
EXECUTIVE SUMMARY

1.0 INTRODUCTION

The Proposed Project is about constructing and operating a tolled expressway linking Kajang SILK Highway (E18) at the southern side to Karak Expressway (E8) at the northern side of the expressway. It will provide bypass route for inter-urban traffic that do not need to pass through the city centre of Kuala Lumpur for those who intent to travel from the southern part of the Klang Valley (e.g. Cheras, Bangi, Subang) to the northern parts of Kuala Lumpur (e.g. Selayang, Gombak) or vice versa. It also serves as a bypass around Kuala Lumpur for inter-regional traffic from the Karak Highway to other regions. The proposed expressway is part of the planned Kuala Lumpur Outer Ring Road.

Currently, the completed sections of KLORR include part of the Kuala Lumpur – Kuala Selangor Expressway (LATAR Expressway, E25) beginning from Templer’s Park Interchange along Federal Route 1 (KL-Rawang) to the Guthrie Corridor Expressway (GCE, E35) linking to Elite Expressway (E6) from Bukit Jelutong, Shah Alam to Saujana Putra, and the South Klang Valley Expressway (SKVE, E26) from Saujana Putra to Kajang.

In addition, KLORR connects Kajang to Hulu Langat via the Kajang SILK Highway (E18). With the impending completion of the Proposed Project, the complete KLORR network will be formed.

1.1 PROJECT PROPONENT

The project proponent of the Proposed Project is EKVE Sdn Bhd (herein after shall be referred to as “the Project Proponent”). The contact details of the Project Proponent are as follow:

Address : EKVE Sdn Bhd
No. 88, Jalan Gombak, Setapak
53000 Kuala Lumpur
Contact Person : Dato' Wan Zakariah Haji Wan Muda
Project Director
Tel/Fax : 03 – 4024 1000 / 03 – 4024 2000

1.2 AUTHORIZATION AND EIA CONSULTANTS

To facilitate the DEIA report preparation, Project Proponent has commissioned UKM Pakarunding Sdn Bhd (UKMP) to carry out the study. The address of UKMP is as follows:

Address : UKM Pakarunding Sdn Bhd. (561663-U)
University Kebangsaan Malaysia
43600, Bangi,
Selangor

Contact Person : En Mirza Safri Sufian
Chief Executive Officer

Tel/Fax : 03 – 8921 3142 / 03 – 8925 2469

Table ES 1.1 shows the list of consultants and their expertise in the team involved in the preparation of this DEIA report.

Table ES 1.1: List of Consultants

Name	DOE Registration	Registered Area	Qualification	Role/Specification
Prof Dr Norhamidi Muhamad	C0161	Noise & Vibration Air Quality General Environmental Management	PhD (Mechanical Engineering)	Environmental Management/ Leader
Dr Zahedi Fisal	CS0220	Quantitative Risk Assessment Chemical Processes Industrial Processes General Environmental Management	PhD (Chemical Engineering)	Environmental management
Prof Dr Nor Ghani Md Nor	SS0252	Economic Evaluation of Environmental Impacts/Env. CBA	PhD (Economics)	Environmental Economy
Ir Dr Tew Kia Hui	CS0014	Soil Erosion Geotechnical Studies General Environmental Management	PhD (Civil)	ESCP
Prof Dr Abdul Ghani Rafek	SS 0264	Geotechnical Studies	PhD (Engineering Geology/ Geomechanics)	Geology
Prof Dr Sahibin Abd Rahim	SS0111	Geology Soil Science	PhD (Land Evaluation)	Soil Erosion
Dr Zulfahmi Bin Ali Rahman	AC0258	Geology & Soil Geomorphology Geotechnical Studies	MSc (Applied Environmental Geology)	Geomorphology
En Zaini Sakawi	SS0324	Social Impact Assessment	MSc (Environmental Science)	Landuse
En Khairul Nizam Abdul Maulud	AC0552	Landuse & Mapping	MSc (Geoinformatic)	Landuse

Name	DOE Registration	Registered Area	Qualification	Role/Specification
Prof Dr Sahrim Hj Ahmad	SS0233	Air Quality Noise Environmental Management	PhD (Materials Physics)	Air Quality
Prof Dr Md. Pauzi Abdullah	CS0215	Water Quality Wastewater General Environmental Management	PhD (Analytical Chemistry)	Water Quality
Assoc Prof Dr Mohd Ekhwan Toriman	SS0248	Hydrological Studies	PhD (Hydrology and GIS Application)	Hydrology
Prof Ir Dr Shahrir Abdullah	CS 0543	Noise & Vibration	PhD (Mechanical Engineering)	Noise
Prof Ir Dr Nik Abdullah Nik Mohamed	SS0232	Noise & Vibration Modelling & Simulation of Engineering Problem	PhD (Mechanical Engineering)	Vibration
Prof Ir Dr Amiruddin Ismail	CS0264	Traffic Impact Assessment Noise & Vibration General Environmental Management	PhD (Civil Eng.)	Traffic
Prof Dr Shukor Md Nor	CS0256	Ecological Studies Fisheries Aquatic System (Life)	PhD (Zoology and Ecology)	Terrestrial Fauna
Assoc Prof Dr Norhayati Ahmad	SS0270	Ecological Studies	PhD (Zoology)	Herpetofauna
Dr Abdul Aziz Bidin	CS0266	Ecological Studies (Terrestrial & Aquatic) General Environmental Management	PhD (Plant Biology)	Terrestrial Flora

Name	DOE Registration	Registered Area	Qualification	Role/Specification
Dr Ahmad Abas Kutty	C0263	Aquatic Ecology Biology Monitoring Water Quality Freshwater	PhD (Freshwater Pollution)	Aquatic Ecology
Prof Dr Abdul Rahim Md Nor	CS0536	Socio-Economic Impact Social Impacts Transport Impacts Traffic Impacts	PhD (Transport Studies)	Socioeconomy
Assoc Prof Dr Mohd Hasni Jaafar	SS0249	Environmental Health Impact Assessment	M (Community Health)	Public Health
Nur Hafizah Supaat	AC0251	Geology & Soil	Msc (Industrial Safety)	Senior Associate consultant
Amir Irfan Sufi Shuib	-	-	BSc (Environmental Science)	Associate Consultant

1.3 PROJECT LOCATION

Figure ES 1.1 shows the location of the Proposed Project. It should be noted that the whole alignment is located in the state of Selangor. The coordinates of the southern and northern tips of the proposed project are 3° 1' 3.48"N, 113° 30' 22.03"E and 3° 14' 42.94"N, 113° 25' 25.51"E respectively.

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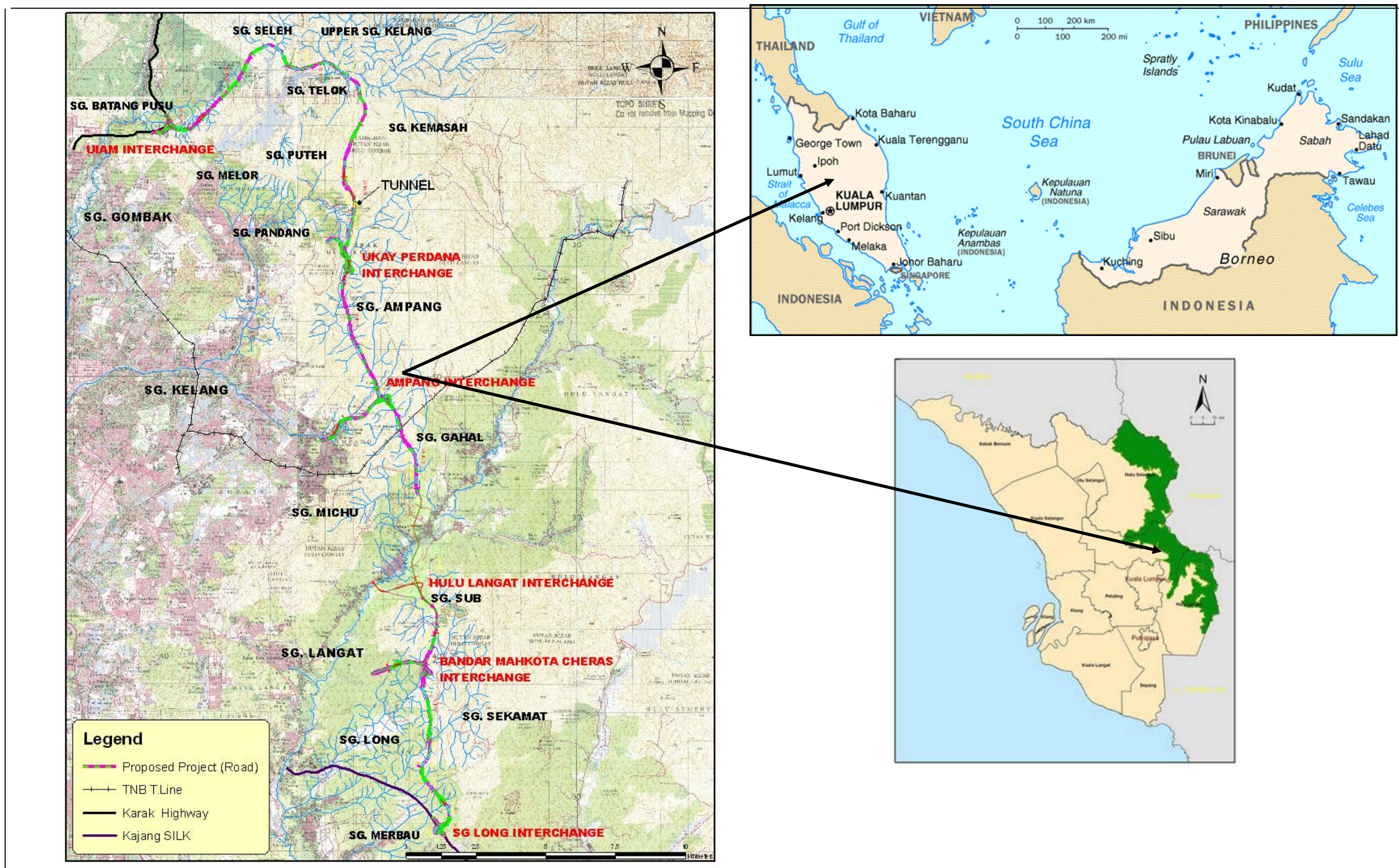


Figure ES 1.1: Maps showing the Location of Proposed Project

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2.0 LEGAL REQUIREMENT

The Proposed Project is a prescribed activity as stipulated in the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987 (EIA Order) made under Section 34A of the Environmental Quality Act 1974. The prescribed activity as in the EIA Order relevant to the Proposed Project is:

Schedule 9 (c): Construction of expressways

In compliance with the above requirement, a report on the potential impacts of the Proposed Project on the environment and the recommendations to mitigate the impacts is to be prepared for the approval of the Department of Environment.

3.0 STATEMENT OF NEED

The rapid economic expansion followed by the urbanization and motorization in the region requires continual upgrading of road network infrastructure to cater for the increase in demand for mobility. The Proposed Project is expected to be part of this upgrading effort. It will improve the existing network configuration both inter and intra region. The need for the Proposed Project is also reflected in Rancangan Struktur Negeri Selangor 2020 where its construction is part of the infrastructure programmes of Dasar Ekonomi 4.

The Proposed Project will provide bypass route for through traffic that do not need to pass through the city centre of Kuala Lumpur. It is also planned to serve inter-urban traffic such as from Selayang to Bangi or Subang without causing unnecessary interference to localized KL city traffic. It will also serve as a bypass around Kuala Lumpur for inter-regional traffic from the KL-Karak Highway to other regions. As a bypass route, the Proposed Project will contribute in minimizing travel time, vehicle operating cost, as well as environmental externalities such as air and noise pollution.

4.0 EXISTING ENVIRONMENT, POTENTIAL IMPACTS AND MITIGATING MEASURES

4.1 Geology and Geomorphology

The alignment of the proposed Kuala Lumpur Outer Ring Road, KLORR is underlain by granite and metamorphic rocks such as schist and phyllite. Weathering of granite produces a thick weathering profile, attaining a depth of up to 30 m. The resulting soil is predominantly sandy. The granite rock mass is generally blocky. The weathering

profile of the metamorphic rocks is relatively shallow and rarely exceeds 10 m. Mainly silty soils result from the weathering of metamorphic rocks.

The preliminary design drawings provided by the project proponent indicate at least seven high cut slopes along the proposed alignment (CH 300 – CH 900, CH 1300 – 1800, CH 2400 – 3100, CH 18500 – 18800, CH 24900 – 25100, CH 33800 – 34200, CH 36600 – 37150). In addition, a substantial part to this alignment is underlain by granite bedrock which is characterised by a thick layer of weathered material exceeding 30 m. Therefore the possibility of slope failures, especially for high cut slopes in granite areas exists.

For cut slopes along the proposed alignment, the project proponent intends to excavate slope of 1(V):1.5(H) and 3(V):2(H) for cut slopes based of the geotechnical characterization of the material. Soil nailing, grouting, rock bolts and anchors, together with slope surface protection have been proposed to mitigate potential environmental impacts related to slope excavation.

There will be two parallel tunnels, each with a length of 200m and a separation distance of 15 m between them are proposed beneath the Quartz Ridge within Hulu Gombak Forest Reserve. The potential impacts of this tunnelling operation are ground vibration due to blasting, dust generation and instability of the excavation. Control blasting technique will be employed to minimize the ground vibration. For the stabilization of the excavation, the project proponent has envisaged systematic rock bolting and shotcreting. Dust generation can be mitigated by using water spraying and application of forced ventilation.

4.2 Soil and Soil Erosion

During the field observation showed that most of the topsoil and soil profiles are completely weathered and forming thick soil. Due to high rainfall and warm climate conditions, most of this subsoil formed a lateritic soil. Under forest canopy the granitic soil form a loose and porous soil which readily permeates water through it. Soil developed from sedimentary and volcanic rocks is more clayey in texture and compact. It is expected that under equatorial climate the soil will be 10-20 meters.

Soil physical and chemical properties in address pH, organic matter, hydraulic conductivity, moisture content, particle size distribution, and texture. The pH of soil was between 4.07 to 4.61. Organic matter in soil ranges from 1.93 to 7.28%. The soil has a very fast hydraulic conductivity which ranges from 5.77 to 24.56 cm/hour. Soil analysis indicated that soil is dominated by sand fraction more than 36% of the total

particle content. Sand content is the highest followed by clay and silt. Low clay and silt content is one of the indications that chemical weathering state of the soil is still occurring and may render the soil as weakly bound thus may not be able to withstand dispersion due to direct impact of rainfall and disturbance by moving water. Most of the soil texture was dominated by sandy clay loam, followed by sandy clay and clay.

Surface runoff will be high at the steeply cut slopes along the proposed alignment (CH 300 – CH 900, CH 1300 – 1800, CH 2400 – 3100, CH 18500 – 18800, CH 24900 – 25100, CH 33800 – 34200, CH 36600 – 37150). To minimise the impact of surface runoff, a buffer zone of about 10 to 25 m between the cut areas to the affected river along the spur road at Interchange No 4 Ampang (CH400 – 1400), Sg. Ampang (CH19800-21100), Sg. Sikamat (CH3200-3600) must be allocated as proposed in the conceptual ESCP.

The worst-case scenario represents a situation where the area is completely disturbed leaving a bare top soil and no crops cover was planted and terracing or any conservation practices was not employed. In this situation the amount of eroded soil is so great with values ranges from 1,317.04 to 10,946.94 ton/ha/year. The potential soil loss per hectare per year is considered very high during construction in the study area. However the construction of the proposed highway will utilize only a narrow passage of the land. If conservation practice is employed such as terracing the soil loss can be reduced by up to 82% and by mulching soil loss reduced by 80% or by combination of mulching/terracing during the construction period soil loss can be reduced by 90%. By implementing buffer zones together with terracing and mulching in certain section of the road project (e.g. Interchange No 4 Ampang (CH400 – 1400), Sg. Ampang (CH19800-21100), Sg. Sikamat (CH3200-3600)) the amount of soil transported to the river body can be reduced by more than 90%.

4.3 Landuse and Topography

Generally, the topography along the proposed highway is hilly and slightly sloping. The highest contour is near the Ukay Perdana Interchange with 200-300 meters. The proposed project route through several major rivers and streams such as Sg. Merbau, Sg. Long, Sg. Sekamat, Sg. Langat, Sg. Sub, Sg. Michu, Sg. Gahal, Sg. Kelang, Sg. Ampang, Sg. Pandang, Sg. Kemesah, Sg. Telok, Sg. Selek dan Sg. Batang Pusu.

The main land use along the project alignment is made up of vegetation and development (settlement). The majority of the affected forest areas are forest reserve which is Hulu Gombak Forest Reserve, Ampang Forest Reserve and Hulu Langat Forest Reserve. The entire of Forest Reserve area affected along the corridor of the proposed

project is 214.7 ha. The land use of the development such as for residential, industry and institutional that are directly involved with the proposed project is minimal.

Majority of the development land use, especially the residential area in the vicinity of the proposed project of the interchange route, such as Sg. Long interchange, Bukit Mahkota Cheras interchange, Hulu Langat interchange, Ampang Interchange, Ukay Perdana interchange and UIA interchange

The proposed route is in compliance with the landuse classification that has been agreed by the State Government as an area of highway construction zone in accordance with approved plans. Based on the potential impact on current landuse and future, the areas involved will lose the status of the current landuse such as forest to highway development.

4.4 Climate and Meteorology

Generally the average annual rainfall depth at the project area is approximately 2,400 mm. The return period of the highest rainfalls of 124mm, 201 mm, 322 mm, 455 mm and 642 mm for the 0.25, 0.50, 1, 6, 12 hrs respectively were estimated to be about 27 years. The analysis indicates that the cloudy or rainy months are the months with lower evaporation while the dry months are the months with higher rate. The temperature at the proposed site fluctuated between a minimum of 25.6°C (January) to a maximum of 29.7°C (April). The mean monthly relative humidity falls within 70 to 90%.

4.5 Surface Hydrology

The proposed road will cross approximately 19 rivers including majors and tributaries. Upstream of the alignment was Kelang River where Klang Gate Dam is located. Three river reaches are involved namely Batang Pusu Reach (Sg Gombak tributary), Upper Sg Klang Reach (Sg Klang tributary), Sg Gahal, Sg Minchu, Sg Long and Sg Sekamat (Sg Langat tributary) and Sg Ampang (Sg Ampang tributary).

As the proposed road located at the higher elevation (> 20^o at m.s.l), the potential of flash flood and monsoon floods are minimal to be happened along the stretching. However, flooding is a frequent occurrence in downstream sites especially in the lower areas and along river banks.

Potential impact anticipating during construction of access road is the problem of soil erosion into existing water drain. This will increase water turbidity and sediment

deposit that can lead to flash flood. The construction of bridge crossing the rivers can result in soil erosion due to rain, increasing the sediment load in the river during the period of construction especially at Sg. Batang Pusu's tributary

For mitigation measures, disturbed or loose soil must be re-compacted as soon as possible. Access roads should be paved as soon as possible to avoid surface erosion particularly during wet seasons. The drainage system should be established before the actual construction begins. Series of artificial routes should be constructed to divert runoff from the working areas of the proposed alignment into the respective silt traps prior to discharge to the rivers and streams.

4.6 Water Quality

The measured physico-chemical water quality parameters of rivers of Langat and Klang river basins within the project area, indicate that the water quality of the rivers studied were clean and of class I and II according to the Interim National Water Quality Standard (INWQS). This means that all the rivers can be used as sources of drinking water supply as well as for conservation of natural environment and sensitive aquatic species. Variations in the levels of some physico-chemical parameters, namely turbidity and suspended solids were recorded after rain slightly influenced the values of water quality indices (WQI). However, except for Sg. Ampang, these WQI changes were not to the extent that they can affect changes to the classes of the rivers.

During construction, significant site clearing and earth works activities, constructions of embankment, road sections with heavy cut & fill and bridges and the presence of base camps will definitely affect the water quality of adjacent rivers within the project area. The main effects will be from the run-off containing water of high turbidity and high suspended solids (especially on rainy days) due to the activities. This is particularly important for the upper Sg. Klang namely Sg. Tangga and Sg. Konggo, which flow into Klang Gate Reservoir and Sg. Ampang. Klang Gate and Ampang catchments are important sources for water supply for Kuala Lumpur. In addition, Sg. Ampang at Taman Rimba is also a recreational area for general public. Impacts due to oil & grease, solid waste and sewage, particularly from base camp, are not considered very significant since they are localised and easier to manage. Mitigating measures in the form of adequate constructions of temporary drainage, effective and well maintained silt fences and silt traps, right scheduling of construction, immediate compaction and turfing of exposed surfaces, good management practices and proper management of solid waste and sewage will minimise the impacts on the rivers water quality.

During operation, accidents, especially involving oil or chemical tankers will potentially pollute adjacent rivers with spilled chemical, fuel or oil and grease. This is particularly important at elevated stretches above Klang Gate Reservoir. Without proper and adequate oil/water interceptors the impact can be considered serious for the Klang Gate Reservoir water. Wastes (solid and water effluent), sewage and sullage generated at RSA facilities will create solid waste and effluent disposal problem thus adequate toilet facilities with efficient onsite treatment system that discharge its treated effluent into the nearby water ways should be installed. Some of the waste water from car washing at RSA can be reused after oil separation and sedimentation treatment. Solid waste or garbage should be collected by contractor to be disposed off at approved disposal ground. No open burning should be allowed at the RSA areas.

4.7 Air Quality

The ambient existing air quality at study site was determined at 5 sampling point. The result shows all tested parameter are below the recommended level. All parameters recorded at point A4 are the highest compare to other sampling points. Value recorded for PM10, total suspended solid, nitrogen dioxide, and carbon monoxide is $52 \mu\text{g}/\text{m}^3$, $127 \mu\text{g}/\text{m}^3$, $44 \mu\text{g}/\text{m}^3$, 0.89 ppm respectively. Sulphur dioxide was not detected at all sampling points. Main factor that contributes to the high existing pollution parameters at point A4 are cause by moving vehicle. Moving vehicle will emit gasses that cause air pollution and harming the health of public.

Activities such as site clearing, earthwork and transporting construction material will increase the dust levels in the air. During dry period, strong wind can increase dust into the atmosphere. This situation can affect the health of residence especially at nearest residential area namely Kg Muhibbah, Ampang dan Kg Dato' Mufti Shuib, Ampang. Machine and trucks that transport the construction material can cause dust due to spillage. Lorries need to be properly covered to avoid any spillage especially on public road. Wash through shall be installed at the entrance of the construction site to prevent the mud from tyres from being carried out to the public roads

During operation of this highway, air pollution is mainly come from exhaust emission from moving vehicle. Traffic congestion will increase the concentration of emission gasses. Emission loads from this entire factor will increase the concentration of major pollutants such as CO, NO, SO, lead, and hydrocarbon. The nearby local roads and interchanges should be planned carefully to minimize congestion as this can alleviate the air pollution problem.

4.8 Noise

The ambient existing noise levels at the noise sampling stations vary between 56.4 dBA to 66.8 dBA during day-time, and 47.1 dBA to 58.5 dBA during night-time. It is found that most of the existing day-time baseline noise levels measured at the selected noise sampling stations are lower than the permissible sound level as in the guideline, except at N3 (Desa Lembah Permai, Ampang) and N4 (Taman Desa Raya, Hulu Langat) where its level is higher than 60 dBA. However, most the existing night-time baseline levels are higher than the permissible sound level, except at N4 (Taman Desa Raya, Hulu Langat) which recorded a level lower than 55 dBA. The night-time noise levels are mainly due to traffic from nearby road.

During construction phase, activities that may cause potential noise impacts to noise sensitive areas and residential areas along the proposed alignment include impact from piling activities during construction of highway and ancillary facilities as well as transportation of equipment and construction material. The impact of noise level during the construction phase can be minimised by scheduling the noisy activities and the movement of the heavy vehicles during day-time.

During the operation phase, noise levels are dependent on the traffic volume using this highway. Noise modelling has been conducted to predict noise levels contributed by the highway after the commissioning in 2016, 2021 and 2031. From the noise contours produced by numerical simulation, it is found that the highway has minimal impact to the nearest residential areas since they are located at least 100 metres away from the highway alignment. However, the most affected area is Pekan Batu 14 in the Hulu Langat district. In this area, noise barrier needs to be erected to reduce noise impact to the surrounding community.

4.9 Vibration

The ambient existing vibration levels at five vibration sampling stations ranging between 0.31 mm/s to 1.21 mm/s. These levels are mainly less than the critical value of 2.5 mm/s and they are considered to be safe. It is found that most of the existing baseline vibration levels measured at the selected vibration sampling stations significantly lower than the permissible vibration level as in the guideline.

During construction phase, activities that may cause potential vibration impacts to vibration sensitive areas and residential areas along the proposed alignment include impact from piling activities during construction of highway and ancillary facilities as well as transportation of equipment and construction material. The residential areas

identified to be affected by piling activities are Jalan Batu 14 to Kg. Bestari Sg. Michu (CH11400 to CH11800), Taman Serenia (CH21300 to CH24650 and Interchange No 5 Ukay Perdana CH1500 to CH2100) and Kg. Sg. Pusu (CH35100 to 35800) UIAM (CH36600 to CH38000 and Interchange No 6 UIAM CH0 to CH800). In addition to these areas, four sensitive receptors (Masjid Pekan Batu 14, Sekolah Rendah Agama Pekan Hulu Langat, Sek. Ren. Tun Abdul Aziz Majid and SMK Abdul Jalil) have also been identified located relatively close to the proposed alignment.

The impact of vibration level during the construction phase can be minimised by opting the bored pile method and closely monitor the movement of the heavy vehicles. Controlled rock blasting technique should be implemented to minimise the ground vibration during the tunnelling work. Should the vibration level at the nearest recipient exceeds the safe zone level (3.0 mm/s ppv) the significantly lower blasting dosage should be implemented.

During the operation phase, vibration levels are dependent on the traffic volume using this highway. The impact of vibration level during the operation can be reduced by ground improvement i.e. replacing poor sub-soil layer of weak geo-technical property with granular soil materials that can be compacted. As the natural frequency of whole building cannot be adjusted easily, excavation of trenches of adequate depth (at least one third of vibration wavelength) can provide passive protection against resonance. The specification and location of the trenches can be made based on the result obtain vibration monitoring program.

It is recommended that vibration monitoring program should be implemented during the operational phase of Proposed Project. Monitoring program should be carried out to anticipate and to assess any potential adverse impact.

4.10 Land Transportation Traffic

Study for the existing environment indicated the Level of Service (LOS) of Stations 1, 2 and 6 registered A grades respectively representing excellent condition. However, for Stations 3, 4 and 5 registered B to F grades representing good to worst conditions and highly congested during peaks flow. These stations experienced long queue, delay, a very low average travel speed and the need to be upgraded.

During construction there will be an increase in construction vehicles and the affected road are Jalan Hulu Langat B 52, Jalan Kuari Sg. Long, Jalan Hulu Langat-Jalan Ampang, Jalan Ampang, Jalan Bukit Belacan, Jalan Ukay Perdana and Jalan Sg. Pusu and this increase may create localised traffic congestions. Flagmen and signs to indicate slow

moving heavy vehicles travelling on public roads near the junctions to the constructions site should be constructed.

During operation there would be an increase vehicles volume on the new highway due to shorter time travel from Sg. Long Toll Plaza to UIAM Toll Plaza. In between of these toll plazas there would be also traffic attracted to use this highway also due to convenient and shorter in time travel from one point to another. Due to the increase of traffic expected to use the new highway, the feeder and spur road (especially at Ukay Perdana Interchange, Ampang Interchange, Ulu Langat Interchange and Bandar Mahkota Cheras Interchange) leading to the toll plazas or interchanges must be upgraded to a reasonable number of lanes and width with adequate signalised traffic light control where applicable.

4.11 Terrestrial Fauna

Terrestrial fauna which comprises of terrestrial large and small mammals, bats and birds were investigated based on detail study method at six study sites located within Hulu Gombak FR and Ampang FR. Rapid survey were made at two sites located within Hulu Langat FR. The alignment between Km 10 and 15 were visited since the areas are quite steep and undulating not suitable for trapping. This alignment runs along the forest boundary of Hulu Langat FR near Batu 14 town. The study sites were selected based on habitat type, size and quality.

From this study a total of 18 large and medium mammal species comprising of 12 families from 5 orders were recorded from all study sites. From this number, 5 species are Ungulates, 4 species are Carnivores (cat and civets), 1 species is Tapir, 7 species are Primates, and 1 species is Pangolin. Among these species, 9 are categorized as Totally Protected. All the other species are either considered as Protected (2 species), Game Animal or not listed as protected (7 species) under the Wildlife Conservation Act (2010). Based on IUCN Red Data Book, species categorized as Endangered, Near Threatened and Vulnerable are the main conservation concern and from this study 5 species are identified as Vulnerable, 5 as Endangered, and 3 species considered as Near Threatened.

Among five most important large mammal species in Peninsular Malaysia, only two species are still inhabiting the forest habitat of Selangor especially the three largest forest reserves; Ulu Gombak, Hulu Langat and Ampang FRs. The two large mammal species are tiger and tapir. For tiger, if food resources are still available, with large track of forest that still available, this species still can survive as long as without disturbance from poachers and logging activities. Tapir is another large mammal

species that easily adapting the changing environment from pristine forest to degraded forest patch. The trade off from this adaptation is the individual of these species could be displaced to the neighbouring plantations, orchards or villagers. The displaced individual tapir in plantations and villagers could be killed by the poachers and if food resources are limited, tigers might shift to livestock that can easily be hunted and killed.

Among terrestrial small mammals (excluding bats), a total of 15 species comprising of 5 families from 2 orders were recorded from the study sites. From this number, one species is Tree shrew, and 14 are Rodents (rats and squirrels). Among these species only 3 species are listed under Totally Protected and 1 under Protected according to local Wildlife Act (2010). Among the study sites, the highest numbers of terrestrial small mammal species were recorded at Kemensah with 7 species from 3 families and 1 order, followed by Klang Gate Dam with 6 species from 3 families and 1 order. Both study sites are within Ulu Gombak FR. The diversity of terrestrial small mammals at the other study sites is below 3 species. Further, only 1 species of terrestrial small mammal is categorized as Vulnerable under the IUCN Red Data Book, 2 species as Near Threatened and the others are as Least Concerned. Under the local law (Wildlife Act, 2010), three (3) species are categorized as Totally Protected, 1 species as Protected and the remaining species are not protected.

Bats are more diverse than other mammal groups and the highest reported at Kemensah (Ulu Gombak FR) with 21 species from 5 families followed by Klang Gate Trail (Ulu Gombak FR) with 13 species from 4 families, Sg Pusu Trail (degraded Ulu Gombak FR) with 9 species from 3 families and Bukit Belacan (Ampang FR) with 7 species from 3 families. The other two study sites are considered relatively low in diversity with below 4 species. None of bats are locally protected and only 3 species are considered important for conservation (categorized as Near Threatened) based on IUCN Red Data Book.

Finally, birds are considered relatively low with only 67 species from 24 families recorded at Kemensah, followed by Sg Pusu Trail with 57 species from 26 families, Kelang Gate Trail with 47 species from 21 families and finally Klang Gate Dam with 38 species from 22 families. At Desa Budiman and Darul Iman only recorded 29 and 15 species, respectively. The bird community at the study area is dominated by family Timaliidae followed by Pycnonotidae and Cuculidae. Among these species around 70-80% are either Protected or Totally Protected according to local Wildlife Act (2010). Finally, it can be concluded that the diversity of wildlife recorded along the alignment is a reflection of the habitat type, size and quality which is degraded primarily due to logging and human activities.

There are many activities during construction stage which require site clearing and earthworks such as construction of haul or access roads, road embankment and roads.

Potential impacts of these activities on wildlife are as follow;

- i) Increase disturbance to wildlife,
- ii) Increase disorientation and displacement due to habitat lost,
- iii) Lost of animals due to clearing.

The presence of vehicles and heavy machinery may increase disturbance and the number 'road kill' of wildlife. If clearing activities is done during the late evening, it will disrupt the movement of large mammal species such as tapir, and tiger which normally start active in late evening.

To minimize the impacts it is suggested to:-

- i) Minimize clearing activity,
- ii) Minimize earth work activity,
- iii) Phasing the construction activities,
- iv) Follow ROW.

Further, choosing the right alignment (e.g. shortest) for new roads is also required to reduce erosion and also to reduce cutting and earthworks to minimize disturbance to wildlife habitats. Earthworks and erosion will destroy animals' habitats and nests. Any sightings of wildlife especially endangered species such as tapirs and tigers need to be reported by workers to the authority (PERHILITAN) for further action. Again, hunting of endangered species is prohibited. To control hunting, workers should not be allowed to stay inside forest reserves after their working hour.

During operation the presence of cleared strip along the forest areas (e.g. forest reserves) will have an impact on wildlife movements, roaming habitat and migratory route especially on larger mammal species (tapir and tiger) and primate (e.g. Gibbon). The cleared forest strip directly reduces the habitat (resources) availability for wildlife species to maintain the viable population especially the larger species and open areas would invite poachers to come for hunting. The impact of barrier (the existence of cleared forest strip and structures) is expected to be permanent. However the impact can be reduced in several ways; i) Placement of alignment as close or along the forest boundary, ii) Construction of via duct for wildlife crossing, and iii) Construction of wildlife corridor. Displaced wildlife, although as a last resort can be mitigated by i) wildlife translocation (e.g. Hulu Langat FR), and ii) guiding back to the existing habitat or other neighbouring habitat, especially at Ampang FR and Hulu Gombak FR.

Finally, poaching can be prevented (or reduced) by keeping the poachers out of the forest reserves by i) controlling the human movement in and out of the reserves by providing entrance gate, ii) fencing the forest strips along the highway, and iii) wildlife enforcement.

4.12 Terrestrial Herpetofauna

A total of 15 species of amphibians from five families were caught at both Hulu Perdik and Klang Gate project sites. Both sites show that *Limnonectes blythii*, *Odorrana hosii* and *Leptophryne borbonica* were frequently found. Some of the species are indicator of disturbed or open spaces habitat such as *Fejervarya limnocharis* and *F. cancrivora*. There are also species that are confined to closed-canopy forests, such as *Nyctixalus pictus*, while others are associated with clean, medium-to-fast flowing river, such as *Phrymiodis aspera*, *Limnonectes kuhlii*, *L. blythii*, *L. paramacrodon*, *Odorrana hosii*, *Hylarana labialis*, *H. picturata*, and *Leptophryne borbonica*.

At any construction site there will be temporary workforce. Employer will be providing temporary place to stay primarily close to the work areas. Since most of the work areas are within forest reserves, the presence of workers pose threat to wildlife through illegal hunting. Unsupervised workers will lead to illegal hunting, which is not only endangering the survival of wildlife but also safety of the workers, since many species of reptiles are venomous and must not be handled by anyone.

Workers need to be educated on the importance of maintaining diversity of flora and fauna. They also need to be briefed on the local laws. Site supervisors need to be responsible in managing their employees. Regular law enforcement (e.g. PERHILITAN) needs to monitor workers at the work areas. Workers should not be allowed to stay inside the forest reserve, except during working hours and their movements must be restricted to only the work areas.

4.13 Terrestrial Flora

The six study sites, i.e. Sg Gahal (Hulu Langat Forest Reserve); Ampang Water Intake Point/Bukit Belacan and Kemensah/Kem Ghaffar Baba (Ampang Forest Reserve); Sg Telaga, Klang Gate Reservoir Southwest and Sg Pusu (Gombak Forest Reserve) are slowly recovering after recent years of logging operations and in some cases agricultural activities such as oil palm and rubber cultivations as in the Sg Pusu sector of the alignments. Species diversity at all sites are still high especially from Sector 3 (CH20,000 Ampang Interchange) to Sector 4 (CH36,000 Sg Pusu).

A small number of the species are categorized as endangered or vulnerable under IUCN Red List, i.e. *Dipterocarpus crinitus*, *Shorea leprosula*, *Shorea sumatrana*, *Hopea beccariana*, *Shorea acuminata*, *Shorea guiso* and *Shorea pauciflora* from the family Dipterocarpaceae, whilst *Castanopsis nephelioides* (Fagaceae), *Hydrocarpus humei* (Flacourtiaceae) and *Aquilaria malaccensis* (Thymeliaceae) are all non-dipterocarp species.

The highest estimated total above ground biomass was recorded by Sg. Telaga (Gombak Forest Reserve) with a value of 1022.23 t/ha. The rationale behind this is that this place also recorded the highest total number of collected trees with girth (dbh) of 5 cm and above (142) when compared to the other five locations. On the other hand, Kemensah recorded the highest total number of species with a total of 88 species from 34 families and 129 trees collected compared to the other five locations. Naturally, Kemensah also has the highest value of diversity index of 4.33 and richness index of 17.9.

Sg. Pusu being a degraded and disturbed secondary forest recorded the lowest total above ground biomass of 112.78 t/ha as the location only managed to accumulate a total of 90 trees. However, Klang Gate Reservoir (Southwest) which is an undisturbed quartz ridge forest has the lowest number of species (42) which lead to low value of diversity index (3.24) and richness index (8.67) which is typical of a quartz ridge flora. Whilst Sg. Pusu recorded the lowest number of families (24).

Generally, Sg. Pusu (112.78 t/ha), Klang Gate Reservoir (Southwest) (168.41 t/ha), and Bukit Belacan (240.94) t/ha recorded low figures of above ground biomass compared to the lowland forest in Pasoh Forest Reserve (in Negeri Sembilan) which accumulated 475 t/ha in the primary forest and 664 t/ha in the logged over forest. The other three locations i.e. Sg. Telaga (1022.23 t/ha), Kemensah (609.48 t/ha) and Sg. Gahal (827.27 t/ha) recorded higher value of above ground biomass compared to Pasoh Forest Reserve. This is because these three locations have higher number of trees with bigger diameter at breast height.

Since the road alignments would traverse a number of forest reserves which harbour significant amount of merchantable timbers (Ulu Langat Forest Reserve at Sg. Gahal, Ampang Forest Reserve at Kemensah and especially the Gombak Forest Reserve at Sg. Telaga), extraction (logging) of these timbers would have adverse effects to the forest environment. The harvesting and clearing of such a linear but large area could pose several potential environmental impacts during harvesting, transporting, processing of wood and disposal of biomass.

The project proponent (AZRB) has outlined the procedure as regard to site clearance (Method Statement for site clearing). The contractors awarded the jobs must adhere strictly to the “Guidelines for Reduced Impact Logging (RIL) for Peninsular Malaysia” produced by the Forestry Department of Peninsular Malaysia. The guidelines take into account the ecological, environmental and socio-economic factors in the implementation of “RIL” in the timber harvesting process.

4.14 Freshwater Ecology

The proposed highway expected to cause temporary adverse impacts to the freshwater ecosystem especially at pristine area such as upstream of Klang Gate and Bukit Belacan Recreational area. The excessive load of suspended solids from land clearance, oil and grease leak and release, improper garbage wastes and habitat damage are important environmental issues need to be considered.

Only minimum and temporary adverse effects are predicted to occur during the pre-construction phase since only intermediate scale land clearance is required for road preparation and materials transportation.

During the construction phase, the suspended load expected to cause serious hazard to aquatic communities especially fish and invertebrates at pristine area. Excessive load could deteriorate breathing and feeding efficiency and they could die if the load is above the tolerance limits. The use of silt fence, sedimentation pond at targeted area could reduce the hazard.

River crossing should be avoided where possible since it could cause permanent damage to invertebrates’ habitat. Fish and other larger organisms use invertebrates as their food and could be affected. The use of temporary bridge could be very environmental friendly method to maintain aquatic communities.

The offensive behaviour by workers could cause garbage and other solid materials wastes contamination. The proponent should prepare sufficient wastes bin and advice their workers not to contaminate the area.

Only minimum environmental effects are expected to occur during the operational phase. During the operation phase, the proponent should provide proper drainage system to avoid rain water on the road surface to flow directly into the nearby river system. All water should be collected and treated if necessary prior to release to the nearby river.

The highway will traverse several pristine ecosystems such as upstream of Klang Gate Dam and Bukit Belacan which have high fish diversity. The no fishing sign should be located along the highway that cross or traverse nearby the pristine area.

4.15 Socio-economy

Only several short stretches of the proposed 35.5 km highway will traverse through populated areas, in the east and north. The southern part will traverse through unpopulated areas. Public dialogue sessions were conducted at Kg Sg Pusu and Hulu Langat Town, where the alignment is the closest to human population. Public awareness of the dialogue sessions will be enhanced through distribution of fliers in public building such as surau and mosque.

The areas in the southern parts of the highway are generally unpopulated. However, as the highway approaches the Hulu Langat town, it begins to traverse densely populated area of Hulu Langat Malay Reserve Area, Pekan Bt 14 Hulu Langat. The proposed alignment does not encroach to the Ukay Perdana housing estates and will traverse through dense forest areas to the east and later north of Klang Gate Reservoir, before it turn to south and traverse through a narrow sloping lands sandwiched by Kg Sg Pusu and Taman Desa Gemilang.

There is several recreational activity spots in the areas traversed by the proposed highway, but mostly are far from the alignment. They are Taman Rimba Ampang, Bukit Tabur and Klang Gate Dam. Local residents and recreational activists come to these spot for a stroll or picnic outing, watch macaque monkeys sneaking about for food treasure, watch the butterflies flutter, beetles trudge along and monitor lizards lurk, hiking and abseiling and jungle trekking.

During construction, several privately owned Malay Reserve land plots in Kg Sg Pusu and Hulu Langat town will have to be acquired. Several houses in Hulu Langat town will have to be acquired and demolished. Recreational activities on the river in Taman Rimba Ampang might be adversely affected because construction activities in the upper stream of the river may pollute the river water. The construction of cross over highway in Hulu Langat town will disrupt traffic on the town's main road. The transportation of construction materials using existing village road in Kg Sg Pusu in Gombak will cause traffic disruption and accident. Construction activities in Kg Sg Pusu may cause rain water flowing down the hills and cause temporary lake and flash flood.

Mitigation during construction include adequate compensation should be given to the affected land owners, according State Government and current land market price. To

minimize traffic disruption to people, Traffic Management Plan should be initiated and implemented during the construction of the flyover in Hulu Langat town and work in Kg Sg Pusu. At work site in Kg Sg Pusu, appropriate measures including temporary retention pool may be provided to contain water and prevent from flowing down the hills to the village.

Once operational, the highway may expose local residents who use it to traffic accident. The highway will enhance accessibility of the areas in traverse. Increased accessibility may open up business opportunities and employment because of reduced cost and time of transportation of goods and services. The enhanced employment and business opportunities are positive impact and local residents may want to benefit from it. Mitigation during operation involve in Kg Sg Pusu, fences should be erected to separate the highway from the village and residential areas and prevent intrusion of people to the highway. In Hulu Langat town, traffic signs should be erected at strategic locations to notify the public the possibility of traffic accident.

4.16 Public Health

This assessment is to appraise health status of sensitive receptors, availability of health facilities and any potential risks from the proposed project. The study areas have reached 100% availability of household clean water supply and electric power. There is also an enough number of health clinics owned by government and private sectors. Selangor is one of the states with a high number of dengue fever in Malaysia. Known hotspot areas are Bandar Bukit Mahkota (Hulu Langat); Ukay Perdana and Kampong Sg Pusu (Gombak).

The public survey involved a total of 210 individuals from Kg Sg. Pusu, Taman Desa Gemilang, Taman Desa Permai, Kampong Lembah Jaya Utara, and Taman Pinggiran Delima had been interviewed. Majority of them has a household sanitary latrine. Use secured water piping system and disposed their household waste using waste collection services provided by the local municipal.

The main health problems were flu and upper respiratory tract infection (URTI) alleged by 22 (10%) of the respondents. This occurred co insight with pandemic of influenza-like illness (ILI) throughout Malaysia in the same period. However, only 7 (3%) of respondents were hospitalised due to an asthmatic attack (three cases), dengue fever (two cases) and heart problem (two cases). The relative low hospital admission suggests that the existing environment does not pose any great health problem among the studied population.

Comparatively, we found that the prevalence rate for respiratory problem (1.8 per 100 000 population) is very much lower than the national prevalence rate. For skin problem, it gives for 1.2 per 100 000 population, which is also low. Obviously, the disease burdens in the study areas are not high and not at any risk compared to the benchmark except for dengue as one of the important communicable diseases identified in the study area. Therefore, the project proponent must carry out all necessary mitigating measures prior to any physical development to prevent the dengue outbreak, especially at worker base camp, and other areas near or within the identified hotspots.

5.0 Economic Evaluation of Environmental Impacts

The proposed project is expected to positively contribute towards the existing road-based transport infrastructure in the Klang Valley. In addition, it will also have some impact on the economy through construction activities and subsequent commercial/economic activities associated with an improved transportation network. Notwithstanding these economic benefits, the proposed project activities may bring about some negative environmental impacts although many of them will be mitigated, as required by law, through the EIA approval process.

As is common for a project of this nature, some of the negative impacts cannot be completely mitigated thus justifying the need to quantify, and to the extent possible in monetary terms, the degradation in services obtainable from the disturbed natural environment. Such valuation exercise will not only highlight the significance of the environmental values of the services but can also complement the project proponent's economic feasibility study by explicitly incorporating the estimated environmental cost into the analysis. Environmental services that would be foregone following project implementation are real opportunity cost to society hence a conscientious attempt must be made in order to quantify the values. Recent advances and refinements in the methods and protocol of environmental resources evaluation afford opportunity for reliable monetary estimates of environmental services to be made with a reasonable degree of certainty.

Four items that rise potentially negative environmental impacts. Item 1 (Removal of forest area), Item 2 (Emission of green house gas during highway operation) and Item 3 (Loss of recreational services at Hutan Lipur Ampang) are evaluated. The remaining item, (Water quality impact during operation) requires no further evaluation and thus omitted from the analysis. The omission of evaluation on the water quality impact during operation is justified on the ground that mitigating measures including an emergency response measure will be implemented during operation to ensure

minimal impact of highway operation on the Klang Gate reservoir and the Ampang water intake. The highway will pass downstream of the Ampang water intake point. In addition, built structures are not expected to hinder flows of streams into the reservoir because they will not be constructed mid-stream.

6.0 CONCLUSION

With good design and responsible implementation and management by the Project Proponent, most of these impacts can be reasonably minimised with appropriate mitigation and control measures as proposed in this report. The proposed monitoring programmes to be carried out will ensure that criteria and standards of environmental quality are observed and abided by the project proponent throughout the project's life. It is important that this project be carried out in full compliance with all the conditions set by DOE and the relevant regulatory agencies.