditanam di kawasan yang dikenalpasti serta memberi sumbangan dalam penyelenggaraan tapak semaian komuniti.

Gambar 6: Contoh cadangan tapak semaian di Kampung Tonggang

- 7.1.4 Penanaman Pokok

Aktiviti penanaman pokok juga merupakan sebahagian daripada aktiviti yang akan disediakan melalui pelan perancangan pembangunan ekopelancongan ini. Objektif aktiviti ini adalah untuk memulihara dan melindungi kawasan hutan terutamanya cerun dan tebing sungai daripada hakisan yang boleh membawa kepada pencemaran badan air (sungai). Selain itu, melalui aktiviti ini juga ianya dapat memelihara dan membaikpulih sesuatu habitat hidupan agar kepelbagaian biologi dapat dikekalkan secara lestari. Perlaksanaan aktiviti ini adalah secara berterusan dengan sokongan dan kerjasama daripada semua pihak terutamanya komuniti Orang Asli tempatan, agensi dan jabatan kerajaan serta badan-badan swasta yang lain yang mempunyai minat serta fokus utama iaitu memelihara alam sekitar. Melalui aktiviti penanaman pokok ini juga ianya dapat menutup kitaran penubuhan tapak semaian dengan cara beli semula semaian yang dihasilkan oleh komuniti.

Cadangan utama penanaman pokok ini adalah disepanjang laluan pendakian ke Gunung Korbu, Bukit Batu Suluh serta sekitar kawasan tebing Sungai Penoh dan Sungai Kinta yang terhakis serta kawasan-kawasan tebing dan cerun yang terjejas yang dikenalpasti.

Selain itu, kawasan utama bagi aktiviti penanaman pokok (bioengineering) akan dilaksanakan di KM45.9 (FT185) Lebuhraya Simpang Pulai – Cameron Highlands iaitu dikawasan cerun yang terhakis. Tapak ini akan menjadi Tapak Perintis kepada kerajaan Negeri Perak bagi perlaksanaan konsep Bioengineering.

Gambar 7: Tapak Perintis bagi Bioengineering KM45.9 (FT185)

Gambar 8: Tapak Penanaman bagi hulu Sungai Penoh

- 7.2 Tempoh Perlaksanaan Projek

Cadangan tempoh masa perlaksanaan projek termasuk aktiviti yang akan dilaksanakan adalah sepanjang Januari 2020 sehingga Mei 2021 dan akan dilanjutkan bergantung kepada keperluan . Pecahan perlaksanaan aktiviti mengikut bulan perlaksanaan adalah seperti jadual dibawah.

Bil	Bulan	Aktiviti
1	Januari hingga Februari 2020	• Konsultasi bersama pihak berkepentingan. • Mengenalpasti cadangan kawasan perlaksanaan.
2	April/ Mei 2020	• Mesyuarat jawatankuasa kerja projek (PWG) khusus bagi ekopelancongan. • Perancangan dan penyelarasan terperinci bersama pihak berkepentingan.
3	Mei -Ogos 2020	• Bengkel 'Input' bersama pihak berkepentingan dalam ekopelancongan. • Lawatan tapak kawasan cadangan projek bersama jawatankuasa kerja projek. • Kursus ekopelancongan (malim gunung) bagi Orang Asli. • Penubuhan tapak semaian komuniti oleh Orang Asli.
4	Jun 2020 hingga Februari 2021	• Penubuhan kawasan rekreasi (chalet). • Penubuhan kumpulan malim gunung. • Pemantauan pertumbuhan semaian. • Bengkel pengurusan projek bagi komuniti Orang Asli. • Penubuhan jawatankuasa pelaksana projek (Orang Asli).
5	Ogos 2020 hingga Februari 2021	• Pelancaran Ekopelancongan Perkampungan Orang Asli Hulu Kinta. • Penanaman pokok bersama komuniti dan pihak berkepentingan. • Promosi dan hebahan projek (lawatan media).
6	Januari 2020 hingga Disember 2021	• Pemantauan perlaksanaan projek. • Perancangan kelestarian projek.

- 8.0 HASIL DARIPADA PERLAKSANAAN PROJEK

Melalui perlaksanaan pembangunan ekopelancongan perkampungan Orang Asli Hulu Kinta, diharapkan beberapa hasil berikut dapat dicapai.

- 8.1 Penubuhan Kumpulan Mesra Alam daripada Kalangan Komuniti Orang Asli Tempatan

Melalui aktiviti dan latihan pemerkasaan berkenaan pengurusan alam sekitar terutamanya hutan dan sungai, projek mempunyai keupayaan untuk mendidik komuniti Orang Asli tempatan untuk menjadi mata dan telinga kepada agensi serta jabatan dalam memelihara, memulihara dan melindungi alam sekitar di kawasan penempatan mereka. Selain itu, kumpulan ini juga akan dilatih untuk lebih peka terhadap isu-isu berkaitan alam sekitar yang

berlaku dan aktif melaporkannya kepada pihak yang tertentu disamping mengambil tindakan secara mengikut kesesuaian dan kemampuan.

- 8.2 Meningkatkan Kesedaran Pengguna Terutamanya Pelancong

Mesej pemuliharaan dan pemulihan alam sekitar dapat disampaikan dengan baik kepada pengguna terutamanya pelancong dan pendaki yang menggunakan perkhidmatan yang disediakan di kawasan perkampungan Orang Asli Hulu Kinta. Peningkatan kesedaran dengan mengenengahkan konsep eko dan hijau semestinya dapat mendidik pengguna agar lebih prihatin dan bertanggungjawab dalam menjaga alam sekitar dan melaksanakan amalan pengurusan yang terbaik bagi memastikan kelestariannya. Ini secara tidak langsung juga boleh mengurangkan sebarang risiko yang tidak baik yang berkemungkinan boleh berlaku. Selain itu, penerapan kesedaran dalam kalangan pelancong juga mampu untuk memperkasakan pelancong menjadi mata dan telinga kepada pihak yang bertanggungjawab dengan melaporkan sebarang keadaan atau isu yang berlaku seperti hakisan tanah, pencemaran sungai dan pencerobohan hutan yang terdapat dalam kawasan hutan semasa pendakian dan sebagainya.

- 8.3 Meningkatkan Taraf Sosio Ekonomi Komuniti Orang Asli Tempatan

Perlaksanaan pembangunan ekopelancongan di perkampungan Orang Asli Hulu Kinta ini berupaya untuk meningkatkan taraf sosio ekonomi mereka ke arah yang lebih baik. Selain itu, ia juga secara tidak langsung dapat meningkatkan tahap kebersihan persekitaran kampung dan komuniti yang terlibat secara aktif dalam memberikan perkhidmatan kepada pengunjung atau pengguna bagi memastikan ianya mendapat sambutan yang baik. Tambahan lagi, ia juga dapat meningkatkan tahap keyakinan dan keupayaan komuniti untuk berkomunikasi, sosial dan berinteraksi dengan masyarakat luar terutama dalam mempromosikan dan meningkatkan jumlah pengunjung atau pelancong.

- 8.4 Mewujudkan Kerjasama Pintar Antara Agensi/ Jabatan Dengan Komuniti/ Organisasi Dalam Pengurusan Kelestarian Alam Sekitar

Melalui keseluruhan perlaksanaan perancangan ini, kerjasama pintar antara agensi/ jabatan dengan komuniti setempat dan organisasi luar dapat dihubungkan terutamanya dalam memastikan kelestarian projek dan pengurusan alam sekitar secara bersepadu. Selain itu, komuniti juga akan menjadi mata dan telinga kepada agensi/ jabatan dalam menangani masalah-masalah yang berkaitan alam sekitar seperti pencemaran sungai, hakisan cerun, pencerobohan hutan, dan lain-lain yang memberi impak kepada kesejahteraan alam sekitar.

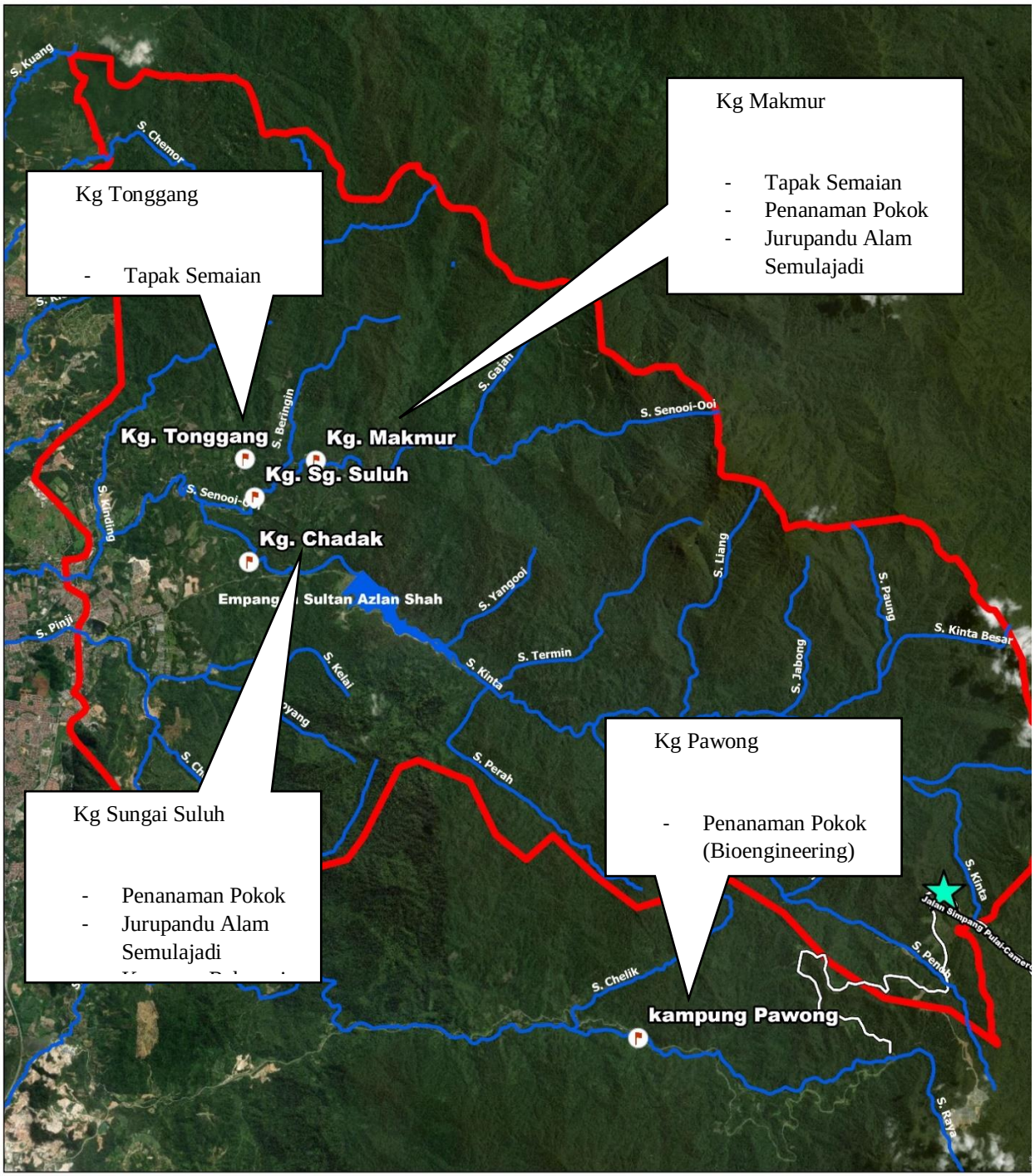
- 9.0 KOS PERLAKSANAAN

Segala kos perlaksanaan program atau aktiviti adalah dibawah projek melalui Global Environment Centre (GEC) bagi tempoh 2020 hingga Mei 2021. Namun begitu, sumbangan kewangan bagi inisiatif bersama, kemahiran, tenaga kerja, pemantauan dan sebarang bentuk sumbangan lain adalah amat dialukan daripada semua pihak berkepentingan yang terlibat. Walaubagaimanapun, GEC akan sentiasa melihat peluang untuk mendapatkan dana daripada

lain-lain penyumbang samada di peringkat antarabangsa, kebangsaan dan tempatan termasuklah daripada badan-badan korporat bagi memastikan kelestarian projek.

- 10.0 RINGKASAN PERLAKSANAAN AKTIVITI MENGIKUT KAMPUNG BAGI FASA PERTAMA (Januari 2020 hingga Mei 2021)

	Penubuhan Tapak Semaian	**Aktiviti Penanaman Pokok**	**Jurupandu Alam Semulajadi**	**Penubuhan Kawasan Rekreasi**
Kampung Tonggang	• 2 tapak semaian: - Dibawah Tok Batin. - Dibawah individu En Alwi (dalam perbincangan).	• Sepanjang tebing Sungai Seno'oi yang dikenalpasti terjejas.	Tiada	Tiada
Kampung Makmur	• 1 Tapak Semaian berdekatan rumah Tok Batin.	• Sekitar laluan pendakian ke Gunung Korbu dan Bukit Batu Suluh.	• Fokus kepada malim gunung pendakian ke Gunung Korbu. • Terlibat dalam mewujudkan laluan pendakian yang baharu.	• Santuari Ikan
Kampung Sungai Suluh	Tiada	• Sepanjang tebing Sungai Seno'oi yang dikenalpasti terjejas.	• Fokus kepada keunikan dan tarikan di kawasan Bukit Batu Suluh dan sekitarnya.	• Sekitar tebing Sungai Seno'oi berhampiran perkampungan.
Kampung Pawong	• 1 Tapak Semaian akan ditubuhkan.	• Di sepanjang tebing Sungai Penoh dan Sungai Kinta. • Di kawasan cerun terhakis di KM45.9 (FT185).	Tiada	Tiada



Gambar 8: Peta ringkasan inisiatif di Kg Orang Asli bagi fasa pertama

- 11.0 PENGLIBATAN KOMUNITI ORANG ASLI

Penglibatan komuniti Orang Asli dalam memastikan segala perancangan projek dapat dilaksanakan dengan lancar adalah amat penting disamping sokongan penuh daripada Jabatan Kemajuan Orang Asli (JAKOA) Negeri Perak dan Daerah Kinta/ Kampar. Berikut adalah cadangan tugasan dan penglibatan komuniti Orang Asli dalam perlaksanaan projek:

Projek/ Aktiviti	**Tugasan/ Penglibatan**
Penubuhan Tapak Semaian	Menyedia dan menubuhkan ruangan bagi tapak semaian.
	Menyedia, menyelia dan menjaga pertumbuhan semaian.
	Menyelenggara dan menyelia kawasan tapak semaian.
	Promosi dan jualan semaian.
Penanaman Pokok	Mengenalpasti kawasan yang sesuai untuk penanaman terutamanya kawasan yang terdapat hakisan.
	Menyediakan laluan masuk ke kawasan cadangan penanaman dengan impak yang minima.
	Terlibat aktif dalam aktiviti penanaman berkala dan mengikut keperluan projek.
	Memantau dan memastikan pertumbuhan pokok yang ditanam dalam keadaan baik.
Jurupandu Alam Semulajadi	Mengikuti kursus berkaitan Jurupandu Alam Semulajadi yang dianjurkan oleh urusetia.
	Terlibat dalam mengenalpasti dan membina laluan pendakian ke Gunung Korbu yang baru bagi menggantikan laluan sedia ada yang melalui empangan.
	Terlibat dalam menyelenggara dan memastikan laluan pendakian ke Gunung Korbu dalam keadaan terjaga.
	Terlibat dalam membaikpulih dan menyelenggara laluan ke Bukit Batu Suluh.
	Memastikan kelestarian kedua-dua laluan mengikut keperluan dan keadaan semasa.
Penubuhan Kawasan Rekreasi	Terlibat aktif dalam penubuhan kawasan rekreasi yang dicadangkan.
	Menyediakan sumber asas bagi pembinaan pondok, wakaf atau kawasan rekreasi seperti menyediakan sumber buluh dan kayu.
	Melakukan pembersihan kawasan rekreasi yang dicadangkan dan pembinaan laluan mengikut kesesuaian dengan impak yang minima.
	Menjaga dan menyelenggara kawasan rekreasi yang ditubuhkan.
	Memastikan kebersihan dan keselamatan kawasan rekreasi.

ANNEX 2 : STRATEGY ON MAINSTREAMING BIODIVERSITY INTO RIVER MANAGEMENT IN UKB

Strategy on Mainstreaming Biodiversity into River Management in UKB

November 2020

JABATAN PENGAIRAN DAN SALIRAN MALAYSIA

UNDP

gef

Global Environment Centre

Contents

1. BACKGROUND

The Upper Kinta Basin Management Strategy or better known as UKBMaS was developed as a guideline to enhance management of the Upper Kinta Basin (UKB) that offers key ecosystem services including water supply to Ipoh town. It was initially developed in 2019-2020 under a project on Integrated Management of Kinta River Basin for Community and Ecosystem Services through Active Community and Stakeholder Participation initiated by Global Environment Centre (GEC) with funding from Yayasan Hasanah and key support from Department of Irrigation and Drainage, Perak, Ipoh City Council, Department of Environment, Perak, Perak Forestry Department and Orang Asli Welfare Department (JAKOA). The project brought together government agencies, local communities, and private sector in a bottom-up integrated approach to managing and conserving the forests and rivers in the Upper Kinta Basin and to streamline the forest and riverine habitat conservation into development planning and policies. The UKBMaS is made up of four main goals with a total of 23 strategies. The goals are as below:

i) To sustainably manage biodiversity in the Upper Kinta Basin (UKB)
ii) To protect and improve rivers and water resources in UKB
iii) To enhance sustainable livelihood and welfare of Orang Asli communities in the Upper Kinta basin
iv) To enhance multi-stakeholder coordination and management

It was initially expected that the current UNDP-GEF supported project on Mainstreaming Biodiversity into River Management would be implemented starting in 2018 and would work in partnership in the development of the UKBMaS, with a particular focus on biodiversity related issues. However as a result of the delay in start of the project, the main version (June 2020) of the UKBMaS had been prepared before the biodiversity surveys under the current project. It has therefore been agreed to develop this separate annex to the UKBMaS focusing on mainstreaming of biodiversity in to the UKB management. This strategy is also linked as an additional strategy (Strategy 1.8) under Goal 1 of the UKBMaS. It was included to incorporate the current need of biodiversity infusion in riverine management as well the UKB Biodiversity study findings made through the current UNDP-GEF project.

The eight strategies under Goal 1 of UKBMaS are:

Strategy	Details
Strategy 1.1	Delineation of Catchment Forest Boundaries and restriction of access
Strategy 1.2	Promoting Linkages with the Central Forest Spine (CFS) Initiative and enhance protection of environmentally sensitive areas (ESA/KSAS)
Strategy 1.3	Promoting Sustainable Eco-tourism in Upstream UKB
Strategy 1.4	Promoting Forest Stewardship by Orang Asli Communities and local communities
Strategy 1.5	Assessment and monitoring of biodiversity and conservation issues
Strategy 1.6	Rehabilitation of degraded forest and riverine areas
Strategy 1.7	Support sustainable development of Kinta Geopark
Strategy 1.8	Mainstreaming biodiversity into river management (new additional)

This additional strategy was developed through support of DID Malaysia/Perak, UNDP-GEF Project as well as the various biodiversity experts involved in the biodiversity assessments of the catchment. Besides this, the strategy has also drawn on the National Policy on Biological Diversity 2016-2025. The final version of UKBMaS (December version) incorporating this additional strategy will be redistributed to all stakeholders.

2. INTRODUCTION

2. 2.1 Biodiversity

Biodiversity is the variety of life and refers collectively to variation at all levels of biological organization. The Convention on Biological Diversity which was signed by more than 150 nations on 5th June 1992 at the United Nations Conference on Environment and Development, held in Rio de Janeiro, states that: *biological diversity means the variability among the living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystem and the ecological complexes of which they are part; this includes diversity within species between species and of ecosystem.*

Biodiversity serves as the variety of life which encompasses all forms, levels and combinations of natural variation and thus serves as a broad unifying concept. Biodiversity comprises of three main elements (Heywood & Baste 1995). The three elements are the ecological diversity, organismal or species diversity and genetic diversity. Within each element, there several sub-group. Ecological diversity includes seven sub-groups which are the biomes, bioregions, landscapes, ecosystems, habitats, niches and populations. Organismal diversity has eight sub-groups of domains or kingdoms, phyla, families, genera, species, subspecies, populations and individuals. Genetic diversity has five sub-groups which are the populations, individuals, chromosomes, genes and nucleotides.

Table 2.1: Elements of biodiversity

Ecological Diversity		**Organismal Diversity**
Biomes		Domains or Kingdoms
Bioregions		Phyla
Landscapes		Families
Ecosystems		Genera
Habitats		Species
Niches	**Genetic Diversity**	Subspecies
Populations	Populations	Populations
	Individuals	Individuals
	Chromosomes	
	Genes	
	Nucleotides	

(Adapted from Heywood and Baste 1995)

Genetic diversity encompasses the components of the genetic coding that structures organisms (nucleotides, genes, chromosomes) and variation in the genetic make-up between individuals within a population and between populations. Organismal diversity encompasses the taxonomic hierarchy and its components from individuals upwards to species, genera and beyond. Ecological diversity encompasses the scales of ecological differences from

populations, through niches and habitats, on up to biomes. Although presented separately, the groups are intimately linked and in some cases share the elements in common. For example, the population is appears in all three elements.

3. 2.2 Introduction to ecosystem services

The ecosystem services term was first used by Ehrlich and Ehrlich (1981). Initially in 1977, Westman suggested that the social value of the benefits that ecosystems provide could potentially be enumerated so that the society can make more informed policy and management decisions. Westman termed these social benefits as 'nature's services'. According to Barbier (2007), there are three commonly used and cited definitions on the ecosystem services. The commonly cited definitions are:

- …the conditions and processes through which natural ecosystems and the species that make them up, sustain and fulfill human life (Daily, 1997)
- …the benefits human populations derive, directly or indirectly, from the ecosystem functions (Costanza et al, 1997)
- …the benefits people obtain from ecosystem (Ma, 2005)

Based on the definitions explained above, there is broad agreement on the general idea of the ecosystem services with important differences can be highlighted. According to the Daily (1997), the ecosystem services are the 'conditions and processes' and on the actual life-support functions. The Costanza et al. (1997) agreed the ecosystem services represent the goods and services derived from the functions and utilization by humanity. Ecosystem cannot provide any benefits to people without the presence of people (human capital), their communities (social capital), and their built environment (built capital). Thus ecosystem services should be perceived as a contribution of the natural capital to human well-being, which forms only by interaction with human, social and built capital (Figure 2.1).

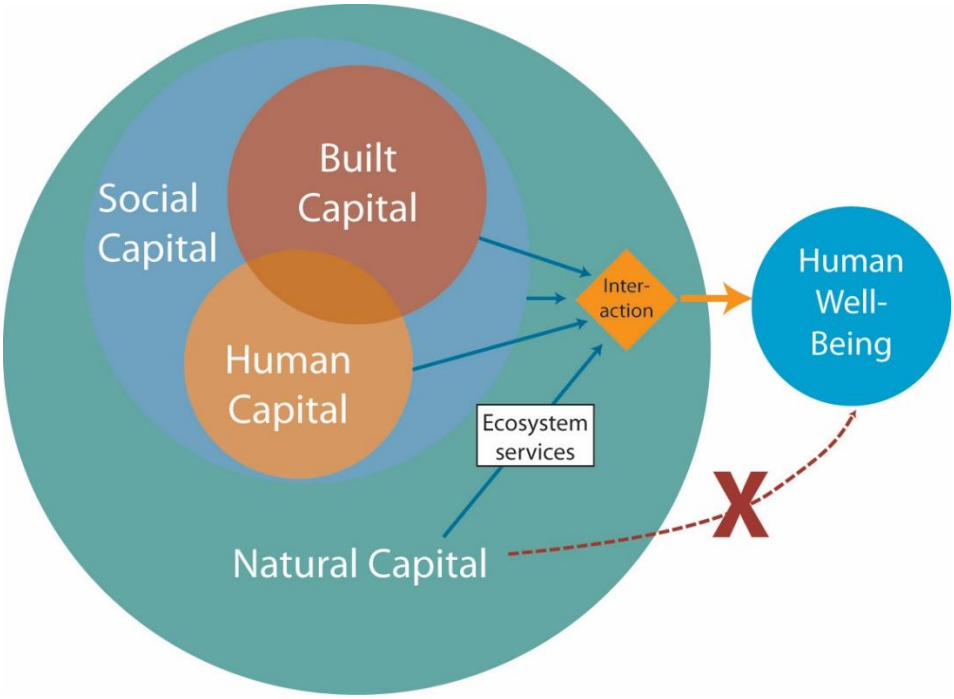


Figure 2.1: The interaction between built, social, human and natural capital required to produce human well-being (Costanza et al., 2014)

According to Boyd and Banzhaf (2007), ecosystem services are not the benefits humans obtain from the ecosystems, but rather the ecological components directly consumed or enjoyed to produce human well-being. The services are directly consumed components, meaning indirect processes and functions are not ecosystem services. The important distinction that is highlighted by Boyd (2007) are the services and benefits are not identical. Recreation often called an ecosystem services is actually a benefit of multiple inputs; often human, social and built capital inputs are necessary for recreation.

Based on Brendan Fisher et al. (2007), ecosystem services are the aspects of ecosystems utilized either actively or passively to produce human well-being. The services must be the ecological phenomena and that they do not have to be directly utilized. Ecosystem services include ecosystem organization or structure/ processes/ functions if they are utilized by humanity either directly or indirectly. Without human beneficiaries, they are nor services.

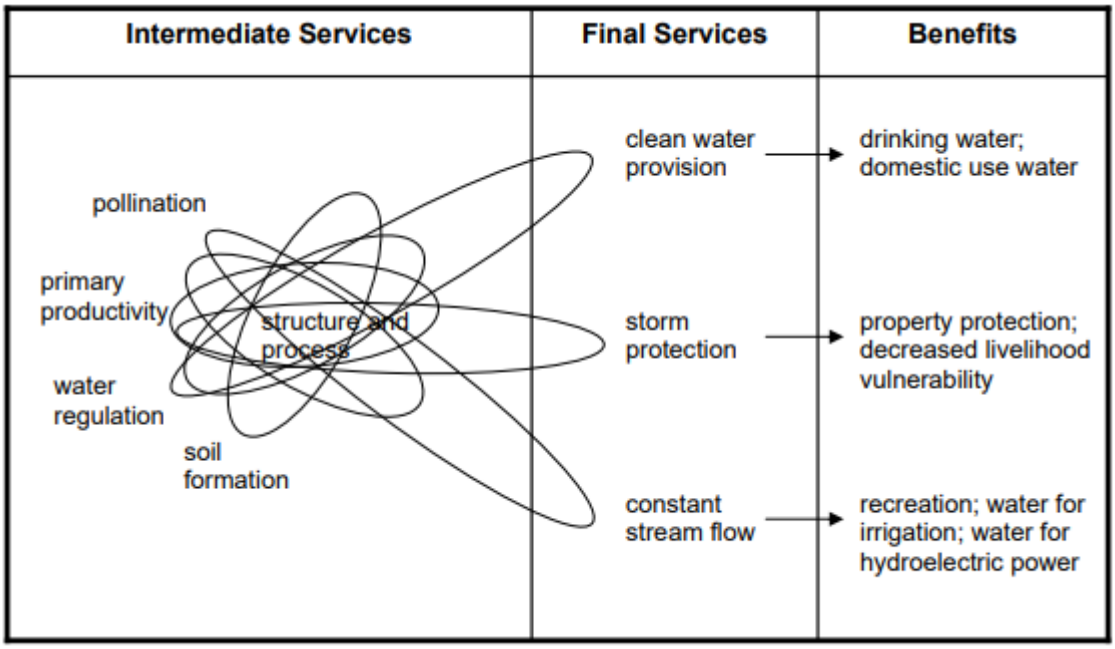


Figure 2.2: The conceptual relationship between intermediate and final services. (Adapted from Brendan Fisher et al. (2007)

The Figure 2.2 is a conceptual model of the connections between ecosystem structure, processes and services. From this figure, any step in the system can be considered an ecosystem service regardless of where it occurs along the chain of events as long as human utilize it to produce welfare.

4. 2.3 Value of biodiversity

Human beings is blessed with the most precious gift of nature which is biodiversity. Organisms in an ecosystem are interlinked and interdependent and the value of biodiversity in the life of all organisms including human beings is enormous. Besides the facts of human well-being, the health, economic and political security are highly influenced by the value of biodiversity. The sources of new foods, medicines and energy which further fuel the economic activity and lead to a healthier and wealthier population. Biodiversity is proven to hold an enormous value when adapted in health, agricultural or industrial applications.

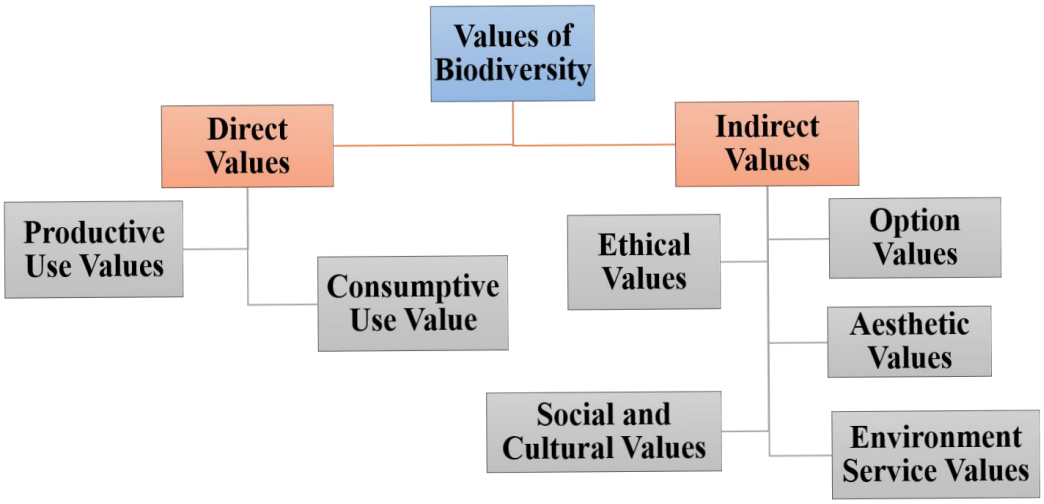


Figure 2.3: The values of biodiversity.

There are a lot of direct and indirectly major values in biodiversity. Some of the major values such as the environmental value, social value, ecosystem services, economic value, consumptive use value, productive use value, ethical and moral value and aesthetic value (Pearce, 2003) (Figure 2.3).

The process of examining each ecosystem process and identifying the ecosystem services can determine the environmental value of biodiversity. For example, the process of phytoremediation is a clear example of this type of process. Wetlands plants breaks down the nutrients and pollutants by capturing the water-carried sediment and the soil particles. This process helps in purifying the water and providing a breeding ground and shelter for fishes and other aquatic organisms.

The social value of biodiversity includes the aesthetic, recreational, cultural and spiritual values which are directly proportional to human being's health benefits. Apart from the local use or sale of products of biodiversity, there is a social aspect in which more and more resources are used by affluent societies. The traditional societies or Orang Asli who are usually in small groups or community, have utilised less resources and had preserved their biodiversity as a life supporting resources and appreciated that its severe depletion would be a great loss to their society (Gowdy, J. W., 1997).

The ecosystem services support the human needs and activities. These includes the production of oxygen by the plants, trees and algae, the provision of foods such as fish, timber, fire wood and harvested wildlife and plants for food or medical purposes and more. Besides that, the pollination process is also one good example of ecosystem services. The pollination of agricultural crops, forest trees and native flowering plants by native insects, birds and other creatures. Even the pest control in the agricultural land by the beneficial native predators is also a good example of ecosystem services. Ecosystem services also

provides beneficial to human beings by maintenance of habitats that are attractive to humans for recreation, tourism and cultural activities which has spiritual importance.

The economic potential of biodiversity is closely associated with the food, medicinal, ethical and social values as the biodiversity forms the major resources for different industries which govern the world economy.

The consumptive use value is highly linked with the economic value of biodiversity. It's related to the natural products that are used directly for food, fuels and others. Human beings are highly dependent on plants and animal as a source of food, shelter and clothing on a daily basis.

Productive use value refers to the products that are commercially harvested and marketed. Biodiversity usually represents the original stock from which the new varieties are being developed as nowadays the biotechnologist are continuously use the wild species of plants for developing new, better yielding and disease resistant varieties.

Ethical values refers to the biodiversity conservation that are based on the importance of protecting all forms of life. All forms of life have the right to exist as human beings always neglecting the facts that human beings is only a small part of the ecosystem. The morality and ethics guide the human beings to preserve all forms of life and not to harm the organisms unnecessarily.

Biological diversity adds quality of life and provides beautiful aspects of our existence as biodiversity is responsible for the beauty of a landscapes. Eco-tourism is a new phenomenal as people love to go far off places to enjoy natural scenery and be surrounding the wildlife and nature. The diversity of flora and fauna has become a part of the traditions and culture of certain societies in particular regions, thus added the aesthetic values to the place.

5. 2.4 Factors affecting biodiversity

Biodiversity consists of variety of living things that evolved over millions of years on particular habitat which contributes to the beauty of natural ecosystem. The biodiversity is often effected by certain stressors which are mostly cause by human beings. The stressors cause the biodiversity to be threaten and reduce in biodiversity quality and quantity. As the creatures and plants are interdependent, the loss of one species may effects on the entire ecosystem and indirectly affect other ecosystems and human beings as well (Figure 2.4).

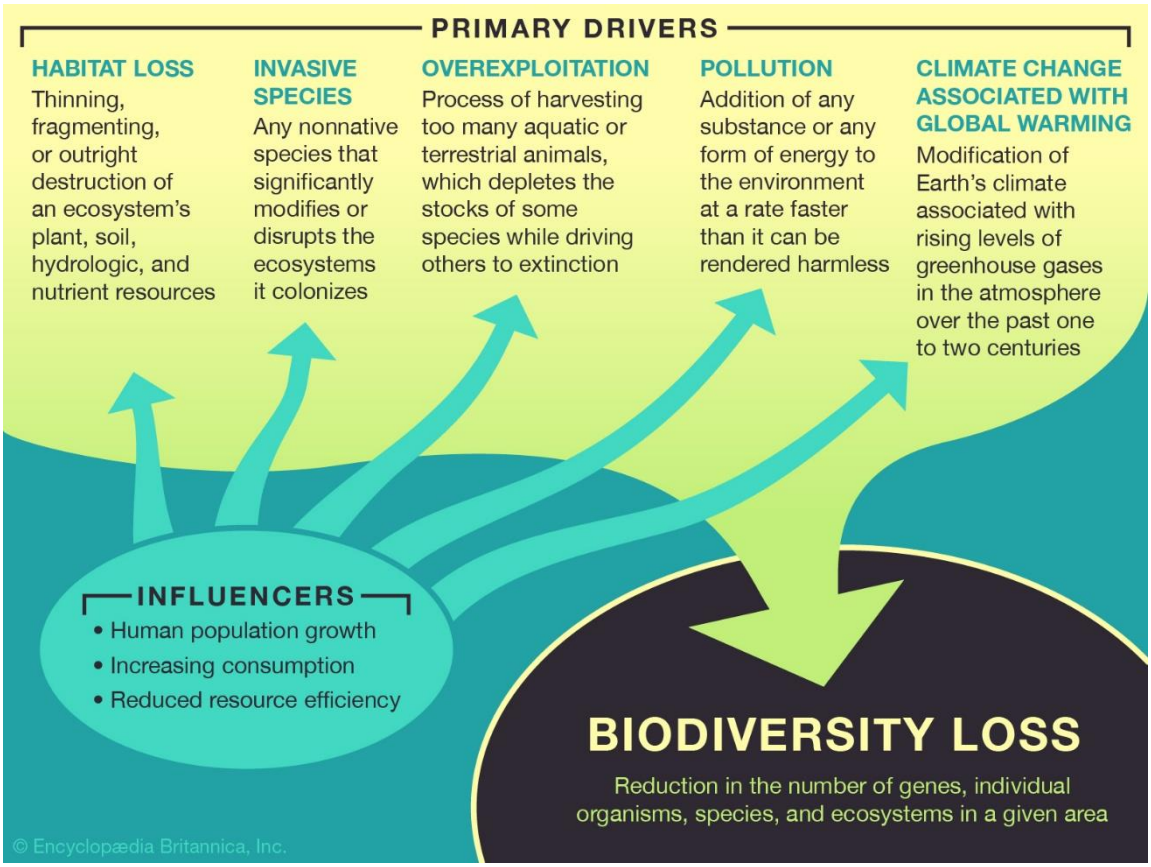


Figure 2.4: The infographic on the primary drivers on the biodiversity loss (Source: Encyclopedia Britannica)

Overexploitation means harvesting the species more rapidly than populations can replenish itself or the harvesting process in unsustainable levels. Humans hunt or harvest wild plants, birds, mammals, amphibians, fish and reptiles and other animals for commercial purposes, fur, fashion, the pet trade and zoos. Hunting threatens the mammals and birds populations especially large mammals that reproduce slowly, including elephants and primates (Lampert, A. 2019).

Development, agricultural activities and pollution cause habitat loss and fragmentation has a huge impact on biodiversity as human populations continue to grow. Habitat fragmentation cause the division of ecosystems and populations of species into smaller, isolated in unsustainable parcels which causes loss of biodiversity by increasing vulnerability of some populations to disease or other stressors. It leaving the habitats too small for some species to survive. The pollutants such as acid rain, air pollution, fertilizers, herbicides and pesticides alter and destroy habitats and their species in numerous ways as well (J. Barlow et al. 2016).

The plants, animals, disease or other organisms transferred unnaturally from one ecosystem to another ecosystem are known as non-native, introduced, alien or invasive species. The invasive species pose a threat to biodiversity when the species possess adaptations that help the species to out-compete or interbreed with the native species in the new ecosystem.

Scientist estimate that introduced species have contributed to at least half of the species extinctions that have occurred since 1600. The example of invasive species introductions to the freshwater ecosystems is the presents of tilapia spp. The tilapia species is strong and dominates the whole stretch of river and causing the native species to lose dominancy. Figure 1.5 shows the good representation of how the invasive species begin to become a threat to native's species and the actions that should take place to keep it under control.

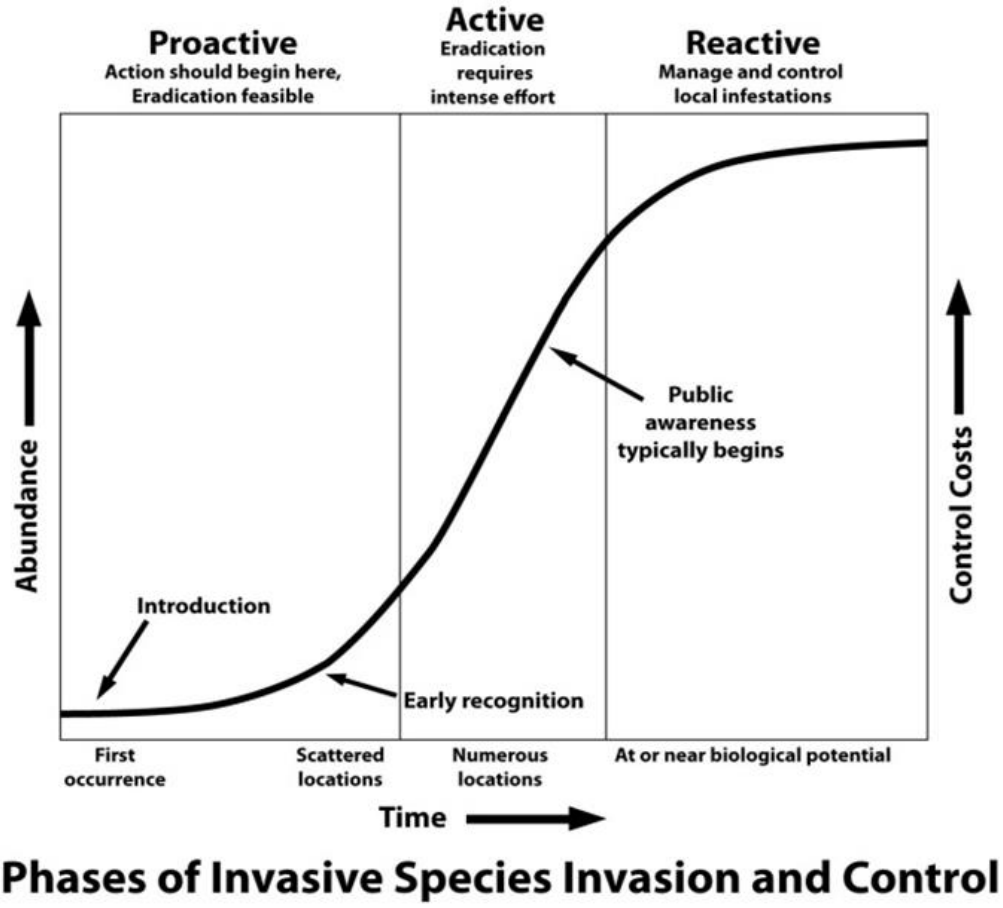


Figure 2.5: The phases of invasive species invasion and control (E. Garcia-Berthou 2007)

Climate change is more gradual than the habitat destruction but the climate change strongly influences the kinds of organisms that have adapted to each ecosystem. The increase in atmospheric carbon dioxide and methane from combustion and burning of fossil fuels increase the average global temperatures and scientist predicts the temperature to rise by up to 4◦C by 2100. Climate change will lead to major changes in precipitation amount and seasonality, shortages in food and fresh water, severely impact the breeding patterns, lead to immediate change in species geographic ranges and increase drought in some areas and flooding issues as well.

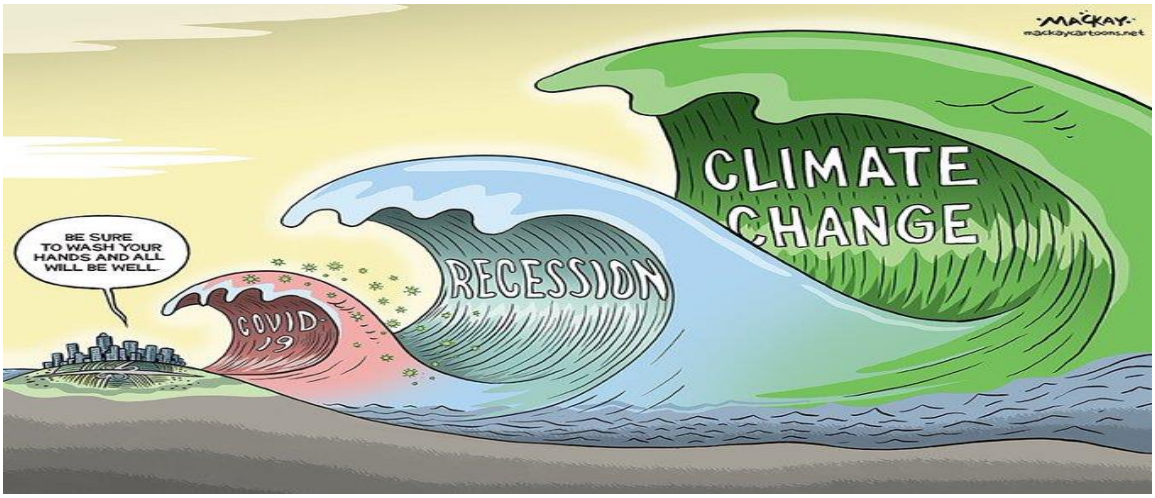


Figure 2.6: An artist illustration on the correlation of recession and climate changes. (Source: Graeme Mackay, The Hamilton Spectator, March 11th 2020)

6. 2.5 Riverine biodiversity: Values and challenges

Riverine biodiversity refers to the biodiversity that is present along the river either on the river banks or in the river itself. Riverine biodiversity is divided into flora and fauna. The flora and fauna is sub-divided into aquatic and terrestrial.

Aquatic flora is refer to the microscopic and macroscopic photosynthesis organisms, both vascular and non-vascular (Diaz-Paniagua et al., 2010) The aquatic plants such as aquatic macrophytes (plants visible to the unaided eye) includes flowering plants, conifers, mosses, ferns and fern allies, charophytes, macro-algae and any other plant found in the standing and moving water. Aquatic plants grow partially or completely in water. As with other plants, they require light and carbon dioxide or other inorganic carbon source for photosynthesis, oxygen for respiration, water, and nutrients such as nitrogen, phosphorus and others. Plants that grow with emergent or floating leaves are productive as they are rarely limited by water availability. With leaves exposed to the air, they have a ready source of light, carbon dioxide and oxygen. Submerged plants are defined as rooted plants with flaccid/soft stems and most of their vegetative mass are below the water surface (Pointier, J. P. & David, P., 2004). Meanwhile, emergent plants are rooted plants with stiff/firm stem which usually found along the shoreline and stand above the surface of the water (De Szalay, F. A. & Resh, V. H. 2000).

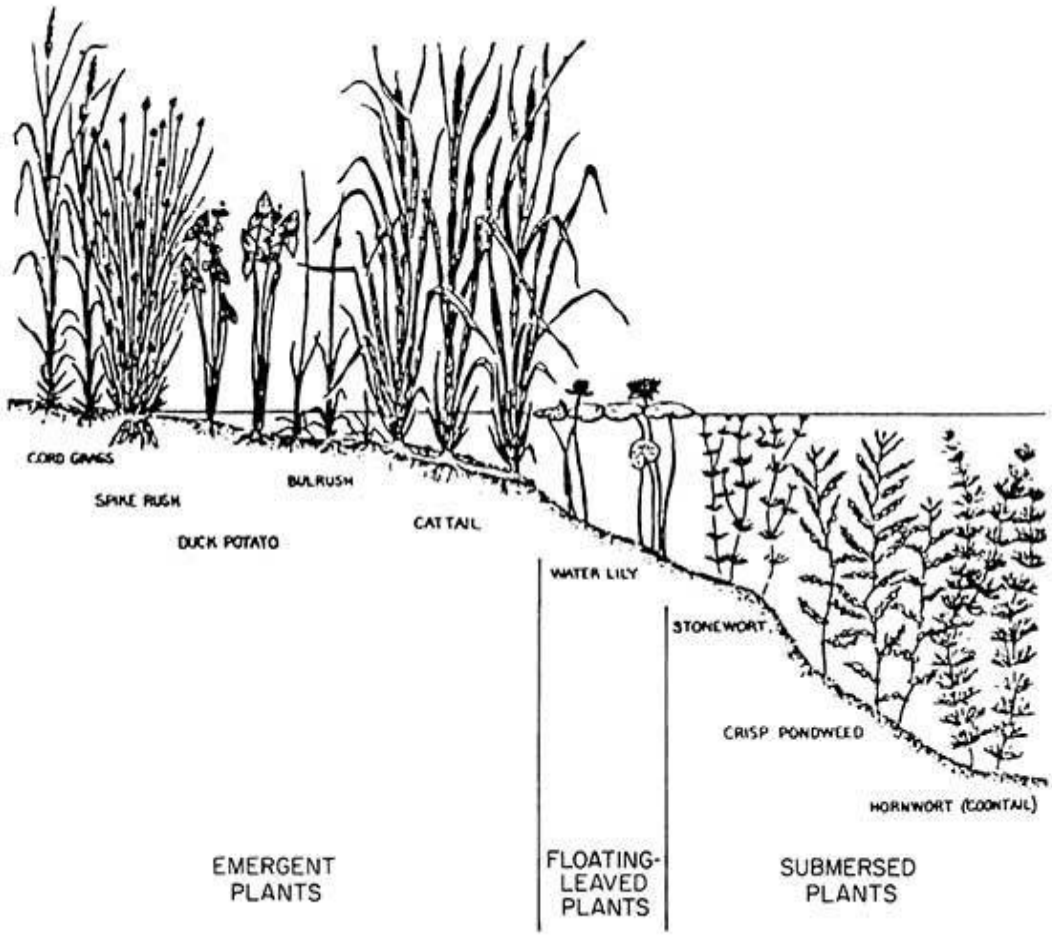


Figure 2.7: The type and example of aquatic plants

Fish and benthic macroinvertebrates (including dragonflies - Odonata) are part of aquatic fauna. Freshwater fishes in Peninsular Malaysia occur in a wide range of habitats including small streams in the lowlands and foothills. These habitats appear to be particularly important repositories of biodiversity (Ahmad & Samat 2005; Ahmad et al. 2018). In general, freshwater fish diversity in Peninsular Malaysia is similar to that of the mainland Asiatic ichthyofauna and is of Sundaic origin. High diversity of freshwater fish in the tropics is attributed to several explanations including climate stability, heterogeneous habitats, competition, predation or primary productivity (Lowe-McConnell 1987; Ahmad et al. 2018). Benthic macroinvertebrate are the small aquatic animals and the aquatic larval stages of insects. These includes dragonfly, stonefly larvae, snails, worms and beetles. The benthic macroinvertebrate lack a backbone and are visible without the aid of a microscope and are found in and around water bodies. Benthic macroinvertebrates are often found attached to rocks, vegetation, logs and sticks or burrowed into the bottom sand and sediments.

A terrestrial plants are plants from the members of the kingdom Plantae that grow in non-aquatic habitats, including forests, agricultural fields, rangelands, forests, urban landscapes, wildland and along the waterways (Delwiche, C. F., & Cooper, E. D., 2015). Terrestrial plants including shrubs, herbs, forest floor plants, ferns and trees. Terrestrial plants have root and shoot systems. Native terrestrial plants refer to the indigenous or native plants in a specific area (Strother, P. K., 2000). The invasive plants is the non-native plants to the ecosystem under consideration and whose introduction causes or is likely to cause economic and environmental harm to human health (Strother, P. K., 2000).

Terrestrial fauna is defined as animals which survive and live in the terrestrial habitat. The fauna of riverine terrestrial fauna comprises a mix of obligate mammals, reptiles, birds, amphibians and with other complex species.

The important aspects of dynamic riverine landscapes for animals including the faunal-habitat diversity relationship, the environmental gradients which binds varying habitat requirements such as complex life cycles, refugia and fragmentation, genetic maintenance, diversity of species, corridor dynamic and fauna habitat feedbacks. The faunal habitat feedbacks suggest that animals play a vital role in sustaining the heterogeneity of the riverine landscapes through biotic legacies. The fauna associated with the riverine landscapes varies considerably.

The fauna distribution is closely linked to environmental and biotic legacies with a strong association of present patterns and with past events. These legacies derived from the geological changes. One common and clear evident patterns is the effect of temperature on the species movement and distribution and population dynamics especially in response to past and present climates. The geographical distribution of species can be modified over geological time, thus profoundly affecting temporary fauna dynamics.

Environmental changes also cause successional alterations in faunal distribution and abundance. The species-specific habitat requirement especially in terrestrial landscapes govern the temporal sequence in faunal succession. The dynamic riverine landscapes are vital for a high diversity of habitats at different stages of succession.

7. 2.6 Upper Kinta Basin

2.6.1 Land use of the Upper Kinta Basin

The Upper Kinta River Basin (UKB) in Perak (see Figure 2.8) covers an area of 31,470 ha in the basin of the Kinta river upstream of Ipoh city. UKB is important as a management of the upper catchment of Sg Kinta for biodiversity conservation and water supply purposes.

Figure 2.8: Upper Kinta Basin showing river system, Sultan Azlan Shah Reservoir and Orang Asli Villages.

The total area of Upper Kinta Basin (UKB) is 31,470 ha. Overall, the most extensive land use type within UKB is forest (84.84 %), followed by agriculture covering 7.64 % of the total area of UKB. Institution and Public Facility (3.82 %), residential area (1.28%) and transport facility (0.87%). The main land use(s) are shown in Table 2.2 and the land use map of UKB is in Figure 2.9.

Table 2.2: Breakdown of land uses within Upper Kinta Basin (UKB)

Type of Land Use	Area (ha)	%
Water Bodies	231	0.73
Forest	26,841	84.84
Infrastructure and Utility	156	0.49
Institution and Public Facility	1,210	3.82
Commercial	9	0.03
Transportation Facility	275	0.87
Agriculture	2,418	7.64
Residential	405	1.28
Empty Land	61	0.19
Open Area and Recreational Area	31	0.10
Total	**31,470**	**100**

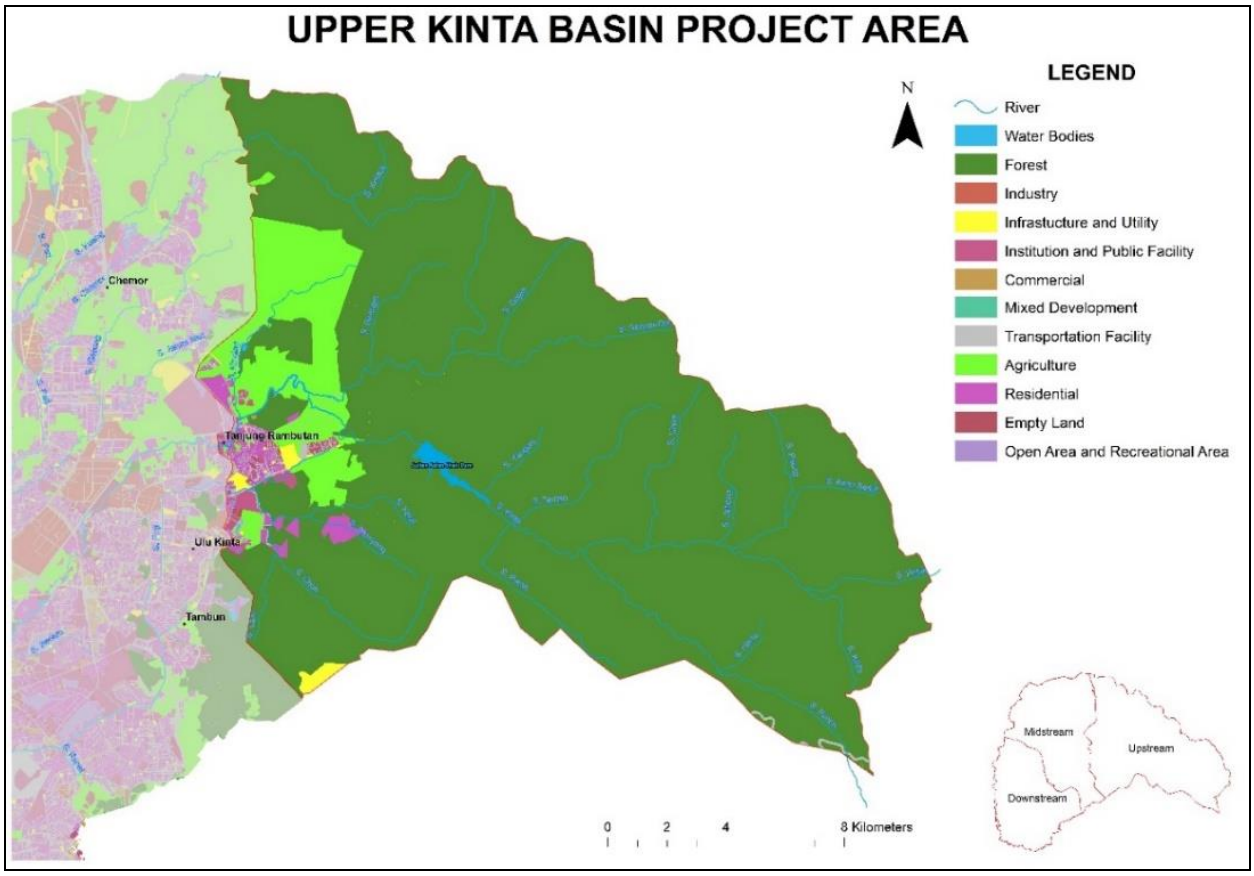


Figure 2.9: Land Use of Upper Kinta Basin

8. 2.6.1.1 Forest

The forest area recorded within UKB as is 26,841 ha. The highest point is in Mount Korbu which is 2,183 metres above sea level and it is the second highest mountain in the Peninsula of Malaysia after Gunung Tahan. The Forestry Department has gazetted almost the entire forest area at Bukit Kinta and a small portion of forestland at Kledang Saiong as a 'Water Catchment Area'. A number of high conservation value (HCV) species are found in the UKB area such as the Resak abdulrahman (*Vatica abdurahmaniana*) and Gerutu Pasir Daun Besar (*Parashorea globose)*.

9.

10. 2.6.1.2 Agriculture

The total area of land use within UKB for agriculture is 7.64 % of total land or 2,418 ha. Agriculture activities can cause deterioration of river water quality by being a source of phosphate and nitrate contaminants, heavy metals, organic metals and sediments (Moriken Camara, 2019). The agricultural activities at UKB include the fruit farms, rubber plantations, palm oil plantations, mixed agriculture and others.

11. 2.6.1.3 Residential and transportation facility

The Upper Kinta is less populated compared to downstream of the Kinta River Basin. The residential area at the upstream covers only 405 ha with 4169 unit. The total area covered by residential units is 1.28% of the total land use within UKB. For the transportation facilities, the UKB area consist of 20 facilities (roads) with the area covered up to 275 ha.

12.

13. 2.6.1.4 Waterbodies

The overall water bodies at UKB are cover an area of 231 ha or 0.73 % of the total area within UKB. The largest area is of the Sultan Azlan Shah Reservoir covering 103 ha.

14. 2.6.1.5 Others

The infrastructure and utilities covered 156 ha with 132 infrastructure facilities at UKB. The institutional and public facilities covered 3.82 % of the land used. For recreational purpose, the UKB recorded 146 units which cover 31 ha with 61 ha is recorded as empty land. There is no land use recorded for the industrial and mixed development purpose.

15. 2.6.2 Environmental issues in UKB

The main environmental issues in the UKB are:

a) Slope erosion along the Simpang Pulai-Cameron Highlands Highway
b) Highland Agriculture
c) Small scale agriculture and plantations in the lower catchment

The most important issue is the slope erosion along the Simpang Pulai-Cameron Highlands Highway which contributes hundred of thousands of toinnes of sediment to the Penoh and Kinta rivers and leads to significant siltation of the Sultan Azlan Shah Dam and downstream Sg Kinta. The major source is at Km 44-46 of the Simpang Pulai-Cameron Highland Highway. Figure 1.2 shows the location of the water catchment area, the highway and the Sultan Azlan Shah Dam. Sultan Azlan Shah Dam (SASD) catchment has experienced changes in land cover due to Simpang Pulai-Cameron Highlands Road Project in 2001 which crosses the catchment at the highland regions. These changes have resulted in modification and alteration in the status of land cover and cause increased upland erosion and higher concentrations of suspended sediment within the catchment (Mohd Firdaus, 2013).

Figure 2.10: Water catchment area, location of the highway and the Sultan Azlan Shah Dam

Figure 2.11-2.13 shows the main area in the UKB affected by slope erosion affected is the western hillside of the Gunung Pass ridge; where the eroded landslides were washed down to the Penoh River especially during the heavy downpour. The deeply-incised Penoh River is a tributary of Kinta River, leading down from the Gunung Pass which has an elevation of 1587 m above the sea level

Figure 2.11: Satellite image and drone photo of the landslide and the erosion ending up into the Penoh River feeding into the Kinta River (Sultan Azlan Shah Dam)

Figure 2.12 Landslide area at KM46, Simpang Pulai Highway, leading to sedimentation in Sg Penoh, hence to Sultan Azlan Shah Dam (captured on 24 February 2020)

Figure 2.13: Sediment in the bed of the Sg Penoh due to eroding highway slopes

16. 2.6.3 Biodiversity of Upper Kinta Basin

A riverine biodiversity study focusing UKB catchment was carried out between 19 to 26 July 2020. A total of 56 sampling stations were surveyed as part of the study. The study team was led by Global Environment Centre (GEC) with researchers and assistants from Universiti Kebangsaan Malaysia (UKM) and Universiti Institute of Technology Mara (UITM); and other wildlife survey specialists, with support from local Orang Asli communities.

The key elements studied were aquatic flora, aquatic fauna, terrestrial flora, terrestrial fauna, and river water quality as well as geomorphology. Aquatic fauna included fish and benthic macroinvertebrates. Terrestrial flora was sampled in the river corridor while aquatic flora was assessed within the rivers. Terrestrial fauna sampling focused on large mammals. In addition, river water quality samples were taken..

A total of 281 fish, comprising 18 species from eight families were collected from all study sites. Cyprinidae was the most dominant family overall with 200 individuals which are 71.3%, followed by Bagridae (27, 9.6%), Danionidae (18, 6.4%), Sisoridae (17, 6.1%), and Channidae (8, 2.9%). Clariidae and Mastacembelidae consist of 5 individuals each (1.8% each), while Balitoridae is composed of only one individual (0.4%). The biggest threat to the aquatic community of Upper Kinta Basin is the unrestrained sedimentation (sediment pollution or siltation) due to accelerated soil erosion caused by deforestation and road building. Studies of the impact of excess sedimentation on bottom-dwelling communities such as fish have unfolded generally consistent patterns of reduced species richness among fishes in the bottom habitat adjacent to highly disturbed drainages. In Upper Penoh, most physical substrates were buried under fine sediment, thus important habitats for small-sized fishes such as woody debris, leaf litter, and root mats were buried too. N. soroides was abundant in clear upstream and clear feeder stream of Sungai Penoh compared with disturbed, highly sedimented water of the same tributary. The fish community of UKB affected by soil erosion showed a reduced diversity and a low number of species compared

with undisturbed sites. Fishes of UKB may have been adversely affected by both deposited and suspended sediment.

For avifauna, a total of 132 bird species from 46 families were recorded and identified from the study area at Upper Kinta Basin (UKB). Overall, the distribution of birds in this study are in good state as 16% of the total bird species of Malaysia were present in the study areas. About 29.5 % (39 bird species) from the recorded species were from the highland area. Among all other species, bulbuls were the most widely recorded group of species with 14 species from this family.

A total of 269 individuals from 23 families of benthic macroinvertebrates sampled within 8 days of sampling. It was found that Heptageniidae (flattened mayfly) holds the highest distribution with 47 (17.5%) individuals found during the sampling period. The high abundance of flattened mayfly shows that overall UKB is in very good biological river water quality status. However, a pairwise comparison made especially at sites with the presence and absence of erosion issues indicated benthic macroinvertebrates heavily affected by siltation. Average ASPT score of clean sites reported to be 7.6 (very clean) while the average ASPT score with high TSS reported only 5.8 (clean). At certain sites affected by heavy siltation, benthic macroinvertebrates were absent. For instance, sampling sites (lower TSS value, P1 and P2) in Zone 1 UP occupied by 5 families of benthic macroinvertebrates from sensitive categories and 2 families from moderately tolerant categories with ASPT Index score 6.00 and 8.75 respectively. However, no benthic macroinvertebrates were found at site P3 at Zone 1 UP (ASPT score: 0) as the stream water carries heavy sediment from slope erosion at Simpang Pulai Highway. After the confluence with the heavily sedimented stream from P3 site, the water quality of stream from P2 site reduced to an extent unable to support benthic macroinvertebrates families from the sensitive category as only 1 common net spinner from moderately tolerant family recorded at P4 site (ASPT score: 5). After mayfly, Gerridae (pondskater) is second highest with 14.9 % (40 individuals) found during sampling followed by Perlidae (36 individuals, 13.4%). Hydropsychidae and Atyidae are two families that reported the same number of individuals respectively which was 35.

The mammal survey (through camera traps as well as a survey of tracks and signs) recorded a total of 11 species of mammals. Seven species recorded are common species that are constituted under Least Concern (LC) category in IUCN Redlist, one Vulnerable (VU) species (Southern pig-tailed macaque) and three Endangered (EN) species (white-handed gibbon, large-spotted civet and Malayan tiger). Over 20 days of camera trapping, a total of 7 species of wild animals have been successfully recorded throughout the sampling points. Of these, 5 species are terrestrial mammals, namely *Muntiacus muntjak* (red muntjac), *Paguma larvata* (masked palm civet), *Sus scrofa* (Eurasian wild pig), *Tragulus kanchil* (lesser mousedeer) and *Viverra megaspila* (Large-spotted civet). The other two species are arboreal mammals namely *Macaca fascicularis* (long-tailed macaque) and *Macaca nemestrina* (Southern pig-tailed macaque). Among most species recorded are long-tailed macaque, red muntjak and wild pig. Based on the signs survey by direct observation of mammals, footprints left by four terrestrial species have been identified, namely leopard cat (*Prionailurus bengalensis*), red muntjac (*Muntiacus muntjak*), Eurasian wild pig (*Sus scrofa*) and Malayan tiger (*Panthera tigris*). Vocal behaviour from two species of arboreal animal

were also recorded, namely white-handed gibbon (*Hylobates lar*) and long-tailed macaque (*Macaca fascicularis*).

For Odonata, a total of 170 individuals, comprised of eight families and 24 species were recorded in the study area. The most dominant family recorded was Libellulidae or skimmers (73%), which is also known to be the largest odonatan family in the world, followed by Chlorocyphidae (9%) and Calopterygidae (7%). The most dominant species was the Blue Marsh Hawk (*Orthetrum glaucum*) and Crimson Marsh Glider (*Trithemis aurora*) with both shared the same number of individuals, 31 (18%), followed by *Orthetrum chrysis* (12%) and *Libellago lineata* (9%). In Zone 2B at Sg. Termin, a rare and threatened species, namely *Macromia callisto* was found. In terms of comparison with water quality, there was no Odonata individual found in sampling sites with high TSS value in Zone 1 Upper Penoh and Zone 2A, thus indicating that very high sedimentation in these rivers had affected Odonata populations. A similar situation happened to the high sedimentation Sg. Kinta in Zone 2B, in which only one species was found in Sg. Kinta, while six species were found in the clean river Sg. Termin. However, the number of species in high sedimentation river Sg. Kinta in Zone 2D is a bit higher (with one species more) than low sedimentation in Sg. Senoi. This can be explained by most species found in Sg. Kinta were generalists or tolerant species, which could adapt the habitat changes and disturbance occurred, such as increased sedimentation in water.

A total of 567 species from 101 plant families and were recorded in UKB. A total of 195 (34.4%) of plants within UKB were found to be IUCN redlisted species that have high conservation value (see table 2.3). The submontane forest zone was dominated by Myrtaceae, Lauraceae and Fagaceae. The lowland forest to hill forest zone was dominated by Rubiaceae and Euphorbiacea. Site 2D reported the highest number of of species (268) and families (111) while site 2B & 2C together reported the lowest number of species (163) and families (62).

Table 2.3: IUCN red-listed plants species recorded in UKB

Status	Number of species
Endangered	16
Near Threatened	18
Least Concern/Vulnerable	161

Overall average Water Quality Index (WQI) value for all sampling sites at Upper Kinta Basin (UKB) is 91.5 indicates the upper limit of the class II category. Total suspended solids (TSS) (mg/L) parameter is a parameter greatly varies (2 mg/L (class I) to 1020 mg/L (class V)) between 21 sampling points. This is mainly due to erosion and sedimentation impacts. The erosion/low water quality had significant negative impact on aquatic biodiversity especially benthic macroinvertebrates.

17. 2.6.3.1 Key Recommendations from Biodiversity Study

The study indicated UKB is rich with riverine biodiversity components ranging from flora, fauna and some portions have clean water quality status. Sedimentation and siltation were observed to be the main deteriorating factor for UKB overall biodiversity health. The study reported high sediment transport even from its upper catchment, especially from Upper Penoh. This is mainly due to siltation from the cut as well as fill slopes from the Simpang Pulai-Cameron Highlands Highway. Water entering Sultan Azlan Shah Dam also observed to be turbid and the trend continues along Sg Kinta. The sedimentation had a negative impact on aquatic biodiversity, especially on benthic macroinvertebrates.

Besides this, the study found IUCN redlisted flora species recorded in UKB as well. A significant percentage (34.4) indicates that the site needs protection and conservation in the long run. Although the permanent forest reserve status adds value for the forest side, it also suggested being gazetted as a formal protected area. Besides flora, notable fish species as well as Odonata too found which indicates the surrounding and water cleanliness needs to be protected at all times. The Forest is one of the few remaining habitats of the critically endangered Malayan Tiger whose population may be as low as 250 animals.

Some of the key recommendations proposed based on the biodiversity survey were:

a) Protect the high-risk slopes along the highway from further failure
b) Utilize bio-engineering concept for slope treatment
c) Reduce sedimentation and siltation into rivers
d) Conduct rapid assessment of riverine biodiversity often
e) Empower communities especially Orang Asli to be the eyes and ears of UKB.
f) Empower agencies on riverine biodiversity monitoring
g) Infuse riverine biodiversity monitoring together with river water quality monitoring

3 STRATEGIES

18. 3.1 Introduction

The overall framework for the management of the Upper Kinta Basin is outlines in the Upper Kinta Basin Management Strategy (UKBMaS) as described in the Introduction to this document. As a result of the additional specific work undertaken through this current UNDP_GEF supported project, an additional strategy (Strategy 1.8) has been developed under The UKBMaS Goal 1 notably:

Strategy 1.8 Mainstreaming biodiversity into river management

A total of three thrusts are outlined for this new strategy. They are:

h) To rehabilitate the eroded highway slopes and river banks within UKB
i) To maintain and enhance riverine biodiversity richness within UKB
j) To empower all stakeholders to protect and conserve riverine biodiversity through holistic Communication, Education and Public Awareness (CEPA)

19. 3. 2 Thrust 1: To rehabilitate the eroded highway slopes and river banks within UKB

UKBMAS as well as latest UKB Riverine Biodiversity Assessment report have identified slope erosion along the Simpang Pulai to Cameron Highlands Highway as the main environmental factor leading to river pollution, aquatic biodiversity loss as well as endangering water security within UKB. Hence, key action plans need to be taken by all stakeholders to mitigate the impacts from slope erosion.

- **Action plan 1.1**: Map in detail the highway slopes and river banks within UKB with current and potential risk for erosion
  - Carry out assessment of eroded highway slopes and river banks within UKB
  - Document the impacts of failed slopes especially towards river water quality and biodiversity

- Categorize failed slopes within UKB according to low, medium and high current erosion and future erosion risk levels
- Prioritize degraded slopes for rehabilitation and at risk slopes for protection.

- **Action plan 1.2**: Prepare rehabilitation plans for failed slopes and eroded river banks within UKB
  - Conduct stakeholder consultation and workshops to discuss rehabilitation plans
  - Classify priority slopes by responsible agencies and develop agency specific plans for slope erosion control and rehabilitation
  - Develop detailed erosion control and slope rehabilitation plans
  - Secure budgets from Federal, state government and other sources
  - Carry out rehabilitation plans, using a combination of traditional hard engineering, combined with soil-bio-engineering.

- **Action plan 1.3**: Enhance maintenance and management of highway slopes to prevent new erosion sources
  - Regularly monitor highway slopes at risk of erosion
  - Undertake management measures to reduce degradation and erosion
  - Construct and maintain silt traps and silt fences to prevent any eroded materials from washing to streams and water ways.

- **Action plan 1.4**: Remove or stabilize eroded sediments in the Upper Sg Penoh
  - Remove accumulated sediment from highway slope erosion from the upper Sg Penoh.
  - Construct gabions, ponds, silt traps or other structures to stabilize deposited sediments in the bed of the upper Sg Penoh
  - Plant suitable vegetation on stabilized sediments in the Sg Penoh to prevent surface erosion.

- **Action plan 1.5**: Innovate and promote nature based solutions for slope treatment and eroded river bank rehabilitation
  - Stabilize sediments along the banks of the Sg Kinta above the Sultan Azlan Shah Reservoir to reduce sediment flow
  - Enhance efficiency of sediment removal and check dams at the Sultan Azlan Shah Reservoir
  - Established closed sediment ponds, silt fences and constructed wetland systems at the upper portion of the Sultan Aslan Shah Reservoir to remove and stabilize sediment before it reaches the reservoir.

- **Action plan 1.6**: Develop and promote nature based solutions for slope treatment and eroded river bank rehabilitation
  - Promote nature based solution like bio-engineering for slope sustainability and river bank protection
  - Promote planting of indigenous trees and plants to stabilize eroded sites

- Restore riverine native species habitat to enhance the present of healthy bio indicator

- **Action plan 1.7**: Recognize traditional knowledge integration into slope and eroded river bank treatment
  - Identify and nurture local champions especially Orang Asli as catalysts and workforce for slope and eroded river bank treatment
  - Protect and document the traditional knowledge, innovations and practices of indigenous people and local communities regarding their works on slope and eroded river banks treatment
  - Protect against misappropriation of related knowledge

20. 3. 3 Thrust 2: To maintain and enhance riverine biodiversity within UKB

UKB has a diverse flora and fauna including many rare and endangered species. The riverine biodiversity, especially aquatic biodiversity, is severely impacted by erosion. So, preservation of current biodiversity as well as introduction or improvement of biodiversity at disturbed sites need to be done simultaneously.

- **Action plan 2.1**: Document biodiversity and biological indicators of UKB
  - Carry out research and field survey to identify biological indicators of UKB
  - Categorize biological indicators into clean and polluted indicators
  - Study and document the association in terms of presence and diversity of biological indicators with environmental factors in UKB
  - Present and outreach the findings to relevant departments

- **Action plan 2.2**: Enhance riverine biodiversity within UKB
  - Enhance riverine biodiversity habitat by planting suitable vegetation in areas where siltation has been stabilized
  - Recreate habitat for aquatic biodiversity in streams and rivers badly impacted by siltation
  - Reintroduce species from adjacent rivers to sites where species have been lost due to siltation
  - Undertake field studies in riverine biodiversity research to monitor progress in rehabilitation of riverine biodiversity
  - Enhance patrolling and protection of key sites for biodiversity in UKB
  - Integrate biological monitoring along with physico-chemical monitoring
  - Monitor the progress of biological diversity targets along with link to water quality targets of basin

- **Action plan 2.3**: Promote riverine biological targets and richness in job scope of stakeholders
  - Support action by Perak Water Board to enhance and monitor biodiversity in Sultan Azlan Shah Reservoir management area

- Support action by Public Works Department to maintain and monitor biodiversity along the highway and rehabilitated slopes.
- Strengthen work by Perak Forestry Department and Department of Wildlife and national parks to protect forests and wildlife in UKB
- Strengthen programmes by Department of Irrigation and Drainage Perak to enhance riverine habitat and biodiversity in UKB. Integrate riverine biological targets and action plans in local, department, and state plans related to environment
- Conduct regular (twice/year) meeting of the riverine biodiversity working group

➢ **Action plan 2.4**: Establish comprehensive riverine biodiversity databases and monitoring programmes for UKB
- Enhance efforts on documenting UKB flora and fauna taxonomic data
- Establish permanent sites for riverine biodiversity monitoring
- Train local communities and other stakeholders on biodiversity monitoring
- Conduct periodical surveys especially at vulnerable river ecosystems and disturbed riverbeds
- Provide UKB riverine biodiversity related data to national biodiversity databases
- Establish reference collection of photographs and other materials for UKB biodiversity.

➢ **Action plan 2.5**: Protect genetic diversity and riverine species within UKB
- Improve stakeholder understanding and public awareness about invasive species
- Protect and maintain riverine biodiversity and genetic diversity in peri-urban portion of UKB
- Ensure connectivity of habitat and adequate green spaces
- Encourage creation of habitats within private sectors and landowners

21. 3.4 Thrust 3: To empower all stakeholders to protect and conserve biodiversity through holistic Communication, Education and Public Awareness (CEPA)

UKB is home to various stakeholders and beneficiaries as highlighted earlier as well in Chapter 2 and Chapter 3 of UKBMaS (November). Hence, a holistic outreach and awareness programs relating to riverine biodiversity conservation need to be planned for stakeholders.

➢ **Action 3.1**: Create awareness on riverine biodiversity by all stakeholders within UKB
- Develop and implement awareness programme including trainings and workshops on riverine biodiversity in UKB
- Promote public especially youth, children and women engagement in UKB Biodiversity conservation
- Develop UKB riverine biodiversity module for public engagement
- Promote citizen science based riverine biodiversity monitoring
- Promote and encourage dissemination of community based findings and monitoring data

- Develop educational materials and displays to showcase the impacts of erosion along the highway on the water supply for Ipoh and the riverine biodiversity of the Kinta River.

- **Action 3.2**: Empower key stakeholders to be the river biodiversity ambassadors
  - Encourage key government agencies operating in UKB to incorporate riverine biodiversity conservation into their functions and work
  - Train indigenous communities on eco-tourism and local guide initiatives
  - Empower local community on monitoring and reporting of pollution and biodiversity threat
  - Empower local communities (Orang Asli) on sustainable usage of forest and river resources

- **Action 3.3**: Establish educational and attractions on riverine biodiversity promotion
  - Establish the Sg Kinta River Open Classroom at the source of the Kinta River adjacent to the Highway to Cameron Highlands
  - Establish an open classroom at Sg Senoi Ooi in the lower UKM to act as a focal site to educate local community and residents of Ipoh on riverine biodiversity
  - Construct and promote eco-trails promoting natural water resources and biodiversity within UKB
  - Construct and promote outdoor sustainable recreational and eco-tourism within UKB
  - Promote establishment of community-based forest and aquatic plant nurseries as part of alternative livelihood and river restoration programmes.
  - Develop and promote virtual tours of environmental attractions within UKB
  - Promote and encourage Co-curricular activities such as nature clubs, green camps, and eco-tourism based educational visits within UKB

The proposed overall management strategy; implementing the strategy and key performance indicators all are given in the main UKBMaS (November) document chapter 4, 5 and 6 respectively. A separate study supported by Yayasan Hasanah is supporting the development of a UKBMaS Financing Framework which is expected to be available in mid-2021.

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