5 RESIDUAL IMPACT

5.1 Introduction

Residual impacts are impacts that may persist, even though mitigation measures are fully implemented. From the impact assessment made in Chapter 4, the significance of the impacts identified may be potentially reduced or minimize by incorporation of the proposed mitigating measures. However, some residual impacts will remain as presented in the following sections.

5.2 Operation Stage

From the impact assessment summary as in **Table** 5-1, majority of the environmental impacts identified are moderate impacts. Upon the implementation of the proposed mitigating measures, the impacts can be lowered to minor category.

Table 5-1: Summary of Impacts, Significance and Residual Impacts after Mitigating Measures Incorporated for Operation Phase

No	Operation Phase	Significance of Impacts (Without Mitigating Measures)	Residual Impacts (After Mitigating Measures)
1.	Discharges Effluent	Moderate	Minor
2	Gaseous Emission		
a)	Normal and Abnormal Operations	Moderate	Minor
b)	Emergency Scenario	Major	Minor
3.	Waste Management	Moderate	Minor
4.	Noise Level	Moderate	Minor
5	Health Impact	Moderate	Minor

The residual impacts for activities during operation stage is as tabulated in **Table 5-2**.

Table 5-2 Summary of the Residual Impacts for Activities during Operation Stage

NO	PROJECT ACTIVITIES		POTENTIAL IMPACT	IMPACT SIGNIFICANCE	DURATION	RECOMMENDED MITIGATING MEASURES	RESIDUAL IMPACT
1	**Discharged Effluent**	a) Effluent Treatment Plant and via Marine Outfall b) Sewage Treatment Facility c) Surface water runoff d) Spillage of toxic and hazardous chemicals	• Discharge via the marine outfall of the followings that may disrupt the marine ecology and marine life: - Ambient sea water temperature - Concentration of free chlorine in the discharge. • Discharge from the sewage treatment may disrupt the marine and river water quality and the ecology systems. • Discharge from the retention basin may cause flooding downstream of the receiving water bodies. • Spillage of toxic and hazardous chemicals which may find its way into the marine and water bodies through surface runoff.	MODERATE a) Water Quality b) Marine and River biological Life c) Fishery Industry	LONG TERM	a) Surface Water Runoff • Design of the Plant that separates stormwater drainage and the accidentally chemical contaminated (ACC) drainage system. In the event of heavy rain and overflow of the ACC surface runoff will be directed to the storm water collection pond to contain the flow from finding its way into the surface water drainage and water bodies outside of RAPID premise. b) Discharge via Marine outfall • The effluent treatment plant will also be designed to meet DOE's requirement for IETS which requires the incorporation of the continuous online monitoring, BAT and best practices. • Routine monitoring by the regulatory agencies on the treatment performance and compliance to the discharged standards. c) Incorporation of various preventive and control measures in the RAPID design and operation among which are: <u>Design Stage:</u> • Effluent treatment plant will be	MINOR

NO	PROJECT ACTIVITIES		POTENTIAL IMPACT	IMPACT SIGNIFICANCE	DURATION	RECOMMENDED MITIGATING MEASURES	RESIDUAL IMPACT
						designed to meet DOE's requirement for IETS, PETRONAS Technical Code and Standards and applicable internal standards and guidelines, BAT and best practices considered in the design. • Conduct design integrity review at every critical progress of the design stage. • Carryout the effluent dispersion and simulations using acceptable simulation models to help in designing the appropriate outfall locations, discharged temperature that verify no significant environmental impacts during when the plant is in operation. <u>Plant Operation:</u> • Routine monitoring by the regulatory agencies on the treatment performance. • Environmental Management Plan that monitor compliance and treatment performance. • Competent staff assigned for the operation and continuous training program for the staff. • All manuals and Standards Operating Procedures (SOP) updated and readily available. • Routine maintenance of the treatment	

NO	PROJECT ACTIVITIES		POTENTIAL IMPACT	IMPACT SIGNIFICANCE	DURATION	RECOMMENDED MITIGATING MEASURES	RESIDUAL IMPACT
						system via turnaround exercise.	
2	**Noise Level**	a) Noise Level generated by Plant Equipment and Processes; b) Noise level generated by the increased in traffic volume for road leading to RAPID access points;	a) Increase in the background noise level at the sensitive receptors b) Public nuisance and disruption to daily life	MODERATE a) Noise level b) Public Health c) Nuisance in Public	LONG TERM	• Noise emission from RAPID is hardly felt by the adjacent receptors as the baseline noise at the sensitive receptors is currently high; • Provision of 500m buffer zones all around the site boundary and undeveloped areas to the west with landscaping will further attenuate the noise; • The impact of the noise level will be further reduce if the surrounding areas are gazette as heavy industry under RKK;	MINOR
3	**Waste Management**	a) Storage of Waste on site; b) Transportation of Waste to disposal Site; c) Disposal Locations and capacity of the waste operators to accept the waste	a) Waste cannot be stored on site and has to be sent to the licensed schedule waste premise immediately. b) Capacity and availability of the disposal area/waste operators to handle the volume of waste generated c) Inadequate capacity of the current scheduled waste disposal facility will cause stocking of scheduled waste within RAPID premise;	MODERATE a) Water Quality b) Soil and ground water quality c) Marine and River biological Life d) Fishery Industry e) Public Health and sanitation f) Amenities	LONG TERM	a) Spent catalyst sent to the catalyst vendor or the recyclers will for recovery; b) Location of the schedule waste areas need to be designed to include adequate bunding, collection of the spilled waste that are routed to the wastewater treatment plant collection chamber; c) Within RAPID site, solid and liquid waste is expected to be transported using trucks or forklifts. Waste will be properly contained in drums, intermediate bulk containers, cylinders	MINOR

NO	PROJECT ACTIVITIES		POTENTIAL IMPACT	IMPACT SIGNIFICANCE	DURATION	RECOMMENDED MITIGATING MEASURES	RESIDUAL IMPACT
			d) Spillage of the spilled scheduled waste will be impacting the ground water quality and soil quality; e) Domestic waste disposal at illegal dumping sites that may result in odour generation, issues on aesthetic and breeding ground of mosquitoes and vermin;			and poly bags. d) To manage the waste movement and storage efficiently and safely, several temporary storages will be located within the complex areas. For unit processes which frequently generate waste, dedicated transit areas will be provided. e) A proper loading and unloading bay will be part of the transit areas and temporary storage areas. From the collection system, the waste will be sent to the waste pre-treatment and treatment facilities. f) Due to the complexity and extensive size of RAPID project, many types of waste are expected to be generated.. Therefore, the central waste treatment facility will comprise of several facilities utilizing Best Available Techniques to manage the waste. g) Waste management within RAPID also incorporates the 3R concept to reduce the final waste to be removed from RAPID. This indirectly contributes to natural resources conservation and environmental protection.	

NO	PROJECT ACTIVITIES		POTENTIAL IMPACT	IMPACT SIGNIFICANCE	DURATION	RECOMMENDED MITIGATING MEASURES	RESIDUAL IMPACT
4	**Gaseous Emission**	a) Emission from refinery and cracker complex process units b) Emission from RAPID Complex	**A. Refinery and Cracker Complex Process Units** <u>Normal Operating Conditions</u> a) The predicted maximum ambient air concentrations for all of the parameters of concern at the sensitive receptors locations are below the 2013 MAAQS and other reference limits used. b) Non-compliance is confined to NO2 and at only two non-sensitive receptors, Bukit Pelali for the 1-hour average and Bukit Pengerang for the 24-hour average for less than 0.4% of the time. <u>Abnormal Operating Conditions</u> a) Non-compliance of NO_2 and SO_2. <u>Emergency Operating Conditions</u> a) Predicted concentrations of gaseous pollutant are compliant to 2013 MAAQS limits. B. **Emissions from RAPID Complex** <u>Normal Operating Conditions</u>	MODERATE a) Public Health b) Deterioration of the Ambient Air Quality c) GHG Emission	LONG TERM	a) Gaseous emission is designed to meet the emission limit as regulated by DOE for each process units. To ensure this, all gaseous emissions are to be treated by air pollution control systems during normal operation scenario or by elevated flares during abnormal situations b) Provision of a backup or standby units for the refinery and cracker flares; c) All flares shall be designed to be smokeless flares; d) The design philosophy adopted for the refinery and cracker process units shall be such that there will be no venting of emission streams containing hydrocarbons or pollutants directly to atmosphere and has to be treated air pollution control systems; e) Environmental Management Plan that ensure routine ambient air monitoring of ground level concentrations of air pollutants of concern at selected sensitive receptors, to verify compliance to ambient air standard limits. f) During the planning and design stage, various preventive and control measures will be incorporated into each	MINOR

NO	PROJECT ACTIVITIES		POTENTIAL IMPACT	IMPACT SIGNIFICANCE	DURATION	RECOMMENDED MITIGATING MEASURES	RESIDUAL IMPACT
			a) There is no issue of concern except for NO_2 where the NO_2 level exceeds the MAAQS 2013 limit at Bkt Pelali and Bukit Pengerang and 3 locations within the RAPID Complex i.e. Pengelih Naval Base, Sg Reggit and Kg Bukit Buloh will have NO_2 level exceeding the MAAQS 2013 limit. <u>Abnormal Operating Conditions</u> a) Non-compliance of NO_2 and SO_2. <u>Emergency Operating Conditions</u> a) Predicted concentrations of gaseous pollutant are compliant to 2013 MAAQS limits.			individual process unit, i.e : • Applying lessons learnt and adoption of the best practices based on other operating units or other similar plants globally; • Incorporation of BAT and other design review ; g) During the operation stage of the process units, among the control measures recommended are: • Documented Operating Procedures to be adhered by the plant operators; • Process Safety Management, risk based inspection and asset life study; • Structured maintenance programmes, i.e. scheduled turnaround, to ensure process and pollution control equipment are in optimal operating condition; • Training programs to produce competent personnel to operate and maintain the process units.	

NO	PROJECT ACTIVITIES		POTENTIAL IMPACT	IMPACT SIGNIFICANCE	DURATION	RECOMMENDED MITIGATING MEASURES	RESIDUAL IMPACT
5	**Health Impact**	a) Emission from plant operations during abnormal operating conditions	**Refinery and Cracker Complex :** <u>Abnormal Operating Conditions</u> a) The highest point for SO_2 is within RAPID itself with 40582.8 µg/m^3 that give HQ of 162.33. b) For NO_2, the highest point is within RAPID with concentration of 2073.8 µg/m^3 (HQ of 7.4). c) Among other receptors, Pengelih Naval base and Kampung Sg. Buloh are both predicted to have high HQs. **Emission Dispersion from cumulative RAPID Complex** <u>Abnormal Operating Conditions</u> a) The highest point for SO_2 is within RAPID itself with 40582.8 µg/m^3 that give HQ of 162.33. b) For NO_2, the highest point is also within RAPID with concentration of 2073.8 µg/m^3 with HQ of 7.4.	MODERATE	LONG TERM	The mitigating measures for both Refinery and Cracker complex and cumulative RAPID complex abnormal operating conditions. a) In the Emergency Management Plan, the release should not exceed more than 30 minutes into the ambient air. b) An Emergency Planning Committee has to be set up for planning and conducting suitable programs related or during an emergency. c) Several education and training programs to ensure that all support systems, individuals and communities are familiar with their roles and responsibilities. Programs like on emergency precautions, and how to identify SO_2 and NO_2 gases.	MINOR

6 ENVIRONMENTAL MANAGEMENT PLAN

6.1 Introduction

This section describes the environmental management requirements for the operation of the EURO 5 MOGAS Units and Olefin Storage Tanks located in the RAPID Refinery Cracker Complex. This EMP is an environmental management framework to comply with the requirements of the Environmental Quality Act 1974 relating to prevention, abatement and mitigation of environmental impacts resulted from the operation of the RAPID EURO 5 MOGAS and Olefin Storage Tanks. A detailed EMP report is required to be prepared and submitted for approval from the State DOE after the approval of this Additional Information Report is obtained. The EMP to be prepared for each of the RAPID Refinery Cracker Complex and should be aligned to the EMP for the overall RAPID Complex.

6.2 Objective of EMP

The EMP shall ensure that sound environmental practices are adopted at all stages of the project and that the proposed mitigating measures contained in this report and in this Addendum DEIA Conditions of Approval are adopted in the day to day operation at site during construction and during the plant operation.

The objectives of the EMP are:

- To comply with the requirement by DOE and any relevant laws, regulation and/or guidelines pertaining to the project activities;
- To be a part of the HSE Management Plan for RAPID Project;
- To check and balance the project activities so that they will not result in environmental pollution to areas surrounding the project site;
- To be an early trigger in order to remediate the environmental nonconformance; and

- To establish an environmental monitoring and audit program that will be used as a guide to track the environmental performance of the project implementation.

The EMP should contain recommendations of the followings:

- Environmental Monitoring which include the parameters, location and frequency of the monitoring to be implemented based on the existing baseline study and the potential impact identified;
- Environmental Audit requirements
- Environmental Training requirements
- Environmental Coordination Plan
- Environmental Incident Closure Procedures

6.2.1 RAPID HSE Management System

RAPID Project implements a HSE Management System (HSEMS) for all its business activities and the HSEMS subscribes to the PETRONAS HSEMS. The HSEMS is defined as a structured set of controls for managing HSE related matters in the business to ensure and to demonstrate that HSE objective are met and serves also as a tool for maintaining sustainable business activities.

The PETRONAS Health, Safety and Environment (HSE) Policy is shown in **Figure 6-1**. In addition to the corporate policy and strategic objective, HSEMS also ensures the followings:

- Organization including responsibilities, resources, training, competency, standards and document management;
- Risk Management including the Hazards and Effects Management Process (HEMP) and Environmental Aspect Impact (EAI), which identifies and assesses hazard and effects and develops the measures to control the release of hazards and for recovery in the event of release of the hazard;
- Planning & Procedure including asset integrity, work instructions, management of change contingency and emergency response planning;

- Implementation & Monitoring including monitoring activities, record, non-compliance and corrective action, incident report and follow up; and
- Auditing & Management Review.

Figure 6-1 PETRONAS Health, Safety and Environment Policy

PETRONAS

PETRONAS HEALTH, SAFETY AND ENVIRONMENT POLICY

PETRONAS is committed to Health, Safety and Environment excellence in all its activities wherever it operates.

We shall identify and manage risks of injuries, occupational illnesses and damage to properties.

We shall ensure that measures are taken to protect the environment and that natural resources are used sustainably.

We shall:

- ensure that the facilities where we operate, the products we manufacture and the services we provide are in accordance with applicable legal requirements and company standards.
- provide the necessary resources and organisation, and where appropriate, engage with key stakeholders on Health, Safety and Environment matters.
- ensure that contingency plans are in place to deal with emergencies.
- ensure continual improvement in our Health, Safety and Environment management and performance, leveraging on people, process and technology.

We require all our employees and contractors to strictly adhere to this policy at all times.

Datuk Wan Zulkiflee
President and Group CEO

1 April 2015

6.2.2 Legislation and Guidelines

The main objective of the EMP is to comply with the relevant legislation and guidelines applicable during the construction and operation activities of the EURO 5 MOGAS and Olefin Storage Tanks as shown below in **Table 6-1** and are not limited to the followings:

Table 6-1 Legislation and Guidelines

Aspects	Legislation and Guidelines
Noise	• The Planning Guidelines for Environmental Noise Limits and Control, 2007 • Guidelines For Noise Labeling and Emission Limits of Outdoor Sources, 2007 • Factories and Machinery (Noise Exposure) Regulations, 2006 • DOE Recommended Noise Levels, 2004 • Environmental Quality (Motor Vehicle Noise) Regulations (EQA), 1987
Ambient air	• Environmental Quality for Clean Air Regulations (EQA), 2003 • Environmental Quality for Clean Air Regulations (EQA), 2014 • Factories and Machinery (Mineral Dust) Regulations (FMA), 1989 • Motor Vehicles (Control of Smoke and Gas Emission) Rules (EQA), 1977 • Malaysian Ambient Air Quality Standards, 2013 • Environmental Quality (Control of Emissions from Diesel Engines) Regulations, 1996 • Environmental Quality (Control of Emissions from Petrol Engines) Regulations, 1996
Water quality	• Water Act 1920(Cap 146); DID Role in River Management on Flood Mitigation and River Conservancy DID Guidelines on the Protection of Water Courses and Limits of Buffer Zones; • National Water Quality Standards (EQA), 1974 • Manual Saliran Mesra Alam (MASMA), JPS • Standard B in Third Schedule of the EQ (Industrial Effluents) Regulations 2009 • Standard B in Third Schedule of the EQ (Sewage) Reg 2009 • Flood Preparedness Guideline • National Guidelines for Raw Drinking Water Quality Benchmark for Groundwater Quality in Malaysia • Marine Water Quality Criteria and Standards for Malaysia (MWQCS)
Planning	• Local Government Act, 1976 • Street, Drainage & Building Act, 1974 • Irrigation Areas Act 1953 • Drainage Works Act 1954

Aspects	Legislation and Guidelines
Soil	• Guidelines for Prevention and Control of Soil Erosion and Siltation in Malaysia (DOE), 1996 • Contaminated Land Management and Control Guidelines: Malaysian Recommended Site Screening Levels for Contaminated Land, 2009
Land matters	• Land Acquisition Act, 1960 • National Land Code, 1965 • Environmental Quality Act, 1974 and Amendments
Waste	• Environmental Quality (Scheduled Wastes) Regulations, 2005 • Environmental Quality (Sewage) Regulations, 2009 • Environmental Quality (Industrial Effluent) Regulations, 2009
Workers	• Occupational Safety and Health Act (OSHA), 1994 • Worker's Minimum Standards of Housing and Amenities Act, 1990
Health and safety	• Factories and Machinery (Fencing of Machinery and Safety) Regulations, 1970 • Factories and Machinery (Safety, Health and Welfare) Regulations, 1970 • Local Authority (Cleanliness) By-Law, 1999 • Malaria Eradication Act, 1971 • Occupational Safety and Health Act, 1994 • Petroleum Safety Measures Act, 1984
Other applicable guidelines	• PETRONAS Technical Standard on Waste Management (PTS 18.72.01, December 2014) • PETRONAS Technical Guideline 18.71.02 Environmental Aspect Impact (December 2015)

6.2.3 Key Information in the EMP

The EMP to be prepared for the RAPID EURO 5 MOGAS and Olefin Storage Tank units should be aligned to the overall RAPID Complex EMP and to contain the key information as shown in **Table 6-2** below.

Table 6-2 Outline of the EMP Content

Content	Description
Introduction	• The objectives of the EMP • The scope and area of coverage for the EMP • Description of the existing environment and development schedule.
Environmental Policy	• Project RAPID HSE policy and the HSE Management Systems

Content	Description
Specific DOE conditions and legal requirements	• The relevant legislation and guidelines applicable for the Project. • Commitment to include the Approval Conditions to the DEIA in the EMP • Reporting procedures
Environmental Monitoring and Auditing Requirements	• Environmental monitoring location, frequency and parameter to be monitored • Monitoring Methodology • Environmental audit program • Roles of Responsibility in the EMP implementation • Key procedures in closure of the non-compliance detected from the monitoring activities
Impact and Mitigation measures	• Relevant measures that are proposed in accordance with the DOE Conditions of Approval, EIA recommendation and proposals for environmental auditing • Detailed ESCP report including the ESCP and BMPs progress reporting framework
Environmental Contingency	• Potential environmental emergencies • Environmental non-compliance and closure of the non-compliance • Reporting procedures

6.3 Scope of the EMP

The scope of works to achieve these objectives are as follows:

1. Evaluate the environmental monitoring baseline data and the recommended mitigation measures to establish the environmental profile of the RAPID project site and determine compliance with DOE requirements for environmental quality and mitigation measures;
2. Identify sources(s) of impact with environmental quality standards/legislative requirements as comparison to review the effectiveness of the EMP and mitigation measures proposed in **Chapter 4**;
3. Recommended additional mitigation and remedial measures as necessary and recommend any environmental monitoring changes in parameters, locations or frequencies;

4. Develop relevant environmental monitoring and audit procedures to be complied by all Contractors undertaking activities at RAPID site during construction stage of the EURO 5 MOGAS and Olefin Storage Tanks;
5. Assess the effectiveness of the environmental management practices and procedures during the construction and operation period; and
6. Identify any future environmental issues and recommend any appropriate mitigation measures.

6.4 EMP for Site Preparation and Construction Phases

Environmental monitoring for the site clearing and site preparation of the EURO 5 MOGAS and Olefin Storage Tank units aligns with the RAPID EMP and the monitoring and audit program as approved by DOE Johor.

The sequences for the RAPID site preparation and construction phase are as follows:

a) RAPID Phase 1 site preparation and clearing
b) RAPID Phase 2 site preparation and clearing
c) RAPID Refinery Cracker Complex including the EURO 5 MOGAS and Olefin Storage Tanks construction stage

The RAPID project is currently nearing the completion of the site clearing and preparation works. The overall RAPID EMP that includes the environmental monitoring exercise and audit program is ongoing. The monthly monitoring report and quarterly audit report is submitted to DOE Johor since 2012.

However, it is to note that there was no requirements spelt out for the environmental monitoring program specific for the construction phase in RAPID DEIA 2012 Conditions of Approval.

Hence in this Addendum Report, the EMP for the site clearing and preparation shall be revised to include the update of the environmental monitoring and audit program to reflect the requirements specific for the construction phase for the RAPID EURO 5 MOGAS and Olefin Storage Tanks.

6.4.1 Environmental Monitoring for RAPID EURO 5 MOGAS and Olefin Storage Tanks during Site Clearing and Site Preparation

As an overview, the baseline monitoring for the overall RAPID project was conducted in October 2012 prior to commencement of the RAPID site clearing and preparation for Phase 1 and Phase 2 areas.

The Environmental Monitoring Report (EMR) is submitted to DOE Johor on a monthly basis to meet the followings:

i. EMP for Phase 1 Site Preparation and Clearing and its approval conditions from DOE Johor dated 22nd October 2012 (Ref. No.: AS(B)J62/490/000/269 Jilid 3(7));

ii. EMP Rev.1 (May 2013) and its approval conditions from DOE Johor dated 17th July 2013 (Ref. No.: AS(B)J62/490/000/269 Jilid 5);

iii. Supplementary EMP Phase 1 (Option Areas) and its approval conditions from DOE Johor dated 19th March 2014 (Ref. No.: AS(B)J62/490/000/269 Jilid 7(11)); and

iv. EMP Phase 2 and its approval conditions from DOE Johor dated 29th April 2014 (Ref. No.: AS(B)J62/490/000/269 Jilid 8(9)).

The present monitoring exercise for the site preparation and clearing works consists of the following environmental parameters:

a) Surface water quality at the rivers and from the sediment basins and detention corridor;

b) Groundwater and soil quality;

c) Air quality;

d) Noise level; and

e) Marine water and seabed sediment quality.

The parameters above are monitored against the baseline conditions in 2012, and the results are reported in the monthly submission of the Environmental Monitoring Report (EMR) to DOE Johor.

As mentioned in **Section 2.3.1**, **Chapter 2** of this Addendum Report, Phase 1 site preparation works had been completed and current on-going activities taking place are the preliminary construction works such as piling, construction of temporary common facilities and workers accommodation. As of September 2016, the overall progress of the site preparation works for Phase 2 has been completed.

The sensitive receptors for Phase 2 site preparation comprise the population surrounding the RAPID site (within 5 km radius). The list of the sensitive communities/receptors are:

i. The Pengelih Naval Base
ii. Kg Pengerang
iii. Kg Lepau
iv. Taman Renggit Jaya
v. Kg Bukit Buloh
vi. Kg Sg Buntu
vii. Kg Sg Kapal

The monitoring locations for the RAPID Refinery and Cracker Complex including the EURO 5 MOGAS and Olefin Storage Tanks, during site clearing and site preparation shall be covered under the monitoring plan for the overall RAPID site clearing and preparation. The monitoring locations are selected based on the identified sensitive receptors listed above.

The monitoring locations are as of the latest RAPID Environmental Monitoring Report (EMR) dated October 2016 (refer to **Table 6-3** and **Figure 6-2** – **Figure 6-6**). A summary of the monitoring parameters is given in **Table 6-4**.

Table 6-3 Location of Sensitive Receptors and Monitoring Points for the Overall RAPID Site Clearing and Preparation Stage

No.	Monitoring Station	Description of Location
A.	**Surface Water Quality (refer to Figure 6-2)**	
1.	SW1	Sg Johor
2.	SW2	Sg Sebina
3.	SW3	Sg Lanjut
4.	SW4	Sg Pengkalan Pinang
5.	SW5	Sg Lepau
6.	SW6a	Sg Lepau
7.	SW7	Sg Sebina
8.	SW9	Sg Kapal
9.	SW10	Sg Buntu
10.	SW14	Sg Lepau
11.	SW15	Sg Lepau
12.	SW19*	Sg Kapal
Note: * means this new sampling station was added in March 2015 (SW19) as part of the ongoing monitoring exercise. Hence, there is no baseline data in October 2012 for this station.		
B.	**Discharges from Sediment Basins and Detention Corridors (refer to Figure 6-3)**	
1.	SB1	To Detention Corridor (DC1)
2.	SB2	
3.	SB3	
4.	SB4	
5.	SB5	To Detention Corridor (DC2)
6.	SB6	
7.	SB7	
8	SB9	
9	SB21	Discharge to Sg Haji Ahmad
10.	SB22	Discharge to the coast
11.	SB23	Parit Teluk Ampang
12.	SB24	Discharge to the coast
13.	SB25	Discharge to the coast
14.	NDC(A)-1	Discharge to Sg Lepau
15.	NDC(A)-2	
16.	NDC(A)-3	
17.	NDC(A)-4	
18.	NDC(B)-1	Discharge to Sg Shanti and Sg Pengkalan Pinang
19.	NDC(B)-2	
20.	NDC(B)-3	
21.	NDC(B)-4	
22.	NDC(B)-5	
C.	**Groundwater and Soil Quality (refer to Figure 6-4)**	
1.	GW/SS-1	West of RAPID border near Kg. Pengelih
2.	GW/SS-3	South of RAPID site near Kg. Teluk Empang
3.	GW/SS-14	North of RAPID border near Kg. Lepau
D.	**Air Quality and Noise Level (refer to Figure 6-5)**	

No.	Monitoring Station	Description of Location
1.	A/N1	Jetty Tg Pengelih near to TNB sub-station
2.	A/N2a*	Kg. Pengerang
3.	A/N3a*	Kg. Sebong
4.	A/N7a*	Kg. Sg. Kapal Darat
5.	A/N8	Kg. Sg. Kapal Darat
6.	A/N9	Taman Rengit Jaya
7.	A/N10	Kg. Sg. Buntu
8.	A/N11	Kg. Bukit Buloh (South)
9.	A/N12	Kg. Bukit Buloh (North)
10.	A/N13	Orchard Farm at the North East boundary of RAPID
11.	A/N14a*	Oil palm plantation
12.	A/N17	Oil palm plantation located at the Northern boundary of RAPID
13.	A/N18	Oil palm plantation located at North West boundary of RAPID
14.	A/N19	Oil palm plantation (Close to alternative road from Kg. Lepau to Tg. Pengelih)
15.	A/N20	Oil palm plantation at Western boundary of RAPID
16.	A/N21	Oil palm plantation at Kg Lepau
17.	A/N22	North East RAPID
18.	A/N26*	Lot 17 Jalan Hj. Mantek, Kg. Lepau
19.	A/N(T)20C3-1	Kg. Teluk Ramunia
20.	A/N(T)20C3-2	Kg. Teluk Ramunia
21.	A/N(T)20C3-3	Kg. Teluk Ramunia
Note: * means this new sampling station was added in May 2014 (A26), September 2014 (A2a), November 2014 (A14a), March 2015 (A7a) and July 2015 (A3a) as part of the ongoing monitoring exercise. Hence, there is no baseline data in October 2012 for these stations.		
E.	**Marine Water and Seabed Sediment Quality (refer to Figure 6-6)**	
1.	CS1	3 km from Project boundary, South of project site
2.	CS2	3 km from Project boundary, South of project site
3.	CS3	3 km from Project boundary, South West of project site
4.	CS4	3 km from Project boundary, North West of project site
5.	CS5	3 km from Project boundary, South West of project site
6.	CS6*	3 km from Project boundary, North West of project site
Note: * means this new sampling station was added in May 2014 (CS6) as part of the ongoing monitoring exercise. Hence, there is no baseline data in October 2012 for this station.		

Table 6-4 Summary of Environmental Monitoring Parameters for the Overall RAPID Site Clearing and Preparation Stage

No.	Issues & Sources	Monitoring Location	Number of Sampling Point	Parameter	Compliance	Monitoring Frequency	Reporting Frequency
1.	**Surface Water (Inland and Estuarine)**	Refer to **Figure 6-2**	12 nos	Parameters as per Class III of the National Water Quality Standards (NWQS): Temperature, pH, Dissolved Oxygen, Total Suspended Solids, BOD, COD, Oil and Grease, Phenol, Cyanide, Sulphide, Nitrate, Nitrite, Ammoniacal Nitrogen, Phosphate, Iron (II), Arsenic, Boron, Cadmium, Copper, Chromium (III), Total Iron, Lead, Manganese, Tin, Mercury, and Faecal coliform Parameters as per Marine Water Quality Criteria and Standards for Malaysia (Class E): Temperature, pH, Dissolved Oxygen, Turbidity, Total Suspended Solid, BOD, COD, Oil & Grease, Phenol, Cyanide, Nitrate, Nitrite, Ammoniacal Nitrogen, Phosphate, Iron (II), Arsenic, Boron, Cadmium, Copper, Chromium (III), Total Iron, Lead, Manganese, Tin, Mercury, Ammonia (unionized), Total Organic Carbon, Total Nitrogen, Arsenic (III), Zinc, Total Hydrocarbon, Faecal Coliform, Total Petroleum Hydrocarbon (TPH)(Fractionized), and Polynuclear Aromatic Hydrocarbon (PAH)	Stations SW4, SW6a, SW9, SW10, SW14, SW15 and SW19 to comply with National Water Quality Standards (NWQS)-Class III (river water) Stations SW1, SW2, SW3, SW5 and SW7 to comply with Marine Water Quality and Standards for Malaysia (MWQCS)-Class E (Estuarine water)	Monthly	Monthly
2.	**Sediment Basin and Detention Corridor Discharges**	Refer to **Figure 6-3**	22 nos	TSS, Turbidity	RAPID DEIA 2012 Condition of Approval No. 42 (i) Turbidity <250 NTU (ii) TSS <50 mg/l	Monthly	Monthly

No.	Issues & Sources	Monitoring Location	Number of Sampling Point	Parameter	Compliance	Monitoring Frequency	Reporting Frequency
3.	**Groundwater Quality**	Refer to **Figure 6-4**	3 nos	Total Hydrocarbon, Total Phenol, Sulphide, Cyanide, Oil & Grease, Arsenic, Boron, Cadmium, Copper, Iron, Lead, Manganese, Tin, Mercury, Volatile Organic Carbon (VOC) and Polynuclear Aromatic Hydrocarbon (PAH)	National Guidelines for Raw Water Quality (NGRWQ) Benchmark for Groundwater Quality in Malaysia Results from baseline EMR No. 1 (October 2012) and EMR No. 36 (September 2015)	Quarterly	Quarterly
4.	**Soil Quality**	Refer to **Figure 6-4**	3 nos	Total Hydrocarbon, Total Phenol, Sulphide, Cyanide, Oil & Grease, Arsenic, Boron, Cadmium, Copper, Iron, Lead, Manganese, Tin, Mercury, Volatile Organic Carbon (VOC) and Polynuclear Aromatic Hydrocarbon (PAH)	Contaminated Land Management: SSLs (Site screening levels)	Quarterly	Quarterly
5.	**Ambient Air Quality**	Refer to **Figure 6-5**	21 nos	Particulate Matter(PM10); Sulphur Dioxide (SO_2); Nitrogen Dioxide (NO_2); Carbon Monoxide (CO)	Malaysian Ambient Air Quality Guidelines (MAAQG) 2013	Monthly	Monthly

No.	Issues & Sources	Monitoring Location	Number of Sampling Point	Parameter	Compliance	Monitoring Frequency	Reporting Frequency
6.	**Noise Level**	Refer to **Figure 6-5**	21 nos	Noise levels during day and night	Factory and Machinery (Noise) Regulations DOE Recommended Limit 2004: (i) Northern & Western boundaries: 60 dBA (day time) and 50 dBA (night time) (ii) Southern & Eastern boundaries: 70 dBA (day time and 60 dBA (night time)	Monthly	Monthly
7.	**Marine Water Quality**	Refer to **Figure 6-6**	6 nos	Top & bottom water depths: Temperature, pH, Dissolved Oxygen, Cadmium, Copper, Mercury, Lead, Iron, Manganese, Arsenic, Tin, Total Suspended Solid, Oil & Grease, Total Petroleum Hydrocarbon (TPH)(Fractionized), Total Organic Carbon, Total Hydrocarbon, Nitrate as N, Phosphate, Total Nitrogen, Iron (II), Chromium Trivalent, Polynuclear Aromatic Hydrocarbon (PAH), Arsenic (III), Zinc, Chromium (VI), Cyanide, Nitrite, Ammonia (unionized), Phenol, Faecal Coliform	Marine Water Quality Criteria and Standards for Malaysia (MWQCS)-Class 3	Monthly	Monthly
8.	**Seabed Sediment Quality**	Refer to **Figure 6-6**	6 nos	Total Hydrocarbon, Cadmium, Chromium (III), Copper, Mercury, Lead, Iron, Manganese, Arsenic, Tin, Total Organic Carbon, Total Petroleum Hydrocarbon (TPH) (Fractionized), Oil & Grease, Redox potential, and Polynuclear Aromatic Hydrocarbon (PAH)	United State National Oceanic and Atmospheric Administration Screening Quick Reference Tables (US NOAA SQuiRTs)	Quarterly	Quarterly

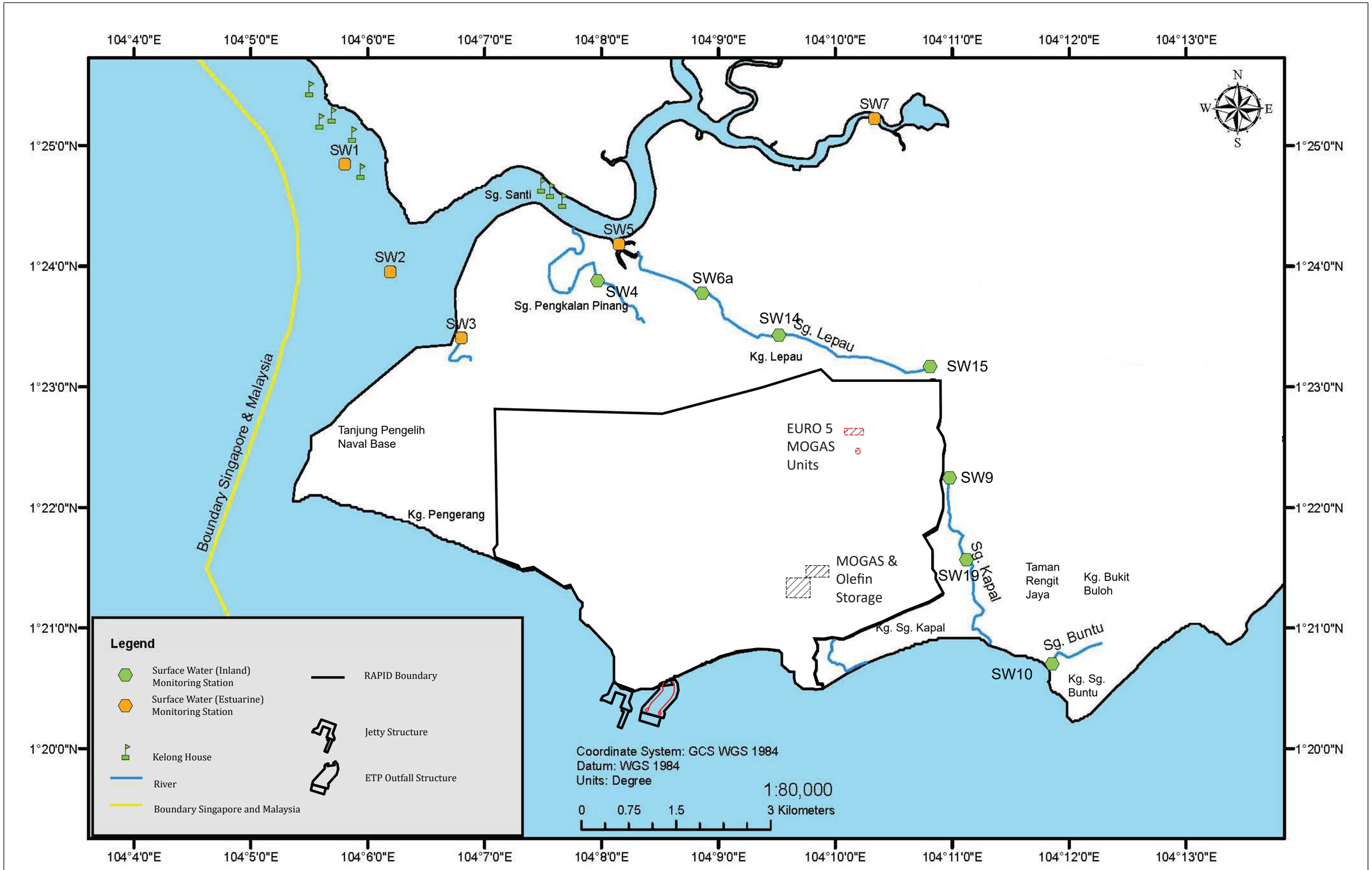


Figure 6-2: Surface Water Quality Monitoring Stations during Site Clearing and Site Preparation

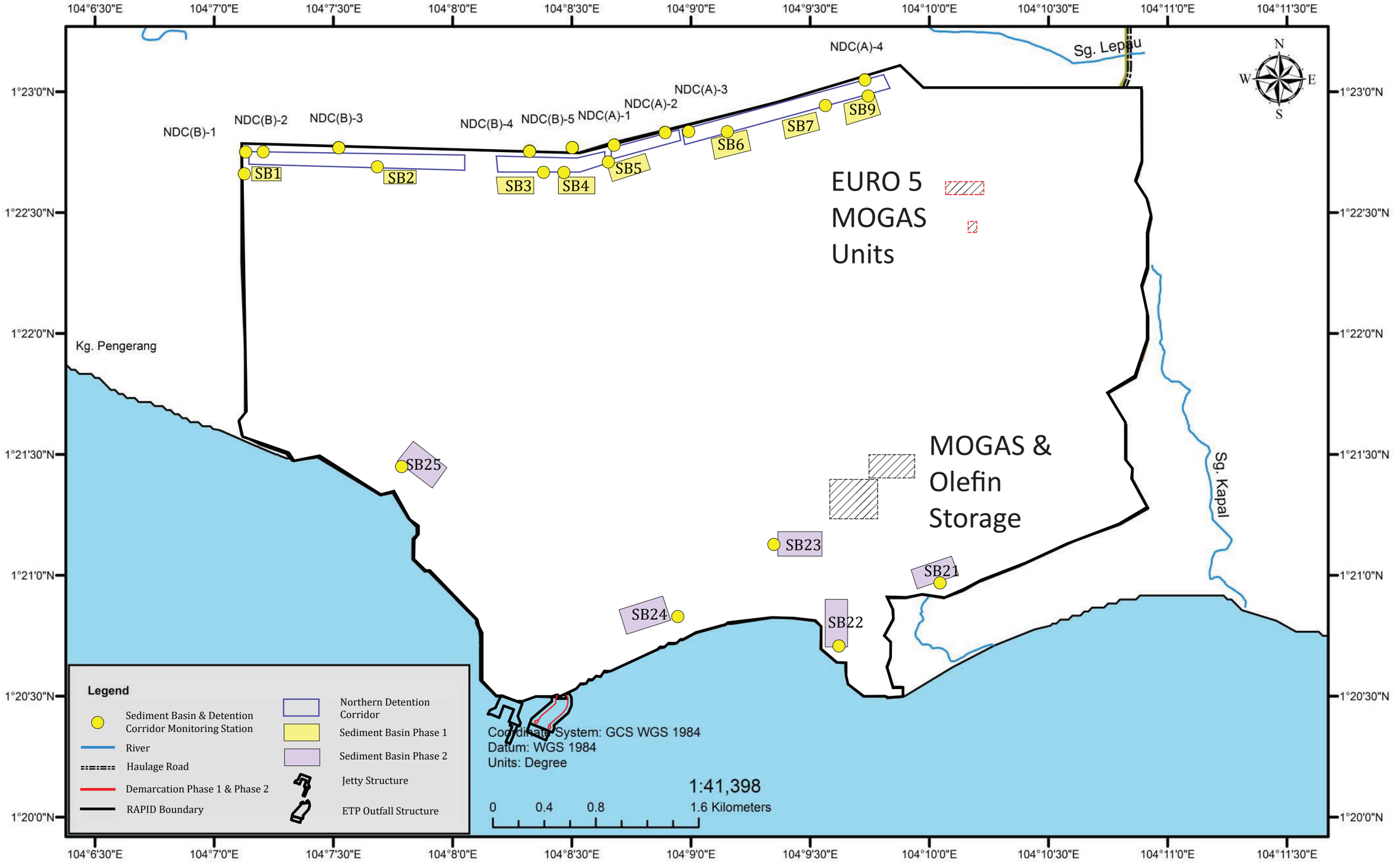


Figure 6-3 : Monitoring Stations for Discharge from Sediment Basins and Detention Corridors during Site Clearing and Site Preparation

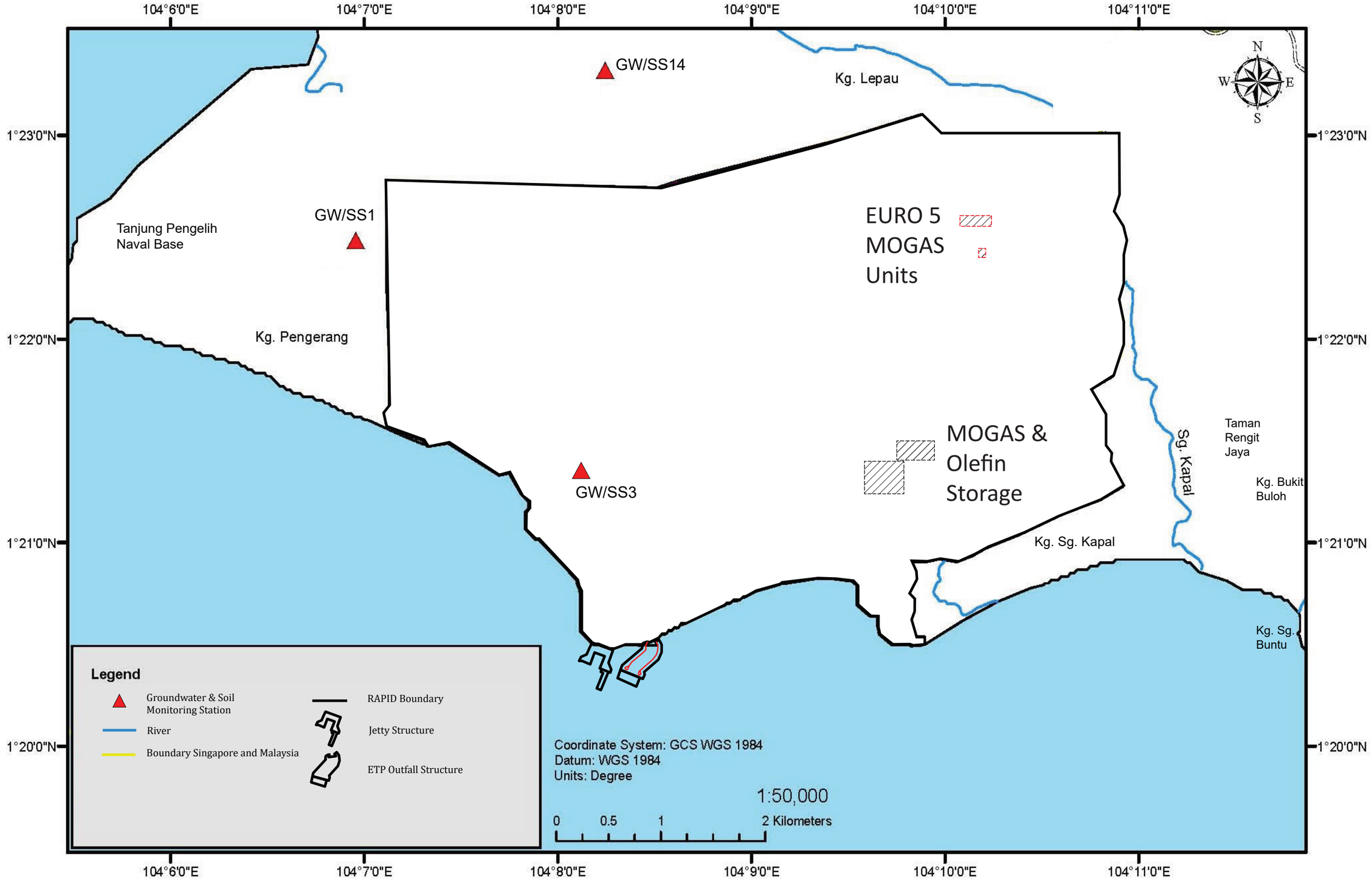


Figure 6-4: Groundwater and Soil Monitoring Stations during Site Clearing and Site Preparation

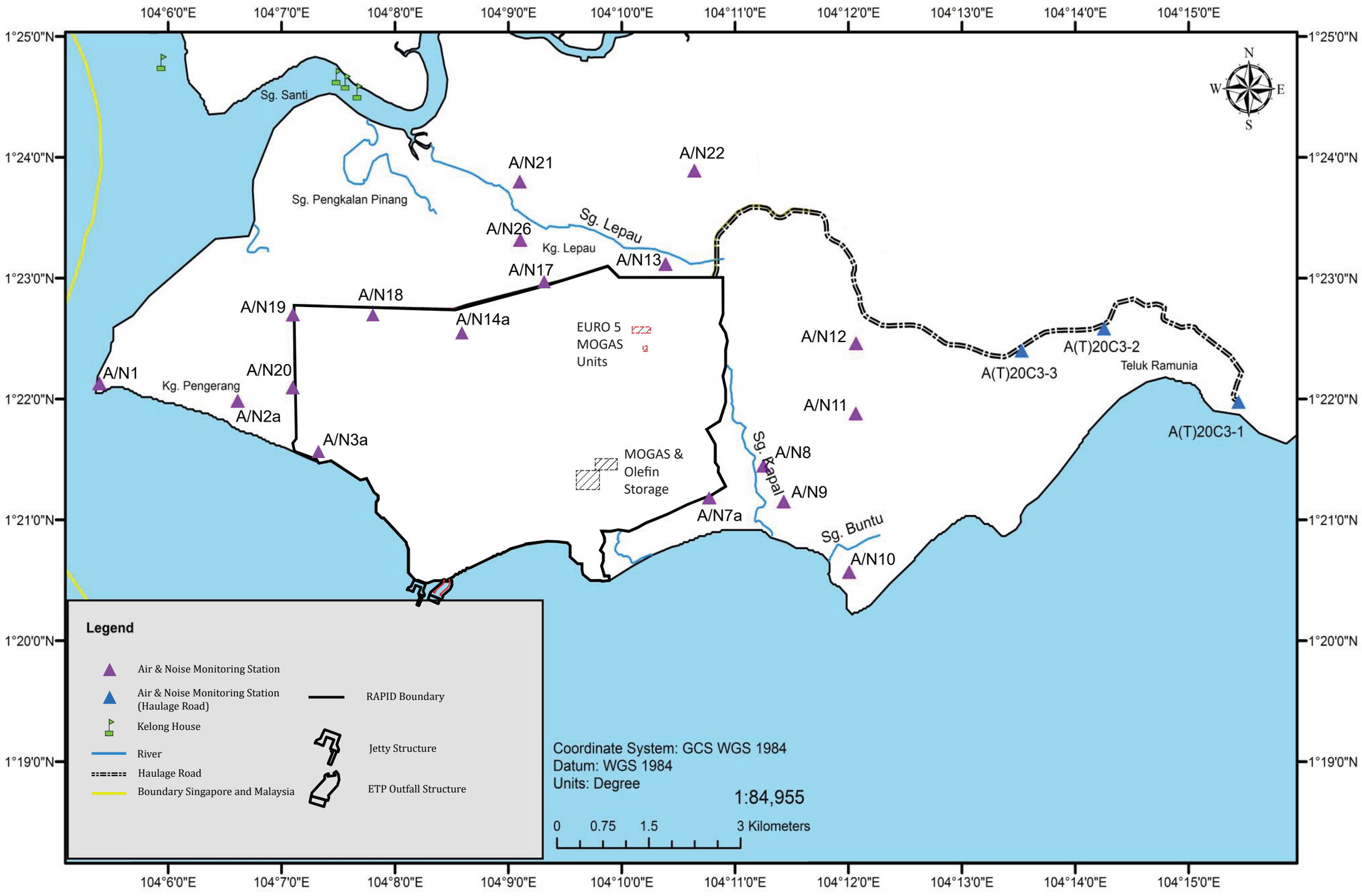


Figure 6-5 : Air Quality and Noise Level Monitoring Stations during Site Clearing and Site Preparation

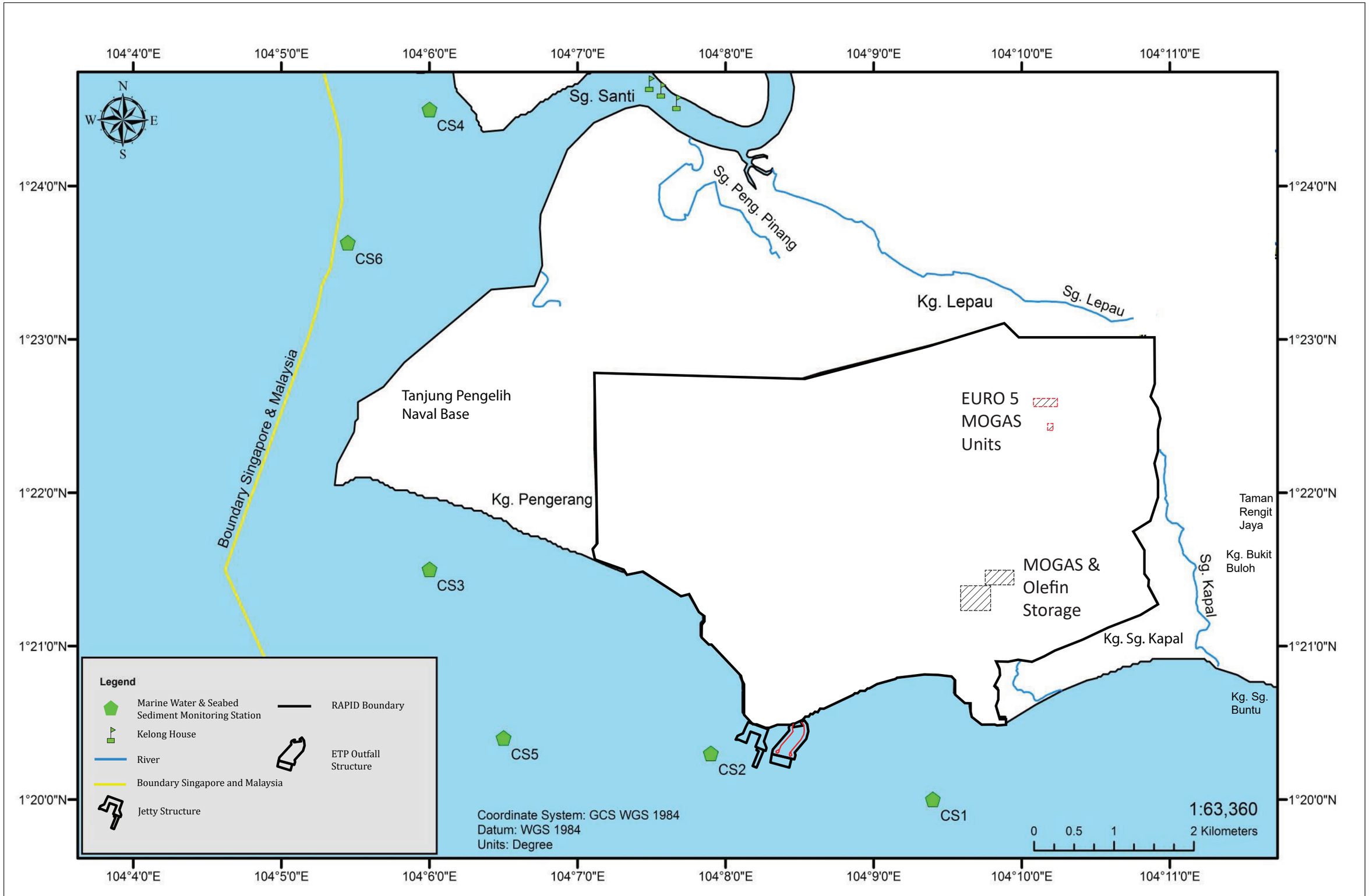


Figure 6-6: Marine Water and Seabed Sediment Monitoring Stations during Site Clearing and Site Preparation

6.4.2 Environmental Monitoring for Construction Stage

At the construction stage, the monitoring locations for river water, marine water, groundwater, soil and surface water from detention basins that are located outside the RAPID Refinery Cracker Complex and also outside of the other components in the RAPID Complex shall be continued to be monitored by the Project Proponent. The frequency of monitoring and audit reporting shall be maintained as the current ongoing monitoring exercise (refer to **Section 6.4.1**).

The requirement for monitoring program at the construction stage for each of the EURO 5 MOGAS and Olefin Storage Tanks is incorporated as part of the tender document for the Contractors to implement. The scope of the environmental monitoring to be conducted by the Contractor within their own work site are:

a) Surface water quality;

b) Groundwater and soil quality;

c) Ambient air quality; and

d) Noise level.

The monitoring program under this EMP during construction shall be tied up with the followings:

a) Locations of the drainage network within each of the EURO 5 MOGAS and Olefin Storage Tanks working area that are tied up with the main construction drainage for RAPID Complex;
b) Location of the storage areas for the chemical, diesel skip and genset and waste storage area;
c) Location at the boundary of the Contractor's work area .

As per the **RAPID DEIA 2012 Conditions of Approval No. 12** where it states that the EMP is to be submitted to the State DOE and is to be revised from time to time to suit the requirements of the progress of the project activities.

6.4.2.1 Surface Water Monitoring

The locations, parameters and frequency for surface water monitoring during construction of the EURO 5 MOGAS and Olefin Storage Tank units are presented in **Table 6-5** – **Table 6-8** and shown in **Figure 6-7** – **Figure 6-10**.

Results shall be in compliance with the RAPID DEIA 2012 Approval Condition No. 42 which states the following:

i. Turbidity not exceeding 250 Nephelometric Turbidity Unit (NTU); and

ii. The Total Suspended Solids, TSS greater than 50 mg/l, with an option to be monitored to meet Standard B discharge due to construction activities may involve usage of diesel and chemicals that may be spilled into the drainage network and later carried over by surface runoff into the receiving water bodies.

As construction works progressively, the site is to be paved and covered and therefore the monitoring of turbidity and TSS only shall not be relevant. To meet the RAPID DEIA 2012 Conditions of Approval Item 12, as construction activities involve the usage of chemical, diesel and schedule waste, it is recommended to monitor other salient water quality parameters such as oil and grease, heavy metals and inorganic parameters and this is to be confirmed at later stage when Contractor's site work plan is obtained.

6.4.2.2 Groundwater and Soil Quality Monitoring:

A baseline soil and groundwater monitoring shall be established prior to the construction of each of the EURO 5 MOGAS and Olefin Storage Tank units. The baseline is to be selected at the boundary of the Contractor's work area and data is to be used as the benchmark in future monitoring exercises.

Other location of the soil and groundwater monitoring will be at potential spillage location such as the schedule waste and chemical storage area and the diesel skip and generator set area. The soil and groundwater quality shall be compared against the Contaminated Land Management and Control Guidelines No. 1: Site Screening Levels published by the DOE.

The soil and groundwater quality monitoring for each of the EURO 5 MOGAS and Olefin Storage Tanks units, including the monitoring location, parameter and frequency for each process unit is tabulated in **Table 6-5** – **Table 6-8** and shown in **Figure 6-7** – **Figure 6-10**.

A minimum of two (2) groundwater monitoring wells are proposed for each unit, positioned at the boundary selected based on the up-gradient and down-gradient locations of anticipated groundwater flow directions (determined based on the outcome of groundwater hydrogeological regime study shown in Appendix 7, Volume 2 of the RAPID PETCHEM DEIA 2014). A monitoring location is also required at the location of the potential spillage area where the well is positioned close to the scheduled waste/chemical/diesel storage area.

6.4.2.3 Ambient Air Monitoring

A baseline ambient air monitoring shall be established prior to the construction of each of the EURO 5 MOGAS and Olefin Storage Tank units and the baseline data is to be used as the benchmark in future monitoring exercises. The proposed locations, parameters, and frequency for ambient air monitoring during construction of the EURO 5 MOGAS and Olefin Storage Tank units are presented in **Table 6-5** – **Table 6-8** and shown in **Figure 6-7** – **Figure 6-10**. Ambient air levels shall be in compliance with the limits stipulated in the Malaysia Ambient Air Quality Standard (MAAQS) 2013. Monitoring is to include the PM2.5 parameters consistent with the Malaysia Ambient Air Quality Standard (MAAQS) 2013 and Singapore requirements for ambient air monitoring.

6.4.2.4 Noise Monitoring

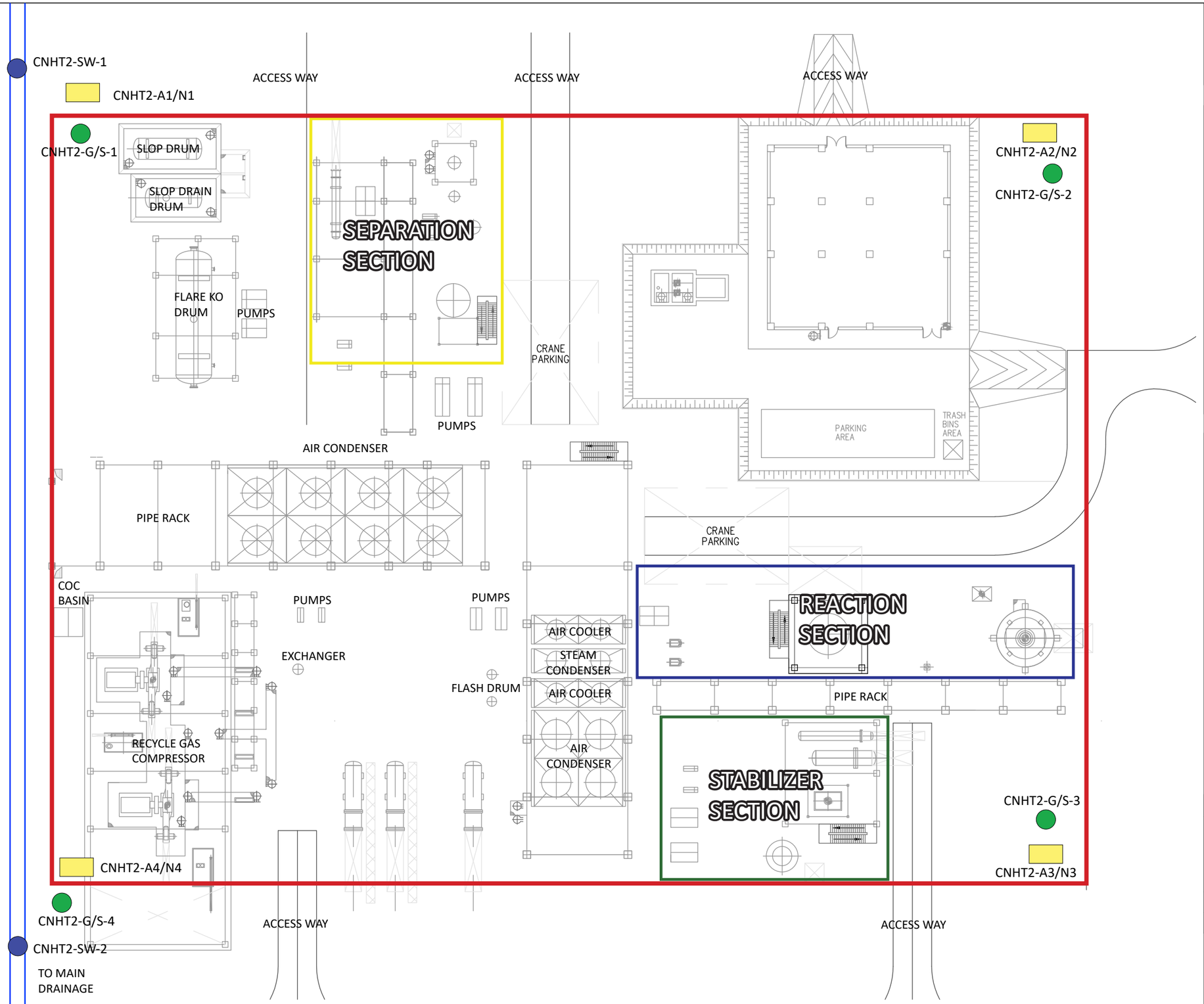
Similarly, a baseline noise level monitoring shall be established at the boundary of the Contractor's work area prior to commencement of the construction activities. The proposed noise monitoring locations for each process unit shall be at its boundary (north, east, south, and west boundaries); to be carried out on quarterly basis, for day time (7am – 10pm) and night time (10pm – 7am).

Noise levels shall be in compliance with the limits stipulated in the RAPID DEIA 2012 Approval Condition No. 58, i.e. not exceeding 55 dB(A) for day time (7am – 10pm) and not exceeding 45 dB(A) for night time (10pm – 7am). The proposed noise monitoring stations are as given in **Table 6-5** – **Table 6-8** and shown in **Figure 6-7** – **Figure 6-10**.

Table 6-5 Proposed Sampling Locations and Monitoring Frequency for EURO 5 MOGAS - CNHT2 during Construction Stage

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
CNHT2 (refer to **Figure 6-7**)	**A. Groundwater and Soil Quality Monitoring**				
	CNHT2-G/S-1	At the northwestern corner boundary of the process unit	Quarterly for groundwater and six-monthly for soil monitoring	Volatile organic compounds (VOC) – including benzene, toluene, ethylbenzene and xylenes (BTEX), semi volatile organic compounds (SVOC) – including polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) and heavy metals (13 metals: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, zinc and mercury)	Contaminated Land Management: SSLs (Site screening levels)
	CNHT2-G/S-2	At the northeastern corner boundary of the process unit			
	CNHT2-G/S-3	At the southeastern corner boundary of the process unit			
	CNHT2-G/S-4	At the southeastern corner boundary of the process unit			
	B. Ambient Air Monitoring				
	CNHT2-A1	At the northwestern corner boundary of the process unit	Monthly	Particulate Matter(PM_{10}), Particulate Matter 2.5 ($PM_{2.5}$), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Ground Level Ozone (O_3), and Carbon Monoxide (CO).	Malaysia Ambient Air Quality Guideline (MAAQG) 2013
	CNHT2-A2	At the northeastern corner boundary of the process unit			
	CNHT2-A3	At the southeastern corner boundary of the process unit			
	CNHT2-A4	At the southwestern corner boundary of the process unit			
	C. Noise Monitoring				
	CNHT2-N1	At the northwestern corner boundary of the process unit	Monthly	Monitoring for day time and night time	RAPID DEIA 2012 Approval Condition No. 58: a) Not exceeding
	CNHT2-N2	At the northeastern corner boundary of the process unit			

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
	CNHT2-N3	At the southeastern corner boundary of the process unit			55 dB(A) for day time b) Not exceeding 45 dB(A) for night time
	CNHT2-N4	At the southwestern corner boundary of the process unit			
	D. Surface Water Monitoring				
	CNHT2-SW-1	At the upstream drainage, south of the process unit before discharge to main drainage	Monthly	Turbidity, Total Suspended Solids (TSS); To include relevant parameters to meet surface water quality standards such as oil and grease, heavy metals and inorganic parameters and this is to be confirmed at later stage when Contractor's site work plan is obtained.	RAPID DEIA 2012 Approval Condition No. 42: a) Turbidity not exceeding 250 NTU; b) TSS not exceeding 50 mg/l
	CNHT2-SW-2	At the downstream drainage, south of the process unit before discharge to main drainage			



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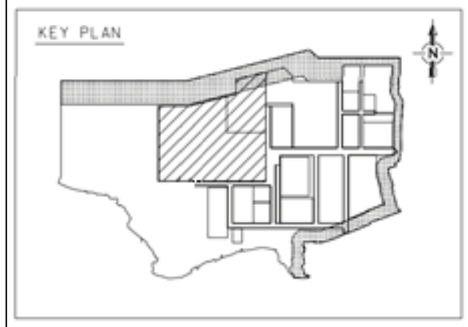

LEGEND

- CNHT 2 Unit Boundary
- Ambient Air & Noise Level Monitoring Point
- Soil & Groundwater Monitoring Point
- Surface Water Monitoring Point
- Drainage
- Direction of Groundwater Flow

PROJECTION PARAMETERS

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Additional Information To The DEIA Refinery & Petrochemical Integrated Development (RAPID) Project, Pengerang Johor, 2012 To Include EURO 5 MOGAS & Olefin Tank Units

Proposed Environmental Monitoring Points for EURO 5 MOGAS - CNHT2 Unit during Construction Phase

FIGURE 6-7

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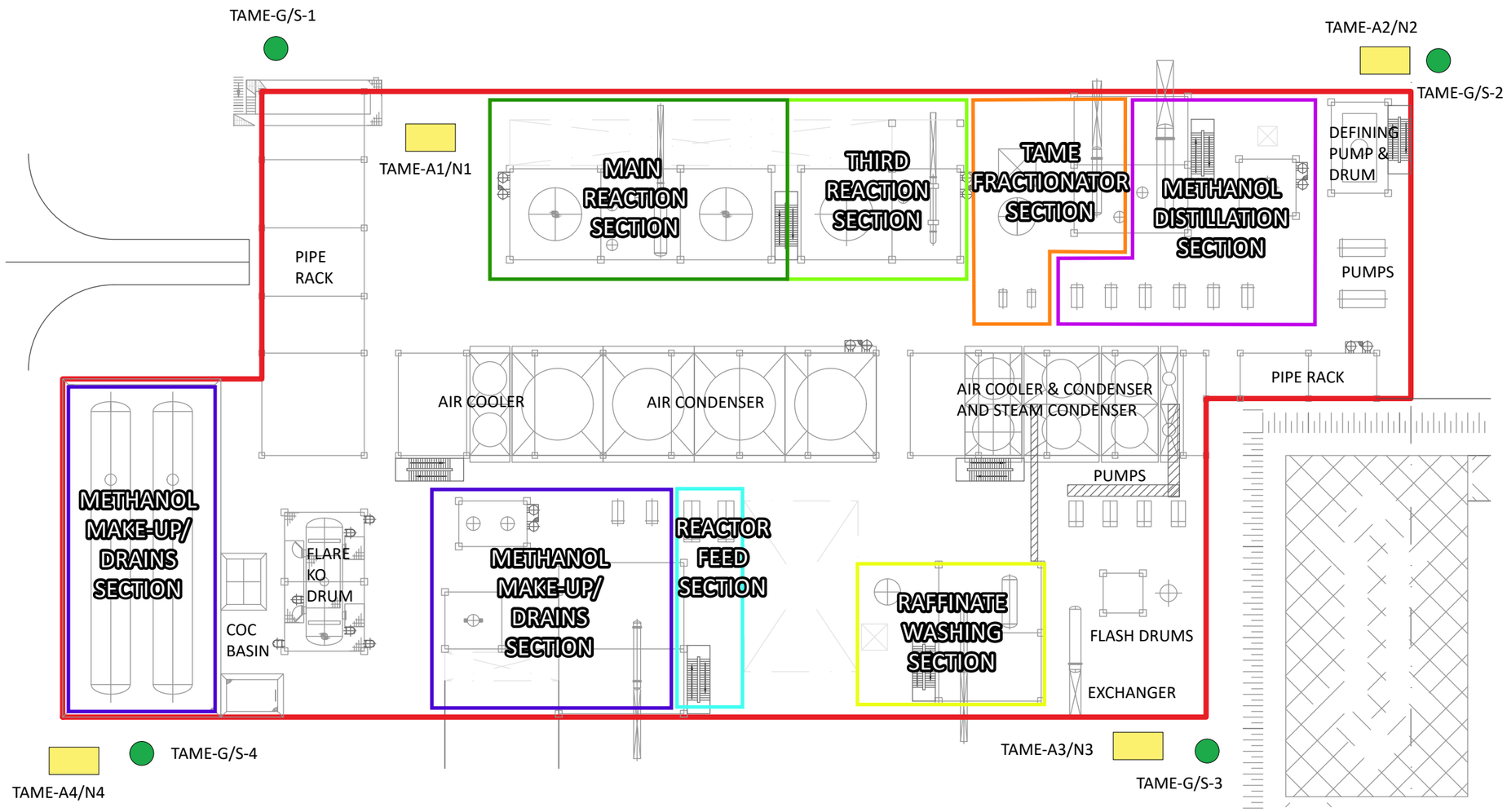
Table 6-6 Proposed Sampling Locations and Monitoring Frequency for EURO 5 MOGAS - TAME during Construction Stage

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
TAME (refer to **Figure 6-8**)	**A. Groundwater and Soil Quality Monitoring**				
	TAME-G/S-1	At the northwestern corner boundary of the process unit	Quarterly for groundwater and six-monthly for soil monitoring	Volatile organic compounds (VOC) – including benzene, toluene, ethylbenzene and xylenes (BTEX), semi volatile organic compounds (SVOC) – including polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) and heavy metals (13 metals: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, zinc and mercury)	Contaminated Land Management: SSLs (Site screening levels)
	TAME-G/S-2	At the northeastern corner boundary of the process unit			
	TAME-G/S-3	At the southeastern corner boundary of the process unit			
	TAME-G/S-4	At the southwestern corner boundary of the process unit			
	B. Ambient Air Monitoring				
	TAME-A1	At the northwestern corner boundary of the process unit	Monthly	Particulate Matter (PM_{10}), Particulate Matter 2.5 ($PM_{2.5}$), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Ground Level Ozone (O_3), and Carbon Monoxide (CO).	Malaysia Ambient Air Quality Guideline (MAAQG) 2013
	TAME-A2	At the northeastern corner boundary of the process unit			
	TAME-A3	At the southeastern corner boundary of the process unit			
	TAME-A4	At the southwestern corner boundary of the process unit			
	C. Noise Monitoring				
	TAME-N1	At the northwestern corner boundary of the process unit	Monthly	Monitoring for day time and night time	RAPID DEIA 2012 Approval Condition No. 58: a) Not exceeding
	TAME-N2	At the northeastern corner boundary of the process unit			

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
	TAME-N3	At the southeastern corner boundary of the process unit			55 dB(A) for day time b) Not exceeding 45 dB(A) for night time
	TAME-N4	At the southwestern corner boundary of the process unit			
	D. Surface Water Monitoring (Not required as no drainage at TAME unit. Surface water is monitored at Isomerization Unit drainage				



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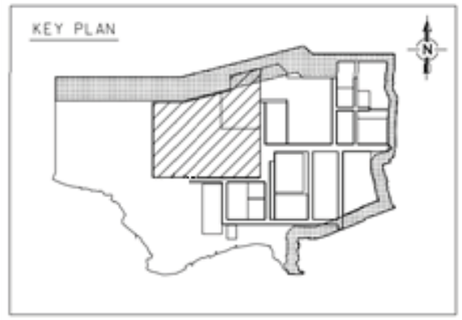

LEGEND

- TAME Unit Boundary
- Ambient Air & Noise Level Monitoring Point
- Soil & Groundwater Monitoring Point
- Surface Water Monitoring Point
- Drainage
- Direction of Groundwater Flow

PROJECTION PARAMETERS

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Additional Information To The DEIA Refinery & Petrochemical Integrated Development (RAPID) Project, Pengerang Johor, 2012 To Include EURO 5 MOGAS & Olefin Tank Units

Proposed Environmental Monitoring Points for EURO 5 MOGAS - TAME Process Unit during Construction Phase

FIGURE 6-8

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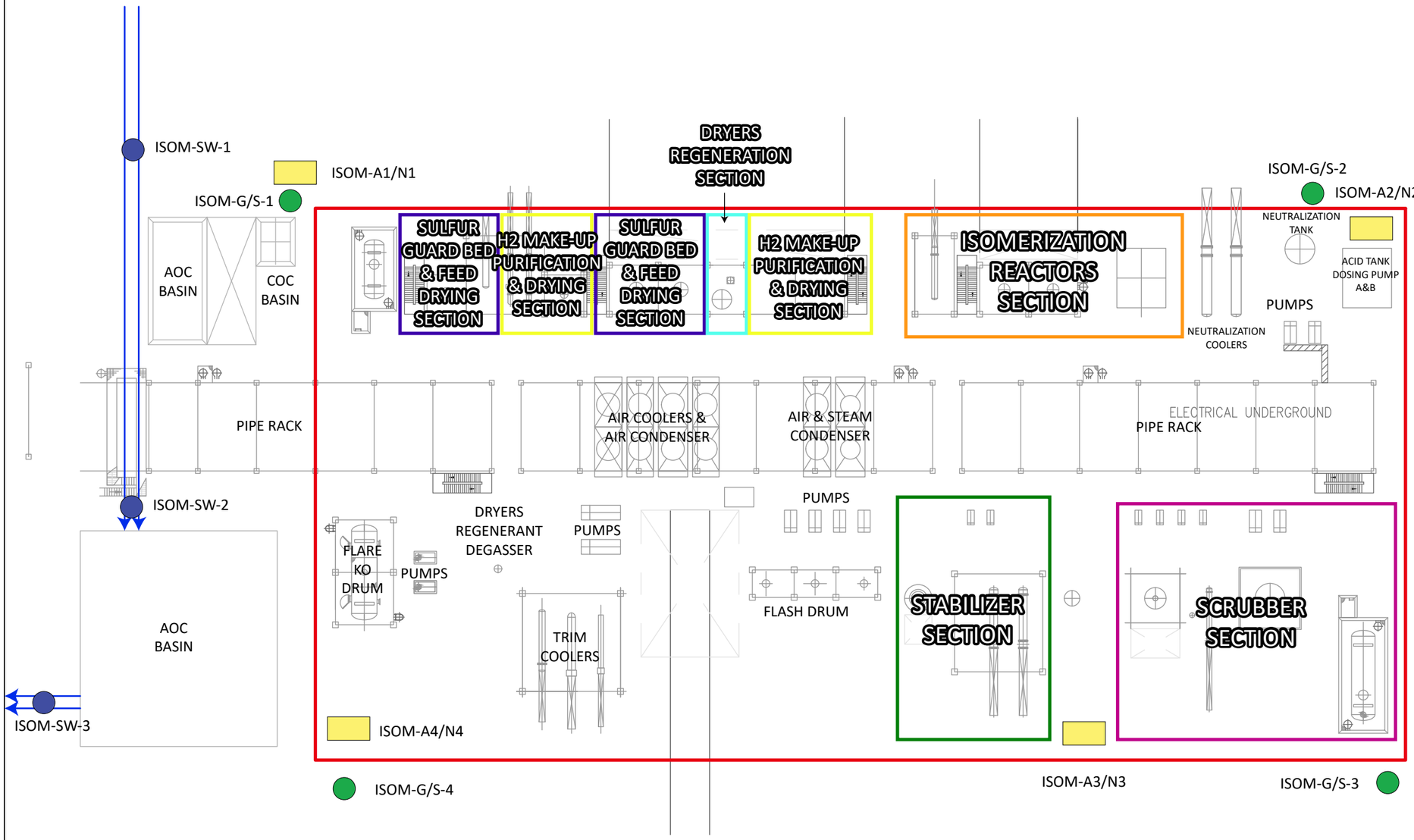
Table 6-7 Proposed Sampling Locations and Monitoring Frequency for EURO 5 MOGAS - Isomerization unit (ISOM) during Construction Stage

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
Isomerization Unit (ISOM) (refer to **Figure 6-9**)	**A. Groundwater and Soil Quality Monitoring**				
	ISOM-G/S-1	At the northwestern corner boundary of the process unit	Quarterly for groundwater and six-monthly for soil monitoring	Volatile organic compounds (VOC) – including benzene, toluene, ethylbenzene and xylenes (BTEX), semi volatile organic compounds (SVOC) – including polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) and heavy metals (13 metals: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, zinc and mercury)	Contaminated Land Management: SSLs (Site screening levels)
	ISOM-G/S-2	At the northeastern corner boundary of the process unit			
	ISOM-G/S-3	At the southeastern corner boundary of the process unit			
	ISOM-G/S-4	At the southwestern corner boundary of the process unit			
	B. Ambient Air Monitoring				
	ISOM -A1	At the northwestern corner boundary of the process unit	Monthly	Particulate Matter (PM_{10}), Particulate Matter 2.5 ($PM_{2.5}$), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Ground Level Ozone (O_3), and Carbon Monoxide (CO).	Malaysia Ambient Air Quality Guideline (MAAQG) 2013
	ISOM-A2	At the northeastern corner boundary of the process unit			
	ISOM-A3	At the southeastern corner boundary of the process unit			
	ISOM-A4	At the southwestern corner boundary of the process unit			
	C. Noise Monitoring				
	ISOM-N1	At the northwestern corner boundary of the process unit	Monthly	Monitoring for day time and night time	RAPID DEIA 2012 Approval Condition No. 58: a) Not exceeding
	ISOM-N2	At the northeastern corner boundary of the process unit			

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
	ISOM-N3	At the southeastern corner boundary of the process unit			55 dB(A) for day time b) Not exceeding 45 dB(A) for night time
	ISOM-N4	At the southwestern corner boundary of the process unit			
	D. Surface Water Monitoring				
	ISOM-SW-1	At the northwestern corner of drainage (upstream) before entering AOC basin	Monthly	Turbidity, Total Suspended Solids (TSS); To include relevant parameters to meet surface water quality standards such as oil and grease, heavy metals and inorganic parameters and this is to be confirmed at later stage when Contractor's site work plan is obtained.	RAPID DEIA 2012 Approval Condition No. 42: a) Turbidity not exceeding 250 NTU; b) TSS not exceeding 50 mg/l
	ISOM-SW-2	At the southwestern corner of drainage (downstream) before entering AOC basin			
	ISOM-SW-3	At the southwestern corner of drainage (downstream) before discharge to main drainage			



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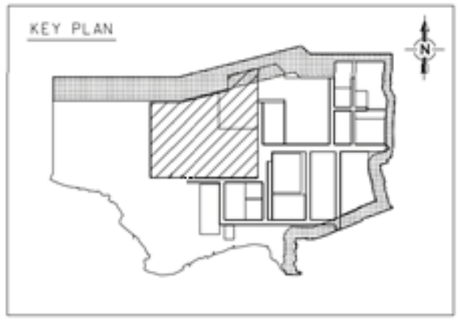

LEGEND

- Isomerization Unit Boundary
- Ambient Air & Noise Level Monitoring Point
- Soil & Groundwater Monitoring Point
- Surface Water Monitoring Point
- Drainage
- Direction of Groundwater Flow

PROJECTION PARAMETERS

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Additional Information To The DEIA Refinery & Petrochemical Integrated Development (RAPID) Project, Pengerang Johor, 2012 To Include EURO 5 MOGAS & Olefin Tank Units

Proposed Environmental Monitoring Points for EURO 5 MOGAS - Isomerization Unit during Construction Phase

FIGURE 6-9

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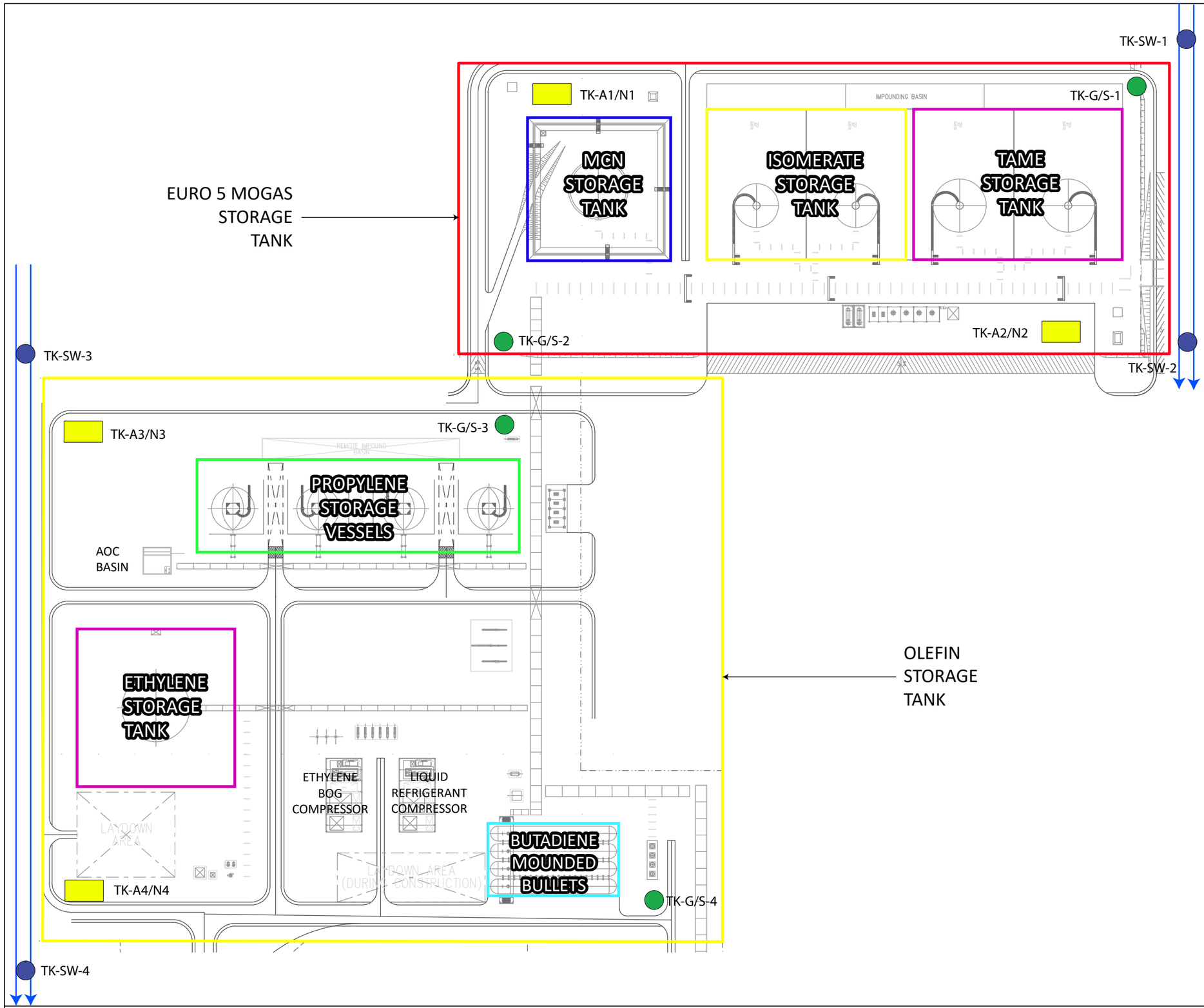
Table 6-8 Proposed Sampling Locations and Monitoring Frequency for MOGAS & Additional Olefin Storage Tankages during Construction Stage

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
MOGAS & Additional Olefin Storage Tankages (TK) (refer to **Figure 6-10**)	**A. Groundwater and Soil Quality Monitoring**				
	TK-G/S-1	At the northeastern corner boundary of MOGAS Storage Tank	Quarterly for groundwater and six-monthly for soil monitoring	Volatile organic compounds (VOC) – including benzene, toluene, ethylbenzene and xylenes (BTEX), semi volatile organic compounds (SVOC) – including polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) and heavy metals (13 metals: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, zinc and mercury)	Contaminated Land Management: SSLs (Site screening levels)
	TK -G/S-2	At the southwestern corner boundary of MOGAS Storage Tank			
	TK -G/S-3	At the northeastern corner boundary of Olefin Storage Tank			
	TK -G/S-4	At the southeastern corner boundary of Olefin Storage Tank			
	B. Ambient Air Monitoring				
	TK -A1	At the northwestern corner boundary of MOGAS Storage Tank	Monthly	Particulate Matter (PM_{10}), Particulate Matter 2.5 ($PM_{2.5}$), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Ground Level Ozone (O_3), and Carbon Monoxide (CO).	Malaysia Ambient Air Quality Guideline (MAAQG) 2013
	TK -A2	At the southeastern corner boundary of MOGAS Storage Tank			
	TK -A3	At the northwestern corner boundary of Olefin Storage Tank			
	TK -A4	At the southwestern corner boundary of Olefin Storage Tank			
	C. Noise Monitoring				
	TK -N1	At the northwestern corner boundary of MOGAS Storage Tank	Monthly	Monitoring for day time and night time	RAPID DEIA 2012 Approval Condition No. 58: a) Not exceeding
	TK -N2	At the southeastern corner boundary of MOGAS Storage Tank			

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
	TK -N3	At the northwestern corner boundary of Olefin Storage Tank			55 dB(A) for day time b) Not exceeding 45 dB(A) for night time
	TK -N4	At the southwestern corner boundary of Olefin Storage Tank			
	D. Surface Water Monitoring				
	TK -SW-1	At the upstream drainage, east of the MOGAS Storage Tank before discharge to main drainage	Monthly	Turbidity, Total Suspended Solids (TSS); To include relevant parameters to meet surface water quality standards such as oil and grease, heavy metals and inorganic parameters and this is to be confirmed at later stage when Contractor's site work plan is obtained.	RAPID DEIA 2012 Approval Condition No. 42: a) Turbidity not exceeding 250 NTU; b) TSS not exceeding 50 mg/l
	TK -SW-2	At the downstream drainage, east of the MOGAS Storage Tank before discharge to main drainage			
	TK -SW-3	At the upstream drainage, west of the Olefin Storage Tank before discharge to main drainage			
	TK -SW-4	At the upstream drainage, west of the Olefin Storage Tank before discharge to main drainage			



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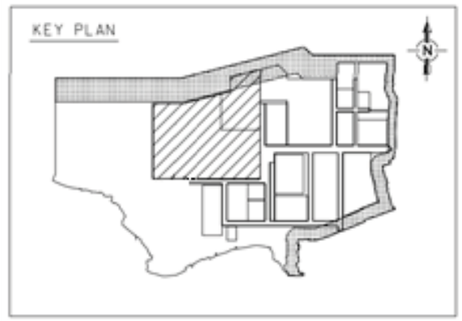

LEGEND

- MOGAS Storage Tank Unit Boundary
- Olefin Storage Tank Unit Boundary
- Ambient Air & Noise Level Monitoring Point
- Soil & Groundwater Monitoring Point
- Surface Water Monitoring Point
- Drainage
- Direction of Groundwater Flow

PROJECTION PARAMETERS

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Additional Information To The DEIA Refinery & Petrochemical Integrated Development (RAPID) Project, Pengerang Johor, 2012 To Include EURO 5 MOGAS & Olefin Tank Units

Proposed Environmental Monitoring Points for EURO 5 MOGAS & Additional Olefin Storage Tankages Unit during Construction Phase

FIGURE 6-10

INTEGRATED ENVIROTECH

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6.5 EMP for Operation Phase

The EMP during EURO 5 MOGAS and Olefin Storage Tanks operation will be required to be submitted as per the RAPID DEIA 2012 Conditions of Approval. The environmental monitoring plan is to be implemented within the operating boundary of each of the RAPID EURO 5 MOGAS and Olefin Storage Tank units.

However, the monitoring of the ambient environmental components at identified sensitive locations outside of the RAPID Complex will be conducted by the entity to be set up by RAPID management at a later stage.

6.5.1 Environmental Monitoring for EURO 5 MOGAS and Olefin Storage Tanks at Operation Stage

In general, the monitoring locations for each of the EURO 5 MOGAS and Olefin Storage Tanks during operation should be at the same locations where the baseline was taken at the boundary i.e. prior to the construction works. The ambient environmental monitoring will have to be continuously monitored at these locations.

The environmental monitoring shall be conducted for the following environmental parameters during operation period:

a) Groundwater and soil quality;

b) Gaseous emission (stack);

c) Ambient air quality; and

d) Ambient noise level.

A summary of the monitoring parameters during operation of EURO 5 MOGAS and Olefin Storage Tanks are given in **Table 6-9** – **Table 6-12**.

6.5.1.1 Groundwater and Soil Quality Monitoring

The groundwater and soil quality monitored during operation shall be compared against the Contaminated Land Management and Control Guidelines No. 1: Site Screening Levels published by the DOE as well as the baseline data taken prior to the construction of the EURO 5 MOGAS and Olefin Storage Tanks.

Similar to the construction phase, the location of the groundwater and soil quality is to be identified where there are location of potential spillage of toxic and hazardous materials and this include the scheduled waste and chemical storage area.

The monitoring location, parameter and frequency for groundwater and soil quality monitoring is tabulated in **Table 6-9** – **Table 6-12** and shown in **Figure 6-11** – **Figure 6-14.**

6.5.1.2 Stack Monitoring

The stack monitoring, including the location/ sources, parameters, and frequency for air emission are presented in **Table 6-9** – **Table 6-12.** There are no emission for EURO 5 MOGAS units. The only emission source to the atmosphere is flue gas from the 2nd HDS Reactor Heater. All gaseous emission from the additional storage tanks for EURO 5 MOGAS Unit shall be sent to the Refinery Tank Farm Flare. Emission from the sources shall be in compliance with the emission standards specified in Volume I: Guideline for the Installation & Maintenance of Continuous Emission Monitoring Systems (CEMS) Version 6.0 of Nov 2009 (refer to RAPID DEIA 2012 Approval Condition No. 50).

6.5.1.3 Ambient Air Monitoring

The locations, parameters, and frequency for ambient air monitoring are presented in **Table 6-9** – **Table 6-12** and shown in **Figure 6-11** – **Figure 6-14**. Ambient air levels shall be compared with the baseline data taken prior to the construction of the EURO 5 MOGAS and Olefin Storage Tanks and should be in compliance with the limits stipulated in the Malaysia Ambient Air Quality Guideline (MAAQG) 2013.

6.5.1.4 Noise Monitoring

The locations, parameters, and frequency for noise monitoring are presented in **Table 6-9** – **Table 6-12** and shown in **Figure 6-11** – **Figure 6-14**. Noise levels shall be compared with the baseline data taken prior to the construction of the units and should be in compliance with the limits stipulated in the RAPID DEIA 2012 Approval Condition No. 58 i.e. not exceeding 55 dB(A) for day time (7am – 10pm) and not exceeding 45 dB(A) for night time (10pm – 7am).

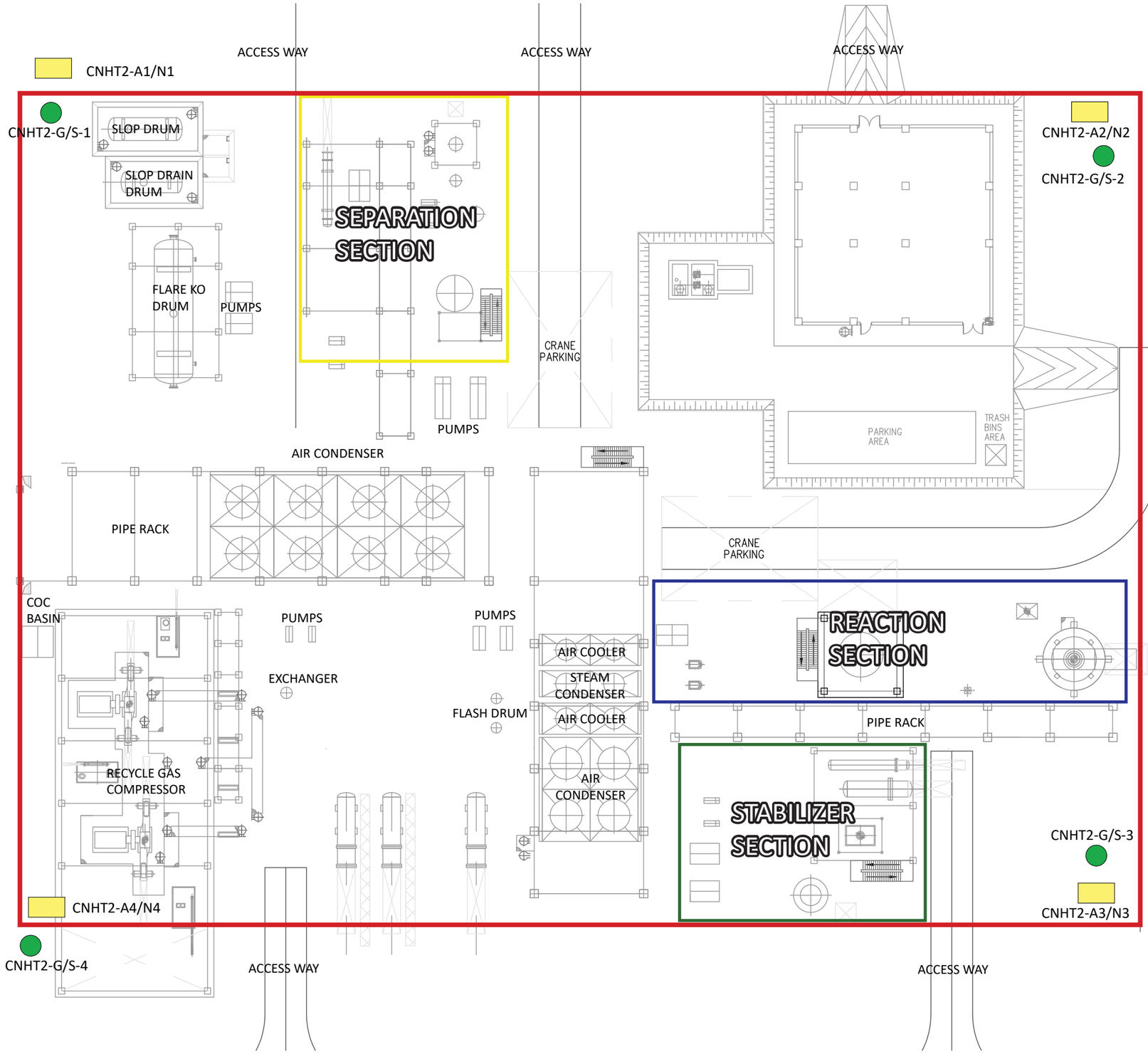
6.5.1.5 Surface Water Monitoring

As the surface water runoff into the stormwater pond is designed such a way to only cater for the non contaminated surface runoff. Hence the discharge from the drainage into the Stormwater Pond is considered clean. The contaminated surface runoff from the paved process areas in the EURO 5 MOGAS and Olefin Storage Tank units shall be directed to the AOC drain and routed to Centralised ETP for treatment prior to discharge into the ETP outfall and the coast. Hence, no surface water runoff monitoring will be required.

Table 6-9 Proposed Sampling Locations and Monitoring Frequency for EURO 5 MOGAS - CNHT2 during Operation Stage

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
CNHT2 (refer to **Figure 6-11)**	**A. Groundwater and Soil Quality Monitoring**				
	CNHT2-G/S-1	At the northwestern corner boundary of the process unit	Every six monthly	Volatile organic compounds (VOC) – including benzene, toluene, ethylbenzene and xylenes (BTEX), semi volatile organic compounds (SVOC) – including polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) and heavy metals (13 metals: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, zinc and mercury)	Contaminated Land Management: SSLs (Site screening levels)
	CNHT2-G/S-2	At the northeastern corner boundary of the process unit			
	CNHT2-G/S-3	At the southeastern corner boundary of the process unit			
	CNHT2-G/S-4	At the southeastern corner boundary of the process unit			
	B. Stack Monitoring (Stack monitoring not required as no emission from CNHT2. The nearest emission source is from CNHT1)				
	C. Ambient Air Monitoring				
	CNHT2-A1	At the northwestern corner boundary of the process unit	Quarterly	Particulate Matter (PM10), Particulate Matter 2.5 (PM2.5), Sulphur Dioxide (SO2), Nitrogen Dioxide (NO2), Ground Level Ozone (O3), and Carbon Monoxide (CO)	Malaysia Ambient Air Quality Guideline (MAAQG) 2013
	CNHT2-A2	At the northeastern corner boundary of the process unit			
	CNHT2-A3	At the southeastern corner boundary of the process unit			
	CNHT2-A4	At the southwestern corner boundary of the process unit			
	D. Noise Monitoring				
	CNHT2-N1	At the northwestern corner boundary of the process unit	Quarterly	Monitoring for day time and night time	RAPID DEIA 2014 Approval Condition No. 58: a) Not exceeding 55 dB(A) for day time
	CNHT2-N2	At the northeastern corner boundary of the process unit			

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
	CNHT2-N3	At the southeastern corner boundary of the process unit			b) Not exceeding 45 dB(A) for night time
	CNHT2-N4	At the southwestern corner boundary of the process unit			



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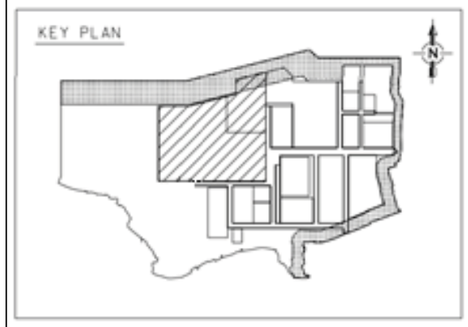

LEGEND

- CNHT 2 Unit Boundary
- Ambient Air & Noise Level Monitoring Point
- Soil & Groundwater Monitoring Point

PROJECTION PARAMETERS

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Additional Information To The DEIA Refinery & Petrochemical Integrated Development (RAPID) Project, Pengerang Johor, 2012 To Include EURO 5 MOGAS & Olefin Tank Units

Proposed Environmental Monitoring Points for EURO 5 MOGAS - CNHT2 Unit during Operation Phase

FIGURE 6-11

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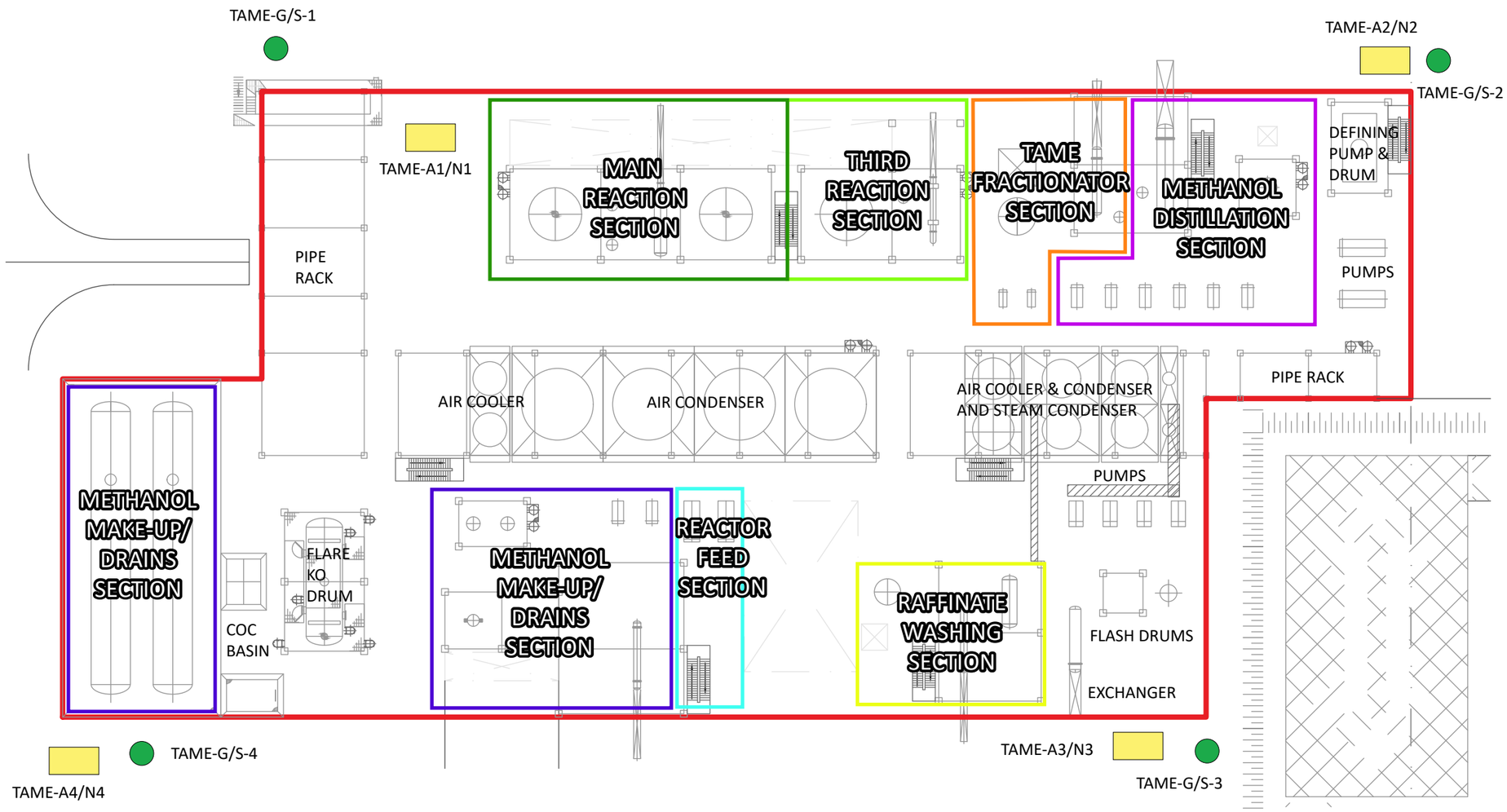
Table 6-10 Proposed Sampling Locations and Monitoring Frequency for EURO 5 MOGAS - TAME during Operation Stage

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
TAME (refer to **Figure 6-12**)	**A. Groundwater and Soil Quality Monitoring**				
	TAME-G/S-1	At the northwestern corner boundary of the process unit	Quarterly for groundwater monitoring and six-monthly for soil monitoring	Volatile organic compounds (VOC) – including benzene, toluene, ethylbenzene and xylenes (BTEX), semi volatile organic compounds (SVOC) – including polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) and heavy metals (13 metals: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, zinc and mercury)	Contaminated Land Management: SSLs (Site screening levels)
	TAME-G/S-2	At the northeastern corner boundary of the process unit			
	TAME-G/S-3	At the southeastern corner boundary of the process unit			
	TAME-G/S-4	At the southwestern corner boundary of the process unit			
	B. Stack Monitoring (Stack monitoring not required as no emission from TAME)				
	C. Ambient Air Monitoring				
	TAME-A1	At the northwestern corner boundary of the process unit	Quarterly	Particulate Matter (PM10), Particulate Matter 2.5 (PM2.5), Sulphur Dioxide (SO2), Nitrogen Dioxide (NO2), Ground Level Ozone (O3), and Carbon Monoxide (CO)	Malaysia Ambient Air Quality Guideline (MAAQG) 2013
	TAME-A2	At the northeastern corner boundary of the process unit			
	TAME-A3	At the southeastern corner boundary of the process unit			
	TAME-A4	At the southwestern corner boundary of the process unit			
	D. Noise Monitoring				
	TAME-N1	At the northwestern corner boundary of the process unit	Quarterly	Monitoring for day time and night time	RAPID DEIA 2012 Approval Condition No. 58: a) Not exceeding 55 dB(A) for day time
	TAME-N2	At the northeastern corner boundary of the process unit			

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
	TAME-N3	At the southeastern corner boundary of the process unit			b) Not exceeding 45 dB(A) for night time
	TAME-N4	At the southwestern corner boundary of the process unit			



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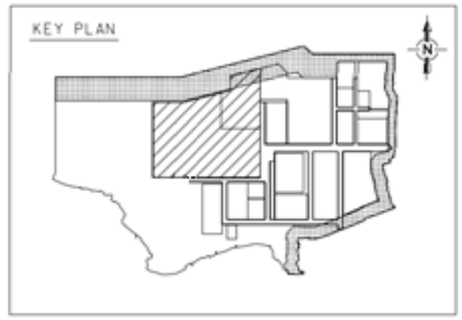

LEGEND

- TAME Unit Boundary
- Ambient Air & Noise Level Monitoring Point
- Soil & Groundwater Monitoring Point

PROJECTION PARAMETERS

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Additional Information To The DEIA Refinery & Petrochemical Integrated Development (RAPID) Project, Pengerang Johor, 2012 To Include EURO 5 MOGAS & Olefin Tank Units

Proposed Environmental Monitoring Points for EURO 5 MOGAS - TAME Process Unit during Operation Phase

FIGURE 6-12

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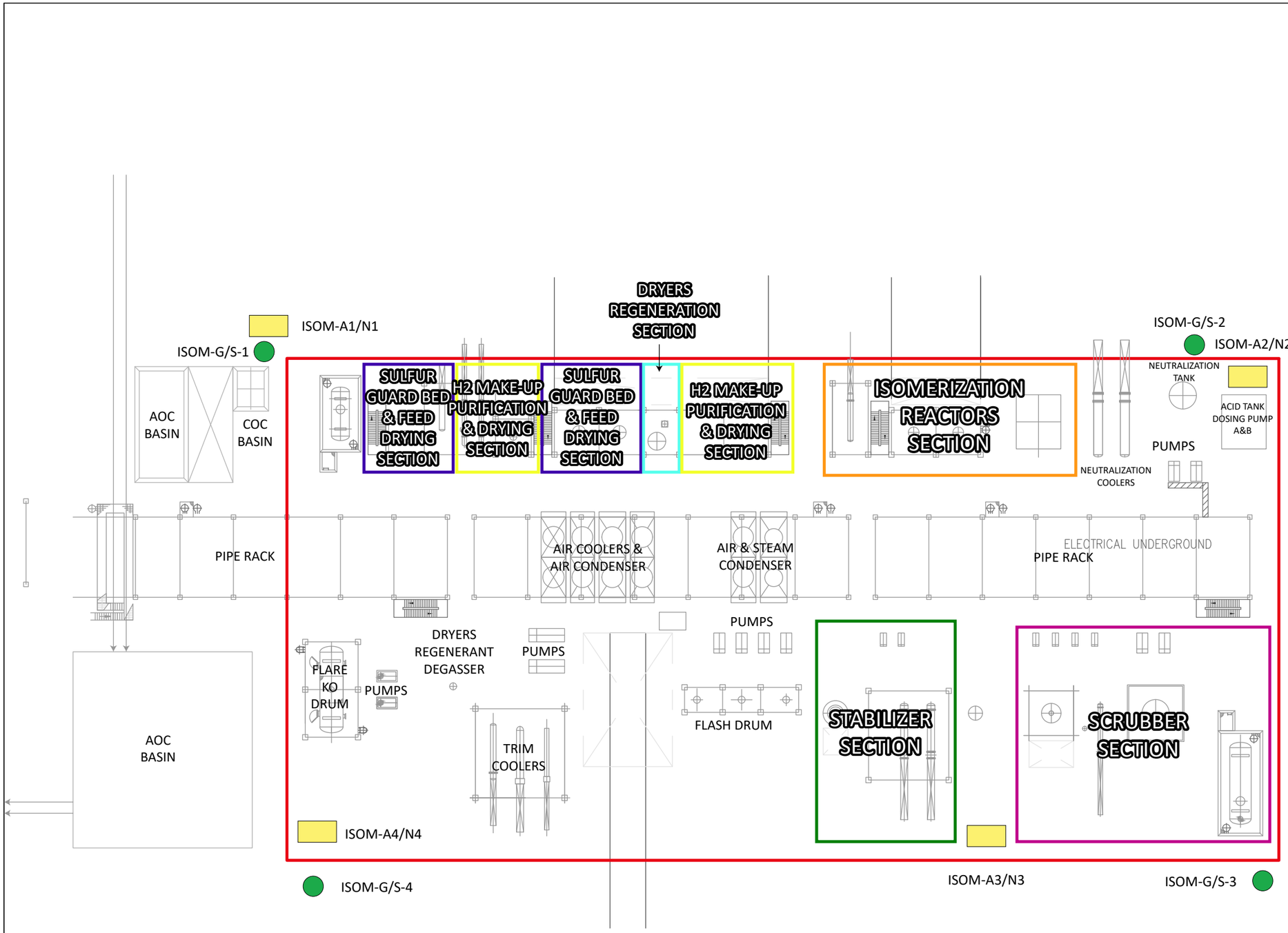
Table 6-11 Proposed Sampling Locations and Monitoring Frequency for EURO 5 MOGAS - Isomerization Unit (ISOM) during Operation Stage

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
Isomerization Unit (ISOM) (refer to **Figure 6-13**)	**A. Groundwater and Soil Quality Monitoring**				
	ISOM-G/S-1	At the northwestern corner boundary of the process unit	Quarterly for groundwater monitoring and six-monthly for soil monitoring	Volatile organic compounds (VOC) – including benzene, toluene, ethylbenzene and xylenes (BTEX), semi volatile organic compounds (SVOC) – including polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) and heavy metals (13 metals: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, zinc and mercury)	Contaminated Land Management: SSLs (Site screening levels)
	ISOM-G/S-2	At the northeastern corner boundary of the process unit			
	ISOM-G/S-3	At the southeastern corner boundary of the process unit			
	ISOM-G/S-4	At the southwestern corner boundary of the process unit			
	B. Stack Monitoring (Stack Monitoring not required as no emission from ISOM)				
	C. Ambient Air Monitoring				
	ISOM -A1	At the northwestern corner boundary of the process unit	Quarterly	Particulate Matter (PM10), Particulate Matter 2.5 (PM2.5), Sulphur Dioxide (SO2), Nitrogen Dioxide (NO2), Ground Level Ozone (O3), and Carbon Monoxide (CO)	Malaysia Ambient Air Quality Guideline (MAAQG) 2013
	ISOM-A2	At the northeastern corner boundary of the process unit			
	ISOM-A3	At the southeastern corner boundary of the process unit			
	ISOM-A4	At the southwestern corner boundary of the process unit			
	D. Noise Monitoring				
	ISOM-N1	At the northwestern corner boundary of the process unit	Quarterly	Monitoring for day time and night time	RAPID DEIA 2012 Approval Condition No. 58: a) Not exceeding 55 dB(A) for day time
	ISOM-N2	At the northeastern corner boundary of the process unit			

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
	ISOM-N3	At the southeastern corner boundary of the process unit			b) Not exceeding 45 dB(A) for night time
	ISOM-N4	At the southwestern corner boundary of the process unit			



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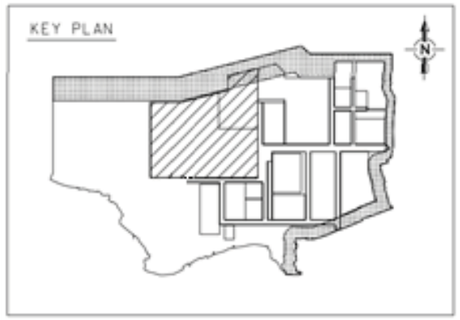

LEGEND

- Isomerization Unit Boundary
- Ambient Air & Noise Level Monitoring Point
- Soil & Groundwater Monitoring Point

PROJECTION PARAMETERS

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Additional Information To The DEIA Refinery & Petrochemical Integrated Development (RAPID) Project, Pengerang Johor, 2012 To Include EURO 5 MOGAS & Olefin Tank Units

Proposed Environmental Monitoring Points for EURO 5 MOGAS - Isomerization Unit during Operation Phase

FIGURE 6-13

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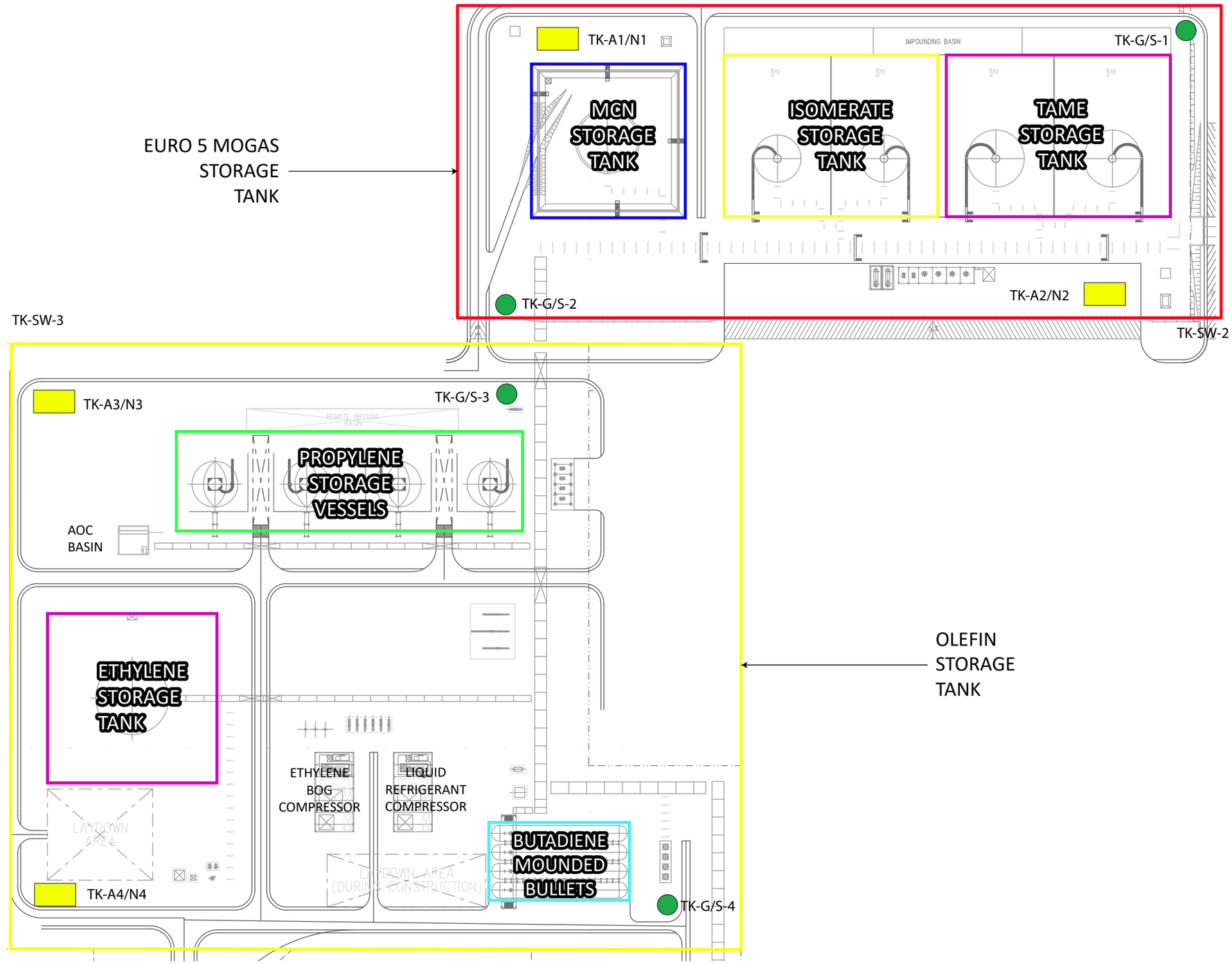
Table 6-12 Proposed Sampling Locations and Monitoring Frequency for MOGAS & Additional Olefin Storage Tankages during Operation Stage

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
MOGAS & Additional Olefin Storage Tankages (TK) (refer to **Figure 6-14**)	**A. Groundwater and Soil Quality Monitoring**				
	TK-G/S-1	At the northwestern corner boundary of the process unit	Quarterly for groundwater monitoring and six-monthly for soil monitoring	Volatile organic compounds (VOC) – including benzene, toluene, ethylbenzene and xylenes (BTEX), semi volatile organic compounds (SVOC) – including polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) and heavy metals (13 metals: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, zinc and mercury)	Contaminated Land Management: SSLs (Site screening levels)
	TK -G/S-2	At the northeastern corner boundary of the process unit			
	TK -G/S-3	At the Scheduled Waste Storage / chemical storage.			
	TK -G/S-4	At the southwestern corner boundary of the process unit			
	B. Stack Monitoring (Not required as no emission from storages. All emission from the additional storage tanks for EURO 5 MOGAS unit shall be sent to the Refinery Tank Farm Flare				
	C. Ambient Air Monitoring				
	TK -A1	At the northwestern corner boundary of MOGAS Storage Tank	Quarterly	Particulate Matter (PM10), Particulate Matter 2.5 (PM2.5), Sulphur Dioxide (SO2), Nitrogen Dioxide (NO2), Ground Level Ozone (O3), and Carbon Monoxide (CO)	Malaysia Ambient Air Quality Guideline (MAAQG) 2013
	TK -A2	At the southeastern corner boundary of MOGAS Storage Tank			
	TK -A3	At the northwestern corner boundary of Olefin Storage Tank			
	TK -A4	At the southwestern corner boundary of Olefin Storage Tank			
	D. Noise Monitoring				
	TK -N1	At the northwestern corner boundary of MOGAS Storage Tank	Quarterly	Monitoring for day time and night time	RAPID DEIA 2012 Approval Condition No. 58: a) Not exceeding 55 dB(A) for day time
	TK -N2	At the southeastern corner boundary of MOGAS Storage Tank			

Process Unit	Sampling Location	Descriptions	Proposed Frequency	Proposed Parameters	Compliance
	TK -N3	At the northwestern corner boundary of Olefin Storage Tank			b) Not exceeding 45 dB(A) for night time
	TK -N4	At the southwestern corner boundary of Olefin Storage Tank			



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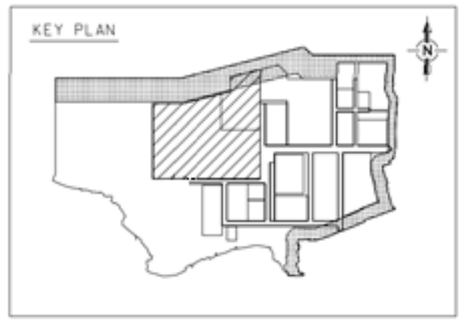

LEGEND

- MOGAS Storage Tank Unit Boundary
- Olefin Storage Tank Unit Boundary
- Ambient Air & Noise Level Monitoring Point
- Soil & Groundwater Monitoring Point

PROJECTION PARAMETERS

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Additional Information To The DEIA Refinery & Petrochemical Integrated Development (RAPID) Project, Pengerang Johor, 2012 To Include EURO 5 MOGAS & Olefin Tank Units

Proposed Environmental Monitoring Points for EURO 5 MOGAS & Additional Olefin Storage Tankages Unit during Operation Phase

FIGURE 6-14

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6.5.2 Environmental Monitoring for Sensitive Receptors outside RAPID Boundary during Operation Stage

Environmental monitoring at the sensitive receptors locations surrounding the overall RAPID Complex during the plants operation will be carried out by the Project Proponent via an entity to be set up later.

In general, the identified sensitive receptors will be the same as the previously approved RAPID DEIA 2012, i.e. population residing within the 5 km radius from the RAPID site boundary. Refer to **Section 6.4.1** of this Chapter for the list of the sensitive receptors.

The environmental monitoring shall be conducted for the following environmental parameters:

- Surface river and estuarine water quality;
- Groundwater and soil quality;
- Ambient air quality;
- Noise level;
- Marine water and seabed sediment quality; and
- Final effluent discharge quality monitoring.

6.5.2.1 Surface River and Estuarine Water Monitoring

Surface river and estuarine water monitoring surrounding the RAPID site boundary will be carried out during operation of the EURO 5 MOGAS and Olefin Storage Tank units. The locations and parameters will be the same whence monitoring was conducted during the site clearing and site preparation phase. A summary of the locations, parameters and frequency is shown in **Table 6-13 – Table 6-14** and illustrated in **Figure 6-15**.

Surface river water quality monitoring results shall comply with Class 3 of the National Water Quality Standards (NWQS) for Malaysia whilst the estuarine water monitoring results shall comply with Class E of the Marine Water Quality Criteria and Standards for Malaysia. The results shall also be compared with the baseline data taken prior to the site clearing and site preparation phase.

6.5.2.2 *Groundwater and Soil Quality Monitoring*

The groundwater and soil quality monitored during operation shall be compared against the Contaminated Land Management and Control Guidelines No. 1: Site Screening Levels published by the DOE as well as the baseline data taken prior to the site clearing and site preparation phase.

The monitoring locations, parameters and frequency for groundwater and soil quality monitoring at sensitive receptors surrounding the RAPID site boundary is tabulated in **Table 6-13** – **Table 6-14** and shown in **Figure 6-15**.

6.5.2.3 *Ambient Air Monitoring*

The locations, parameters, and frequency for ambient air monitoring at sensitive receptors surrounding the RAPID site boundary are presented in **Table 6-13** – **Table 6-14** and shown in **Figure 6-15**. Ambient air levels shall be compared with the baseline data taken prior to the site clearing and site preparation phase and should be in compliance with the limits stipulated in the Malaysia Ambient Air Quality Guideline (MAAQG) 2013.

6.5.2.4 *Noise Monitoring*

The locations, parameters, and frequency for noise monitoring at sensitive receptors surrounding the RAPID site boundary are presented in **Table 6-13** – **Table 6-14** and shown in **Figure 6-15**. Noise levels shall be compared with the baseline data taken prior to the site clearing and site preparation phase and should be in compliance with the limits stipulated in the RAPID DEIA 2012 Approval Condition No. 58 i.e. not exceeding 55 dB(A) for day time (7am – 10pm) and not exceeding 45 dB(A) for night time (10pm – 7am).

6.5.2.5 *Marine Water and Sediment Quality Monitoring*

The locations, parameters, and frequency for marine water and sediment quality monitoring at sensitive receptors surrounding the RAPID site boundary during operation of the EURO 5 MOGAS and Olefin Storage Tank units are presented in **Table 6-13** – **Table 6-14** and shown in **Figure 6-15**. Marine water results should be in compliance with the limits stipulated under Class 3 of the Malaysian Marine Water Quality Criteria and Standards (refer to RAPID DEIA 2012 Approval Condition No. 48). Meanwhile, sediment quality results should comply with the United States National Oceanic and Atmospheric

Administration Screening Quick Reference Tables (US NOAA SQuiRTs) (refer to RAPID DEIA 2012 Approval Condition No. 57).

In addition, monitoring of the final effluent discharge point from the operation of the EURO 5 MOGAS and Olefin Storage Tanks will also be carried out as part of marine water monitoring. Effluent from each EURO 5 MOGAS and Olefin Storage Tank units will be treated at the Centralised Effluent Treatment Plant before being discharged at the marine outfall into the Straits of Johor. The results should comply with Standard B of the Fifth and Seventh Schedules stipulated under the Environmental Quality (Industrial Effluents) Regulations 2009 (refer to RAPID DEIA 2012 Approval Condition No. 45). The location, parameters and frequency for final effluent discharge monitoring during operation of the EURO 5 MOGAS and Olefin Storage Tanks are presented in **Table 6-13** – **Table 6-14** and shown in **Figure 6-15**.

Table 6-13 Monitoring Locations Outside RAPID Boundary during EURO 5 MOGAS and Olefin Storage Tank Units Operation Stage

No.	Monitoring Station	Description of Location
A.	**Surface Water Quality**	
1.	SW1	Sg Johor
2.	SW2	Sg Sebina
3.	SW3	Sg Lanjut
4.	SW4	Sg Pengkalan Pinang
5.	SW5	Sg Lepau
6.	SW6a	Sg Lepau
7.	SW7	Sg Sebina
8.	SW9	Sg Kapal
9.	SW10	Sg Buntu
10.	SW14	Sg Lepau
11.	SW15	Sg Lepau
12.	SW19	Sg Kapal
B.	**Groundwater and Soil Quality**	
1.	GW/SS-1	West of RAPID border near Kg. Pengelih
2.	GW/SS-3	South of RAPID site near Kg. Teluk Empang
3.	GW/SS-14	North of RAPID border near Kg. Lepau
C.	**Air Quality and Noise Level**	
1.	A/N1	Jetty Tg Pengelih near to TNB sub-station
2.	A/N2a	Kg. Pengerang
3.	A/N7a	Kg. Sg. Kapal Darat
4.	A/N8	Kg. Sg. Kapal Darat
5.	A/N9	Taman Rengit Jaya
6.	A/N10	Kg. Sg. Buntu
7.	A/N11	Kg. Bukit Buloh (South)

No.	Monitoring Station	Description of Location
8.	A/N12	Kg. Bukit Buloh (North)
9.	A/N13	Orchard Farm at the North East boundary of RAPID
10.	A/N17	Oil palm plantation located at the Northern boundary of RAPID
11.	A/N18	Oil palm plantation located at North West boundary of RAPID
12.	A/N19	Oil palm plantation (Close to alternative road from Kg. Lepau to Tg. Pengelih)
13.	A/N20	Oil palm plantation at Western boundary of RAPID
14.	A/N21	Oil palm plantation at Kg Lepau
15.	A/N22	North East RAPID
16.	A/N26	Lot 17 Jalan Hj. Mantek, Kg. Lepau
17.	A/N(T)20C3-1	Kg. Teluk Ramunia
18.	A/N(T)20C3-2	Kg. Teluk Ramunia
19.	A/N(T)20C3-3	Kg. Teluk Ramunia
D.	**Marine Water and Seabed Sediment Quality**	
1.	CS1	At the final drainage discharge located in the Straits of Johor; southwest of the RAPID Complex
2.	CS2	At the final drainage discharge located in the Straits of Johor; south of the RAPID Complex
3.	CS3 (marine water monitoring only)	At the final effluent discharge point located in the Straits of Johor

Table 6-14 Summary of Proposed Monitoring Program at Locations Surrounding RAPID Complex during EURO 5 MOGAS and Olefin Storage Tank Units Operation Stage

Item	Issues & Sources	Monitoring Location	Number of Sampling Point	Parameter	Compliance	Monitoring Frequency	Reporting Frequency
1.	**Surface Water (Inland and Estuarine)**	Refer to **Figure 6-15**	12 nos	Parameters as per Class III of the National Water Quality Standards (NWQS): Temperature, pH, Dissolved Oxygen, Total Suspended Solids, BOD, COD, Oil and Grease, Phenol, Cyanide, Sulphide, Nitrate, Nitrite, Ammoniacal Nitrogen, Phosphate, Iron (II), Arsenic, Boron, Cadmium, Copper, Chromium (III), Total Iron, Lead, Manganese, Tin, Mercury, and Faecal coliform Parameters as per Marine Water Quality Criteria and Standards for Malaysia (Class E): Temperature, pH, Dissolved Oxygen, Turbidity, Total Suspended Solid, BOD, COD, Oil & Grease, Phenol, Cyanide, Nitrate, Nitrite, Ammoniacal Nitrogen, Phosphate, Iron (II), Arsenic, Boron, Cadmium, Copper, Chromium (III), Total Iron, Lead, Manganese, Tin, Mercury, Ammonia (unionized), Total Organic Carbon, Total Nitrogen, Arsenic (III), Zinc, Total Hydrocarbon, Faecal Coliform, Total Petroleum Hydrocarbon (TPH)(Fractionized), and Polynuclear Aromatic Hydrocarbon (PAH)	Stations SW4, SW6a, SW9, SW10, SW14, SW15 and SW19 to comply with National Water Quality Standards (NWQS)-Class III (river water) Stations SW1, SW2, SW3, SW5 and SW7 to comply with Marine Water Quality and Standards for Malaysia (MWQCS)-Class E (Estuarine water)	Quarterly	Quarterly

Item	Issues & Sources	Monitoring Location	Number of Sampling Point	Parameter	Compliance	Monitoring Frequency	Reporting Frequency
2.	**Groundwater Quality**	Refer to **Figure 6-15**	3 nos	Total Hydrocarbon, Total Phenol, Sulphide, Cyanide, Oil & Grease, Arsenic, Boron, Cadmium, Copper, Iron, Lead, Manganese, Tin, Mercury, Volatile Organic Carbon (VOC) and Polynuclear Aromatic Hydrocarbon (PAH)	National Guidelines for Raw Water Quality (NGRWQ) Benchmark for Groundwater Quality in Malaysia Results from baseline EMR No. 1 (October 2012) and EMR No. 36 (September 2015)	Quarterly	Quarterly
3.	**Soil Quality**	Refer to **Figure 6-15**	3 nos	Total Hydrocarbon, Total Phenol, Sulphide, Cyanide, Oil & Grease, Arsenic, Boron, Cadmium, Copper, Iron, Lead, Manganese, Tin, Mercury, Volatile Organic Carbon (VOC) and Polynuclear Aromatic Hydrocarbon (PAH)	Contaminated Land Management: SSLs (Site screening levels)	Half-yearly	Half-yearly
4.	**Ambient Air Quality**	Refer to **Figure 6-15**	19 nos	• Total Suspended Particulates (TSP); • Particulate Matter(PM_{10}); • Sulphur Dioxide (SO_2); • Nitrogen Dioxide (NO_2); • Carbon Monoxide (CO); • Hydrogen Sulfide (H_2S); • Volatile Organic Compound (VOC); • Hydrogen Chloride (HCl); • Ammonia (NH_3); • Chlorine (Cl); • Mercury (Hg).	Malaysian Ambient Air Quality Guidelines (MAAQG) 2013	Quarterly	Quarterly
5.	**Noise Level**	Refer to **Figure 6-15**	19 nos	Noise levels during day and night	RAPID DEIA 2012 Approval Condition No. 58: c) Not exceeding 55 dB(A) for day time d) Not exceeding 45 dB(A) for night time	Quarterly	Quarterly

Item	Issues & Sources	Monitoring Location	Number of Sampling Point	Parameter	Compliance	Monitoring Frequency	Reporting Frequency
6.	**Marine Water Quality**	CS-1 & CS-2 Refer to **Figure 6-15**	3 nos	Top & bottom water depths: Temperature, pH, Dissolved Oxygen, Cadmium, Copper, Mercury, Lead, Iron, Manganese, Arsenic, Tin, Total Suspended Solid, Oil & Grease, Total Petroleum Hydrocarbon (TPH)(Fractionized), Total Organic Carbon, Total Hydrocarbon, Nitrate as N, Phosphate, Total Nitrogen, Iron (II), Chromium Trivalent, Polynuclear Aromatic Hydrocarbon (PAH), Arsenic (III), Zinc, Chromium (VI), Cyanide, Nitrite, Ammonia (unionized), Phenol, Faecal Coliform	Marine Water Quality Criteria and Standards for Malaysia (MWQCS)-Class 3	Quarterly	Quarterly
		CS-3 Refer to **Figure 6-15**		Temperature, pH, BOD, COD, Total Suspended Solids, Mercury, Cadmium, Chromium Hexavalent, Arsenic, Cyanide, Lead, Chromium Trivalent, Copper, Manganese, Nickel, Tin, Zinc, Boron, Iron, Phenol, Free Chlorine, Aluminium, Barium, Selenium, Fluoride, Silver, Ammonical Nitrogen, Formaldehyde	Standard B in Fifth Schedule and Seventh Schedule of the EQ (Industrial Effluents) Regulation, 2009	Monthly	Monthly
7.	**Seabed Sediment Quality**	CS-1 & CS-2 Refer to **Figure 6-15**	2 nos	Total Hydrocarbon, Cadmium, Chromium (III), Copper, Mercury, Lead, Iron, Manganese, Arsenic, Tin, Total Organic Carbon, Total Petroleum Hydrocarbon (TPH) (Fractionized), Oil & Grease, Redox potential, and Polynuclear Aromatic Hydrocarbon (PAH)	United State National Oceanic and Atmospheric Administration Screening Quick Reference Tables (US NOAA SQuiRTs)	Quarterly	Quarterly

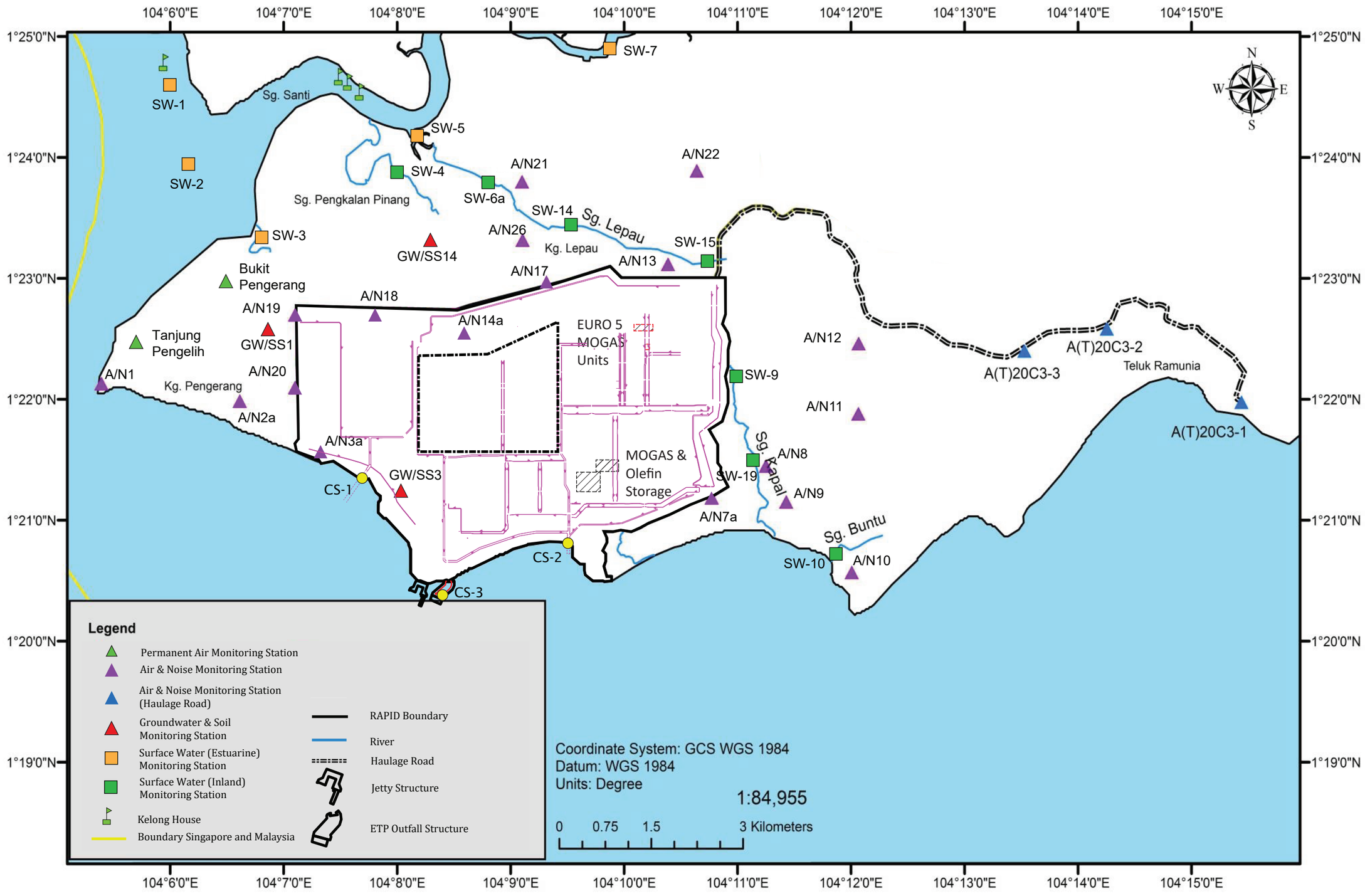


Figure X.X : Proposed Environmental Monitoring Stations Surrounding RAPID Complex During Operation Phase

6.6 Environmental Audit

The Amendments (1996) to the EQA 1974 required environmental audit is made mandatory under Section 33A of the EQA 1974 for projects with EIA approvals. The purpose of the environmental audit is to ensure compliance with the EMP and EIA Conditions of Approval, to determine the environmental management procedures are being followed and the recommended mitigation measures and monitoring recommendations are being fully implemented. The EMP should include a checklist for the environmental auditor to fill in while conducting audit on site. The audit should include the review of documents/records, environmental monitoring reports, complaints and correspondence by other authorities or nearby residents or receptors and a thorough inspection of site activities.

The audit findings should be used to identify any weaknesses in the EMP for the purpose of updating the EMP and to allow for environmental management improvement practice within the Project site.

The proposed audit program to be executed as per RAPID DEIA 2012 Approval Condition No. 70 will be as follows:

i. At the beginning before earthworks and construction stage starts, audit criteria shall include documents as EMP, ESCP and others approvals related, installation of control measures such as silt fence, silt curtain, sediments basins, check dam and etc. to be submitted first to DOE Johor for approval;

ii. At the earthworks and construction stage, once every four (4) months or according to the instructions by DOE Johor, starting from beginning earthwork and construction stage until finish. (Auditor should have certificate of CESSWI – Certified Erosion, Sediment and Storm Water Inspector or equivalent qualifications; and

iii. At the operation stage, once a year during the operation.

The audit findings will be used as tools to check the effectiveness of the EMP and the compliance to the DEIA Conditions of Approval. Any non-compliance detected during the audit will be documented and acknowledged by the

responsible parties. Following this, corrective as well as preventive actions recommended should be initiated within the agreed time period.

6.7 Training Requirements

PETRONAS Performance Management System (PMS) defines the competency and training requirements for each position in the company. An Environmental Training Matrix has been developed to ensure that appropriate and adequate environmental training are identified and provided to its employees at all levels including the contractors. The examples of training courses provided are as below:

- HSE Management System (HSEMS) Awareness;
- HSE Audits;
- Emergency Response;
- Waste Management Procedure;
- Hazardous Waste;
- Spill Prevention and Contaminated Site Management;
- Air Emission Management;
- Water and Waste Water; and
- Scheduled Waste Management.

In addition, PETRONAS will also ensure that all its staff is competent in their respective positions/roles by sending them to undergo DOE certified training courses such as:

- Course on Certified Environmental Professional in Scheduled Waste Management (CePSWAM);
- Course on Certified Environmental Professional in Bag Filter Operation (CePBFO); and
- Course on Certified Environmental Professional in Scrubber Operation (CePSO).

Figure 6-2 Surface Water Quality Monitoring Stations during Site Clearing and Site Preparation

Figure 6-3 Monitoring Location for Discharge from Sediment Basins and Detention Corridors During Site Clearing and Site Preparation

Figure 6-4 Groundwater and Soil Monitoring Stations during Site Clearing and Site Preparation

Figure 6-5 Air Quality and Noise Level Monitoring Stations during Site Clearing and Site Preparation

Figure 6-6 Marine Water and Seabed Sediment Monitoring Stations during Site Clearing and Site Preparation

Figure 6-7 Proposed Environmental Monitoring Points for EURO 5 MOGAS - CNHT2 Unit during Construction Phase

Figure 6-8 Proposed Environmental Monitoring Points for EURO 5 MOGAS - TAME Unit during Construction Phase

Figure 6-9 Proposed Environmental Monitoring Points for EURO 5 MOGAS - Isomerization Unit during Construction Phase

Figure 6-10 Proposed Environmental Monitoring Points for MOGAS & Additional Olefin Storage Tankages Unit during Construction Phase

Figure 6-11 Proposed Environmental Monitoring Points for EURO 5 MOGAS - CNHT2 Unit during Operation Phase

Figure 6-12 Proposed Environmental Monitoring Points for EURO 5 MOGAS - TAME Unit during Operation Phase

Figure 6-13 Proposed Environmental Monitoring Points for EURO 5 MOGAS - Isomerization Unit during Operation Phase

Figure 6-14 Proposed Environmental Monitoring Points for MOGAS & Additional Olefin Storage Tankages Unit during Operation Phase

Figure 6-15 Proposed Environmental Monitoring Stations Surrounding RAPID Complex During Operation Phase

7 EMERGENCY RESPONSE PLAN (ERP)

7.1 Introduction

Due to the scale and complexity of the project, RAPID is constantly exposed to potential emergency incidents. Unpreparedness and lack of foresight in emergency response and crisis management can be costly and detrimental to the organization to continue its activities. Emergency if not managed well may result in injury and fatality to people, environment, asset damage and tarnished reputation.

7.2 Objective

The emergency response plan developed for RAPID Project outlines the response to be taken in the event of an emergency or unplanned event to minimize:

1. Injury to people
2. Damage to the environment
3. Damage to assets
4. Harm to local and international reputation

The emergency response system has been established to prevent or minimize the consequences of an incident and to manage the return to normal and safe operations.

To achieve this, RAPID project will ensure:

1. An appropriate level of emergency preparedness is achieved and maintained.
2. Staff and contractors are trained and exercised in their roles.
3. Competent line staff are available to manage an emergency response
4. Links to other emergency and crisis systems are established and tested

The Project Management Consultant, Contractors and Sub-Contractors will be required to provide evidence of their own Emergency Management and Response Procedures and to demonstrate their ability to effectively implement and comply with those procedures in an emergency. The procedures will be required to align with and link to the RAPID Emergency Response Plan.

Failure to adequately identify and control the consequences of an emergency through a robust emergency response procedure may result in serious injury, death, severe environmental pollution, damage to assets and loss of local and international reputation.

Failure to identify competent personnel to administer the emergency response procedure may result in the RAPID project being incapable of controlling the consequences of an emergency.

Failure to monitor the effectiveness of the emergency response procedure may result in inadequate control of the consequences of an emergency and the ability to manage the return to normal safe operations.

7.3 Scope

The RAPID Emergency Response Procedure covers all activities where RAPID has prevailing influence to all RAPID personnel and contractors.

The RAPID Emergency Response Plan (ERP) is applicable to:

- Site preparation and early work contractors
- Project Management Consultant (PMC)
- PETRONAS Refinery and Petrochemical Corporation (PRPC)
- All RAPID Contractors and their Sub-Contractors at site
- All the Offices, Accommodations and Camps
- All types of activities being carried out at RAPID site

7.4 Procedure

7.4.1 Emergency Classification

The nature, location and scale of an emergency will determine the level of response required to gain control of the situation and initiate recovery action. The emergency classification structure is designed to provide responses at three levels.

- Tier 1 – Minor
- Tier 2 – Major
- Tier 3 – Crisis

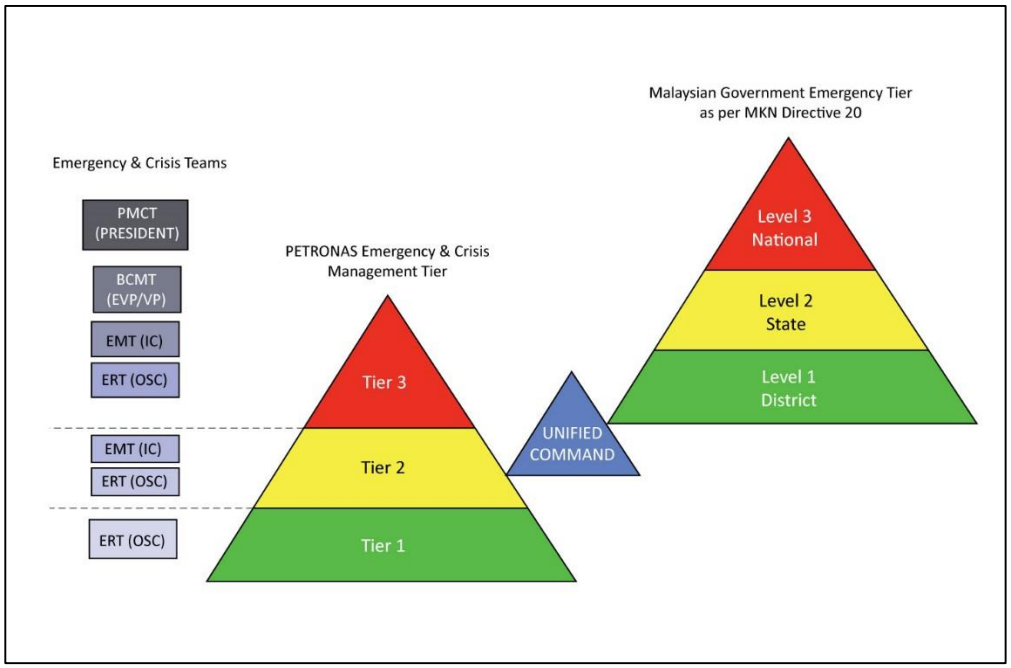
7.4.2 Response Levels

Three tiered approach provides a clear demarcation of roles and responsibilities between Contractors and Sub-Contractors, Project Management Consultant / PETRONAS Refinery and Petrochemical Corporation Management, PETRONAS Corporate and Authorities.

- **Tier 1 – Minor**: A situation where there is no danger to life and where risk of damage to property and environment is minimal. The incident is within the control of the RAPID emergency Response Teams which includes Contractors and Sub-Contractors Emergency Response Team, Central Emergency and Fire Services (CEFS) and Central Security Services (CSS) with no external assistance required.
- **Tier 2 – Major**: A situation where there is danger to life and risk of damage to property and environment. The incident is within the control of the RAPID with external assistance and requires support of Emergency Management Team (EMT). On Scene Commander (OSC) shall declare the Tier 2 activation based on severity of incident.
- **Tier 3 – Crisis**: Where, there is potential for multiple fatalities and severe damage to asset and the environment involving neighbouring sites and surrounding communities. The incident is clearly beyond the capacity of the RAPID to control and consequently requires action from PETRONAS corporate, government or other external parties.

7.4.3 Three Tiered Approach

Figure 7.1 PETRONAS Three-Tiered Emergency Management and Linkage to Malaysian Authorities

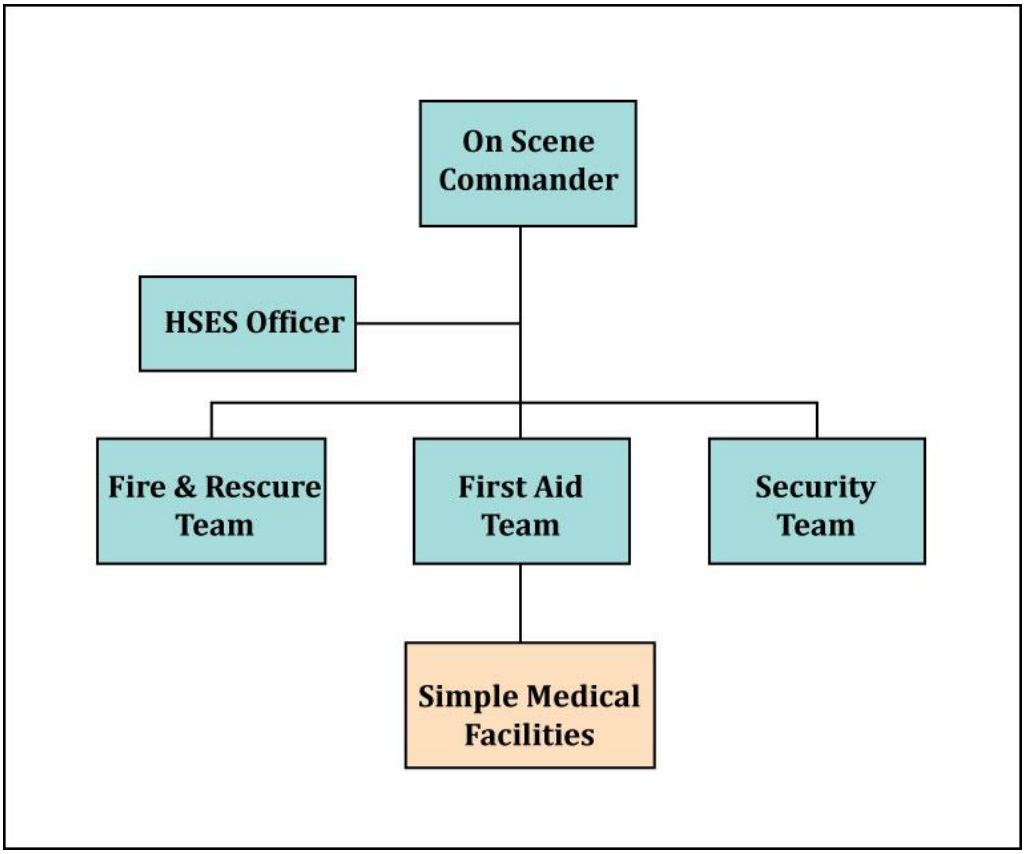


7.4.4 Emergency Organisation and Responsibilities

7.4.4.1 Emergency Response Team (ERT) – Contractors and Sub-Contractors / Unit Project Team (UPT)

Emergency Response Team is the tactical response operations team that carry out tasks under the direction of the On Scene Commander. On Scene Commander is responsible for ensuring that tactical response operations are carried out in a safe and efficient manner. The team should be trained and fit to conduct response operations. Emergency Response Team shall be led by Contractors and Sub-Contractors Project Manager or his delegate as On Scene Commander

Figure 7.2 Typical Organisation Structure of Emergency Response Team



The primary roles of the Emergency Response Team (ERT) are:

i. Sizing up (Assess) the incident.

ii. Ensure response operations are carried out in a safely, well organize and effective manner.

iii. Strategize and implement site control, ensure site safety, control the source, protect and save people, environment and property.

iv. Interacting, advising, as appropriate with RAPID Security Control Centre (RSCC), Emergency Management Team (EMT) and other involved parties.

The declaration of Tier 2 shall be the responsibility of On Scene Commander (OSC) based on the severity of the incident, in consultation with HSES Manager / Head Security.

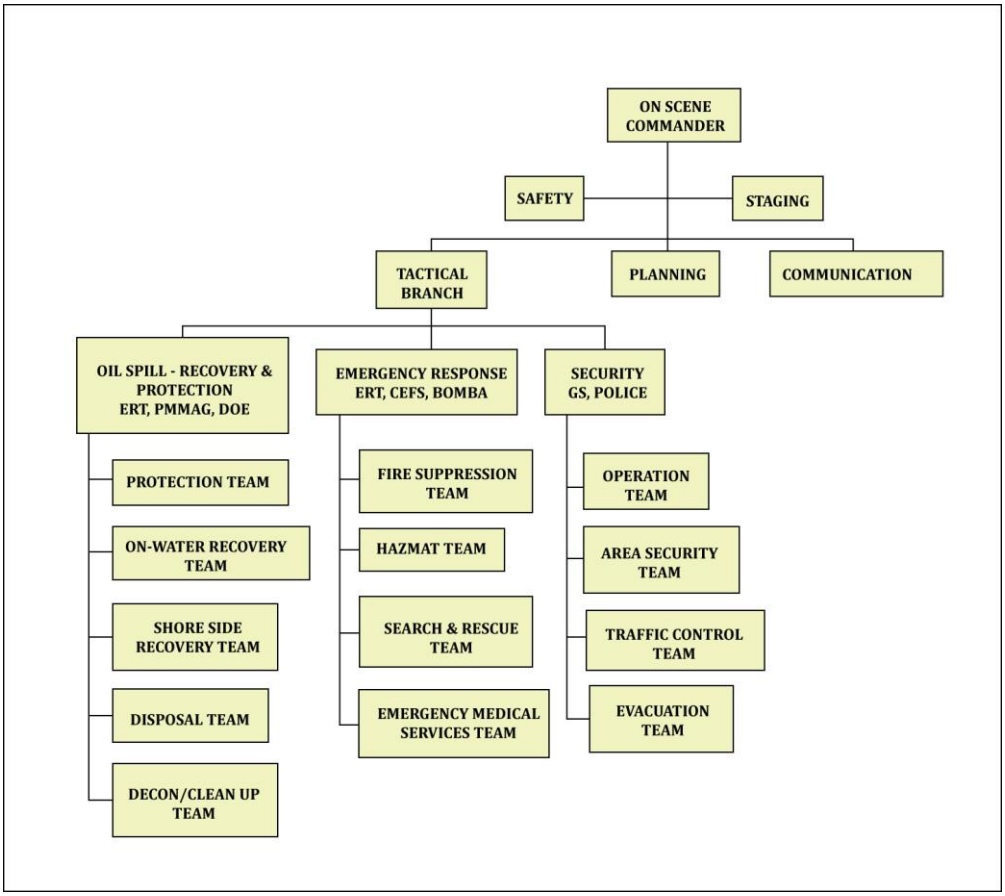
7.4.4.2 Central Emergency and Fire Services (CEFS)

Central Emergency and Fire Services is an organization under HSES – PRPC which provides emergency response services for RAPID site.

Central Emergency and Fire Services will assist Contractors and Sub-Contractors Emergency Response Team as requested by On Scene Commander through RAPID Security Control Centre. Central Emergency and Fire Services shall assist in specialized emergency response operations e.g. Complex rescue operations or structural firefighting where Contractors and Sub-Contractors Emergency Response Team may not have required skills.

Central Emergency and Fire Services shall respond and lead as On Scene Commander for small packages with minimal / limited emergency response system and areas with undefined ownership throughout site.

Figure 7.3 Emergency Response Team for Major Emergencies



The organization chart depicted here is a typical chart which might be needed in case of Tier 2 or Tier 3 emergencies.

This can be situational requirement based on severity of incident and judgement of Emergency Management Team. However in order to manage the incidents, Contractors and Sub-Contractors must be aware and trained on this organization structure.

7.4.5 Implementing the Emergency Response Process

7.4.5.1 Duty Roster

The purpose of a duty roster is to guarantee a minimum coverage of competent personnel to be able to react in support of an emergency across any of the project activities.

As a result of the duty roster there will always be Emergency Response Team and Emergency Management Team members on call within the RAPID

organization. RAPID Security Control Centre will establish a call sequence to enable the Emergency Management Team to be present at Emergency Control Centre.

The Duty Roster is compiled and published monthly by RAPID Security Control Centre. The Duty Roster will contain the name and contact details of the Emergency Response Team, Emergency Management Team and essential personnel.

During their term of duty, rostered personnel must remain within the Pengerang area and shall not consume alcohol so as to be in a fit state to perform duty. They should be able to reach the office within 45 minutes.

7.4.5.2 Response Times

It is a requirement for all representatives of the duty roster to be able to attend the Emergency Control Centre within 45 minutes of being contacted. Requirement for Emergency Response Team to be on sit is 20 minutes after being contacted. Duty representatives should therefore plan their activities taking into account the required response time.

In the event that a representative on the duty roster is required to travel to a location outside of a 45 minutes response radius then emergency duty must be temporarily handed over to someone else of the same discipline and the Project Management Consultant HSE Manager is to be informed of the change.

If an individual cannot be contacted at the number(s) shown on the Duty Roster, he must advise the RAPID Security Control Centre of alternative contact numbers.

The RAPID Security Control Centre Communications Operator will initiate a communications check once per week and reports response times and any communications problems to the Duty Manager and Project Director or his Appointed Deputy.

7.4.5.3 Communications

An up-to-date contact list including telephone numbers will be located in the RAPID Security Control Centre and Emergency Control Centre. The HSE

Manager is responsible for the maintenance of the contact list which will include the following groups:

- Emergency Contact Telephone Numbers;
- Emergency Support Personnel
- Crisis Management Team
- Contractors and Sub Contractors
- Regional and Group Contacts;
- Police
- Hospitals;
- Embassies and Consulates;
- Security Guards at Rapid Offices and those residential compounds occupied by Rapid staff.
- Taxi, Vehicle Suppliers, External Attorney, Police;

The RAPID Security Control Centre Communication Operator will contact the Emergency Management Team and facilitate a communications link with the caller and the On Scene Commander in order that situation reports can be relayed to the On Scene Commander. If the incident escalates to a Tier 2 emergency that requires the mobilization of the external Emergency Response Team/s and/or local emergency response support the On Scene Commander will instruct the RAPID Security Control Centre Communications Operator to initiate an Emergency Management Team 'Call Out'.

On receipt of the 'Call Out' message, the Emergency Management Team member will confirm receipt of the message with the RAPID Security Control Centre Communication Operator and advice the time they expect to arrive at the Emergency Control Centre.

Confirming receipt of the ''Call Out'' message to the Communication Operator is mandatory. In the event that confirmation is not received within 15 minutes of transmission, the Communications Operator will 'Call Out' the alternates in that role and advises the Emergency Management Team.

7.5 ERP during Construction Stage

Emergency Response Plan during construction stage has been outlined and described in detail in previous DEIA report submitted in 2012 and further improved in subsequent EMP report and its revision. This list shows the EMP report submitted and approved which covers the ERP during the construction stage:

- EMP Phase 1 Site Clearing and Preparation approved in 22th October 2012;
- EMP Phase 2 Site Clearing and Preparation approved in 29th April 2014;
- EMP Material Off Loading Facility (MOLF) at Tj Setapa approved in February 2015.

7.6 ERP during Operational Stage

There are two (2) main types of incidents that could take placed at operating plants in RAPID (including the Petrochemical Plants) upon operation and they are the release of toxic gaseous and the flammable gaseous that may cause fire and/or explosion. The detailed procedure will be specified in the finalised ERP.

7.6.1 Emergency Scenario

7.6.1.1 Fire and Explosion

In this case the major risk is that the situation escalated due to radiation damage from the fire. This can manifest itself in either adjacent tanks catching fire, or auto ignition inside any tank or space involving flammable mixtures where metal failure occur with liquids stored under pressure and above their atmospheric boiling point.

In the case of a flame the radiation depends principally upon the flame temperature, which may be as low as 400°C at the bases of the flame, rising to 900°C in the upper reaches. This mean that the radiation profile is variable, being relatively low below the flame and rising when above the flame.

It is important to realize that the fire will not be extinguished unless the foam coverage is total. Attempting to extinguish a fire with insufficient foam will be simply wasteful and will delay final extinguishing until foam will be simply wasteful and will delay final extinguishing until foam stocks can be sufficiently replenished.

7.6.1.2 Land Pipeline Emergency

A Line Pipeline Emergency is similar to the equivalent emergency with the pipeline resembling refinery pipe tracks. Under these circumstances the strategies are generally similar. There are however important differences. Principally there are:

- The separation distance to the public are smaller, hence the risk to the public is higher;
- Public access is easier to the site of the emergency. The risk of sources of ignition due, for example smoking;
- There is a possibility of ground water contamination with hydrocarbon via natural drainage; and
- It is however relatively easy to depressurize leaks quickly and displace line content with water.

By design, RAPID facilities have an extensive buffer distance to minimise exposure to the public. It may however be necessary to request the assistance of the Local Authorities to cordon off certain areas within 50 meter of the pipeline and to evacuate people from the affected area. It may also be necessary to test groundwater following the incident.

7.6.1.3 Oil Spill Emergency

The major threats in an oil spill emergency are:

- Disruption to the integrity of essential public services
- Disturbance to the ecology of wild life and marine habitats
- The effects on ecology, social amenities and commercial interests if oil reaches the shore
- The effect of disposal of contaminated soil.

The oil spill tiered response is referred to the National Oil Spill Contingency Plan, DOE 2000. The responses are based on factor such as location of oil spill, quantity and capability to respond. Below are the different stages of response.

Tier 1

At this level, oil spill are generally small and the response is based on the local contingency plan, in this case, RAPID emergency response plan. In house resources and equipment are utilized.

Tier 2

Tier two will be mobilized and implemented by the Chairman of State Oil Spill Control Committee (State DOE Director) once it that the local resources and equipment of Tier 1 are insufficient. Tier two will also be mobilized when the spill is beyond the coverage of the local contingency plan.

Tier 3

The third stage of response is mobilized and implemented by the Chairman of National Oil Spill Control Committee (Director of General of DOE). This stage involves major oil spill where local resources are insufficient and foreign assistance is required. Tier 3 will also be implemented when oil spill spared to water of the neighbouring countries.

7.6.2 Relevant Authorities

The list of relevant authorities to be contacted in case of emergency is shown below:

I. Royal Malaysia Police

Police Station	Contact Number
IPD Kota Tinggi	Phone: 07-883 1222
Bukit Besar	Phone :07-897 7222
Gugusan Adela	Phone: 07-882 6299
Kota Tinggi	Phone: 07-897 7222
Kuala Sedili	Phone: 07-891 8222
Mawai	Phone: 07-827 8199
Pengerang	Phone: 07-825 2222
Sungai Rengit	Phone: 07-826 3222 Fax: 07-882 2410
Telok Sengal	Phone: 07-895 5222

II. Fire and Rescue Department of Malaysia

Fire Station	Contact Details
Kota Tinggi	Phone : 07 - 883 1444 Fax : 07 - 882 1644
Pasir Gudang	Phone: 07 - 251 3444 Fax : 07 - 253 2958
Bandar Penawar	Phone : 07 - 822 4444 Fax : 07 - 882 4044

III. Ministry of Health Malaysia

Hospital / Medical Facility / Emergency Medical Services	Contact Details
Kota Tinggi District Health Office	Phone: 07-883 1133 / 7397 Fax: 07-883 127
Kota Tinggi Hospital	Phone: 07-356 5000 Fax : 07-356 5088
Health Clinic Pengerang	Phone:07-825 2455
Health Clinic Sungai Rengit	Phone: 07-826 3285
Health Clinic Felda Adela	Phone: 07-827 7398
Health Clinic Bandar Penawar	Phone: 07-822 1064

IV. Malaysian Maritime Enforcement Agency

Headquarters / Branch	Contact Details
Maritime (Southern Region)	Phone: 07-219 9440 Fax : 07-219 9451
Maritime District Tg. Sedili (DM7)	Phone: 07-891 6595
Maritime Base Mersing	Phone: 07-799 8527

V. Department of Environment Malaysia

Headquarters / Branch	Contact Details
Department of Environment Johor	Phone: 07-235 6042 Fax: 07-235 6071

VI. Department of Occupational Safety and Health

Headquarters / Branch	Contact Details
Department of Occupational Safety and Health Johor	Phone: 07-221 4121 / 07-224 2122 / 07-224 3076

VII. Department of Marine Malaysia

Headquarters / Branch	Contact Details
Marine Department (Southern Region)	Phone: 07-507 2313 Fax: 07-507 3679
Pasir Gudang Port Office	Phone: 07-251 1567 Fax: 07-252 4926
Mersing Port Office	Phone: 07-799 1176 Fax: 07-799 5561

VIII. National Disaster Management Agency

Headquarters / Branch	Contact Details
National Disaster Management Agency (Headquarters), Putrajaya	Phone : 03-8886 6201 Fax: 03-8886 6207

IX. Department of Social Welfare

Headquarters / Branch	Contact Details
Johor Social Welfare Department	Phone: 07-228 2971 / 07-228 2972 Fax: 07-224 0335
Kota Tinggi District Social Welfare Office	Phone: 07-883 4252

X. Malaysian Armed Forces

Headquarters / Branch	Contact Details
Markas Briged Infantri Ke 7	Phone: 07-7788 000
KD Sultan Ismail	Phone: 07-829 2518 / 2528

XI. PRPC HSES Key Personnel

Name	Designation	Contact Details
Saifuddin Shah B Sawkkatali	Head – HSES RAPID	019-260 0532
Awalludin B Hj A Rahman	Head CEFS	012-220 1715
Sanjay D Waje	Head – Emergency Response	010-712 1577
Ramli Mohamad	Head - Security	019-226 2915
W Mohammad B W Mustafa	Head – Performance and Reporting	017-200 9612
Suhairi B Dapat	Head HSE - PETCHEM	019-381 2783
Paimin Kasimon	Head HSE - Refinery	019-385 4958
Fazli Rahim	Head - Environment	019-274 3393

XII. RAPID-PMC HSE Key Personnel

Name	Designation	Contact Details
Micheal Ryken	HSSE Manager (Directorate)	017-656 4934
Ramli	Security Manager	019-226 2915
Carl Garnett	HSE Manager	012-686 8125
Jerry Gumbang	HSSE Superintendent	013-642 1206
Haji Arshad	HSE Manager	019-915 8015
Nor Wahid	HSE Manager	TBA
Zulkifli	HSSE Superintendent	013-931 1836
John See	HSE Manager	019-276 9843
Malai Sethuraman	Deputy HSE Manager	019-925 8330
Menno Van Soest	HSE Manager	019-369 5663
Muthukumar Krishan	HSSE Superintendent	013-761 5100
Shahrulnizam Shah Bin Mohd Padzil	Emergency Response Engineer	011-319 95594

7.6.3 Incident Notification

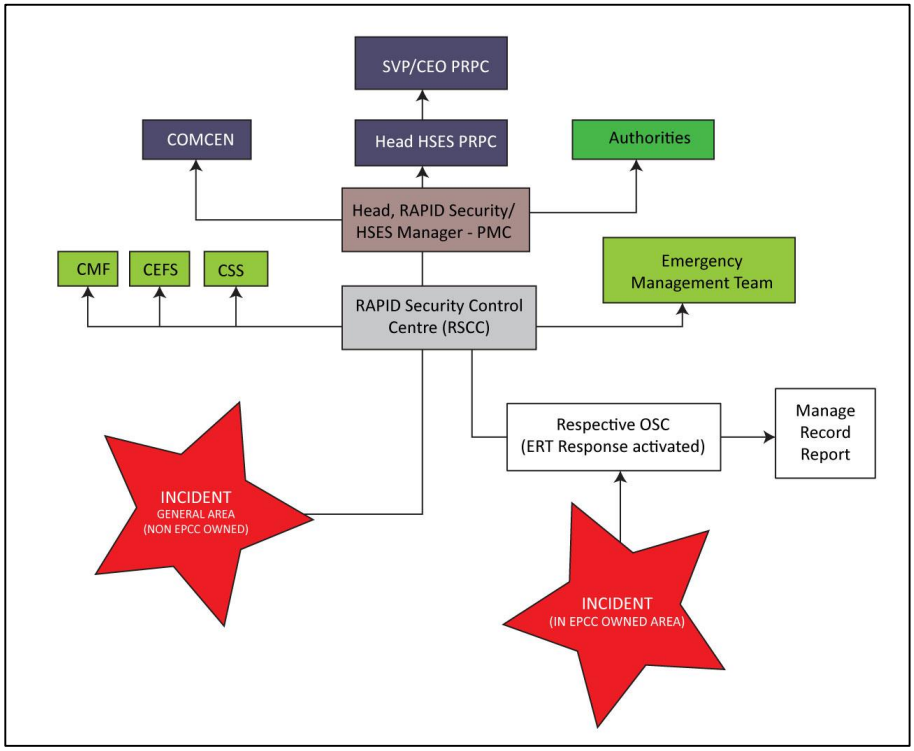
Prompt on-site and off-site notification is essential to the mitigation of the emergency condition and minimization of any impact on personnel on-site and off-site

The purpose of this procedure is to provide common notification actions to be taken in logical sequence during any incident in RAPID. The following procedure are the steps to be followed for prompt notification when an emergency condition occurs.

7.6.3.1 Emergency Response Communication Diagram

The structure of the emergency response organization indicating links to internal and external organizations is shown in **Figure 7.4**.

Figure 7.4 Internal/External Communication Link



7.6.3.2 On – Site

On- site incident can be classified into two types:

I. Incident inside the area which comes under control/ownership of Contractors and Sub-Contractors:

- Respective Contractors and Sub-Contractors shall establish their own incident notification procedure and system in place.
- Each Contractors and Sub-Contractors shall train their personnel to report the incident.
- Incident shall be notified to On Scene Commander of respective Contractors and Sub-Contractors, he shall activate emergency response for his area of influence.
- Respective on Scene Commander shall inform RAPID Security Control Centre.

II. Incident outside the area of control/ownership of Contractors and Sub-Contractors:

Upon the discovery of an emergency condition, notification shall be made to the RAPID Security Control Centre.

Site shall exercise the following protocol's to notify RAPID Security Control Centre as per sequence or priority base on the availability of the systems during such events.

- 1st Call – RAPID Security Control Centre
- 2nd Radio (Walkie-talkie – Emergency Channel)
- 3rd Dispatcher (Last resource if all the above system fails)

Information require when an emergency call is make to RAPID Security Control Centre:

i. Name of caller

ii. Location of Emergency (Following Grid System)

iii. Type of Emergency

Responsibilities of RAPID Security Control Centre (RSCC):

i. RSCC will notify respective On Scene Commander of affected Unit Project team and activate emergency response.

Note: Communication system testing should be done on daily basis via Mobile phone and Emergency Channel. Any deficiencies found shall be addressed immediately.

ii. RSCC shall then immediately inform RAPID Security Head and PMC Directorate HSSE Manager (i.e. Micheal Ryken) for any further communication to Head HSES PRPC, Communication Centre or authorities.

Note: PMC Directorate HSSE Manager will coordinate and lead the overall management and supervision of the RAPID emergency and crisis relief effort.

iii. Notifications to Communication Centre (COMCEN)

Formal initial written notification to COMCEN and Mailing List by fax or by other means of communication within 1 hour after the incident. (Once

Emergency Control Centre is activated, all the communication with COMCEN will be done by Emergency Management Team).

iv. Updating to COMCEN every three hour.

7.6.3.3 Off – site

Depending on the type of emergency and the servility of the incident the off-site notification to public shall be made by RAPID Security Control Centre.

7.6.3.4 Summary of Notification and Activation

Table 7.1 Summary of Notification and Activation

Response Level	Response Team	Notification To
Tier 1	• Contractors and Sub-Contractors Emergency Response Team • Central Emergency and Fire Services • Computerised Monitoring System • Central Security Services	• RAPID Security Control Centre notify: ○ Central Emergency and Fire Services, Computerised Monitoring System, Central Security Services ○ Head Security / HSE Manager • Head Security notify: ○ BOMBA, Pengerang ○ POLICE, Pengerang
Tier II	• Emergency Response Team • Emergency Management Team • Central Emergency and Fire Services • POLICE, Pengerang / Kota Tinggi • BOMBA, Pengerang / Kota Tinggi • HOSPITAL, Pengerang / Kota Tinggi • Any other required responding agency	• RAPID Security Control Centre / Head Security notify Emergency Management Team. • Emergency Management Team notify: ○ Communication Centre ○ RAPID Crisis Management Team • RAPID Security Control Centre notify: ○ POLICE, Pengerang / Kota Tinggi ○ BOMBA, Pengerang / Kota Tinggi ○ HOSPITAL, Pengerang / Kota Tinggi ○ Notify Affected Contractors and Sub-Contractors

Response Level	Response Team	Notification To
Tier III	• Emergency Response Team • Emergency Management Team • RAPID Crisis Management Team • Central Emergency and Fire Services • POLICE, Pengerang / Kota Tinggi • BOMBA, Pengerang / Kota Tinggi • HOSPITAL, Pengerang / Kota Tinggi • UNIFIED COMMAND	• RAPID Crisis Management Team / Emergency Management Team in communication with GCMT / Communication Centre • RAPID Security Control Centre notify: ○ POLICE, Pengerang / Kota Tinggi ○ BOMBA, Pengerang / Kota Tinggi ○ HOSPITAL, Pengerang / Kota Tinggi ○ Emergency Management Team

7.6.4 Emergency and Incident Notification and Communication

RAPID shall follow the emergency and incident notification process established for the project to ensure immediate notification is disseminated to higher management and authorities based on notification list.

7.6.4.1 Emergency Notification – Internal

- Initial emergency notification within RAPID Project shall be made as per RAPID communication and notification process.
- Communication to COMCEN shall be made within 1 hour of the incident by fax / email / phone / SMS.
- Subsequent updates shall be made by fax or email every 3 hours or when there is significant change in the situation using the NF form.
- COMCEN shall be responsible to notify all concerned as indicated in the NF form.

7.6.4.2 Emergency Notification – External

Following external communication shall be done by RAPID crisis management team:

- Notify relevant internal and external stakeholders.

- Notification to public through relevant government agencies on potential and actual Impacts of emergency as soon as possible.

7.6.5 Emergency Response Preparedness

7.6.5.1 Training Programme

Training is an essential component of preparedness and response. The site, region and centre capability to respond to a major disaster is dependent in part on the knowledge and experience of the individuals assigned with responsibility during an incident. The training programme includes the following **Table 7.2**.

Table 7.2 Training Programme for Respective Personnel

No.	Personnel	Training Programmes	Frequency
1.	Emergency Response Team (ERT)	• Fire Fighting & Basic Rescue Training	Once off
		• First Aid	Once off
		• Oil Spill response (Tier 1)	Once off
		• ERT Refresher	Annually
2.	On Scene Commander (OSC)	• Basic Fire Fighting & Rescue	Once off
		• OSC Leadership	Once off
		• OSC Refresher	Once in two years
3.	Incident Commander (IC), Duty Manager, Emergency Management Team (EMT) and Crisis Management Team (CMT)	• Emergency Management & Response ○ Incident Command System (ICS) ○ Command and Control ○ Strategy and Tactics ○ Managing the incident ○ MKN 20 ○ Pre-planning ○ Media response	Once off
		• EMT & CMT Refresher	Once in two years

7.6.5.2 Frequency of Exercises and Drills

Frequent drills and exercises are essential to ensure teams and individuals maintain the understanding and proficiency. The frequency of the exercise activities should be adjusted to meet the requirement of the roles and responsibilities as well as the function to be exercised. Frequency of exercise recommended is shown in **Table 7.3**:

Table 7.3 Training Programme Frequency

Type of Drills	Participation	Frequency
ERT Tier 1 Drill (Fire, Rescue, etc.)	Contractor ERT and CEFS (as needed)	Two Month Once
EMT Tabletop	Contractor and UPT / SD Management	Quarterly
Site Wide Evacuation	Contractors' ERT and CEFS	Annual

7.6.5.3 Drill and Exercise Evaluation

RAPID shall evaluate drills and exercises conducted to identify areas for improvement. Evaluation for Tier 2 drills or exercises, shall consist of a member from Business HSE while for Tier 3 exercise and above, a member from GHSE shall be included.

Drills / Exercises post mortem report shall be developed and maintained by the RAPID HSE Department under Emergency Response Head for continual improvement and assurance purposes.

HSE Department shall ensure gaps identified in the drills and exercises are closed accordingly. Copy of exercise report shall be submitted to GHSE.

8 CONCLUSION

RAPID is one of the biggest projects undertaken by PETRONAS and the magnitude of this development is anticipated to be bigger than the combined PETRONAS existing downstream complexes located in other parts of the country. The project is located on a 6,424 acres of land in Pengerang, Johor. The proposed development will inevitably create a spillover effect of direct and indirect job opportunities, attract foreign direct investments (FDIs) and expand the country's access to world-class state of the art technologies. The Project is envisaged to position PETRONAS as one of the competitive global oil and gas majors and locate Johor in the world map as one of the world class emerging oil and gas hub.

A Detailed Environmental Impact Assessment (DEIA) Study was conducted for the Proposed Refinery and Petrochemical Integrated Development (RAPID) in Pengerang, Johor and was approved by DOE Putrajaya in August 2012. The main components of RAPID Complex are Refinery and Cracker Complex, Petrochemical Complex and Central Utility Facilities.

Currently, RAPID is designed to meet EURO 5 for Diesel. However, for MOGAS production, the design is based on EURO 4M specifications. Due to the growing pressure from government and market demand for EURO 5 products, the current RAPID Refinery and Cracker design is required to be modified to meet full EURO 5 production specifications. Hence, the Project Proponent expanded the process to include the production of MOGAS that meet EURO 5 specification in the current RAPID Refinery and Cracker Complex.

The Project Proponent also intends to construct additional olefins storage facilities to accommodate the storage of Ethylene, Propylene and Butadiene in the current Refinery tank farm area located within the Refinery and Cracker Complex. The requirement arises due to the deletion of the Elastomer and Phenolic process units in the RAPID Petrochemical Complex. The impacts

during the construction stage is similar or has no significant changes from that identified in the approved RAPID DEIA 2012.

At operation stage, the RAPID shall be generating emission to the surrounding environment from stack, effluent discharges, chemical and toxic spillage, scheduled waste spillages and noise generation. The environmental components that may be affected are the ambient air quality, surface and marine water quality, ambient noise level, soil and groundwater contamination and public safety and health.

Six (6) specialised studies i.e. air dispersion modelling, noise dissipation study, quantitative risk assessment, effluent dispersion modelling, waste & chemical handling and management study, and health impact assessment have been conducted in this report to evaluate the impacts to the surrounding environment and communities. Due to the expansion to include the EURO 5 MOGAS and Olefin Storage Tank Units, the study findings will also indicate the changes on the cumulative impact to the environment from that presented in the RAPID DEIA 2012.

For gaseous emission, the normal operations of EURO5 MOGAS expansion indicate that it meets the MAAQS 2013 Interim Target 2020 limits for all pollutants. No abnormal operation for EURO5 MOGAS modelled. As for Olefin Storage tankages, no normal continuous emission from it as the vent will be routed to either the Cold Flare or Refinery Tank Farm Flare. Under abnormal operation, the cold flare modelling result shows the predicted GLCs of CO is below the required respective MAAQS Interim Target 2020 at all receptors for the maximum 1 hour average concentration while the predicted maximum GLC of NO_2 exceeds the stipulated limit but it is located within the RAPID Complex. While under emergency operation, the predicted GLCs of CO, SO_2 and NO_2 are below the required respective MAAQS (IT 2020) at all receptors and the predicted maximum 1 hour average concentration for the prescribed parameters were well within the MAAQS Interim Target 2020.

For normal operations in the Refinery and Cracker Complex, predicted ground level concentrations (GLC) of all pollutants except NO_2 are within the

MAAQS 2013 (IT 2020) limits except for NO_2 level. NO_2 ground level concentrations exceeded the limit only at Bukit Pelali (1-hour average) and Bukit Pengerang (24-hour average), However, the probability of this event to occur is less than 0.4% or equivalent to less than 7 days over a 5-year operating period. Emission modeling from the RAPID Complex indicated no concern except for NO_2 where the level exceeds the MAAQS 2013 (IT 2020) limit at Bukit Pelali and Bukit Pengerang and 3 sensitive receptor locations surrounding RAPID Complex i.e. Pengelih Naval Base, Sg Rengit and Kg Bukit Buloh with NO_2 level marginally exceeding the MAAQS 2013 (IT 2020) standard limit. The predicted ground level concentrations of ammonia (NH_3), methanol, NMVOC and hydrogen sulphide (H_2S) for both Refinery Cracker Complex and RAPID Complex are insignificant compared to the Arizona Ambient Air Quality Guideline levels.

Air dispersion modeling for the abnormal operating conditions which is temporary and transient, predicted CO, PM_{10} and $PM_{2.5}$, concentrations to be below the required limits except for SO_2 and NO_2 concentration. NO_2 concentrations exceed the MAAQS 2013 (IT 2020) for the maximum 1 hour average concentration at 2 sensitive receptors i.e Pengelih Naval Base and Kg Bukit Buloh. SO_2 concentrations exceed the MAAQS 2013 (IT 2020) for the maximum 1 hour average concentration at all sensitive receptors. The air dispersion modelling for the emergency conditions indicated the predicted concentrations of CO, SO_2 and NO_2 are below the MAAQS 2013 (IT 2020) limit at all receptors location. The maximum 1 hour average ground level concentrations of PM_{10} and $PM_{2.5}$ are even below the 24-hour average limit of 100 $\mu g/m^3$.

Health Impact Assessment (HIA) scope under this Addendum report covers the current disease burden on the surrounding communities and potential public health impact based on the gaseous emission dispersion study from MOGAS 5 EURO and Olefin Storage Tanks, the Refinery and Cracker Complex and RAPID Complex gaseous emission sources. As per the air dispersion modelling result, for normal condition (cumulative Refinery Cracker Complex and RAPID Complex), there is no excess of health risk to the surrounding sensitive receptors. Only for the abnormal condition

(cumulative Refinery Cracker Complex and cumulative Refinery Complex), the concern will be the acute health effects of SO_2 exposure as the concentration at all receptor locations exceed the MAAQS limit. However, the condition is predicted to be temporary and less than one hour. The probability for SO_2 to exceed the 1 hour GLC MAAQS 2013 (IT 2020) limit is very low at less than 9 days in five years operating period. There is no excess of health risk seen in the emergency operating scenario for the cumulative Refinery Cracker Complex and cumulative RAPID Complex.

Noise dissipation modelling was undertaken to establish resulting noise levels and cumulative impact from the Refinery and Cracker Complex (with EURO 5 MOGAS Units and Olefins Storage Tankages) combined with other RAPID components (Petrochemical Complex and Utilities process units). Noise levels and contours for sound propagation to the environment were determined at locations within the individual process unit, at individual unit boundaries, at the RAPID Complex boundary, and beyond the RAPID Complex boundary to all sensitive receptors locations of concern.

For normal operating condition, the noise propagated from the EURO 5 MOGAS unit and the Olefin tanks on its own is below the compliance noise level at the RAPID boundary and does not significantly increase the existing noise level at the receptor locations. The cumulative noise level from RAPID Complex (Refinery Cracker Complex, Petrochemical Complex and utilities) were below EIA Approval noise limits (*Pindaan Syarat Kelulusan Laporan EIA Terperinci* dated 7th January 2013) at all RAPID boundaries. Noise propagated to sensitive receptors under normal operational conditions from the Refinery Cracker Complex (inclusive of the EURO 5 MOGAS Units and Olefins Storage Tankages), Petrochemical Complex and Utilities had cumulative noise levels below 35 dBA to all noise sensitive locations, except for Kg. Lepau with noise level of 54.7 dBA at the northern boundary. Noise propagation from the entire RAPID Complex when added to the existing baseline noise of the respective receivers had resultant noise levels maintained at the receivers' current ambient levels at all receivers, except Kg. Lepau that was predicted to have an increase of 8.1 dBA daytime and 7.3 dBA night time.

During abnormal conditions (when the RAPID Common flare is in operation which happens only during upset or emergency conditions) noise levels were typically below EIA Approval limits at all receptors except for marginal exceedance at Pengelih Naval Base, Kg. Pengerang, Kg. Sg. Kapal, Kg. Sg Rengit and Kg. Lepau.

The risk posed by the operation of the EURO 5 MOGAS Units and Olefins tank farm is within the risk acceptance criteria by DOE. However, the risk from the overall RAPID development is not within the DOE's risk acceptance criteria. This is mainly due to catastrophic failure events within the refinery units which result in offsite consequences and subsequently unacceptable risk towards the surrounding present population. The units are:

- Flash Fire event due to catastrophic failures of equipment in 2 Trains of Residue Fluid Catalytic Cracking (RFCC)
- Carbon Monoxide toxic dispersion event from Common Hydrogen Production Unit (HPU)
- Fire events related to catastrophic failure of Intermediate LPG storage vessels of the Refinery Storage Tank Farm.

Considering that the contribution events are from the catastrophic failure, the operators of the Refinery Cracker Complex shall implement the "Predictive Maintenance" programme to eliminate catastrophic equipment failures. When the condition gets to a predetermined unacceptable level, the equipment is shut down to repair or replace damaged components so as to prevent a more costly failure from occurring.

The drainage design in the RAPID Complex ensures that all effluent generated from the process units, contaminated surface water runoff from process area and sewage are routed to be treated in the Centralized Effluent Treatment Plant (ETP). Only treated effluent that meet the Standard B can be discharged from the ETP via the ETP marine outfall for dispersion to meet the Class 3 of the Marine Water Quality Guidelines (MMWQG). Modelling results indicated minimal impact of the pollutant loading to the marine waters and

ecosystem, and that the 1.5 km offshore ETP outfall is able to disperse the effluent pollutant concentration to meet the Class 3 of the MMWQG.

The chemical storage in RAPID Complex is a centralised facility at the Common Chemical Warehouse. The design of the storage cells are based on types of chemical and chemical reactivity matrix to ensure safety requirements are met and that incidences such as fire and explosion can be minimised. Spillage of the chemicals in the warehouse shall be contained in pits segregated from connection to drainage areas to ensure no toxic or hazardous substances can endangered the aquatic life of the surrounding water bodies. With the establishment of chemical handling and management procedures and controls, impacts from chemical storage, transport, and handling and disposal are minimal and not expected to be significant.

All the spent chemical, lubricants, adsorbents, catalyst and waste generated from the process areas shall be treated as scheduled waste and to be managed in the main and temporary schedule waste torage facility in the Refinery Cracker Complex. The amount of scheduled waste generated from the Refinery Cracker Complex is estimated to be approximately **7,562.8 tonnes per year** from the normal operation while approximately **4,723.7 tonnes** from the turn around and scheduled maintenance activities. Similar to the chemical warehouse design, the schedule waste storage facility in each of the RAPID petrochemical plants shall be designed in accordance to the type of wastes to ensure waste compatibility that prevent safety and health concerns. The schedule waste storage design is also meeting DOE's requirements of 20 tones storage or less, or 180 days storage and in the event where DOE storage requirements are exhausted, the waste need to be removed on a more frequent basis. From the assessment of the RAPID Complex design philosophy, the impacts associated with the storage, transfer, handling, transport and disposal of the scheduled wastes during operational phase is expected to be minor and mostly contained from impacting the surrounding environmental components and causing public safety/health concerns..

In conclusion, majority of the environmental impacts identified are mostly moderate and upon implementation of the mitigating measures it can be further reduced to minor impact. With the incorporation of best available technologies (BATs) in the engineering design and operational procedures, the impacts can be localised and contained without effecting the ambient environmental conditions or causing any public safety and health concerns in the long run.