CHAPTER 7

EVALUATION OF POTENTIAL IMPACTS

7.1 INTRODUCTION

The main activities for the proposed project are listed and related to potential environmental impacts in **Table 7.1(1)** below, with potential impacts summarised in **Table 7.1(2)**. From the list, it can be seen that those with potential environmental impacts are due to earthworks and plant operations; these can all be mitigated, with mitigating measures discussed in Chapter 8.

Table 7.1(1) Project Activities and Potential Environmental Impacts

Main activities	Sub-project activities			
Note: (O: No significant Impacts; ⦿: Less significant/Insignificant Impacts; ●Potentially Significant Impacts)				
Project phase: Pre-Construction and Preliminaries		O	⦿	●
Surveys, Investigations and Preliminaries	Project Planning	√		
	Preparation and submission of EIA S1 for approval by DOE	√		
	Application for Written Permission for Setting-up of Scheduled Waste Off-Site Recovery Facility (Section 19 of EQA1974)	√		
	Application for Licence for Setting-up of Scheduled Waste Off-Site Recovery Facility (Section 18 of EQA1974)	√		
	Preparation and submission of EMP for approval by DOE	√		
	Preparation and submission of Written Permission for APCS and IETS for approval by DOE	√		
	Access to Project Site which is next to main road	√		
	Surveys/ Site Investigations	√		
	Technical and Engineering Feasibility Investigations	√		
Project phase: Construction				
Stage 1: Site clearing and erosion control measures	Marking of areas to be cleared	√		
	Placement of temporary toilets (workers stay offsite)	√		
	Digging up and completion of runoff retention pond (RP) and earth drains feeding to the RP, as per ESCP designs, with silt trap(s) and silt fence(s) to avoid surface run-off flow directly to the water body.			√
	Stockpiling of excavated earth at an area near to the site for			√

Main activities	Sub-project activities			
	future backfilling.			
	Clearing of vegetation and manual chopping of branches for easier handling			√
	Loading of green wastes not utilised for mulching into roro bins and transporting the wastes to nearest landfill	√		
	Clearing off wastes found dumped onto site by others and hauling to nearest landfill	√		
	Mobilization of Land Surveyor for setting out of proposed site and the existing platform level.	√		
	Covering of slopes of earth stockpile with plastic sheets to prevent soil erosion and turfing of areas not for construction.	√		
Stage 2: Foundation Works	Mobilization of Land Surveyor for setting out of foundation points and layouts at site	√		
	Construction of onsite roads and drains			√
	Constructing and occupying a small workers housing			√
	Construction of foundations for various equipment as per structural design			√
Stage 3: Construction of Structures	On site steel bars cutting and bending works at required schedules; commenced at fabrication yard and completed concurrently upon completion of lean concreting.		√	
	Formwork placed layer by layer, maintained by 1.2m (plywood) or 0.6m (metal formwork) each to prevent occurrence of any cold joint.	√		
	Water stop will be placed along the horizontal and vertical construction joints.	√		
	Concreting works using approved concrete from permitted sources upon further inspection by clerk of works (COW). High Alumina cement applied at all internal surfaces of structures.	√		
Stage 4: Equipment Installations and commissionin g	Installations of plant equipment	√		
	Installation of electricity supply system	√		
	Testing of each equipment	√		
	Commissioning of plant			√
	Monitoring to ensure designed performance and emission compliance.	√		
Project phase: Operation				
SCaRF Operation	Operation of SCaRF and IETS			√
	Operation of SCaRF and APCS			√
	Traffic movement		√	
	Maintenance work	√		
	Amenities	√		

The proposed project's 5 km Zone of Impacts (ZOI) and the nearest sensitive receptors are shown in Figure 7.1(1). The sensitive receptors are about 2 km or more from the proposed project site.

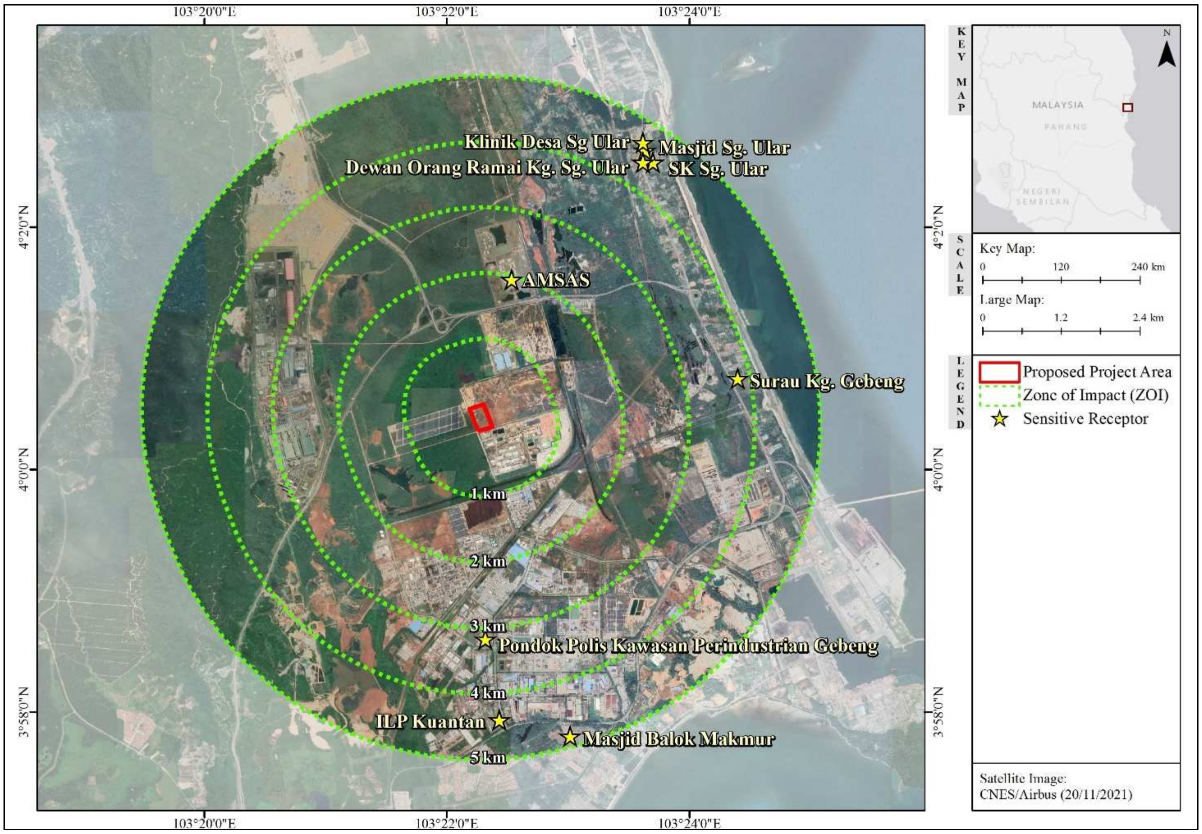


Figure 7.1(1) ZOI and nearest sensitive receptors

7.2 POTENTIAL IMPACTS DURING CONSTRUCTION PHASE

Table 7.1(1) lists the construction activities for the proposed project. The potentially significant impacts of these activities are addressed according to the following components: Vehicles and machineries will enter the project site using the existing road. The access point (intersection) to the project site will be upgraded and an internal roads within the site will be built and paved. During construction, including site clearing, exit from site shall be through a wheel wash facility,

7.2.1 Site Clearing

Platform level for the proposed plant has been readied when the site was filled and prepared as an industrial lot, thus there is no clearing of large trees to be carried out. The site is currently covered by secondary vegetation of mainly bushes of acacias and lalangs. There are some industrial scraps illegally dumped on the site. Site clearing of acacia bushes will result in vegetative wastes. If the scraps and vegetative wastes are not properly disposed in a sanitary landfill, the resulting piles of wastes will be an eyesore, generate leachate which will contribute to pollution of nearby water bodies and imposes clearing cost to the local authority (LA).

7.2.2 Construction Earthworks - Water Quality Due To Erosion

Earthworks for construction of onsite roads, process units and facilities expose soils and slopes to runoffs during rains, leading to increased suspended solids (SS) in Sg. Baluk and potential deposits in the river beds, contributing to flow blockages, etc. These impacts are temporary. The erosion and sediment control facilities (ESCP) would be readied before start of any earthworks, thus rain event should not lead to ouflow of sediments.

LDP2M2 assessment has been carried out (see **Section 7.4**) and the results show that as the project site area is small, and the land has been levelled and compacted prior to the SCaRF development, the estimated amount of TSS discharged is relatively low. During worst case scenario, where LDP2M2 measures, such as Sediment basin, and perimeter drain has not been installed onsite, the sediments could affect the SS in Sg. Baluk, but with adherence to the LDP2M2 measures, the estimated TSS discharge can be reduced by about 90% from the worst case value, whereby, the impact to Sg. Baluk would be insignificant, as shown by the Water Quality Modelling given in **Section 6.7**.

7.2.3 Air Quality during construction

Air quality during construction would potentially be impacted during land clearing, construction activities and vehicular movements. These are discussed below:

a) Land clearing

During land clearing, the acacia leaves and branches and the lalangs are very burnable and may cause fire, which may flare to nearby areas. Any burning during construction, <u>accidental or otherwise</u>, is strictly prohibited as highlighted by the poster from the DOE below:

<table>
<tr><td colspan="2">Environmental Quality (Prescribed Activity) (Open Burning) Order 2003. The relevant regulations under the EQA 1974 for open burnings are as follows:</td></tr>
<tr><td>

29A: Prohibition on open burning;
29AA: Exclusion from “open burning”;
29B: Owner or occupier of premises liable for open burning; and
29C: Defence.

</td><td>


</td></tr>
<tr><td colspan="2">Note: Graphics from Department of Environment Malaysia (July 2021)</td></tr>
</table>

b) Earthworks and construction

For this Project, no major earthwork is anticipated as construction only involves a fairly small area and involves mainly installations of readymade equipment onto a prepared platform. Nevertheless, earthworks for construction of onsite roads, foundations for process units and facilities expose soils, material stockpiles, etc., to the weather, leading to dust dispersion by winds, with potential to dust spread to nearby areas. The sources of air pollutant during the Project construction activities at site would be vehicular emissions from transportation of heavy equipment and construction of roads and supporting facilities. The air pollutants would be mainly combustion gases such as Particulate Matters (PM), Nitrogen Dioxide (NO_2) and Carbon Monoxide (CO) due to incomplete combustion, if any, but with negligible SO_2 due to low sulphur content in the fuel.

Dusty materials produced as a result of construction works being carried out may include cement, earth, aggregates, silt, stone fines, sand and debris. Fugitive dusts are mainly Total Suspended Particulates (TSP), which includes Particulate Matters less than 10 micron and 2.5 micron (PM_{10} and $PM_{2.5}$) and small airborne particulates, such as dust, fumes and smoke with a diameter of less than 100 micrometres. The area of influence for fugitive dust is anticipated to be localised within the construction area (usually less than 50 m away) as the work area will be limited in nature. The duration of impact for the construction phase will be short term to medium term. For this Project, the nearest residential area is more than 1 km away from the Project site, hence, the air quality impact due to the construction activity is anticipated to be minimal.

c) Vehicular Movements

Transportation of construction materials, may lead to tyre tracks bearing earth, all of which contribute to increased dust on site, leading to dust dispersion by winds, leading to dust spread to nearby areas. Heavy vehicles which are not well maintained often emit black smokes, polluting the routes as well as the construction site. Heavy vehicles may endanger other road users. However, the potential impacts are temporary and as the platform was already readied, there is no dusty cut and fill earthworks. With appropriate mitigating measures, the potential impacts will not be significant.

7.2.4 Noise Level due to Construction works

Sources of higher noise level during construction are heavy vehicles for transportation of materials and machineries operating at the construction site during building construction, haulage operations and stationary equipment, such as pumps and generators. Machineries used during construction which are not well maintained will lead to discharge of fumes and noise. The temporary increase in the number of heavy vehicles in the site during the construction period is likely to influence noise levels in the area. The tallest building at site is a two-storey site office, thus only normal house building piling would be required, if any (as will be determined by soil investigation before construction starts). However, the noise generated during the construction phase is generally short term and confined to daytime hours. The potential impacts are temporary. With appropriate mitigating measures, the potential impacts will become insignificant.

7.2.5 Workers' Discharge of Sewage, sullage and solid wastes

There is expected to be about 50 workers and staff, which will not be staying at site; instead they will be staying in the surrounding hotels and homestays. As seen in landuse assessment in **Chapter 6** the adjacent townships are rapidly growing with housings under construction, thus should be able to absorb the requirements due to this proposed project.

At the site, temporary toilets from a reliable service provider will be installed; these will be regularly serviced and taken away once construction finishes. Thus, sewage during construction is not expected to have any significant impact on river water quality.

Improper management of workers' domestic solid wastes will lead to leachate, odour, pests, etc., in particular rats which may lead to spread of leptospirosis. If not properly disposed, will lead to littering, with litter eventually carried to the river by runoffs, contributing to river pollution.

7.2.6 Construction Solid Wastes Management

Improper management of construction wastes and debris, such as empty containers, will lead to hazards of dengue which would impact not just the workers but also the surrounding population. Accumulation of waste woods, cardboards and other burnables will lead to fire hazards.

7.2.7 Construction Scheduled Wastes Management

Spilt waste oils, such as fuel oils, diesel, solvents, lubricants, paints, etc., and their containers, will pollute the receiving water body, as well as pose fire hazards, if not properly managed. Among possible scheduled wastes are:

SW 311	Waste oil or oily sludges	From machineries employed
SW 313	Oil contaminated earth	From oil spillages, etc
SW 409	Disposed containers, bags or equipment contaminated with chemicals, pesticides, mineral oil or scheduled wastes	From usage of chemicals, pesticides, etc.
SW 410	Rags, plastics, papers or filters contaminated with scheduled wastes	From wiping of oils etc.

7.2.8 Runoff Drainage during Construction

The drainage system during construction consists of onsite drains and retention pond that discharge to the roadside monsoon drain that finally discharges into Sg. Baluk. If the retention pond is not constructed according to MSMA guidelines and before site clearing begins, runoff water overflows to the monsoon drain may carry sediments. LDP2M2 assessments during construction have been carried out and is given in **Section 7.4**. Improper management of wastes during the construction stage too could lead to blockage of the drainage system.

7.2.9 Traffic due to Transportation of materials and movement of vehicles

Traffic of slow moving construction vehicles, such as bulldozers and cranes, may hinder traffic movement and endanger other road users. Transportation of construction materials and process units may involve large vehicles, which may hinder traffic movement and endanger other road users.

7.2.10 Socioeconomic Impacts during Construction

From the social survey carried out, the main concerns of the Respondents during construction were:

a) Employment opportunities, which they hope would improve economic activities within the construction, installation, and service-related sectors, such as engineering works and others. Thus, if employment of locals is not made a policy by SCaRF at construction stage, the locals would feel that they would gain no benefit from having the plant in their area.

b) Increased small businesses from consumption of food and other needs; thus if the SCaRF does not make it a policy to purchase from the locals, the small businesses would not benefit from having the plant in their area. The Respondents felt that sourcing from locals could create socio-economic spin-off effects on local businesses, such as traders, sundry shops, and restaurants, as well as housing demands for the workers.

c) Influx of foreign workers: the Respondents are concerned it may cause social conflict if they are unfamiliar with the local culture, values, and health issues, especially Covid-19.

d) Road safety and dust: the Respondents felt that movement of heavy vehicles and machinery may increase the noise level and dust, which could cause discomfort to the residents. There would be temporary disruptions of local traffics during the development of proposed project if there is poor traffic road management. The heavy vehicle will use the existing road to access the project site. The sharing of the access road may also jeopardize the nearby population's safety and road users' safety.

7.3 POTENTIAL IMPACTS DURING OPERATIONAL PHASE

7.3.1 Gaseous wastes discharge

Waste gases are treated to meet the Environmental Quality (Clean Air) Regulation 2014 or the CAR2014 and discharged via two stacks. The treatment processes to ensure the gases released meet the CAR2014 or better at all times during operation are described in **Section 5.4** The dispersion modelling of the released gases are given in **Section 7.5** where the modelling indicate that (for details see **Section 7.5**) if discharges comply to the limits in CAR2014 there will not be any significant impact to the ambient air quality from the operations of the proposed plant. However, if the air pollution control system (APCS) is not working properly or any part of it is faulty, non-compliance to the CAR limits may occur and the exhaust gases may affect the air quality of the surrounding environment. Malperformance at any stage of the APCS may affect the performance of the overall system. For example, for roasting kiln exhaust gas treatment, under performance at scrubber 1, may jeopardise performance of Scrubber 2, and the problem may be carried on to the electrostatic precipitator (EP).

7.3.2 Water quality due to effluent discharge

IETS treated effluent contributes to the total flow entering Sg. Baluk, although the contribution is small compared to that from other sites in the Gebeng Industrial Estate. This flow contribution is beneficial during dry periods, as the water is necessary for sustaining the wetland and aquatic life of the river. The flowrate of Sg. Baluk at normal conditions is much greater than the effluent discharge flowrate of effluent; at point WQ4 the river low flowrates were estimated (see **Section 7.6**) as 0.12.m^3/s; the effluent discharge flowrate is 385 m^3/d = 0.0045 m^3/s or 3.8% of flowrate at WQ4. The drain from SCaRF joins Sg. Baluk downstream of WQ4. Water quality modellings were carried out for treated effluent discharge as well as for raw effluent without treatment and these are given in **Section 7.6**. The results show that the water quality of Sg. Baluk would not be significantly affected and would remain about the same as the existing water quality, if the treated effluent complies to Standard B of the EQ(IE)R 2009. Malperformance of the IETS may lead to discharge of treated effluents not meeting the Standard B, EQ(IE)R 2009, particularly with respect to pH and ammonia. Thus, it is crucial to ensure that the Standard B of the EQ(IE)R 2009 is complied to at all times, and the IETS process conditions are monitored to prevent the following:

a) <u>Insufficient removal of nutrients</u>

Leading to higher ammonia in receiving river lowering its dissolved oxygen and leading to potential slime growth. The existing water quality already shows moderate levels of Ammonia-N, thus higher discharges than as allowed by the Standard B of EQ(IE)R 2009 could aggravate the situation. Water quality modelling in **Section 7.6** shows that with compliance to Standard B of EQ(IE)R 2009 would not show any significant impact, even at WQ3.

b) <u>Insufficient removal of organics</u>

Leading to higher BOD in receiving river, lowering its dissolved oxygen and leading to potential odour. The existing water quality already shows moderate levels of BOD, thus higher discharges than as allowed by the Standard B of EQ(IE)R 2009 could aggravate the situation. Water quality modelling in **Section 7.6** shows that with compliance to Standard B of EQ(IE)R 2009 would not show any significant impact, even at WQ3.

c) <u>Insufficient removal of suspended solids</u>

Leading to higher turbidity in receiving river lowering light penetration, leading to lower photosynthesis by aquatic plants, lowering its dissolved oxygen level.

d) <u>Malfunction of equipment</u>

Leading to malfunction of blowers, pumps, online monitors, etc., thus causing upset to the treatment system efficiency and lack of treatment leading to discharge of insufficiently treated effluent.

7.3.3 Scheduled Waste Management During Operation

As the spent catalyst is a scheduled waste (SW202) then any waste arising from its processing is also a scheduled waste. Operation of the SCaRF involves running of many rotating mechanical equipment, such as pumps, blowers, etc. These require lubricants and oils, thus generating scheduled wastes during maintenance. There are also wastes associated with scheduled wastes, such as used containers. The potential scheduled wastes are:

- SW 501 – Any residues from treatment or recovery of scheduled wastes
- SW 204 – Sludges containing one or several metals including chromium, copper, nickel, zinc, lead, cadmium, aluminium, tin, vanadium and beryllium.
- SW 406 - Clinker, slag and ashes from scheduled wastes incinerator (here roaster)
- SW 305 – Spent lubricant oil
- SW410 – Rags, plastics, papers or filters contaminated with scheduled wastes
- SW 409 – Disposed containers, bags or equipment contaminated with chemicals, mineral oil or scheduled wastes.

All the scheduled wastes if not properly managed will lead to environmental contamination. Among the issues which may arise are:

- Improper storage leading to spillages, exposure to weather, etc., leading to contamination of surface water;
- Spent catalyst transportation may lead to spillages if it is not securely contained, contributing to water pollution.
- Scheduled Waste (SW) dumping could occur if carried out by unlicensed contractor and delivery system is not secured, leading to water pollution
- Sludge dumping could occur if carried out by unlicensed contractor and delivery system is not secured, leading to water pollution.
- Improper scheduled waste disposal may lead to water pollution if the wastes are disposed in non-designated landfill or facility.
- Sludge disposal may lead to water pollution if the sludges are disposed in non-designated landfills, without proper leachate treatment

7.3.4 Solid Waste Management During Operation

Garbage and other non-hazardous solid wastes generated at the plant, such as containers, sacks, etc, if not properly managed will lead to littering and river water pollution and if not properly managed would generate leachate, and lead to breeding of pests and flies. Accumulation of solid wastes could lead to proliferation of pests at the plant. Improper waste disposal may lead to water pollution if the wastes are disposed in non-designated landfill or facility. Waste dumping could occur if carried out by unlicensed industrial waste contractor and delivery system is not secured, leading to water pollution.

7.3.5 Socioeconomic Impacts during Operation

Respondents to socioeconomic surveys' main concerns during operation of SCaRF are:

1) That employment, when not filled by specialists from Japan, are given to Malaysians, with priority to locals, as otherwise unemployment, especially of fresh graduates, in the district would not be helped by having the project in the area;
2) That the plant at all times be in compliance to DOE emission regulations, and to take precautionary measures such that there would not be accidental or emergency releases that could jeopardise the well-being of the locals;
3) That the use of local roads for heavy loads on the way to the plant be limited to daylight hours;
4) That the SCaRF would help to improve the infrastructural facilities and amenities to improve the well-being of the locals in the area.

7.3.6 Traffic for transport of spent catalyst

Transportation of spent catalyst does not occur everyday; when transportation occurs, i.e. after a batch of spent catalyst is discharged at a plant, there will, at the most, be about 4 weeks of transportation in 3 months, that is 1 month of transportation in 3 months with about 8 trucks per day during that 1 month. Although the frequency is low, movement of these slower and heavy vehicles may hinder traffic movement and endanger other road users.

7.4 LAND DISTURBING POLLUTION PREVENTION AND MITIGATION MEASURES (LD-P2M2) - POTENTIAL IMPACTS DURING PROJECT DEVELOPMENT

7.4.1 Soil Erosion and Sedimentation

Soil erosion and sedimentation is a potential impact that shall occur from uncontrolled land clearing and earthwork activities. The nearby water bodies and eventually Sungai Baluk may be affected in terms of Turbidity and TSS concentrations in the surface water if no control measure is taken. The uncovered soil surface for prolonged period will extend the exposure time to the weather elements that lead to soil erosion process. The direct impacts of water droplets increase soil dispersion, surface sealing, runoff, erosion, and crusting. Soil crusting processes will turn the soil particle into a soil crust which is much more compact. A surface crust indicates poor infiltration and increase runoff and erosion, a problematical seedbed, and reduced air exchange between the soil and atmosphere. Excessive tillage tends to break up soil clods into smaller sizes more susceptible to breakdown, bury most plant residue and accelerate decomposition of organic matter. The phenomenon is likely to happen in bare areas, such as access road, and skid trail. The loose and friable soil is extremely convenient to be washed out by the surface runoff during heavy rainfall and enter the river system. The sedimentation process in the receiving rivers shall affect the water quality and aquatic ecosystems. Excessive sedimentation will reduce river depth or drain capacity and may cause floods.

7.4.2 Soil Erosion Risk

The soil erosion risk assessment for the project is conducted based on the following scenarios:

i. Pre-Development – Existing Condition
ii. During Development (Without Mitigation Measures) – Worst Case Scenario where the development is conducted without any mitigation measures.
iii. During Development (With Mitigation Measures) - The development is conducted with control measures in place.
iv. Post-Development – After construction works are completed, i.e., operations stage

The results of the soil loss potential calculations in the project site are shown in **Table 7.4(1).** Significant increment of soil loss is expected to occur in the worst-case scenario where LD-P2M2 are not adopted. The USLE calculation sheet is shown in **Appendix 3.**

The USLE equation for predicting the long-term average annual soil loss (A) is:

$$A = R \times K \times LS \times C \times P$$

Where;

A	=	average annual soil loss in the project area
R	=	rainfall erosivity index
K	=	soil erodibility factor
LS	=	topographic factor, L for slope length and S for slope steepness
C	=	a cropping-management factor
P	=	conservation practice factor

Table 7.4(1): USLE Factors and Soil Loss Estimation

Catchment: C1
Area (ha): 8.1

R				K				LS				C				P				A (Soil Loss)			
BD	**WC**	**DDWCM**	**PD**	**BD**	**WC**	**DDWCM**	**PD**	**BD**	**WC**	**DDWCM**	**PD**	**BD**	**WC**	**DDWCM**	**PD**	**BD**	**WC**	**DDWCM**	**PD**	**BD**	**WC**	**DDWCM**	**PD**
18,500				0.036				0.146	0.146	0.146	0.146	0.4	1.0	0.1	0.05	1.0	1.0	0.5	0.6	38.89	97.24	4.86	2.92

Notes:

1. The USLE calculation sheet are shown in **Appendix 3**
2. BD – Before Development
3. DDWCM – During Development with Control Measures
4. WC – During Development without Control Measures (Worst Case)
5. PD – Post Development

Soil Loss (ton/ha/yr)	Classification	Color Code
<10	Low	
10 - 50	Moderate	
50 -100	Moderate High	
100 - 150	High	
>150	Very High	

Source: Erosion Risk Map Peninsular Malaysia, Department of Agriculture

Table 7.4(2): Estimation of Total Sediment Yield (Worst case scenario)

Catchment	Area (ha)	Peak Discharge, Q_p (m^3/s)	Runoff Volume, V (m^3)	K	LS	C	P	Y(T)	Remarks
C1	8.1	1.69	2,025	0.036	0.146	1	1	44.9	100% Disturbed

Notes:

1. The MUSLE calculation sheet are shown in **Appendix 3**

Sediment Yield

The result of sediment yield estimation, Y is as shown in **Table 7.4(2)**. Sediment yield was calculated to estimate the amounts of solids loading in the adjacent water bodies during the worst-case scenario. The amount of potential sediment yield is expected to increase without any control measures (such as BMPs and LD-P2M2) in place. The MUSLE calculation sheet is shown in **Appendix 3**.

7.4.3 Conclusion on Erosion Control

Based on Department of Agriculture's erosion risk classification, the erosion risk for the project site is rated as moderate before the project development given the existing condition of the project site which is covered with secondary vegetation i.e., trees, scrubs, and bushes. Soil erosion during the development phase is a transient problem. Without LD-P2M2 in place, the erosion risk of the project site shall be elevated significantly to moderate high category. With the implementation of the proposed LD-P2M2 (Please refer to **Chapter 8**), the soil loss rate shall be kept within the low category. For the Post-Development Scenario, the soil loss rate for the project site shall be low as the ground surface of the project area shall be fully stabilized with erosion control measures.

7.5 AIR DISPERSION MODELLING

7.5.1 Air Quality Regulations and Standards

The relevant regulations in term of air emissions with respect to the **Environmental Quality Act 1974 (EQA 1974)** due to the Project are as follows:

- **Environmental Quality (Clean Air) Regulations 2014 (CAR2014)**;
- **Environmental Quality (Control of Emission from Diesel Engines) Regulations 1996;**
- **Environmental Quality (Control of Emission from Petrol Engines) Regulations 1996;** and
- **Environmental Quality (Declared Activities) (Open Burning) Order 2003**.

The CAR 2014 regulations shall apply to:

a. any premises used for any industrial or trade purposes, or on which matter is burnt in connection with any industrial or trade purposes, including burning of waste;

b. any other premises or process that discharges or is capable of discharging air pollutants into the open air;

c. any industrial plants; and

d. any fuel burning equipment.

The control of emission from diesel and petrol engines from vehicles are regulated under the **Environmental Quality (Control of Emission from Diesel Engines) Regulations 1996** and **Environmental Quality (Control of Emission from Petrol Engines) Regulations 1996**. While, the **Environmental Quality (Control of Petrol and Diesel Properties) Regulations, 2007** and **Environmental Quality (Control of Petrol and Diesel Properties) (Amendment) Regulations 2021** provide for the control of petrol and diesel properties in order to improve air quality. Fuel which is produced, stored, distributed, transported, supplied, sold or offered for sale within Malaysia must comply with the standard of properties as prescribed in the relevant Schedules to the Regulations. The Regulations apply to fuel used in any internal combustion engine (mobile and stationary applications) and in industrial plants.

No open burning of material should be carried out at all times for both the construction and operational phases of the Project and this activity is strictly prohibited under the **Environmental Quality (Prescribed Activity) (Open Burning) Order 2003**. The relevant regulations under the EQA 1974 for open burnings are as follows:

• **29A: Prohibition on open burning;** • **29AA: Exclusion from "open burning";** • **29B: Owner or occupier of premises liable for open burning**; and • **29C: Defence.**	

Note: Graphic from Department of Environment Malaysia (July 2021)

For ambient air quality, the prescribed limits for the criteria pollutants are as those prescribed in the *Standard in 2020* of the *Malaysian Ambient Air Quality Standards (MAAQS (Standard 2020))* as shown in **Table 7.5(1)** below:

Table 7.5(1): Malaysia Ambient Air Quality Standard

Pollutants	Unit	Averaging Time	Ambient Air Quality Standard
			Standard (2020)
Particulate matters, less than 10 microns, PM_{10}	$\mu g/m^3$	1 year	40
		24-hour	100
Particulate matters, less than 5 microns, $PM_{2.5}$	$\mu g/m^3$	1 year	15
		24-hour	35
Sulphur Dioxide, SO_2	$\mu g/m^3$	1 hour	250
		24-hour	80
Nitrogen Dioxide, NO_2	$\mu g/m^3$	1 hour	280
		24-hour	70
Ozone, O_3	$\mu g/m^3$	1 hour	180
		8-hour	100
Carbon Monoxide, CO	mg/m^3	1 hour	30
		8-hour	10

7.5.2 Potential Impacts During Construction Phase

For this Project, no major earthwork is anticipated as construction only involves a fairly small area and involves mainly installations of readymade equipment and tanks onto a prepared platform.

<u>Sources of Pollutants</u>

The sources of air pollutant during the Project construction activity would be vehicular emissions from transportation of heavy equipment, as well as construction of roads and supporting facilities. The air pollutants would be mainly combustion gases such as Particulate Matters (PM), Nitrogen Dioxide (NO_2) and Carbon Monoxide (CO) due to incomplete combustion (*if occur*) and negligible SO_2 due to low sulphur content in the fuel.

Dusty materials produced as a result of construction work being carried out may include cement, earth, aggregates, silt, stone fines, sand and debris. Fugitive dust mainly Total Suspended Particulates (TSP) which includes Particulate Matters less than 10 micron and 2.5 micron (PM_{10} and $PM_{2.5}$) small airborne particulates such as dust, fumes and smoke with a diameter of less than 100 micrometres. The observed human health effects of TSP include breathing and respiratory symptoms, aggravation of existing respiratory disease and damage to lung tissues.

The area of influence for fugitive dust is anticipated to be localised within the construction area (usually less than 50 m away) as the work area will be limited in nature. The duration of impact for the construction phase will be short term to medium term. For this Project, the nearest residential area is more than 1 km away from the Project site, hence, the air quality impact due to the construction activity is anticipated to be minimal.

7.5.3 Potential Impact Assessment for Construction Phase

<u>Dust Emissions</u>

Dust is expected to be generated during the construction stage of the Project especially from the movement of vehicles on-site. However, dust pollution due to the construction activities is temporary and the local air quality is expected to return to its normal ambient levels when the construction ceases.

<u>Vehicle/Equipment Exhaust Emissions</u>

Vehicle exhaust emissions on the local road network will be intermittent and transient in nature where associated impacts are considered minor. Exhaust emissions from the diesel engine driven equipment is also expected to result in insignificant impacts on air quality. Generally, the exhaust emissions for the Project during construction will be minor.

7.5.4 Potential Impacts During Operational Phase

Long term air pollution concern is expected during the operation of the Project. For the Project, air emission sources i.e. stacks as point sources are mainly from the proposed Scrubbers System.

<u>Sources of Pollutants</u>

The stack emission also shall comply with the *Fifth Schedule [Regulation 15]: Emission Standards for Hazardous Substances: Category (4) Gaseous and Volatile Inorganic Substances: (a) Volatile Inorganic Substances other than Oxides of Sulphur and Oxides of Nitrogen, Class (3): In case of an untreated mass flow of 300 grams/hour or more for each substance an emission standard of 30 mg/m^3 applies* for NH_3 and *Category (4) Gaseous and*

Volatile Inorganic Substances: (b) Oxides of Sulphur and Oxides of Nitrogen: general limit values for oxides of sulphur (sum of SO_2 and SO_3 expressed as SO_2) and oxides of nitrogen (sum of NO and NO_2 expressed as NO_2): In the case of an untreated mass flow of 5.0 kilograms/hour or more for each substance an emission standard of 400 mg/m^3 shall apply if not stated otherwise bin the Third Schedule.

For the proposed Scrubber System, the stack emission shall comply with the *Second Schedule [Regulation 13]: Limit Values and Technical Standards (General): (II) Control of NMVOC Emissions: 1 (b).*

7.5.5 Impact Assessment for Operational Phase

For the evaluation of potential impacts, the USEPA AERMOD air quality model has been utilised. The Maximum Avera ge Incremental Concentrations (MAICs) for the identified criteria air pollutants are simulated using the air quality model with utilization of 3 years (2018 to 2020) hourly meteorological data from AERMET-Ready WRF-MMIF for the study. The ambient air quality assessment criteria are mainly the Malaysian Ambient Air Quality Standards for year 2020 i.e. MAAQS [Standard (2020)]. The description of the model and the approach taken to model the emission from the stacks during operation are discussed below.

7.5.6 Air Dispersion Modelling

AERMOD is an air dispersion model that incorporates concepts such as planetary boundary layer theory and advanced methods for handling complex terrain. There are two input data processors that are regulatory components of the AERMOD modelling system namely AERMET and AERMAP. AERMET provides AERMOD with the meteorological information the latter needs to characterise the planetary boundary layer (i.e. the turbulent air layer next to the earth's surface that is controlled by the surface heating and friction and the overlying stratification); AERMAP characterises the terrain and generates receptor grids and elevations for AERMOD from digital elevation data.

<u>Model Input</u>

Model inputs for AERMOD include source information, emission rate, receptor grid system, meteorological data and terrain data. The approach taken to model the emissions from the identified proposed stacks for the Project is as discussed below.

<u>Source Information</u>

The stack specification for the identified stacks of the Project is as tabulated in **Table 7.5(2)**. Inputs to the AERMOD model include emission rates of gaseous pollutants released from the stack and other source information such as stack height and internal diameter, source type, exit velocity and temperature, and coordinates of each source with respect to the receptor grid.

<u>Emission Rates</u>

All stack emissions from the identified point sources for the Project are anticipated to comply with *CAR 2014* during normal operation. The calculated emission rate for the identified criteria air pollutants is tabulated in **Table 7.5(3)**.

<u>Receptor Grid System</u>

In this assessment, a 10 km by 10 km Cartesian grid receptor with 250 m interval was used for the impact modelling. All the grids were centred at the UTM-coordinates of 319167.68 m (x-axis) and 443097.05 m (y-axis) located within the Project site. The discrete Air Sensitive Receptors (ASRs) identified for this study is as shown in the **Table 7.5(4)** and **Figure 7.5(1)**.

<u>Meteorological Data</u>

For this study, data for year 2018 to 2020 was processed from AERMET-Ready WRF-MMIF for the study area, and used in the analysis. The windrose for this modelling period is as shown in **Figure 7.5.2.**

Table 7.5(2): Stack Specifications for the Project

Stack	Unit	Stack 1 (Stack Id: 131)	Stack 2 (Stack Id: 521)
Description		**Value**	**Value**
UTM Coordinate (x, y)	m, m	319211.18, 442958.90	319151.33, 443100.19
Platform Level	m	7.65	7.65
Stack Height	m	40	15
Stack Diameter	m	1.0	0.45
Stack Exit Velocity	m/s	13	12
Stack Exit Temperature	°C	52	50

Table 7.5(3): Maximum Emission Concentrations and Calculated Emission Rates for the Project

Parameter	CAR 2014	Proposed Emission Concentration by SCaRF	
	Emission Concentration (mg/Nm^3)	Emission Concentration (mg/Nm^3)	Calculated Emission Rate (g/s)
STACK 1			
Particulate Matters (PM)	50 (BAT)	1.0	0.010
Sulphur Dioxides (SO_2)	400	70.8	0.7
Nitrogen Oxides (NO_x)	400	43.3	0.4
NMVOC	150	150[@]	1.5
STACK 2			
Ammonia	30	13.9	0.027

Note: BAT = Best Available Technique

The emission concentration for PM10 and PM2.5 is conservatively assumed to be the same with PM

[@]The NMVOC is assumed to comply with the CAR2014 limit, lower VOCs is anticipated as the roasting process will combust the residual VOCs found in the material to be recovered

Table 7.5(4): Location of Identified ASRs

Point	Description	UTM Coordinates (x, y) (m, m)
On-site Air Sensitive Receptor		
ASR1	Within the Project Site	319211.05, 443135.07
Off-site Air Sensitive Receptors		
ASR2	At Coastal Residential Village, Kg. Sungai Ular	321649.94, 446957.22
ASR3	At Seaside Residential Area, East of the Project Site	323097.90, 443681.55
ASR4	Institut Latihan Perindustrian Kuantan (ILPK), South of the Project Site	319492.60, 438558.64
ASR5	Akademi Maritim Sultan Ahmad Shah (AMSAS), North of the Project Site	319565.42, 444808.7
ASR6	Malaysia China Kuantan Industrial Park (MCKIP), West of the Project Site	316771.72, 442404.58

Figure 7.5(1): Location of ASRs

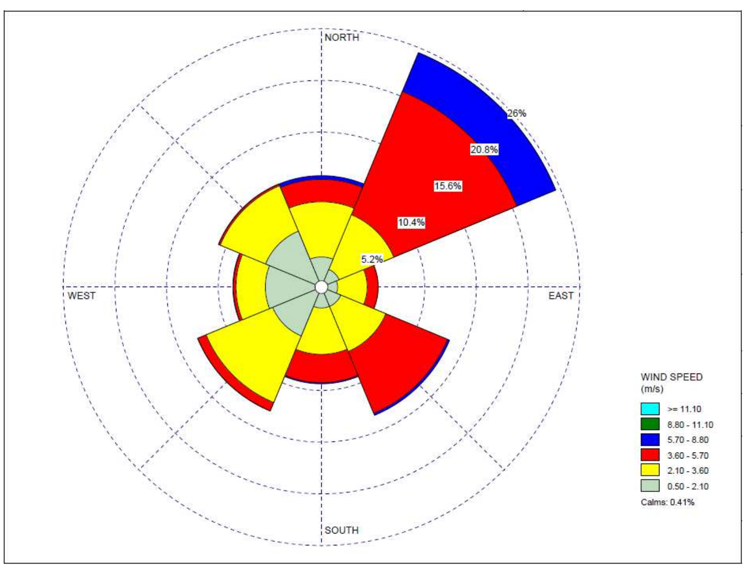


Figure 7.5(2): Windrose for the Study Area

Terrain

The rural mode was chosen as a roughness parameter in view of the terrain and land use of the area. Local topography (i.e. ground elevation above mean sea level) can have significant influence on the dispersion of air pollutants. Local topography (terrain effects) within the defined receptor grid has therefore been incorporated into the model simulation from the terrain data elevation of the Shuttle Radar Topography Mission (SRTM) obtained from NASA (National Aeronautics and Space Administration).

Modelling Scenario

The AERMOD model predicts the Maximum Average Incremental Concentration (MAIC) for each identified air pollutant. During normal operation, appropriate averaging times were simulated for each air pollutant.

7.5.7 Modelling Results

The predicted MAICs for all the criteria air pollutant identified for normal operation were compared against the *Malaysian Ambient Air Quality Standards in 2020 (MAAQS (Standard [2020]***)** and the Ontario Ministry of the Environment (April 2012)'s Ambient Air Quality Criteria (*Ontario AAQC*) for those not specified under the MAAQS.

During Normal Operation

The predicted MAICs for all the criteria air pollutants identified for normal operation are summarised in **Table 7.5.5** while the iso-contours are shown in **Figure 7.5(3)** to **Figure 7.5(8)**. Findings from the modelling during normal operations are discussed below.

(i) **PM_{10}**

The highest 24-hours averaging time and annual average MAICs were predicted at 0.048 μg/m^3 and 0.008 μg/m^3 respectively (as shown in **Figure 7.5(3)**).

The 24-hours averaging time Ground Level Concentration (GLC) i.e. addition of Baseline Level (BL) (9.0–63.0 μg/m^3) and MAIC at the identified ASRs will be within the prescribed limit of 100 μg/m^3 of the MAAQS [Standard (2020)].

(ii) **$PM_{2.5}$**

The highest 24-hours averaging time and annual average MAICs were predicted at 0.048 µg/m^3 and 0.008 µg/m^3 respectively (as shown in **Figure 7.5(4)**). No exceedance was predicted at all identified ASRs. The MAICs for 24-hours averaging time at the identified ASRs comply to the prescribed 24-hour limit of 40 µg/m^3 of the MAAQS [Standard (2020)].

(iii) **SO_2**

The highest predicted 1-hour and 24-hours averaging time MAICs of SO_2 were at 17.6 µg/m^3 and 3.4 µg/m^3 which were within the MAAQS [Standard (2020)] prescribed limits of 250 µg/m^3 and 80 µg/m^3 (as shown in **Figure 7.5(5)**). No exceedance was predicted at all identified ASRs for both EIAs. The GLCs at the identified ASRs comply to the prescribed 1-hour limit of 250 µg/m^3 and 24-hours limit of 80 µg/m^3 of the MAAQS Standard (2020).

(iv) **Nitrogen Oxides as 100% NO_2**

The highest predicted 1-hour and 24-hours averaging time MAICs of NO_2 were at 10.1 µg/m^3 and 1.9 µg/m^3 respectively, which were all within the MAAQS [Standard (2020)] prescribed limits of 280 µg/m^3 and 70 µg/m^3.

The predicted MAICs for 1-hour averaging time and 24-hours averaging time at all 6 identified ASRs ranged from 0.2 µg/m^3 to 0.7 µg/m^3 respectively. No exceedance was predicted at all identified ASRs. The GLCs at the identified ASRs comply to the prescribed limits. The 1-hour and 24-hours averaging time iso-contours for NO_2 are shown in **Figure 7.5(6)**.

(v) **Ammonia as NH_3**

The highest predicted 8-hours, 24-hours and annual averaging time MAICs were at 1.81 µg/m^3, 0.82 µg/m^3 and 0.13 µg/m^3 respectively (as shown in **Figure 7.5(7)**). No exceedance was predicted at all identified ASRs. The MAICs for 24-hours averaging time at the identified ASRs comply to the prescribed 24-hour limit of 100 µg/m^3 of the Ontario's Ambient Air Quality Criteria 2012.

(vi) **NMVOC**

The highest predicted 8-hours, 24-hours and annual averaging time MAICs of NMVOC were at 9.47 µg/m^3, 7.25 µg/m^3 and 1.13 µg/m^3 respectively. Currently, there is no prescribed limit in the MAAQS 2013 for this pollutant.

Table 7.5(5): Predicted Maximum Average Incremental Concentration for Identified Air Pollutants (in µg/m³) During Normal Operation Scenario

Pollutant	Averaging Time	Baseline Level (µg/m³)	Figure	Highest Predicted MAIC	Concentration (µg/m³)												MAAQS 2013 (Standard (2020)) (µg/m³)
					ASR1 Within Project Site		ASR2 At Coastal Residential Village		ASR3 At Seaside Residential Area		ASR4 Institut Latihan Perindustrian Kuantan		ASR5 Akademi Maritim Sultan Ahmad Shah		ASR6 Malaysia China Kuantan Industrial Park		
					MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	
Particulate matter sized 10 microns or less (PM_{10})	24-hours	On-site ASR1 = 38 Off-site ASR2 = 9 ASR3 = 46 ASR4 = 63 ASR5 = 57 ASR6 = 54 (24-hours)	7.5.3	0.048	0.017	38.02	0.006	9.01	0.004	46.00	0.006	63.01	0.007	57.01	0.006	54.01	100
	Annual			0.008	0.007	-	0.005	-	0.002	-	0.004	-	0.006	-	0.002	-	40
Particulate matter sized 2.5 microns or less ($Pm_{2.5}$)	24-hours	On-site ASR1 = NM Off-site ASR2 = NM ASR3 = NM ASR4 = NM ASR5 = NM ASR6 = NM	7.5.4	0.05	0.02	-	0.01	-	0.00	-	0.01	-	0.01	-	0.01	-	35
	Annual			0.008	0.007	-	0.005	-	0.002	-	0.004	-	0.006	-	0.002	-	15
Sulphur Dioxide (SO_2)	1-hour	On-site ASR1 = 38 Off-site ASR2 = 24	7.5.5	17.6	7.1	-	3.2	-	3.7	-	3.0	-	5.2	-	4.3	-	250

Pollutant	Averaging Time	Baseline Level ($\mu g/m^3$)	Figure	Highest Predicted MAIC	Concentration ($\mu g/m^3$) ASR1 Within Project Site		ASR2 At Coastal Residential Village		ASR3 At Seaside Residential Area		ASR4 Institut Latihan Perindustrian Kuantan		ASR5 Akademi Maritim Sultan Ahmad Shah		ASR6 Malaysia China Kuantan Industrial Park		MAAQS 2013 (Standard (2020)) ($\mu g/m^3$)
					MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	
	24-hours	ASR3 = 18 ASR4 = 34 ASR5 = 36 ASR6 = 38 (24-hours)		3.4	1.2	39.2	0.5	24.5	0.3	18.3	0.4	34.4	0.5	36.5	0.4	38.4	80
NOx as 100% Nitrogen Dioxide (NO_2)	1-hour	On-site ASR1 = 38 Off-site ASR2 = 9 ASR3 = 46 ASR4 = 63 ASR5 = 57 ASR6 = 54 (24-hours)	7.5.6	10.1	4.1	-	1.8	-	2.1	-	1.7	-	3.0	-	2.4	-	280
	24-hours			1.9	0.7	38.7	0.3	9.3	0.2	46.2	0.2	63.2	0.3	57.3	0.2	54.2	70
Ammonia (NH_3)	8-hours	On-site ASR1 = NM Off-site ASR2 = NM ASR3 = NM ASR4 = NM ASR5 = NM ASR6 = NM	7.5.7	1.81	0.60	-	23	-	0.17	-	0.14	-	0.24	-	0.32	-	-
	24-hours			0.82	0.20	-	0.08	-	0.06	-	0.05	-	0.09	-	0.11	-	100 (Health) (Ontario)
	Annual			0.13	0.01	-	0.00	-	0.00	-	0.00	-	0.01	-	0.00	-	-

Pollutant	Averaging Time	Baseline Level (µg/m³)	Figure	Highest Predicted MAIC	Concentration (µg/m³)												MAAQS 2013 (Standard (2020)) (µg/m³)
					ASR1 Within Project Site		ASR2 At Coastal Residential Village		ASR3 At Seaside Residential Area		ASR4 Institut Latihan Perindustrian Kuantan		ASR5 Akademi Maritim Sultan Ahmad Shah		ASR6 Malaysia China Kuantan Industrial Park		
					MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	MAIC	GLC	
NMVOC	8-hours	On-site ASR1 = 0.31 Off-site ASR2 = 0.22 ASR3 = 0.39 ASR4 = 0.75 ASR5 = 0.47 ASR6 = 0.68 (8-hours)	7.5.8	9.47	7.23	7.54	2.81	3.03	1.84	2.23	1.96	2.71	2.09	2.56	2.43	3.11	-
	24-hours			7.25	2.54	2.85	0.97	1.19	0.62	1.01	0.84	1.59	1.09	1.56	0.85	1.53	-
	Annual			1.13	0.10	0.41	0.08	0.30	0.03	0.42	0.06	0.81	0.08	0.55	0.04	0.72	-

Note:

NM = Not measured, ASRs – Air Sensitive Receptors

The emission concentration for PM10 and PM2.5 is conservatively assumed to be the same with PM

Ground Level Concentration (GLC) = Baseline Level (BL) + Predicted Maximum Average Incremental Concentration (MAIC)

*: Below detection level not used in the calculation for GLC based on best judgment on the Limit of Detection (LOD)

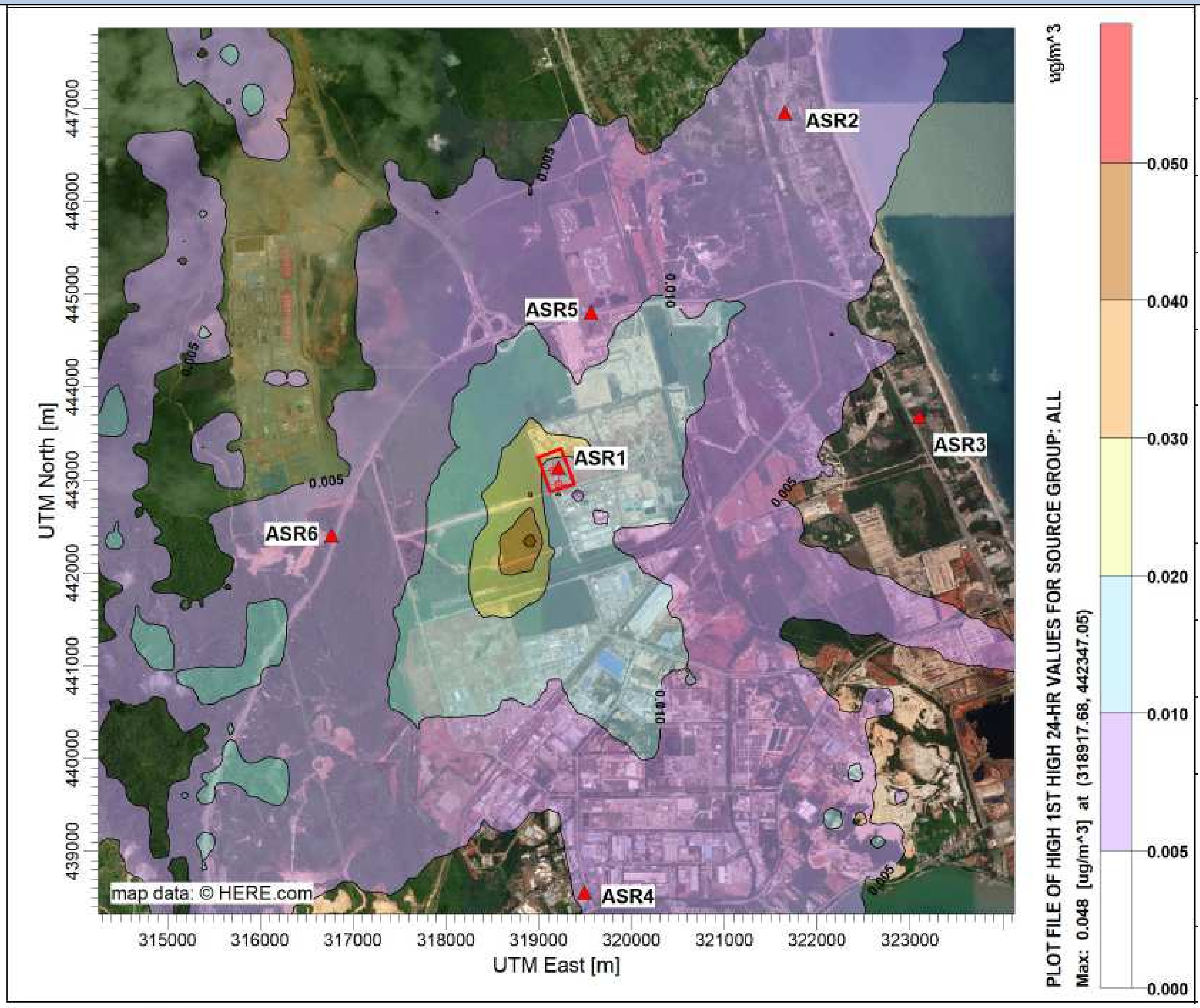
MAAQS (Standard [2020]) = Standard in 2020 of the Malaysian Ambient Air Quality Standards

Ontario = Standard in Ontario's Ambient Air Quality Criteria 2012

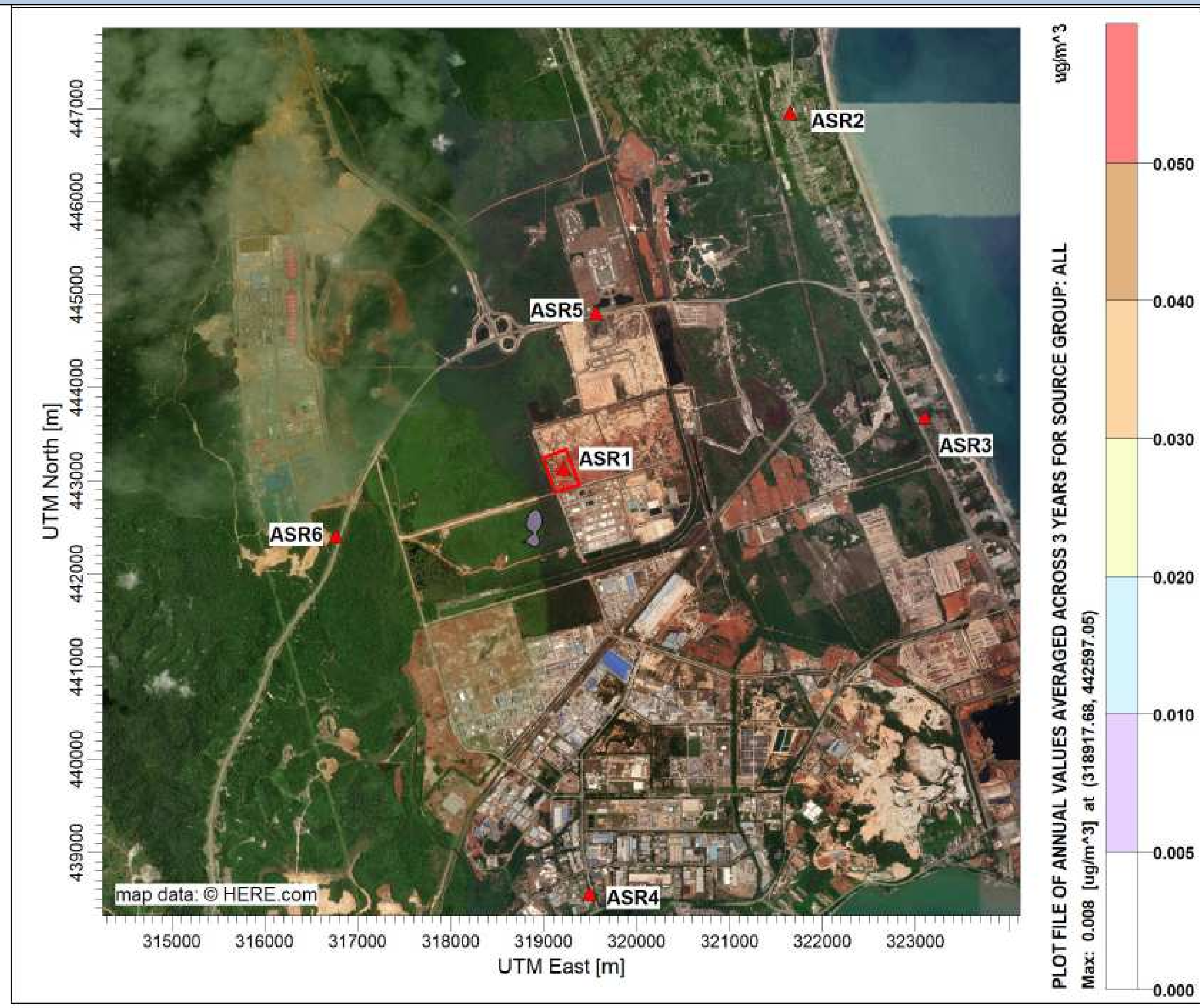
BOLD = Exceedance

Figure 7.5(3): Predicted Maximum Average Incremental Concentration for PM_{10} during Normal Operation

24-hours Averaging Time	**Annual Average**
Highest Predicted MAIC: 0.048 µg/m³ at 318917.68 m, 442347.05 m	Highest Predicted MAIC: 0.008 µg/m³ at 318917.68 m, 442597.05 m



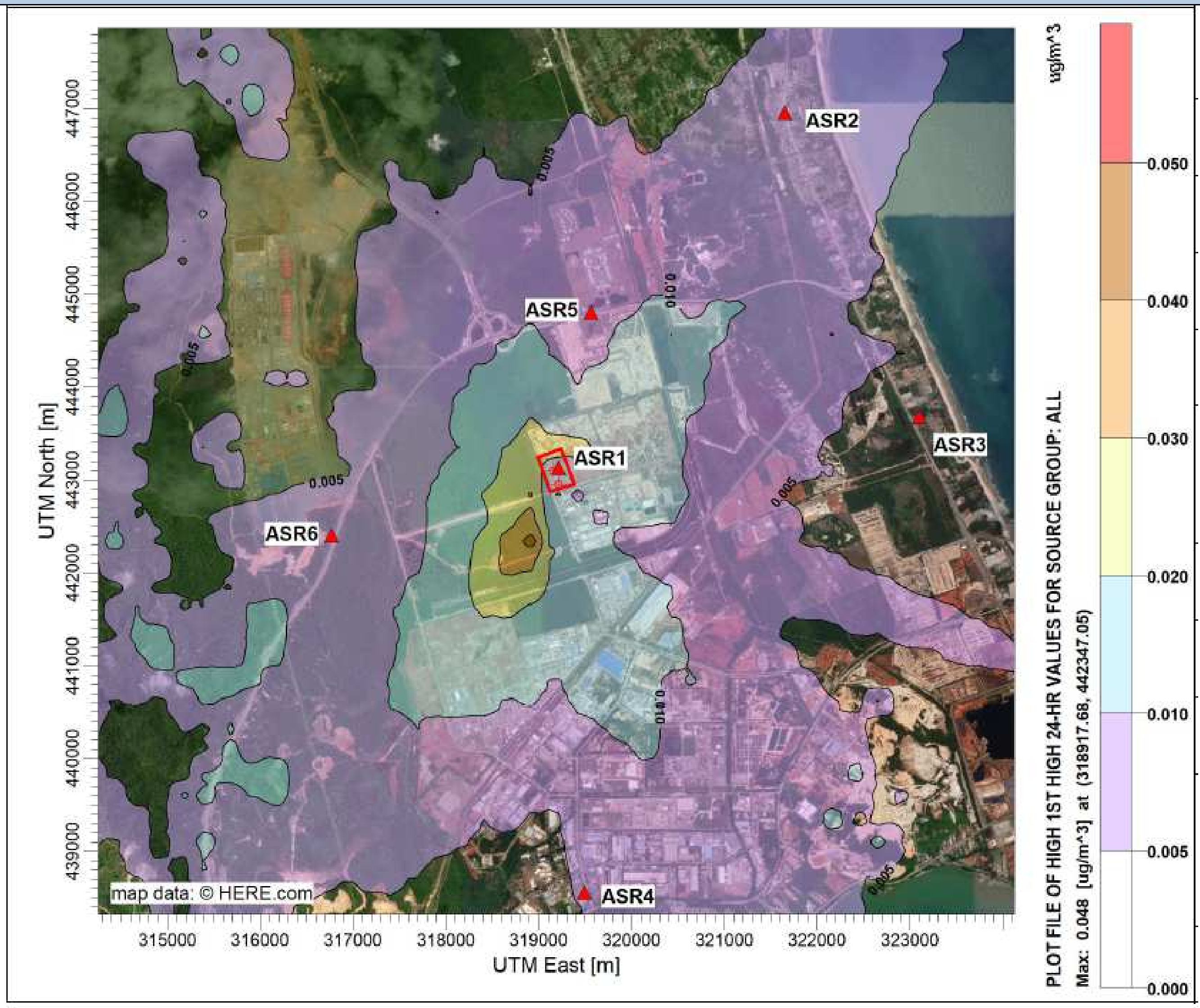
AERMOD View - Lakes Environmental Software



AERMOD View - Lakes Environmental Software

Figure 7.5(4): Predicted Maximum Average Incremental Concentration for $PM_{2.5}$ during Normal Operation

24-hours Averaging Time	Annual Average
Highest Predicted MAIC: 0.048 µg/m³ at 318917.68 m, 442347.05 m	Highest Predicted MAIC: 0.008 µg/m³ at 318917.68 m, 442597.05 m



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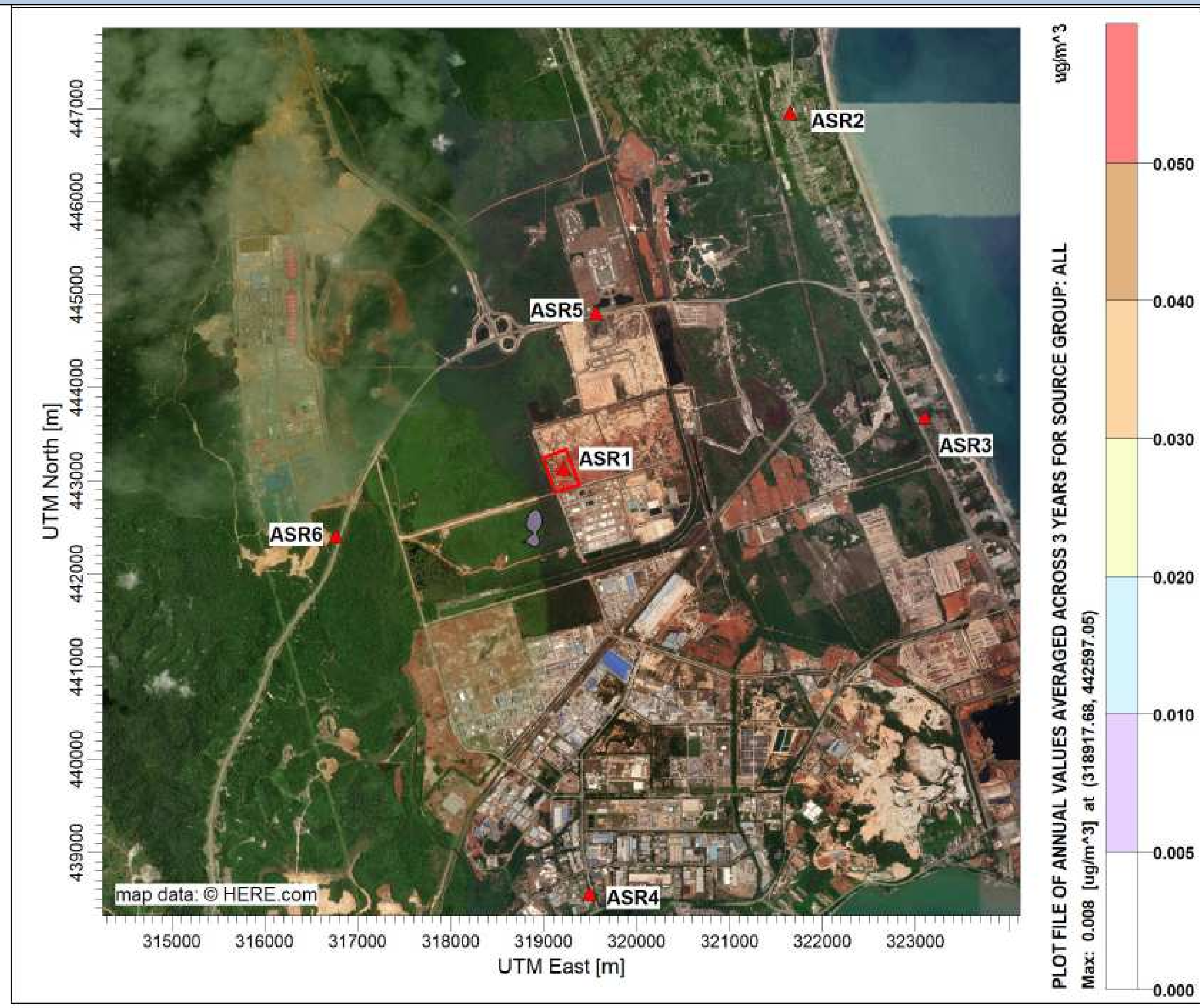

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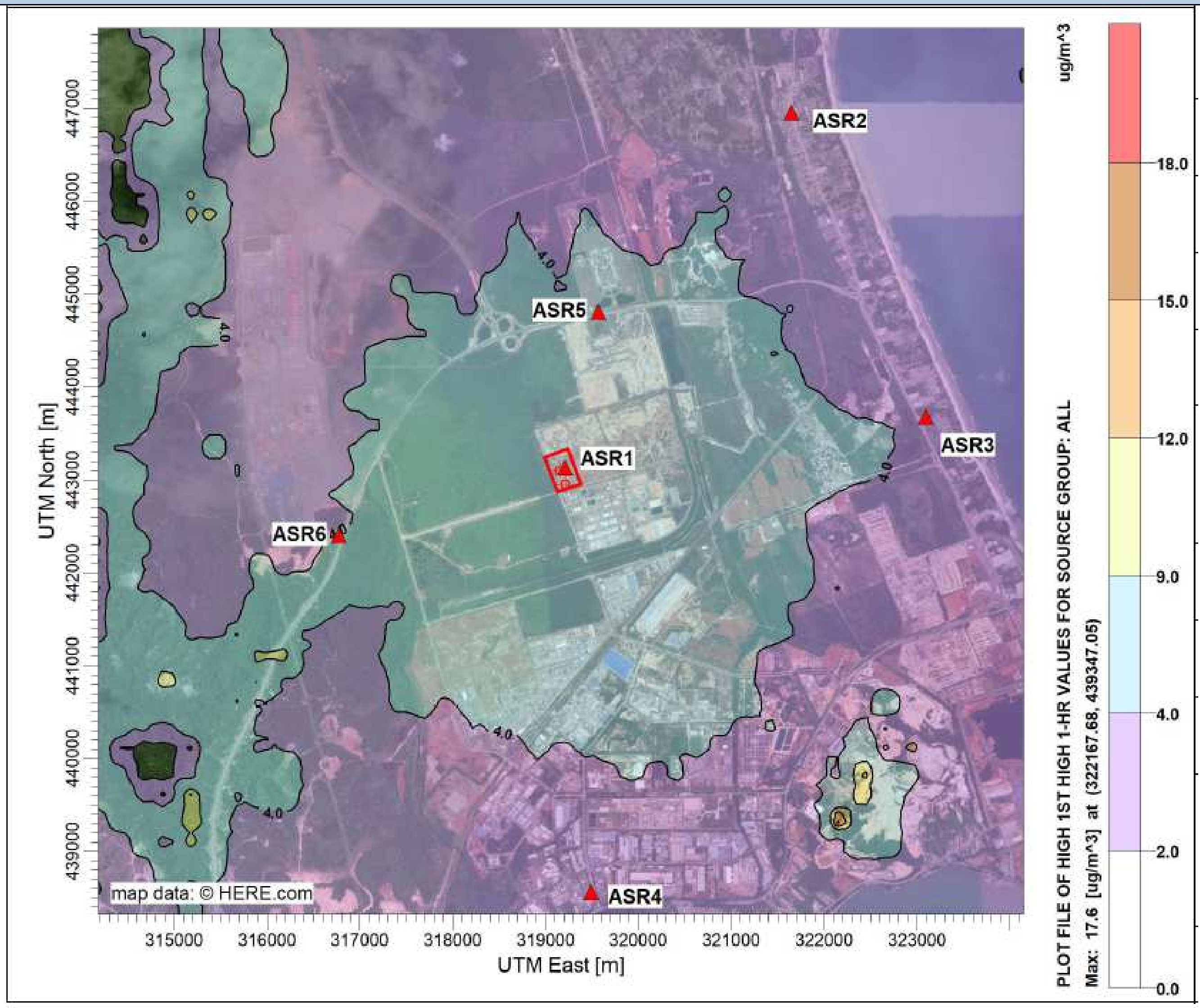
Figure 7.5(5): Predicted Maximum Average Incremental Concentration for SO_2 during Normal Operation

1-hour Averaging Time	24-hours Averaging Time
Highest Predicted MAIC: 17.6 µg/m³ at 322167.68 m, 439347.05 m	Highest Predicted MAIC: 3.4 µg/m³ at 318917.68 m, 442347.05 m



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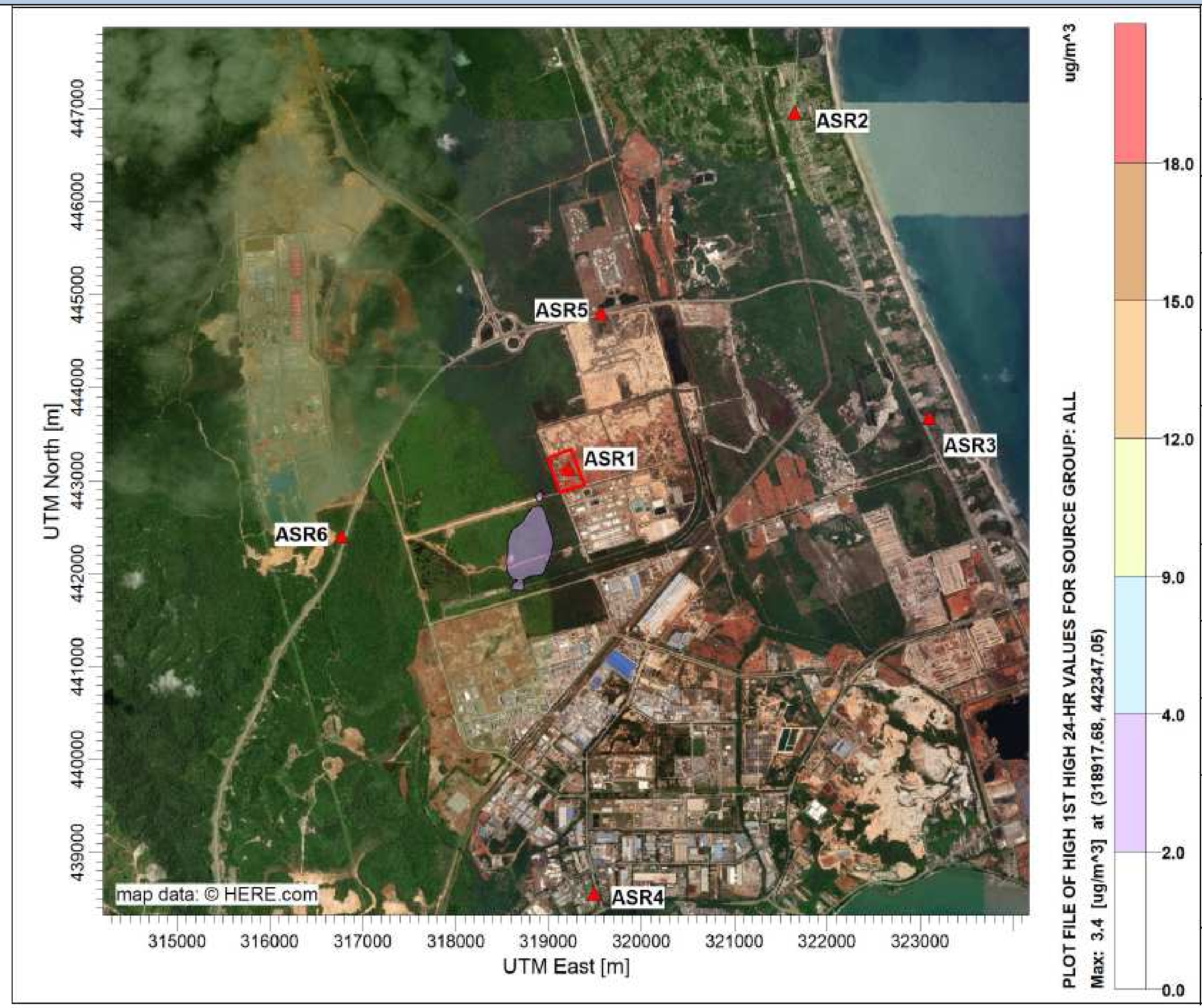

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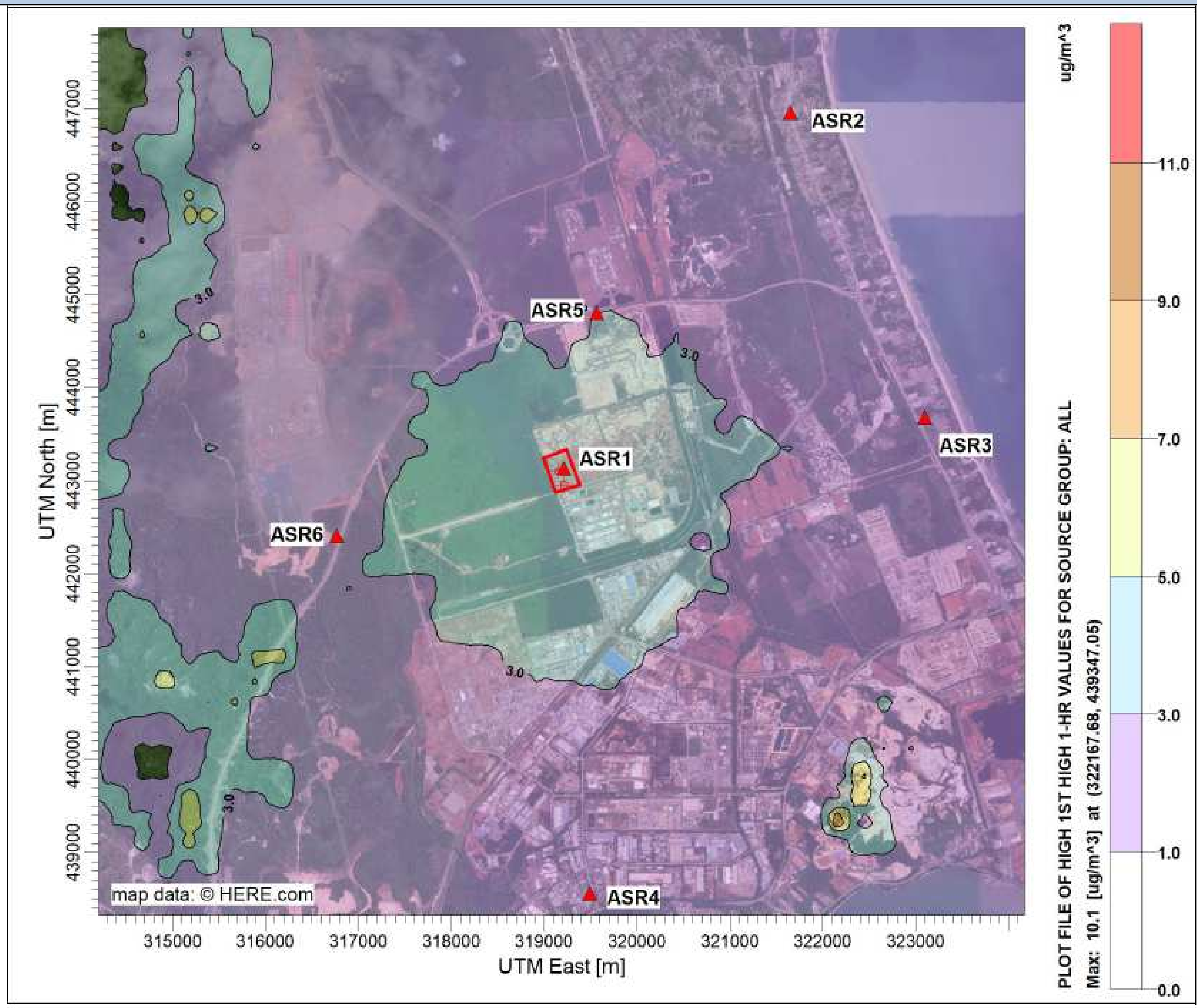
Figure 7.5(6): Predicted Maximum Average Incremental Concentration for NO_x during Normal Operation

1-hour Averaging Time	24-hours Averaging Time
Highest Predicted MAIC: 10.1 µg/m³ at 322167.68 m, 439347.05 m	Highest Predicted MAIC: 1.9 µg/m³ at 318917.68 m, 442347.05 m



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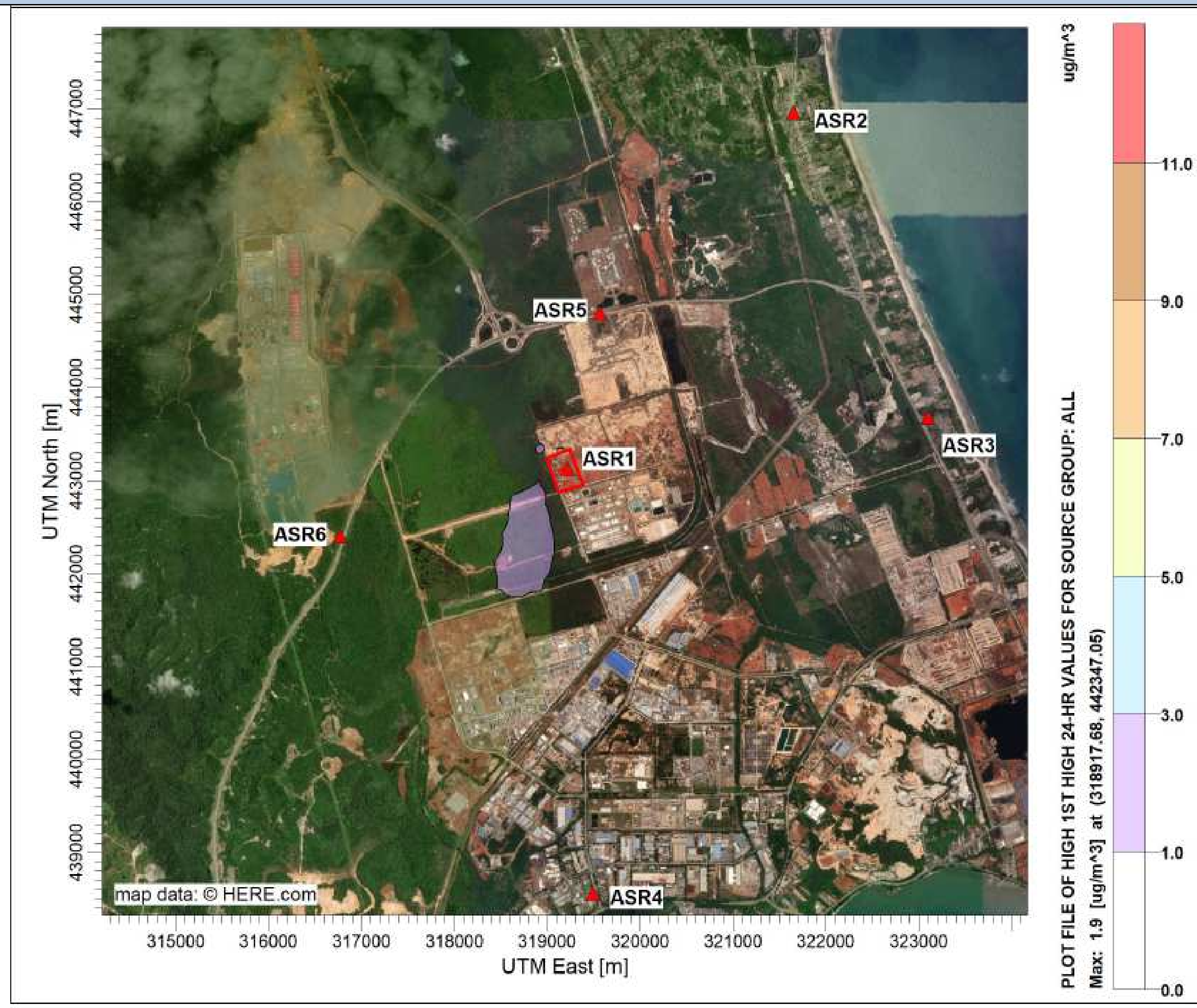
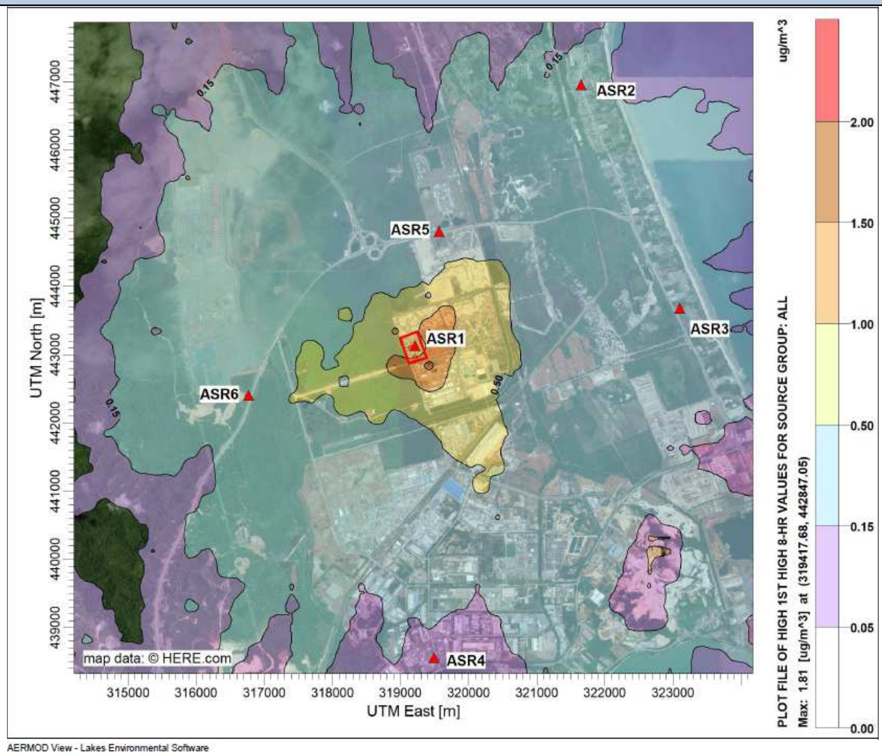
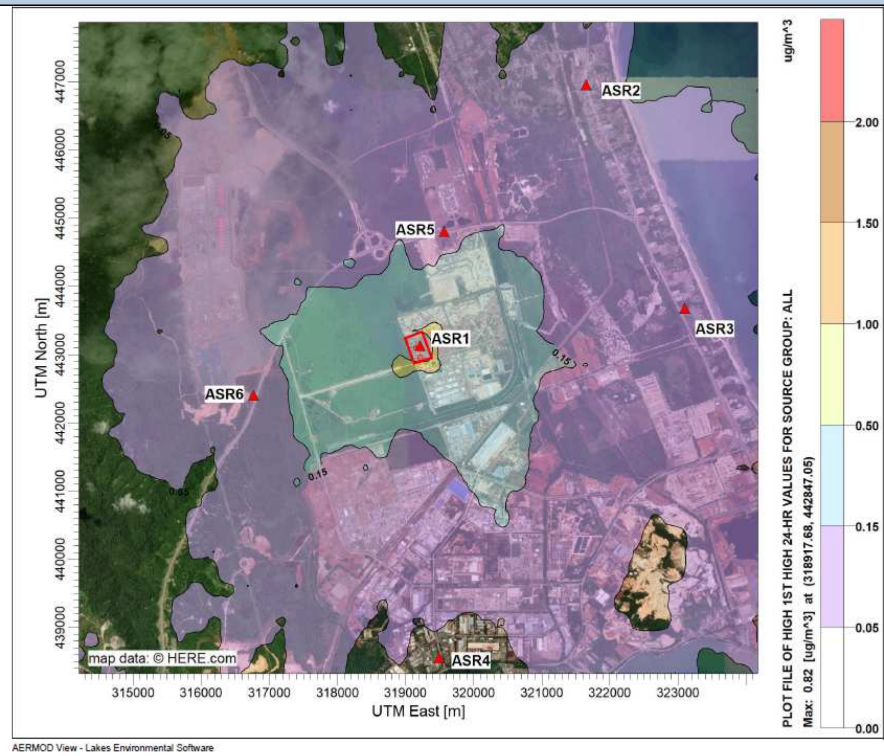


AERMOD View - Lakes Environmental Software

Figure 7.5(7): Predicted Maximum Average Incremental Concentration for NH_3 during Normal Operation

8-hours Averaging Time	**24-hours Averaging Time**
Highest Predicted MAIC: 1.81 µg/m³ at 319417.68 m, 442847.05 m	Highest Predicted MAIC: 0.82 µg/m³ at 318917.68 m, 442847.05 m
	
Annual Average	
Highest Predicted MAIC: 0.13 µg/m³ at 318917.68 m, 442847.05 m	

8-hours Averaging Time	**24-hours Averaging Time**
Highest Predicted MAIC: 1.81 µg/m³ at 319417.68 m, 442847.05 m	Highest Predicted MAIC: 0.82 µg/m³ at 318917.68 m, 442847.05 m

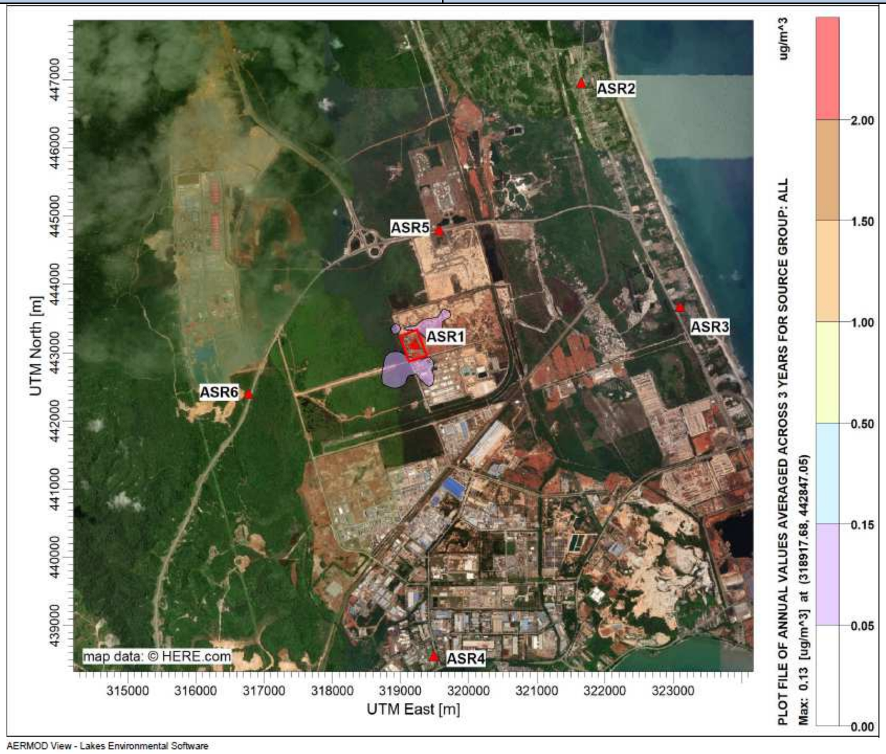
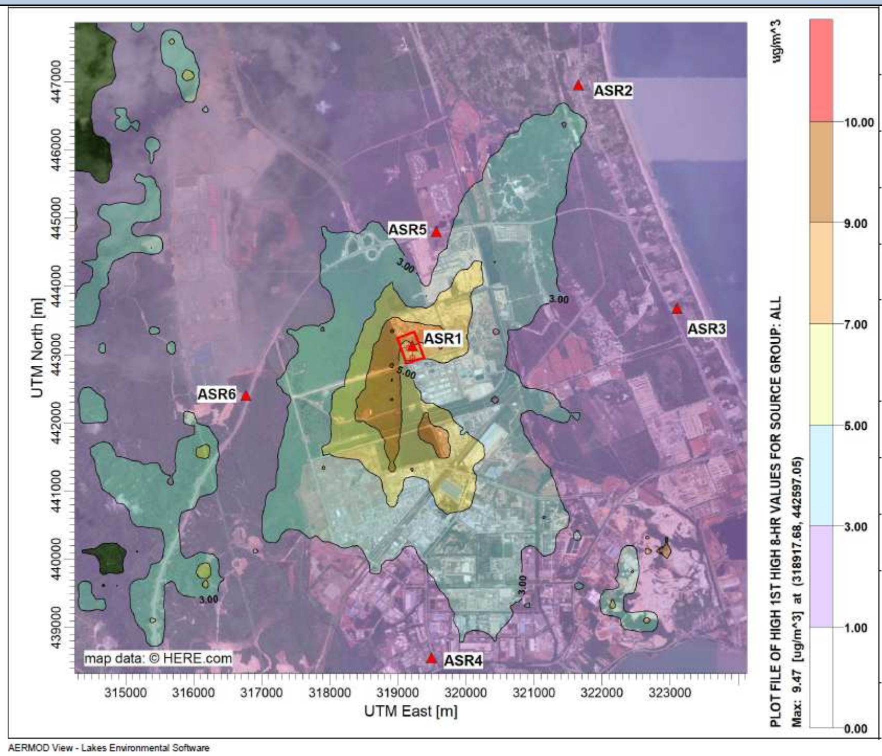
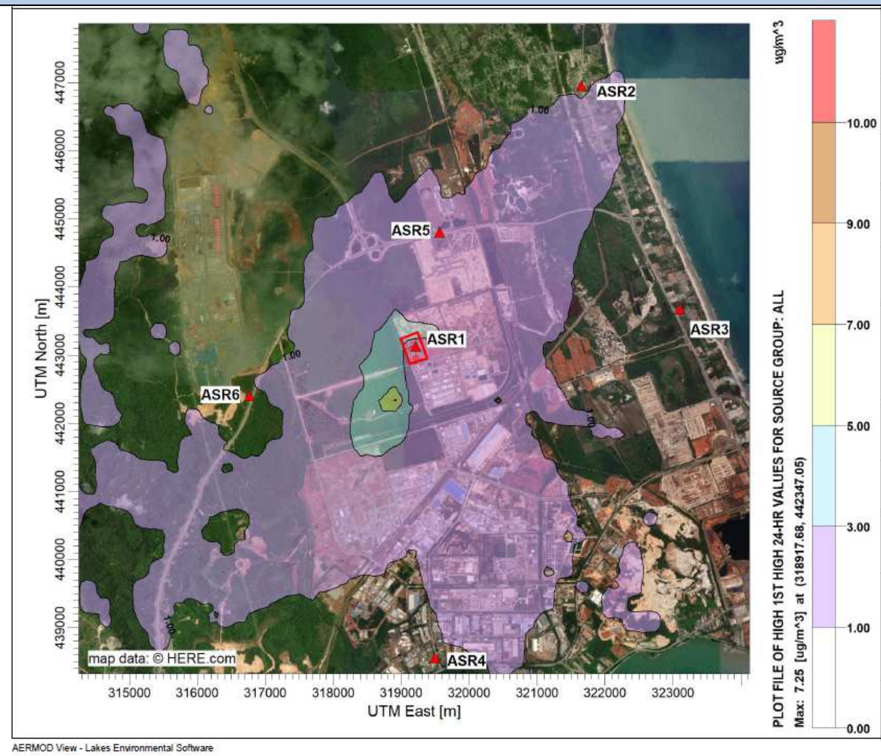


Figure 7.5(8): Predicted Maximum Average Incremental Concentration for NMVOC during Normal Operation

<table>
<tr><th>8-hours Averaging Time</th><th>24-hours Averaging Time</th></tr>
<tr><td>Highest Predicted MAIC: 9.47 µg/m³ at 318917.68 m, 442597.05 m</td><td>Highest Predicted MAIC: 7.25 µg/m³ at 318917.68 m, 442347.05 m</td></tr>
<tr><td>
</td><td>
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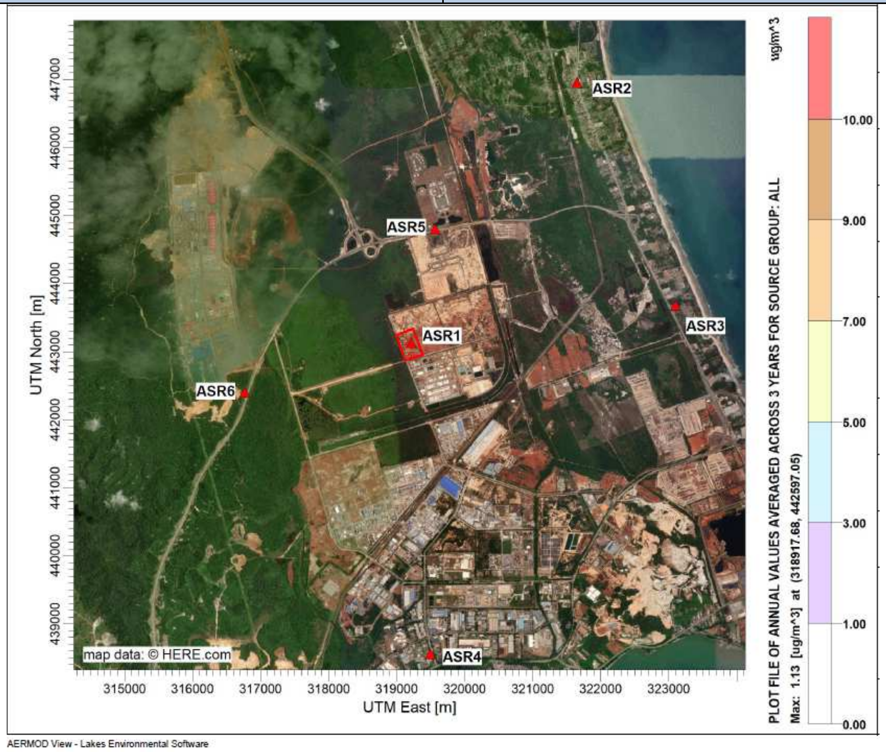
<tr><th colspan="2">Annual Average</th></tr>
<tr><td colspan="2">Highest Predicted MAIC: 1.13 µg/m³ at 318917.68 m, 442597.05 m</td></tr>
</table>

8-hours Averaging Time	**24-hours Averaging Time**
Highest Predicted MAIC: 9.47 µg/m^3 at 318917.68 m, 442597.05 m	Highest Predicted MAIC: 7.25 µg/m^3 at 318917.68 m, 442347.05 m



7.5.8 Airshed Carrying Capacity

For the Project, in order to assess the Project contribution to the existing airshed, the 25% threshold approach as proposed by the International Finance Corporation (IFC) was adopted. It is to be noted that this approach is a **proactive approach** adopted by the consultant in consideration of the recent air pollution episodes occurred in the southern part of Peninsular Malaysia. Currently, there is no dedicated Carrying Capacity study for this airshed.

The statement as per the IFC guidelines entitled *"Environmental, Health, and Safety Guidelines: General EHS Guidelines: Environmental Air Emissions and Ambient Air Quality (2007)"* is reproduced as follows:

> Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25% percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed.

Based on the 25% threshold, the calculated equivalent ambient concentration for the modelled air pollutant as per the Malaysian Ambient Air Quality Standards 2013 is presented in **Table 7.5(6)**.

Table 7.5(6): Calculated 25% Threshold for Identified Air Pollutants

Pollutant	Average Time	Unit	Standard (2020)	Calculated 25% Threshold
Particulate matter sized 10 microns or less (PM_{10})	Annual	µg/m^3	40	10
	24-hours	µg/m^3	100	25
Particulate matter sized 2.5 microns or less ($PM_{2.5}$)	Annual	µg/m^3	15	3.75
	24-hours	µg/m^3	35	8.75
Sulphur dioxide (SO_2)	1-hour	µg/m^3	250	62.5
	24-hours	µg/m^3	80	20
Carbon monoxide (CO)	1-hour	mg/m^3	30	7.5
	8-hours	mg/m^3	10	2.5
Nitrogen dioxide (NO_2)	1-hour	µg/m^3	280	70
	24-hours	µg/m^3	70	17.5

The following example (hypothetical) illustrates the above proactive approach for the sustainable development of the airshed:

Description	Concentration (ug/m^3)
MAAQS for PM_{10} for 24-hours averaging time (e.g.)	100
Baseline Level for PM_{10} at identified Air Sensitive Receptor	40
Contribution of PM_{10} from the Project (Predicted MAIC) limited by the adopted proactive 25% Threshold	25
Contribution of PM_{10} from the Project (Predicted MAIC) not limited by the threshold (Assumed)	50
Ground Level Concentration = (Baseline Level and the adopted proactive 25% Threshold's MAIC)	65
Ground Level Concentration = Baseline Level and without 25% Threshold Consideration's MAIC	90
Based on the above example, it could be observed that although the predicted Ground Level Concentration for both met the MAAQS requirement, the loading from the proactive approach resulted in lower contribution of the criteria air pollutants for the Project to the receiving airshed.	

It is noted that in the air quality assessment, the Nitrogen Dioxide (NO_2) was conservatively assumed to be 100% of NO_x (Nitrogen Oxides) i.e. 100% NO_x as NO_2 (Tier 1). Hence, further refinement was carried in accordance to the following conservative assumption as tabulated in **Table 7.5(7)**.

Table 7.5(7): Assumptions for NO2 Carrying Capacity

Averaging Time	% of NO2	Reference
1-hour (In-stack)	10	Conversion ratios for NOx and NO2 as recommended by UK Environment Agency
24-hour (Short-term)	35	

Table 7.5(8) and **Table 7.5(9)** show the summary of compliance to the calculated 25% threshold for the identified air pollutants.

As shown in the tables above, the MAICs for all identified pollutants were in compliance with the 25% threshold value at all sensitive receptors i.e. ASR1, ASR2, ASR3, ASR4, ASR5 and ASR6. All identified pollutants are not anticipated to create any significant impact to the existing airshed.

Table 7.5.8: Predicted Maximum Average Incremental Concentration for Identified Pollutants (in μg/m³) during Controlled Scenario in Compliance of 25% Threshold

Parameter	Averaging Time	MAAQS 2013 (Standard 2020) (μg/m³)	Calculated 25% Threshold (μg/m³)	ASR	ASR Incremental (μg/m³)	Compliance with 25% Threshold
Particulate matter 10 microns or less (PM_{10})	24-hours	100	25	1: Within Project Site	0.017	YES
				2: At Coastal Residential Village	0.006	YES
				3: At Seaside Residential Area	0.004	YES
				4: Institut Latihan Perindustrian Kuantan	0.006	YES
				5: Akademi Maritim Sultan Ahmad Shah	0.007	YES
				6: Malaysia China Kuantan Industrial Park	0.006	YES
	Annual	40	10	1: Within Project Site	0.007	YES
				2: At Coastal Residential Village	0.005	YES
				3: At Seaside Residential Area	0.002	YES
				4: Institut Latihan Perindustrian Kuantan	0.004	YES
				5: Akademi Maritim Sultan Ahmad Shah	0.006	YES
				6: Malaysia China Kuantan Industrial Park	0.002	YES
Particulate matter	24-hours	35	8.75	1: Within Project Site	0.017	YES

Parameter	Averaging Time	MAAQS 2013 (Standard 2020) (µg/m³)	Calculated 25% Threshold (µg/m³)	ASR	ASR Incremental (µg/m³)	Compliance with 25% Threshold
2.5 microns or less ($PM_{2.5}$)				2: At Coastal Residential Village	0.006	**YES**
				3: At Seaside Residential Area	0.004	**YES**
				4: Institut Latihan Perindustrian Kuantan	0.006	**YES**
				5: Akademi Maritim Sultan Ahmad Shah	0.007	**YES**
				6: Malaysia China Kuantan Industrial Park	0.006	**YES**
	Annual	15	3.75	1: Within Project Site	0.007	**YES**
				2: At Coastal Residential Village	0.005	**YES**
				3: At Seaside Residential Area	0.002	**YES**
				4: Institut Latihan Perindustrian Kuantan	0.004	**YES**
				5: Akademi Maritim Sultan Ahmad Shah	0.006	**YES**
				6: Malaysia China Kuantan Industrial Park	0.002	**YES**
Sulphur Dioxide (SO_2)	1-hour	250	62.5	1: Within Project Site	7.1	**YES**
				2: At Coastal Residential Village	3.2	**YES**
				3: At Seaside Residential Area	3.7	**YES**
				4: Institut Latihan Perindustrian Kuantan	3.0	**YES**

Parameter	Averaging Time	MAAQS 2013 (Standard 2020) (µg/m³)	Calculated 25% Threshold (µg/m³)	ASR	ASR Incremental (µg/m³)	Compliance with 25% Threshold
				5: Akademi Maritim Sultan Ahmad Shah	5.2	YES
				6: Malaysia China Kuantan Industrial Park	4.3	YES
	24-hours	80	20	1: Within Project Site	1.2	YES
				2: At Coastal Residential Village	0.5	YES
				3: At Seaside Residential Area	0.3	YES
				4: Institut Latihan Perindustrian Kuantan	0.4	YES
				5: Akademi Maritim Sultan Ahmad Shah	0.5	YES
				6: Malaysia China Kuantan Industrial Park	0.4	YES

Table 7.5(9): Predicted Maximum Average Incremental Concentration for NO_2 (in µg/m³) in Compliance of 25% Threshold

Condition	Identified ASR	ASR Incremental (µg/m³) - NOx as 100% NO_2	ASR Incremental (µg/m³) - NOx as 10% NO_2	Compliance with 25% Threshold	ASR Incremental (µg/m³)- NOx as 35% NO_2	Compliance with 25% Threshold
1-hour Average Limit: 280 µg/m³ (MAAQS Standard 2020)	1: Within Project Site	4.1	0.41	YES		
	2: At Coastal Residential Village	1.8	0.18	YES		
	3: At Seaside Residential Area	2.1	0.21	YES		

Condition	Identified ASR	ASR Incremental (µg/m³) - NOx as 100% NO_2	ASR Incremental (µg/m³) - NOx as 10% NO_2	Compliance with 25% Threshold	ASR Incremental (µg/m³)- NOx as 35% NO_2	Compliance with 25% Threshold
25% Threshold: 70 µg/m³	4: Institut Latihan Perindustrian Kuantan	1.7	0.17	**YES**		
	5: Akademi Maritim Sultan Ahmad Shah	3.0	0.30	**YES**		
	6: Malaysia China Kuantan Industrial Park	2.4	0.24	**YES**		
24-hours Average Limit: 70 µg/m³ (MAAQS Standard 2020) **25% Threshold: 17.5 µg/m³**	1: Within Project Site	0.7			0.25	**YES**
	2: At Coastal Residential Village	0.3			0.11	**YES**
	3: At Seaside Residential Area	0.2			0.07	**YES**
	4: Institut Latihan Perindustrian Kuantan	0.2			0.07	**YES**
	5: Akademi Maritim Sultan Ahmad Shah	0.3			0.11	**YES**
	6: Malaysia China Kuantan Industrial Park	0.2			0.07	**YES**

7.5.9 Conclusion on Air Modelling

During normal plant operation, the contribution of identified criteria air pollutants from the project to the surrounding environment is assessed to be minimal at all identified off-site ASRs.

Further assessment on the contribution of the Plant to the airshed based on 25% threshold of the adopted IFC standard indicates that the predicted MAICs for all identified pollutants were within the calculated threshold value. All identified pollutants are not anticipated to create any significant impact to the existing airshed.

7.6 WATER QUALITY MODELING FOR SG. BALUK

7.6.1 Introduction

Water quality modeling is a useful tool to predict pollutants fate in a river. The QUAL2K is one of river water quality simulators that uses uni-directional model in river system. This model (*www.qual2k.com*) is capable to show contaminants transportation along a river stretch, taking into account the river assimilation rate. The model which was developed by the United State Environmental Protection Agency (USEPA) uses 1-D modeling principle, of which the river is assumed to be fully-mixed vertically and laterally. The model also works in steady-state hydraulics and steady flow.

7.6.2 Description of the Study Area

The study area is as shown in **Figure 7.6(1)** below. Treated industrial effluent from the proposed IETS will be discharged into a dedicated drain of about 2.7 km long that then discharges to Sg. Baluk. The simulation has been conducted starting from the upper part of Sg. Baluk until WQ8 point. Tides factor has not been considered in the simulation. The discharge rate from the dedicated IETS is 385 m^3/d; it is set here at 17 m^3/h which is equal to 0.0047 m^3/s.

Figure 7.6(1) Flow from the Project site into Sg. Baluk

7.6.3 Methodology

The following are the worksheet in Qual2K interface, which required data inputs:

(a) Model Calibration

Calibration is required to get a representative model of the current river system. This process involves data input for river physical and hydraulic characteristics, as well as the current water quality data. An adjustment on data input needs to be done in order to meet the existing ground data (Frey *et al*. 2002). The baseline data used for the simulation is tabulated below based on water quality analysis results carried out for this EIA. Values from water monitoring station in Sg. Baluk were adopted i.e., WQ4, WQ5, WQ6, WQ7, WQ8.

WQ Point	Location	BOD	COD	AN	TSS
WQ4	On Sg. Baluk before the junction of drain with Sg. Baluk	13	61	3.872	24
WQ5	Downstream of confluence of earth drain with Sg. Baluk	5	98	1.388	50
WQ6	Downstream, along Sg. Baluk	12	61	0.981	56
WQ7	Downstream, along Sg. Baluk	8	42	1.91	14
WQ8	Downstream, along Sg. Baluk	13	20	3.465	38

(b) Reach Worksheet

A serial number of reaches need to be identified based on river characteristics along a studied stretch. Any additional hydrological input (tributaries) must be taken into consideration as a separate reach worksheet.

(c) Point Source Worksheet

The pollutant point source along the river stretch that is required to be identified and entered in to the system as inflow.

(d) Data Worksheet

Consists of information on hydraulic data, such as distance, flow data, depth, velocity, travel time and temperature as well as water quality data.

(e) Output Worksheet

These are a series of worksheets that present simulation outputs which consist of calibration as well as simulation output.

(f) Flow Balance

A steady-state flow balance is implemented for each model reach as follows:

$Q_i = Q_{i-1} + Q_{in,I} - Q_{out,I} - Q_{evap,i}$

Q_i = Outflow from element I into the downstream element I + 1 (m^3/day)

Q_{i+1} = Outflow from reach i+1 (m^3/day)

Q_{i-1} = Inflow from the upstream reach i-1(m^3/day)

$Q_{in,i}$ = Total inflow into the reach from point or nonpoint sources (m^3/day)

$Q_{evap,i}$ = Outflow due to evaporation (m^3/day).

Thus, the downstream outflow is simply the difference between inflow and source gains minus withdrawal and evaporation losses.

7.6.4 Objectives

For this study, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Ammoniacal Nitrogen (NH3-N) were parameters of greatest concern from the Industrial Effluent Treatment System (IETS) during operational stage, while the Total Suspend Solid (TSS) is considered of concern at construction phase. The objectives for this study are to simulate the concentrations of BOD, COD and NH3-N along Sg. Baluk during IETS operation, where the discharge of BOD, COD, and NH3-N from the IETS should adhere to Standard B of Environmental Quality (Industrial Effluent) Regulation 2009, or EQ(IE)R 2009, i.e., BOD = 50 mg/L, COD = 200 mg/l and Ammoniacal Nitrogen = 20 mg/L as the highest limits; and to simulate TSS levels during construction.

7.6.5 Simulated Scenarios for BOD, COD, Ammoniacal Nitrogen

Four (4) scenarios were simulated, these are:

Scenario 1: Baseline Conditions

- The baseline data (simulated data) has been calibrated based on the data obtained from field sampling.
- The pollutants in the river are those in Sg. Baluk prior to IETS operation.

Scenario 2: Standard B Discharge

- BOD, COD and NH3-N discharges in accordance to **Standard B, EQ(IE)R 2009, i.e., 50 mg/l, 200 mg/l and 20 mg/l** respectively, as in Table 7.6 (1).
- The discharge rate from the IETS is based on Daily Average Flow of 17 m^3/hour.
- The simulations were conducted for Normal Flow and Low flow of Sg. Baluk.

Scenario 3: Worst Case Scenario (Total Failure)

- Total failure of IETS system occurred, leading to discharge of raw wastewater.
- The concentrations of BOD, COD and NH3-N discharged into the river system are 115 mg/l, 225 mg/l and 12.4 mg/l respectively, as per IETS design, as in Table 5.6 (2).
- The discharge rate from the IETS is based on Daily Average Flow 17 m^3/hour.
- The simulations were conducted for Normal Flow and Low flow of Sg. Baluk.

7.6.6 Design Requirements to Achieve Permitted Effluent Standard

The EQ(IE)R 2009 specifies two standards for industrial effluent discharge, Standard A for discharge upstream of any raw water intake and Standard B for discharge downstream of any raw water intake, together with National Water Quality Standard (NWQS) in Table 7.6(1). The IETS discharge limit has been permitted to be at Standard B, as there is no water intake at the downstream of Sg. Baluk.

Table 7.6(1): National Water Quality Standard (NWQS) for Malaysia

	CLASSES					
PARAMETER	**I**	**IIA**	**IIB**	**III**	**IV**	**V**
DO (mg/l)	7	5 – 7	5 - 7	3 - 5	3	<1
pH	6.5 - 9	6.5 – 9	6.5 - 9	5 - 9	5 - 9	-
BOD_5 (mg/l)	1	3	3	6	12	>12
COD (mg/l)	10	25	25	50	100	>100
TSS (mg/l)	**25**	**50**	**50**	**150**	**300**	**300**
NH_3-N (mg/l)	0.1	0.3	0.3	0.9	2.7	>2.7
Turbidity (NTU)	5	50	50	-	-	-
Oil & Grease (mg/l)	Natural levels	40; N	40; N	N	-	-
Total coliform (count/100ml)	100	5000	5000	50000	5000	>5000

Source: National Water Quality Standard, DOE.

7.6.7 Simulated Scenarios for Total Suspended Solids (TSS) during Construction

For discharge of TSS during construction, the simulated scenarios are:

Scenario 1: Baseline Conditions

- The baseline data (simulated data) has been calibrated based on the data obtained from field sampling.
- The TSS content is that in Sg. Baluk prior to any activity at the proposed Project Site.
-

Scenario 2: Pollutants Fate with Mitigation Measures

- Development activities follow LDP2M2 measures.
- The discharge from the project site abides the threshold limit of about 50 mg/l.

Scenario 3: Worst Case Scenario

- The LDP2M2 measures failed with the estimated level of TSS of 1347 mg/l released.
- The estimation of TSS used the rational method calculation and mass balance approach as given below:

a) Design Storm						
Design Storm		=	50	mm		
Catchment Area, A		=	8.09	ha	20	Ac
Time of Concentration,tc		=	10	minutes		
$t_c = \dfrac{107\, n\, L^{0.333}}{S^{0.2}}$			L	=	50	m
			S	=	5.0000	
	n	=	0.0275	(From Table 2.2 for Worst Cas (Bare Soil)		
	t_o	=	7.8	minutes	Adopt tc	
Duration of storm,D		=	60	minutes	(Assume 1 hrs)	
Intensity of design storm, I		=	50	mm/h		
b) Calculate Peak Discharge, Qp using Rational Method						
Run Off Coefficient, C		=	0.5	(Bare soil (No Cover))		
$Q_p = \dfrac{C.\,I.\,A}{360}$		=	0.56	m^3/s		

Project Site		
Qpeak	0.56	m3/sec
Qriver	2.03	m3/sec
Qtotal	2.59	m3/sec
TSSmixing (mixing in the river – Class V)*worst case	310	mg/l
TSS River (Baseline Data)	24	mg/l
Qtotal x TSSmixing	802.9	
Qriver x TSSriver	48.720	
Total Discharge	1347	mg/l

7.6.8 Estimations of Normal flow and Low Flow Sg. Baluk

i. Normal Flow

The Normal flow applied in the simulations is based on the river hydrological estimation at the water quality station i.e., WQ4, WQ5, WQ6, WQ7, and WQ8 as stipulation in Table 7.6 (2) which gave the normal flow of Sg. Baluk ranged approximately within 2.03 m^3/s to 103.64 m^3/s. Flow from the IETS is small which is about 0.0047 m^3/s. The normal flow has been estimated based on the following formula: -

Q= vA = (1/n R 2/3 S1/2) A

v = Mean Velocity (m/s)
R = Hydraulic Radius (m)
A = Area m^2
S = Slope of the channel bed (Uniform Flow)
n = Manning's resistant coefficient

Table 7.6(2): Estimation of Normal Flow

Sg Baluk	WQ4	WQ5	WQ6	WQ7	WQ8
Hydraulic Radius, R (m)	0.273	0.680	0.743	0.587	1.065
Slope of the channel bed,S	0.025	0.025	0.025	0.03	0.03
Manning's resistant coefficient, n (Natural Stream)	0.03	0.03	0.03	0.03	0.03
Area, A ($m^{2)}$	0.91	5.40	8.17	5.10	17.22
Normal Flow, Q (m^3/s)	**2.03**	**25.32**	**35.41**	**20.72**	**103.64**

ii. Low Flow

The low flow has been estimated based on Procedure for ungauged Method (Hydrological Procedure 12 (HP12), Ungauged Method, Department of Irrigation and Drainage DID, Malaysia), where the 7 day mean annual minimum flow is estimated based on Equation 5 of the HP12:

$$\mathbf{Q7 = 2.423 \times 10^{-11} \times A^{0.984} \times R^{2.568}}$$

Correlation Coefficient = 0.9837
Correlation Coefficient Squared = 0.9676
A = Catchment Area
R = Rainfall

Source: Hydrological Procedure No.12, 2015, DID.

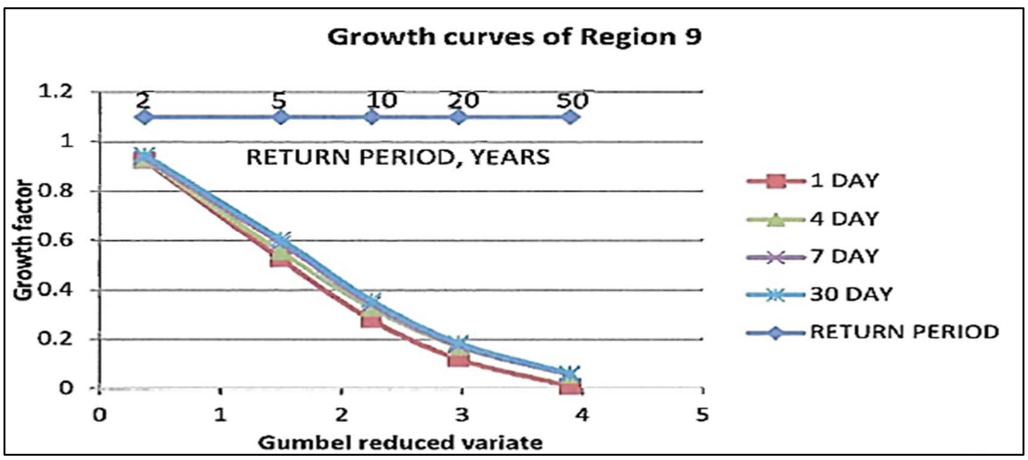
To obtain the 7 day low flow the other parameters used in the calculations are as listed below:

a) L-Moment Region is based on Growth Factor Region 2 (covers Pahang), HP12:

Flow Duration Days	Return Period, years				
	2	5	10	20	50
1	0.970	0.602	0.426	0.289	0.143
4	0.974	0.610	0.442	0.312	0.175
7	0.978	0.618	0.456	0.332	0.202
30	0.995	0.658	0.501	0.368	0.212

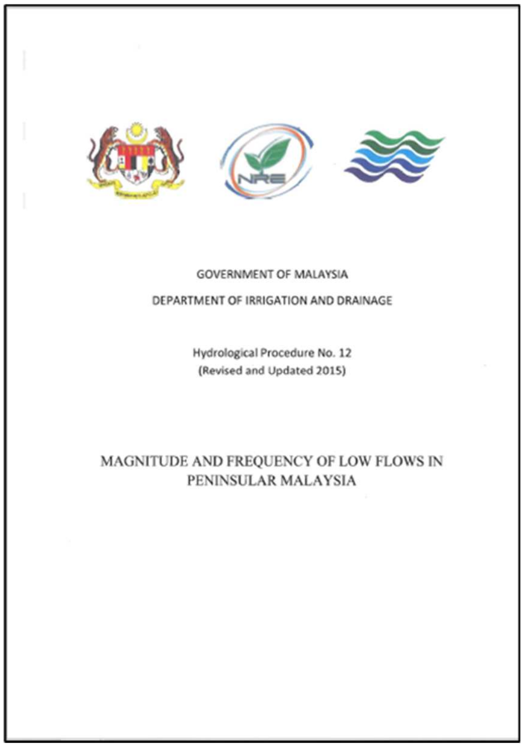
Source: Growth Factor Region 2 (cover Pahang), Hydrological Procedure No.12, 2015, DID.

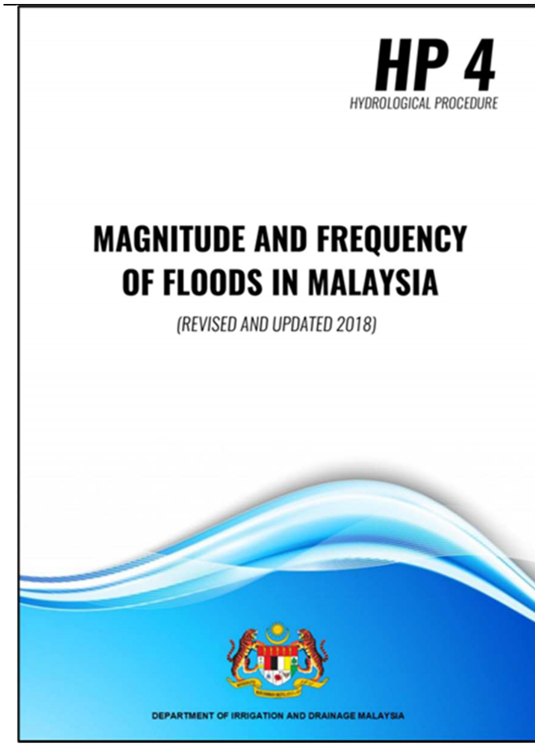
b) Growth Factor is based on Growth Factor for Region 2 (covers Pahang), HP12:



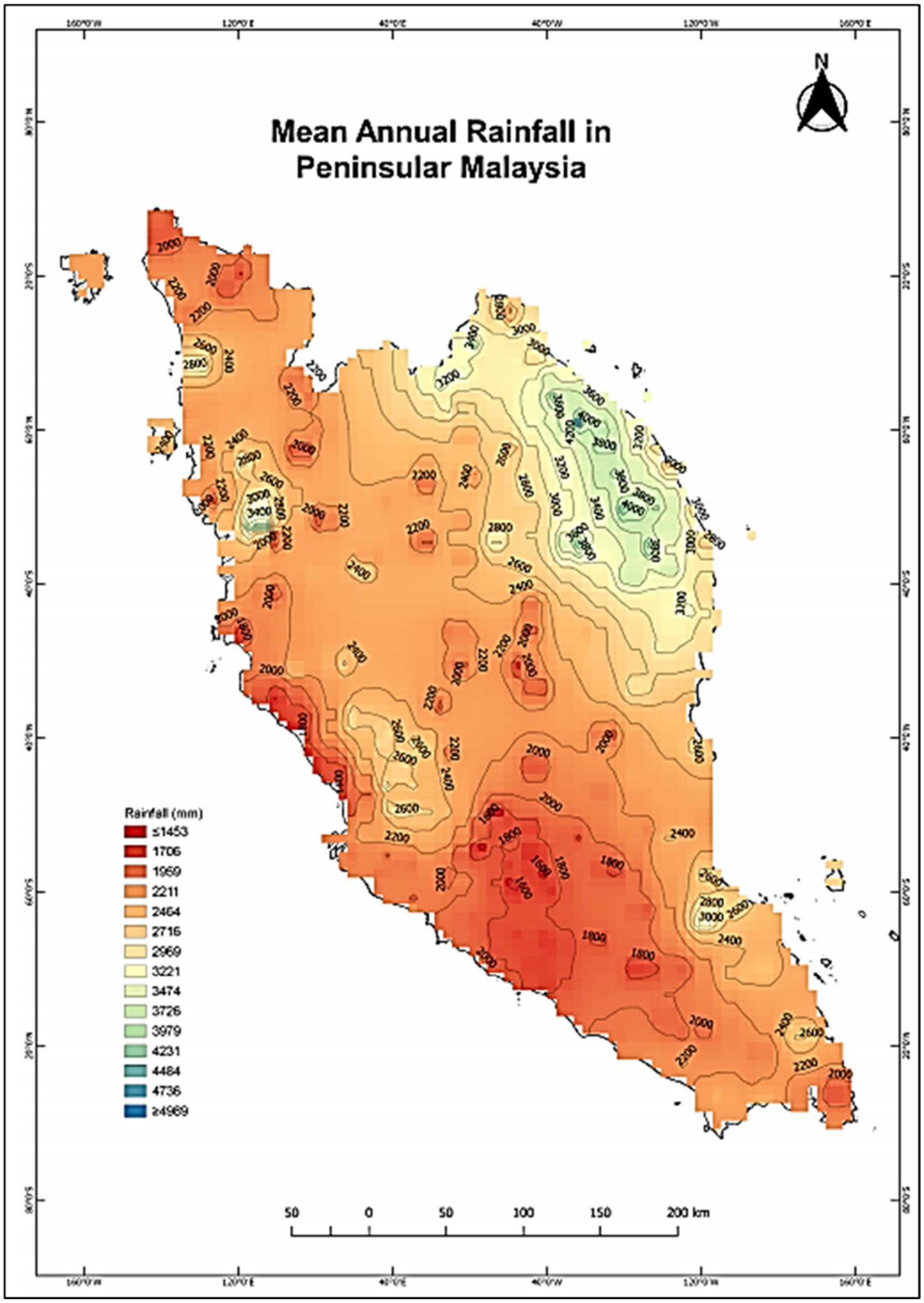
Source: Growth Curve Region 2 (cover Pahang), Hydrological Procedure No.12, 2015, DID (shown below)

Catchment Mean Annual Rainfall is adopted from Mean Annual Rainfall in Peninsular Malaysia, Hydrological Procedure 4, 2018, published by DID (shown below)





c) Catchment Mean Annual Rainfall adopted from Mean Annual Rainfall in Peninsular Malaysia, as in Hydrological Procedure 4, is as shown below:



Source: Mean Annual Rainfall in Peninsular Malaysia, Hydrological Procedure No.4, 2018, DID.

The low flow estimation obtained is tabulated in Table 7.6(6).

Table 7.6(3): Estimation of Low Flow

Sg Baluk	Value
Catchment Area	70 km^2
Catchment Mean Annual Rainfall	2200 mm
L-Moment region	0.456
Growth Factor	0.45
7 Day mean annual minimum flow	0.562 m^3/s
7-day low flow (7Q10)	0.115 m^3/s

Sg. Baluk	Low Flow Estimation
WQ4	0.12
WQ5	14.94
WQ6	20.89
WQ7	12.22
WQ8	61.15

7.6.9 Schematic Diagram of river

For the purpose of the simulation, the river has been segmented into several reaches starting from upstream of Sg. Baluk until WQ8 which is about 9 km downstream. For point sources, the modelling has only considered individual discharges from the proposed project. The schematic diagram is as shown in **Figure 7.6(2):**

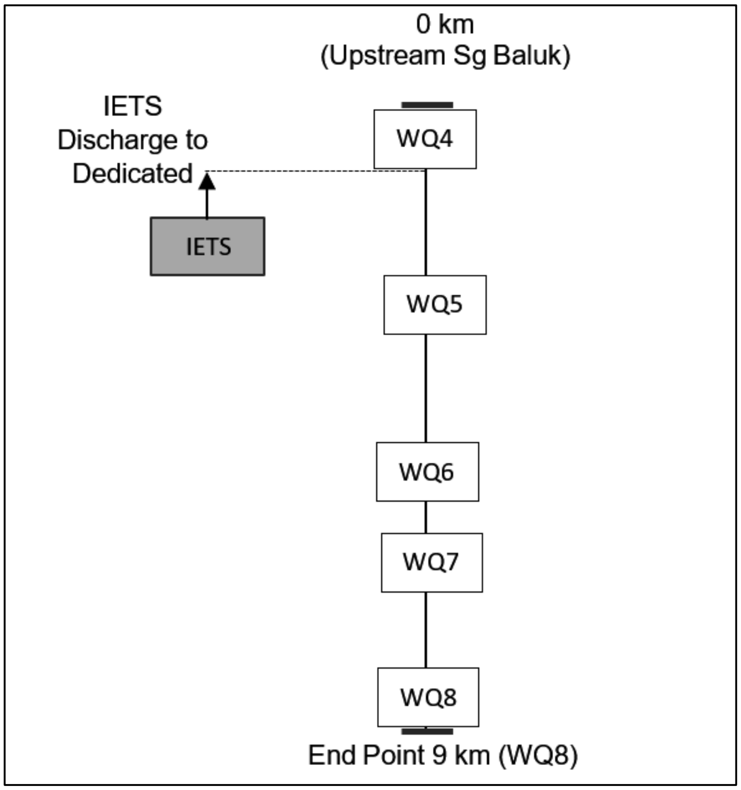


Figure 7.6(2): Schematic Diagram of Sg. Baluk

The simulation has been conducted to predict individual impact from the proposed project site. WQ4 is the baseline data obtained on the upstream, while WQ5, WQ6, WQ7 and WQ8 located at the middle and downstream of Sg. Baluk. The baseline water quality data reflects the current condition of Sg. Baluk based on current land use. The sampling point locations are as given in Section 6.5.

7.6.10 Results and Discussion for Simulations during IETS Operation

The simulations have been conducted during normal flow and low flow of Sg. Baluk. **Figure 7.6(3) to 7.6(8)** show the simulation results for BOD, COD and NH3-N. Simulations using existing data on water quality yield the calibration curves shown below:

(a) Calibrations using field data

i. Biochemical Oxygen Demand (BOD)

In Scenario 1, for existing condition, the BOD varied within 5 mg/l to 13 mg/l. Fluctuation of BOD was observed in Sg Baluk, whereby the concentrations were higher on the upstream (WQ4 = 13 mg/l), middle stream (WQ6=12 mg/l) and at the downstream (WQ8=13 mg/l). The existing baseline BOD is classified within Class III to Class V (6 mg/l->12 mg/l) of NWQS.

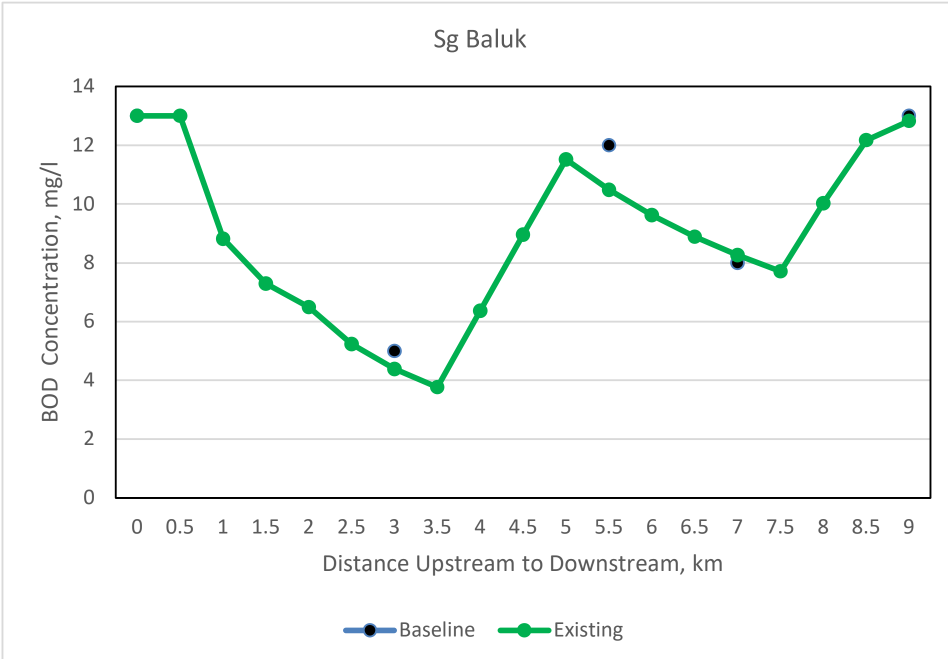


Figure 7.6(3) Calibration of BOD

ii. Chemical Oxygen Demand (COD)

In Scenario 1, for existing condition, the COD varied within 20 mg/l to 98 mg/l. The concentration was higher on the upstream and gradually decreases towards the downstream area. Whilst, COD concentration was higher on the upstream (WQ4=61 mg/l), WQ5 = 98 mg/l and middle stream (WQ6=61 mg/l). At 9 km downstream, the concentration is about 20 mg/l. The existing baseline COD is classified within Class III to Class IV (50 mg/l - 100 mg/l) of NWQS.

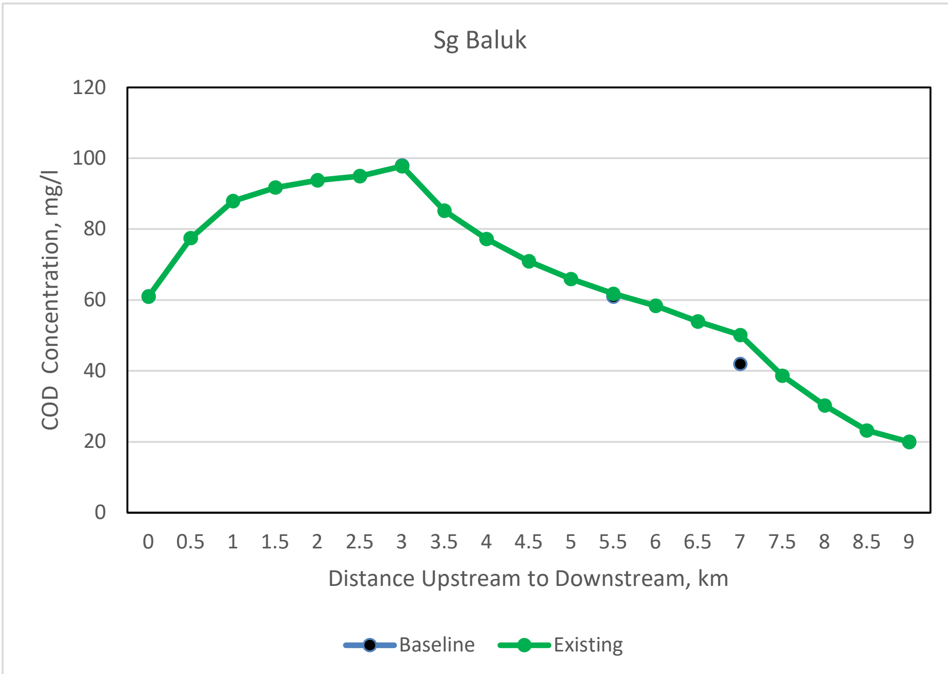


Figure 7.6(4): Calibration of COD

iii. Ammoniacal Nitrogen (NH3-N)

For Scenario 1, for existing condition, the NH3-N varied within 0.981 mg/l to 3.872 mg/l. The concentration was higher at the upstream and downstream area. Whereas, COD concentration on the upstream WQ4 was about 3.872 mg/l and at 9km downstream WQ8, is about 3.465 mg/l. The existing baseline NH3-N is classified within Class IV to Class V (2.7 mg/l - >2.7 mg/l) of NWQS.

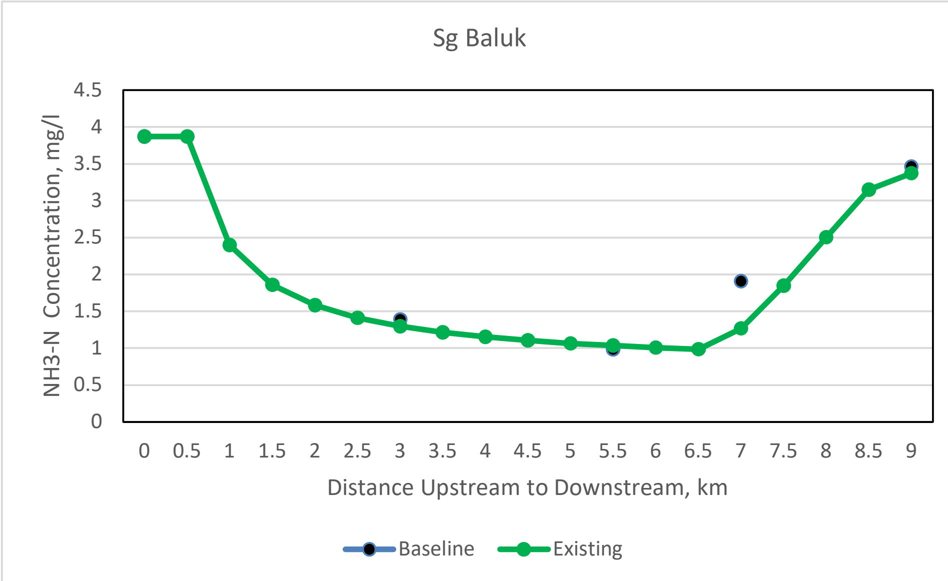


Figure 7.6(5): Calibration of Ammoniacal Nitrogen

iv. Total Suspended Solids

For Scenario 1, for existing condition, the TSS varied within 14 mg/l to 56 mg/l. The concentration was higher at the middle-stream area. Where, COD concentration at WQ6 was about 56 mg/l and about 38 mg/l at 9 km downstream (WQ8). The existing baseline TSS is classified within Class II and Class III (50 mg/l - 150 mg/l) of NWQS.

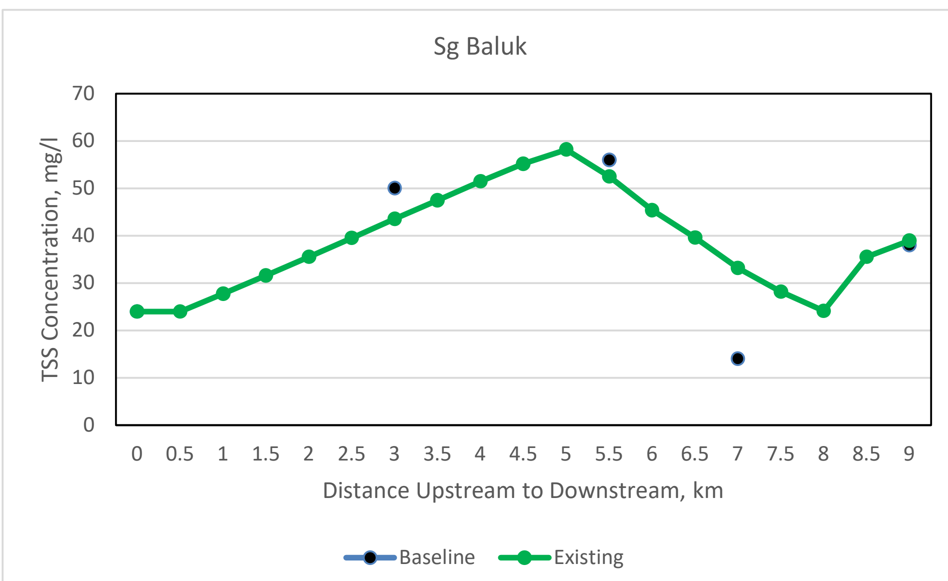


Figure 7.6(6) Calibration of Total Suspended Solids

(b) <u>Simulations at Normal Flow Sg Baluk</u>

The discharge flowrate from the IETS is relatively small which is only about 0.0047 m^3/s. The anticipated variation towards Sg Baluk at worst-case and with adherence to Standard B are minor, if any, as seen below. Figure 7.6(7) to Figure 7.6 (11) show the summary profile for each BOD, COD, NH3-N and TSS for Scenario 2, Scenario 3 and Scenario 4.

a. Biochemical Oxygen Demand

For Scenario 2, with the discharge complying to Standard B or a maximum of 50 mg/l of BOD, the BOD concentrations downstream ranged from 8 mg/l to 13 mg/l. Whereby, the BOD at the middle stream, WQ6 and at the downstream, WQ8 were about 12 mg/l and 13 mg/l. The concentrations along the stretch are classified within Class III to Class V (6 mg/l->12 mg/l) of NWQS.

For Scenario 3, the worst-case scenario with total failure of IETS, BOD discharge is about 115 mg/l. The BOD concentrations along Sg. Baluk ranges from 8 mg/l to 13 mg/l. Concentration of BOD at the middle stream, WQ6 and at the downstream, WQ8 are about 12 mg/l and 13 mg/l. The concentrations along the stretch are still within Class III – Class V (6 mg/l – >12mg/l). As can be seen below, the discharge from proposed SCaRF at Standard B of EQ(IE)R 2009 at normal river flow does not make any significant difference to the existing concentrations (thus only one line is visible).

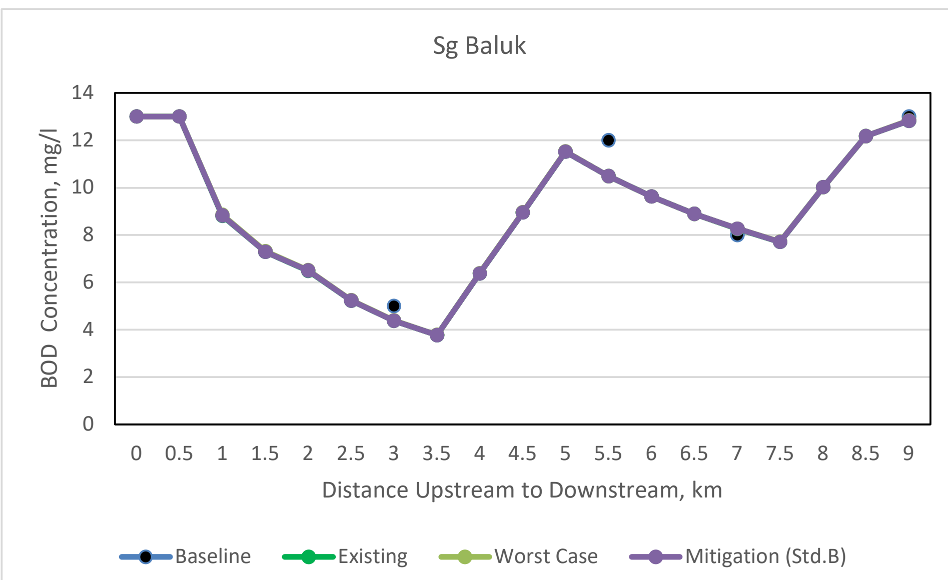


Figure 7.6(7): BOD Profile (Normal Flow)

b. Chemical Oxygen Demand (COD)

For Scenario 2, with the discharge complying to Standard B or a maximum of 200 mg/l of COD, the COD concentrations downstream ranged from 20 mg/l to 98 mg/l. The COD at WQ5 (with the highest existing value) and at the downstream, WQ8 are about 98 mg/l and 20 mg/l. The concentrations along the stretch are classified within Class III to Class IV (50 mg/l - 100 mg/l) of NWQS.

For Scenario 3, the worst-case scenario with total failure of IETS, COD discharge is about 225 mg/l. The COD concentrations along Sg. Baluk ranges from 20 mg/l to 98 mg/l. Whereas, the COD at WQ5 (with the highest existing value) and at the downstream, WQ8 are about 98 mg/l and 20 mg/l. The concentrations along the stretch are still within Class III to Class IV (50 mg/l - 100 mg/l) of NWQS. As can be seen below, the discharge from proposed SCaRF at Standard B of EQ(IE)R 2009 at normal river flow does not make any significant difference to the existing concentrations (thus only one line is visible).

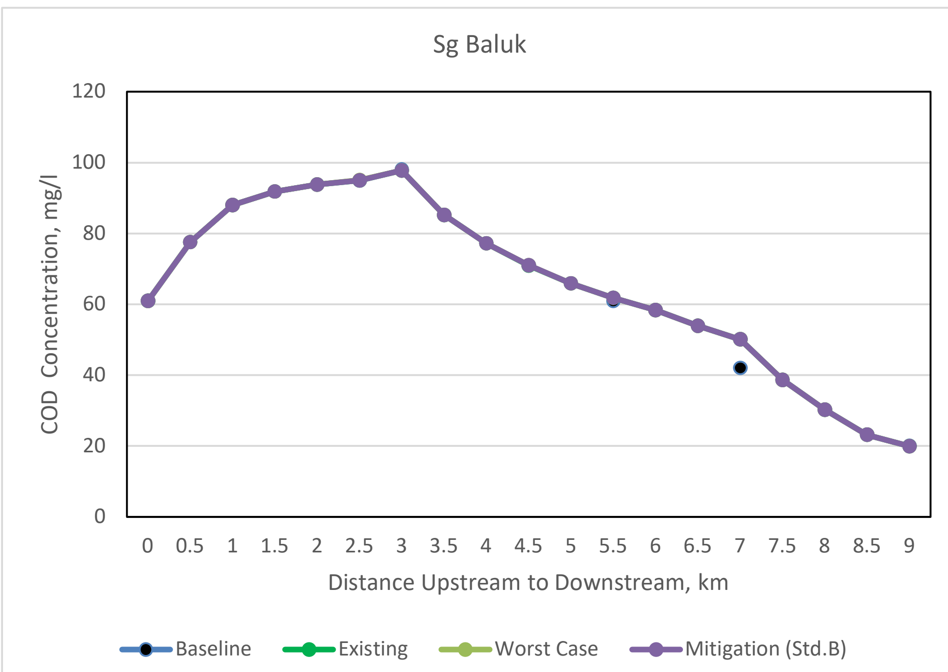


Figure 7.6(8): COD Profile (Normal Flow)

c. Ammoniacal Nitrogen (NH3-N)

For Scenario 2, with the discharge complying to Standard B or a maximum of 20 mg/l of NH3-N, the NH3-N concentrations downstream ranged from 0.981 mg/l to 3.872 mg/l. The COD at 9 km downstream, WQ8 remains at 3.465 mg/l. The concentrations along the stretch are within Class IV to Class V (2.7mg/l - >2.7 mg/l) of NWQS.

For Scenario 3, the worst-case scenario with total failure of IETS, NH3-N is expected to be much lower from Standard B, which is only about 12.4 mg/l, with Standard B discharge of about 20 mg/l. The NH3-N concentration at 9 km downstream is about 3.465 mg/l. The concentrations along the stretch are within Class IV to Class V (2.7mg/l - >2.7 mg/l) of NWQS. As can be seen below, the discharge from proposed SCaRF at Standard B of EQ(IE)R 2009 at normal river flow does not make any significant difference to the existing concentrations (thus only one line is visible).

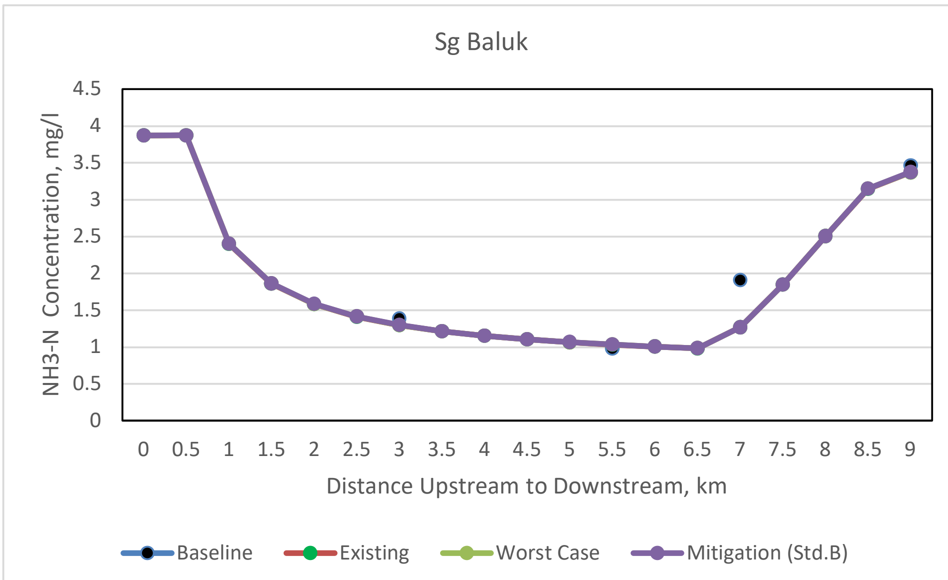


Figure 7.6(9): NH3-N Profile (Normal Flow)

a. Total Suspended Solids

Total suspended solid is a parameter of concern during earthwork and construction stage. For Scenario 2, the threshold discharge limit is about 50 mg/l. The TSS concentrations downstream ranged from 24 mg/l to 58 mg/l. The COD at 9 km downstream, WQ8 is about 39 mg/l. The concentrations along the stretch are within Class II to Class III (50 mg/l – 150 mg/l) of NWQS.

For Scenario 3, the worst-case scenario without implementation of LDP2M2, TSS discharge is about 1347 mg/l. The TSS increase significantly on the upstream area and gradually decline towards downstream area. The peak concentration located at 1 km, which is about 256 mg/l. While, the concentrations at 9km downstream, WQ8, is about 58 mg/l. The concentrations downstream ranges within Class II to Class IV (50 mg/l - 300 mg/l) of NWQS.

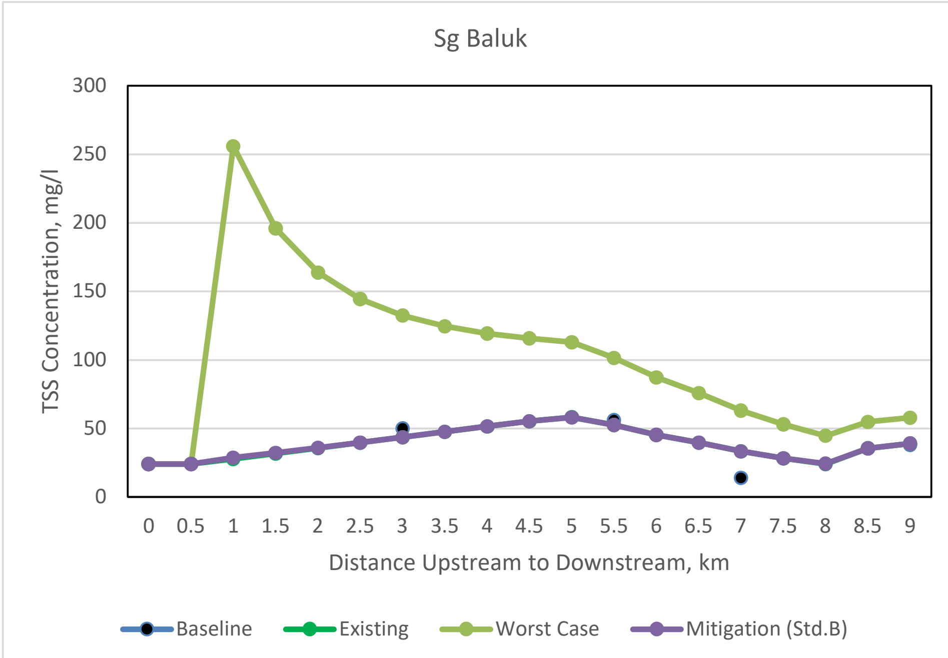


Figure 7.6(10): TSS Profile (Normal Flow)

(a) <u>Simulations at Low Flow of Sg Baluk</u>

Figure 7.6(11) to Figure 7.6(15) show the profile for each parameter at low flow of Sg Baluk.

a. Biochemical Oxygen Demand (BOD)

For Scenario 2, with the discharge complying to Standard B or a maximum of 50 mg/l of BOD, the BOD concentrations downstream ranged from 8 mg/l to 13 mg/l. BOD increment occurred at 1 km distance, which is about 13 mg/l. Whereby, the BOD at the middle stream, WQ6 and at the downstream, WQ8 are about 12 mg/l and 14 mg/l. The concentrations along the stretch are classified within Class III to Class V (6 mg/l->12 mg/l) of NWQS.

For Scenario 3, the worst-case scenario with total failure of IETS, BOD discharge is about 115 mg/l. The BOD varied slightly higher on the upstream, where at 1km distance the concentration is about 13 mg/l. whereby the concentrations along Sg. Baluk increases around 8 mg/l to 15 mg/l. Concentration of BOD at the middle stream, WQ6 and at the downstream, WQ8 are about 13 mg/l and 15 mg/l. The concentrations along the stretch are still within Class III – Class V (6 mg/l – >12mg/l).

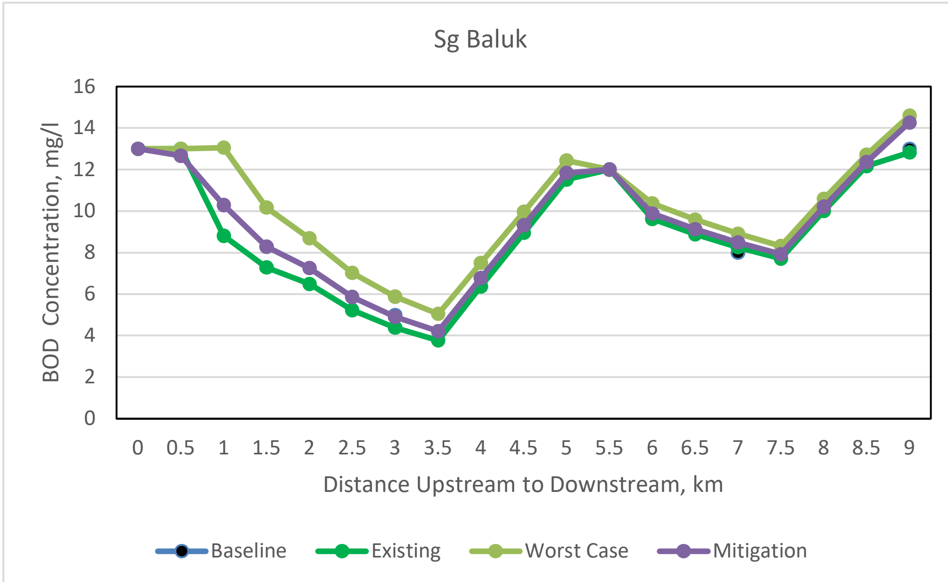


Figure 7.6(11): BOD Profile (Low Flow)

b. Chemical Oxygen Demand (COD)

For Scenario 2, with the discharge complying to Standard B or a maximum of 200 mg/l of COD, the COD concentrations downstream ranged from 24 mg/l to 98 mg/l. Concentration of COD at 1 km distance slightly increases to about 94 mg/l. The COD at WQ5 (with the highest existing value) and at the downstream, WQ8 are about 98 mg/l and 24 mg/l. The concentrations along the stretch are classified within Class III to Class IV (50 mg/l - 100 mg/l) of NWQS.

For Scenario 3, the worst-case scenario with total failure of IETS, COD discharge is about 225 mg/l. Slight variation can be observed on the upstream of Sg Baluk, where at 1 km distance the concentration is about 95 mg/l. The COD concentrations along Sg. Baluk ranges from 24 mg/l to 98 mg/l. Whilst, the COD at WQ5 (with the highest existing value) and at the downstream, WQ8 are about 98 mg/l and 20 mg/l. The concentrations along the stretch are still within Class III to Class IV (50 mg/l - 100 mg/l) of NWQS.

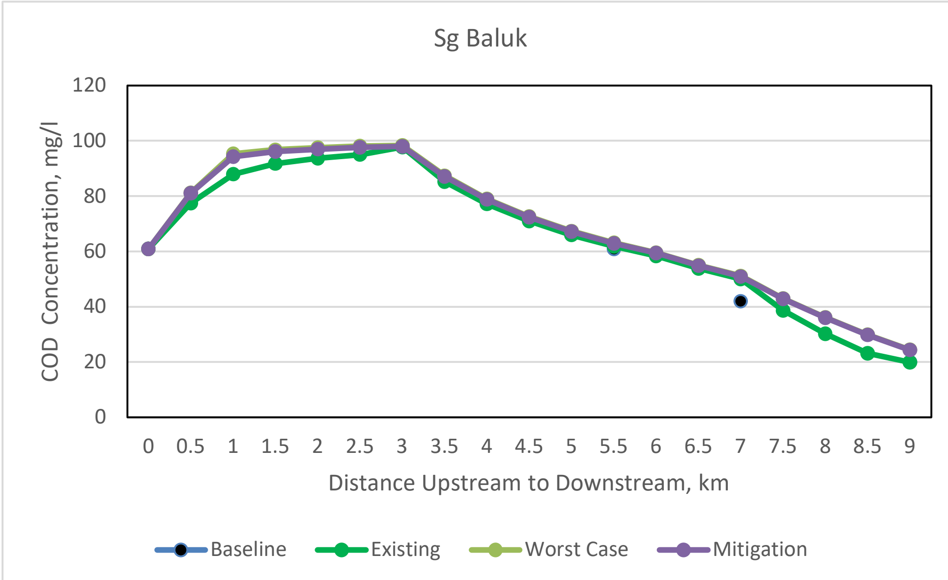


Figure 7.6(12): COD Profile (Low Flow)

c. Ammoniacal Nitrogen (NH3-N)

For Scenario 2, with the discharge complying to Standard B or a maximum of 20 mg/l of NH3-N, the NH3-N concentrations downstream ranged from 1.7 mg/l to 3.9 mg/l. Concentration of NH3-N at 1 km distance increases to about 4 mg/l. The NH3-N at 9 km downstream, WQ8, is about 4.3 mg/l. The concentrations along the stretch are within Class IV to Class V (2.7mg/l - >2.7 mg/l) of NWQS.

For Scenario 3, the worst-case scenario with total failure of IETS, NH3-N is expected to be much lower from Standard B, which is only about 12.4 mg/l, whereby the Standard B discharge is about 20 mg/l. Concentration of NH3-N at 1 km distance increases to about 4.4 mg/l. The NH3-N concentration at 9 km downstream is about 4.3 mg/l. The concentrations along the stretch are within Class IV to Class V (2.7mg/l - >2.7 mg/l) of NWQS.

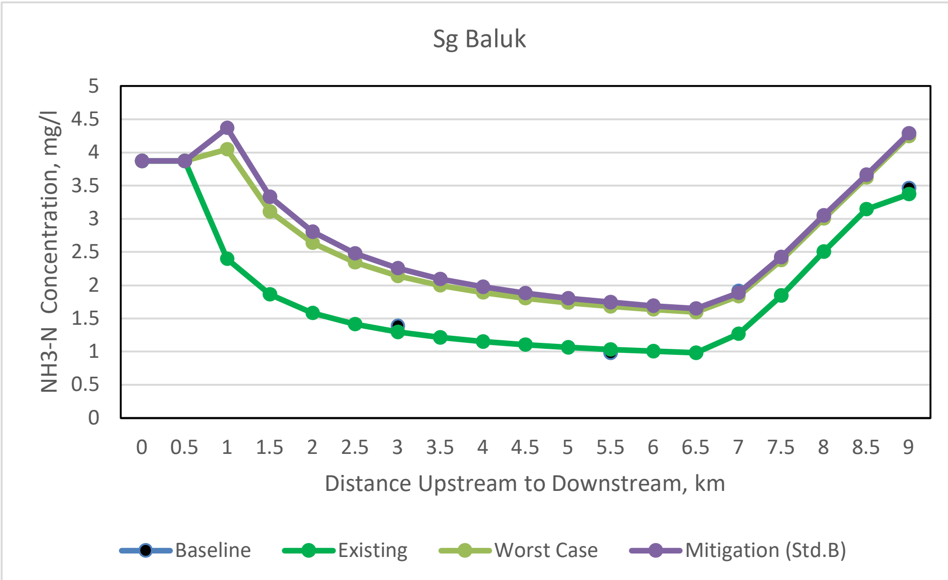


Figure 7.6(13): NH3-N Profile (Low Flow)

d. Total Suspended Solids

Total suspended solid is a parameter of concern during earthwork and construction stage. However, at low flow condition, the number of rainfalls are lesser, hence, the amount of TSS discharge is expected to be lower than the normal flow. For Scenario 2, the threshold discharge limit is about 50 mg/l. The TSS concentrations downstream ranged from 24 mg/l to 58 mg/l. Slight variation occur at 1 km with a concentration of about 29 mg/l. The COD at 9 km downstream, WQ8 is about 39 mg/l. The concentrations along the stretch are within Class II to Class III (50 mg/l – 150 mg/l) of NWQS.

For Scenario 3, the worst-case scenario without implementation of LDP2M2, TSS discharge is about 1347 mg/l. The TSS slightly increases on the upstream area and gradually decline towards downstream area. The highest TSS value can be observed at 1km distance, which is about 39 mg/l. While, the concentrations at 9km downstream, WQ8, is about 43 mg/l. The concentrations downstream ranges within Class II to Class III (50 mg/l - 150 mg/l) of NWQS.

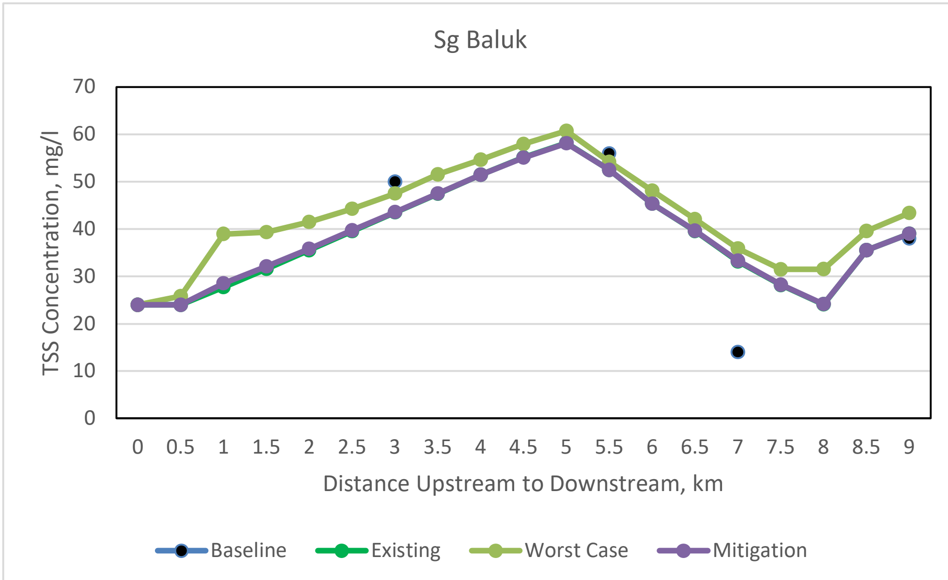


Figure 7.6(14): TSS Profile (Normal Flow)

7.6.11 Conclusion and Recommendation

To conclude on the results of simulations as described above, the simulations' results are summarized below:

a) <u>Summary of results during Normal Flow and Low Flow</u>

Figure 7.6(15): Summary of simulation results for BOD

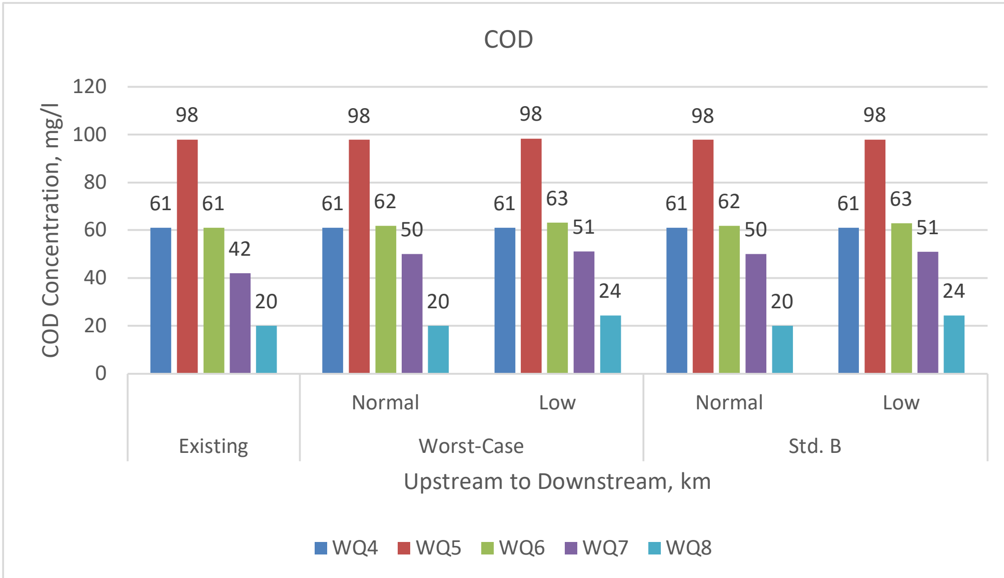


Figure 7.6(16): Summary of simulation results for COD

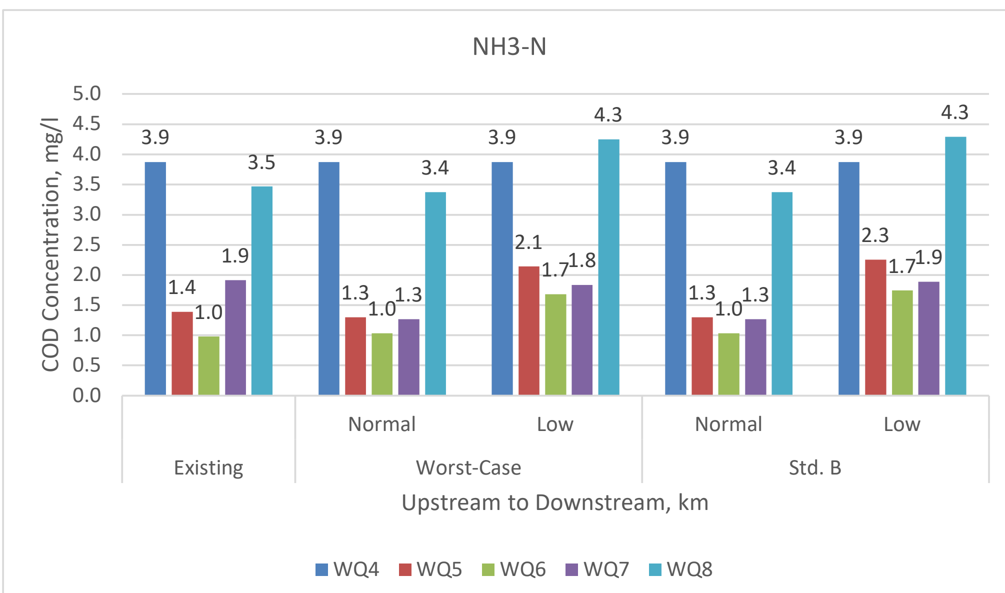


Figure 7.6(17): Summary of simulation results for Ammoniacal Nitrogen

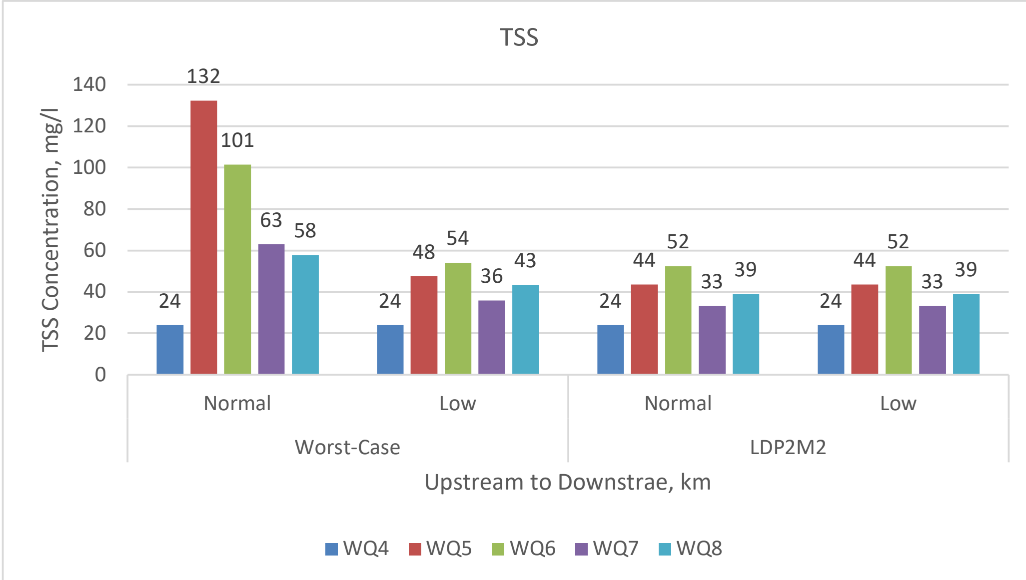


Figure 7.6(18) : Summary of simulation results for TSS

b) <u>Recommendations</u>

The project site area is small, and will be prepared for the propose project development. Thus, there is a potential generation of TSS. During worst case scenario, where LDP2M2 measures such as Sediment trap, and perimeter drain has not been installed onsite, the TSS in Sg. Baluk varied within Class II and Class IV at normal flow. With adherence to the LDP2M2 measures, the estimated TSS discharge can be reduced at about 90% from the worst-case value. Whereby, the impact to Sg. Baluk would be insignificant.

With IETS discharge complying with the Standard B at all times, the simulations have shown that the potential impacts of the discharge to Sg. Baluk water quality would be insignificant, and the water quality would remain about the same as existing conditions under normal/usual conditions.

Therefore, the following measures are recommended to be implemented during development.

- The design of Industrial Effluent Treatment System (IETS) should adhere to discharge Standard B effluent (maximum of 50 mg/l of BOD, 200 mg/l of COD and 20 mg/l of NH3-N) at all times.
- The LDP2M2 measures should be implemented during construction stage. Maintenance of LDP2M2 component must be conducted when necessary, i.e. for sediment traps and perimeter drains.
- Regular maintenance should be conducted to ensure the efficiency of the IETS.

- The operator should apply the Guided Self-Regulation, GSR, to ensure discharge from the IETS complies with the Standard B requirements at all times during the operational stage.
- Performance monitoring should be conducted to ensure the IETS is working at its best capacity.

7.7 POTENTIAL IMPACTS DUE TO ABANDONMENT OR END OF LIFE

At the end of the project life, which may be due to a number of reasons, such as discontinuance of project, investor exit, etc, the proposed site has to be restored to original state, which in practicality means to original state of stability, physically and environmentally. If not carried out, the site might incur costs for the subsequent users, as well as dangers due to wastes and water retention for aedes breeding.

7.8 MATRIX OF POTENTIAL ENVIRONMENTAL IMPACTS

Having considered the potential environmental impacts qualitatively and quantitatively, during construction and operation, the potential impacts are summarised in **Table 7.8(1)** below.

Table 7.8(1): Matrix of Potential Significant Impacts to the Environment

LEGEND:

B - Beneficial Impact
A - Adverse Impact
R – Residual Impact

Degree of Significance:
1 - Low Degree & Short Duration
2 - Low Degree & Long Duration
3 - High Degree & Short Duration
4 - High Degree & Long Duration
Blank - Unrelated
NA – Not applicable
L - Localized
D - Significant Adverse Environmental Impact for which a design solution is identified

	PROJECT ACTIVITIES								
	Pre-Construction	**Construction**			**Operation**				
	Survey& Investigations	Site Clearing	Earth Works	Construction of Structures	Operation of SCaRF plant	Traffic movement	Maintenance work	Amenities	Abandonment & End of Life
	1	**1**	**2**	**3**	**1**	**2**	**3**	**4**	**1**
ENVIRONMENTAL COMPONENTS									
Geology and Soil	NA	1	1	1	NA	NA	NA	NA	NA
Topography and Landuse	NA	1	1	1	1	1	1	1	1
Drainage and Flood	NA	1	1	1	1	NA	NA	NA	NA
Water Quality	NA	3	3	3	2	NA	1	2	1
Waste Management	NA	1	1	1	2	2	2	2	2
Air Quality	NA	1	1	1	2	1	1	1	1
Noise	NA	1	1	1	2	1	1	1	1
Flora and Fauna	L	NA	NA	NA	2	NA	NA	NA	NA
Traffic	NA	2	2	2	2	2	2	1	1
Socio-economic	1	1	1	2	2	1	1	1	1