



Appendix A: Environmental Baseline Survey for PT Domas Agrointi Prima (DAP) Oleochemical Project

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Prepared for Pacific Harbor Group

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Abbreviations

ANZECC	Australian and New Zealand Environment Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AQ	Air Quality
BOD	Biochemical Oxygen Demand
CCC	Criterion Continuous Concentration
CMC	Criterion Maximum Concentration
COD	Chemical Oxygen Demand
DAP	Domas Agrointi Prima
DO	Dissolved Oxygen
ERL	Effects Range Low
ERM	Effect Range Median
ETP	Endangered Threatened Protected
FWQ	Freshwater Quality
GWQ	Groundwater Quality
HVAS	High Volume Air Sampler
IFC	International Finance Corporation
ISQG	Interim Sediment Quality Guideline
N	Noise
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
SVOC	Semi-Volatile Organic Compounds
SWQ	Seawater Quality
TBT	Tributyl Tin
TDS	Total Dissolved Solids
TSP	Total Suspended Particulate
TSS	Total Suspended Solids
VOC	Volatile Organic Compounds
WHO	World Health Organization

EXECUTIVE SUMMARY

PT Hatfield Indonesia (Hatfield) was retained by ESSA Technologies Limited to complete the baseline assessment of the PT Domas Agrointi Prima (DAP) Oleochemical Plant at Kuala Tanjung, on the north coast of Sumatra. The study was completed on behalf of their client, the Pacific Harbor Group and was prompted by gaps noted in the 2010 environmental evaluation conducted by CV Bawana Rekatama related to marine and water quality in the vicinity of the facility. A complete baseline assessment is necessary to accurately and comprehensively document the background environmental conditions prior to operation or before significant operational change. These baseline conditions will be used as a foundation to detect future impacts and demonstrate compliance with national laws, alignment with international standards (i.e. International Financial Corporations performance standards), and adherence to best management practices.

The sampling plan was specifically developed to closely match the sampling locations used and conditions encountered in the 2010 environmental evaluation. Sampling was conducted for air, water (surface, groundwater and ocean), noise, marine health, and ocean sediment taken from the environment surrounding the facility. The study contributes to filling in the remaining gaps in the understanding of baseline environmental conditions at the facility with regard to parameters and locations. No significant differences in the two sampling periods were found except for a potential deterioration of groundwater quality.

Freshwater samples collected from Rindam and Padang River recorded high concentration of phosphorus, BOD₅ and TSS which exceeded the maximum threshold value. These high concentrations were probably due to the recent rains and the presence of plantations upstream of both Rindam and Padang River.

In terms of air quality, all test values for both gaseous and particulate matters in ambient air measurement are below the maximum threshold values. Noise levels inside the plant (N-1) have comply with the WHO guidelines for industrial area, while the noise level in the residential area (N-2) exceed the guideline values for both day time and night time measurement.

Marine habitat quality in and around the jetty area is very low. Substrates appeared covered by silt. These substrate characteristics make the area unsuitable for the growth or presence of coral, seagrass or seaweed ecosystem. As a result, most local fishermen communities are currently exploiting marine resources as far as 12-25 miles from DAP Plant area, in the Berhala, Salanama and Pandan islands.

In light of the baseline assessment results, it is recommended to continue any existing environmental management and monitoring activities as operation begins and to conduct a second round of sampling during the dry season. This second round of sampling will provide a more complete view of the marine conditions when there is not heavy runoff and turbulent surf. It will identify the surface water conditions without considerable effects of runoff and dilution. And finally, for the ambient air sampling, additional sampling in dry season will ensure that both gaseous and particulate parameters are representative of the operating conditions.

I. Introduction

I.1 Background

PT Domas Agrointi Prima (DAP)'s oleochemical complex ("the Project") is located within the larger industrial site of PT Sarana Industama Perkasa and occupies approximately 114 hectares in the Kuala Tanjung export development zone, on the coast of Batu Bara District, North Sumatra. The area around the Project presents a mix of rapidly developing industrial, residential and agricultural areas, with a trend towards more industrialization and the creation of export facilities given its strategic location on the Malacca Strait.

The Project and others in the industrial estate contribute to cumulative environmental impacts, primarily air emissions, increased traffic, and the generation and discharge of solid waste and liquid effluents. The industrial complex is not connected to the PLN electrical grid and energy supply for the various activities is provided by a diesel generator. Water supply for the industrial estate comes from the Besar River, located approximately 7 km from DAP complex, and for some activities from deep groundwater wells located in the estate.

At the request of ESSA Technologies Ltd., PT Hatfield Indonesia (PTHI) conducted a supplemental baseline study focusing on water quality (marine and freshwater), air quality, marine habitats and noise levels in the Project area. This additional baseline information complements the baseline documented in the 2010 AMDAL developed for the industrial estate.

I.2 Objectives

The objectives of this environmental baseline study were the following:

1. Review DAPs existing environmental data and monitoring records to confirm quality and content gaps relative to national and international (IFC) standards, which must be filled to provide a reliable environmental foundation to recommence operations;
2. Design a supplemental baseline sampling plan to provide data required to form the foundation of a robust and internationally accepted environmental sampling and management plans (RPL/RKL);
3. Review and evaluate all applicable Indonesian regulations and permit requirements, as they pertain to the DAP facilities and operations;
4. Identify applicable international guidelines (IFC and Equator Principles); and
5. Provide interpretation and recommendations for achieving compliance with applicable environmental regulations and permit requirements.

I.3 Scope of work

The scope of work to complete this environmental baseline survey included the following steps:

1. Design a sampling plan;
2. Conduct field sampling in and around DAP plant site and coordinate laboratory analysis of:
 - a. Water quality (river water, groundwater and seawater);

- b. Ambient air quality;
- c. Noise;
- d. Marine habitats.

2. Document review

Prior to the field visit, the PTHI team reviewed relevant documentation, mainly the 2010 AMDAL for the industrial estate. A desktop review was also conducted to identify information sources on marine habitats and fisheries. This reviewed determined that there is no marine protected area in the vicinity of the Project.

Information from the local Marine and Fisheries Department of Medan was also gathered prior to conducting the field survey and it was found that Kuala Tanjung coast is designated as industrial area. Also, according to the fisheries service, the nearest fishing area is at the Berhala Island, approximately 25 miles from the nearest village, and at 20 miles at Pandan and Salanama islands.

3. Methods

3.1 Seawater sampling

Seawater samples were collected from four sites (see Figure 1). At each sampling site, a sample was collected from the surface using a 4 L Van Dorn water sampler and transferred directly into the prepared bottles. Sampling personnel wore non-powdered latex gloves and took precautions to minimize the risk of contaminating sampling equipment, bottles and bottle cap surfaces, and samples. Preservatives were added and bottles were kept inside water cooler boxes with ice packs. Sampling, storing and transportation were conducted in accordance with accepted standard procedures.

A number of in-situ measurements and observations were conducted, including: information/data on brightness, pH, salinity, and turbidity, and temperature, presence of floating matters and of oil film. Brightness was determined by using a secchi disk which was lowered and observed to determine how deep sunlight can penetrate the water. pH, salinity, Dissolved Oxygen (DO), turbidity and temperature were measured using a portable water quality meter. In addition, conditions during sampling were also recorded. These included weather condition and other activities present during sampling.

3.2 Freshwater sampling

Freshwater samples were collected from three sites (Figure 1). Site FWQ1 was not sampled as after field observation it was determined that no stream/channel was present at that particular location. In exchange of FWQ1 site, additional sampling was conducted at FWQ4 which is located at Padang River, west of the plant site. At each sampling site, one sample was collected from the surface using a 4 L Van Dorn water sampler and transferred directly into the prepared bottles. Sampling personnel wore non-powdered latex gloves and took precautions to minimize the risk of contaminating sampling equipment, bottles and bottle cap surfaces, and samples. Preservatives were added and bottles were kept inside water cooler boxes with ice packs. Sampling, storing and transportation were conducted in accordance with accepted standard procedures.

A number of in-situ measurements and observations were conducted, including information/data on brightness, pH, DO and temperature. These parameters were measured using a portable water quality

meter. In addition, conditions during sampling were also recorded. These included weather condition and other activities present during sampling.

3.3 Groundwater sampling

Groundwater samples were collected from two sites (Figure 1); one site inside within the industrial estate and another one outside of the Project and in proximity of the residential area. At each sampling site, one sample was collected from the surface. Samples were collected using a 4 L Van Dorn water sampler and transferred directly into the prepared bottles. Sampling personnel wore non-powdered latex gloves and took precautions to minimize the risk of contaminating sampling equipment, bottles and bottle cap surfaces, and samples. Preservatives were added and bottles were kept inside water cooler boxes with ice packs. Sampling, storing and transportation were conducted in accordance with accepted standard procedures.

Just as the seawater samples, a number of in-situ measurements and observations were conducted which include information/data on pH, odor, temperature, and taste. pH and temperature were measured using a portable water quality meter. In addition, conditions during sampling were also recorded. These included weather condition and other activities present during sampling.

3.4 Ambient air sampling

Ambient air samples were collected from two sites (Figure 1). Two sets of equipment were used at each sampling sites. These are three units of High Volume Air Sampler (HVAS) for sampling of particulate parameters and an impinger (RAC-5) for sampling of gaseous parameters.

The three HVAS units were used to collect samples for Total Suspended Particulate (TSP), Particulate Matter with size $< 10 \mu\text{m}$ (PM_{10}), and Particulate Matter with size $< 2.5 \mu\text{m}$ ($\text{PM}_{2.5}$). Each unit is equipped with a suction pump used to suck air into each unit. Within each unit, a filter was put in place. Once all of the HVAS units were completely assembled, these units were positioned at sampling sites with some distances between them. The three units were then connected to a generator set which was operated continuously for 24 hours. This generator set is positioned at some distance from the three units so as to avoid its gas exhaust from interfering with the analysis results. With the power, already available, the suction pump was turned on to funnel air through the filter at a rate of 3 L/minute. After a period of 24 hours, the pump was turned off, the filter removed and stored, and the HVAS units disassembled. The filters were then analyzed at the laboratory.

The impinger unit was used for a number of times during the 24-hour measurement to collect samples for analysis of gaseous parameters. The impinger is consisted of five gas sampler, each for different gas parameters. At each sampler, absorber solution was added which corresponds to the gas parameter to be analyzed. The impinger was then connected to the suction pump in the HVAS unit for a pre-determined duration. Upon completion, impinger was disconnected, and absorber solution transferred into sample bottles which were then stored in sample containers. The samples were then analyzed at the laboratory.

3.5 Noise levels sampling

Noise was measured at two sites (Figure 1). Noise was measured continuously for 24 hours using a sound level meter. Sound level meter was installed on top of a tripod which sits the meter at around 1.5 meters above ground. The meter installation site was at least 5 meters from any structures which may disrupt/affect

the noise measurement. The measurement was supported by the use of a sound recorder. The sound recorder is used to analyze/identify unusual peaks recorded by the sound level meter.

3.6 Marine habitat characterization

The approach to assess the status of marine habitats was timed swim using Scuba Dive equipment and swim 15 minutes each points and manta tow where the observer is towed by the boat. These methods are efficient for large scale area and for rapid assessment of coral reef community. However, due to high levels of water turbidity, these methods could not be used as water visibility was so low that it was impossible and unsafe to make observations this way. An alternative method was applied that includes placing of a 100 m transect line on the bottom substrate as a guiding line. Observers swim over the line and record their observations on benthic habitat status and fish and other invertebrate life in a belt of 2.5m left and 2.5m right of the transect line (English et al 1997). A total of 12 locations were surveyed at different distances from the land, 7 data locations left of the jetty and 5 points on the right side of the jetty.

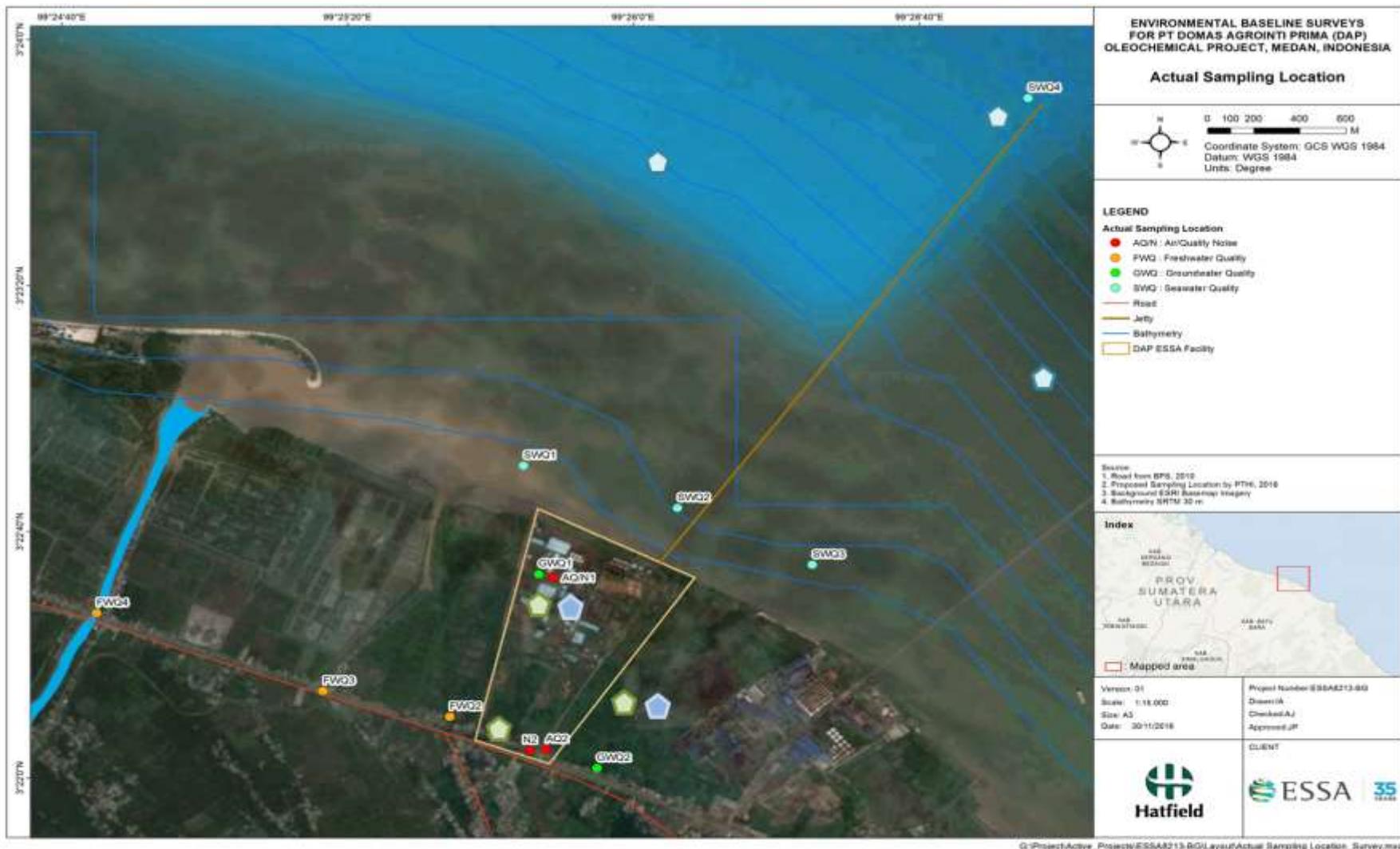
Substrate sediment samples were collected as additional data sampling at 4 points (point 3, 9, 4 and 7). These sediment samples are representative of the substrate condition of the seabed around the jetty.

4. Implementation of the field sampling program

Field sampling was conducted from 3 to 11 November, 2016. The sampling program involved personnel from PTHI, Intertek Laboratory, PHG and DAP support staff. The personnel involved are presented in Table 1, the breakdown of sampling program is presented in Table 2 and the sampling sites are presented in Figure 1.

Table 1: Personnel involved in field sampling

No	Name	Company	Role	Time on Field
1	Josua Partogi	PTHI	Environment sampling coordinator	3-9 November 2016
2	Lukman Hakim	Intertek	Environment sampling technician	3-8 November 2016
3	Fauz Asyrafi Endyan	Intertek	Environment sampling technician	3-8 November 2016
4	Hamzah Al Qowiyul Hamid	Intertek	Environment sampling technician	3-8 November 2016
5	Priska Widyastuti	PTHI	Marine resources specialist (socio-economic surveyor)	7-11 November 2016
6	Windy Rizki Akbar Putri	PTHI	Marine resources specialist (socio-economic surveyor)	7-11 November 2016
7	Sigit Heru Prasetya	PTHI	Marine resources specialist (diver)	7-11 November 2016
8	Dias Natasasmita	PTHI	Marine resources specialist (diver)	7-11 November 2016
9	Andre Barlian	PHG	Observer	3-5 November 2016
10	Andrew Otoshi	PHG	Observer	4-10 November 2016



(Approximate) location of original sampling sites from the 2010 DELH:

Seawater quality Air and noise Freshwater quality

Figure 1: Environmental sampling sites (November 2016 and DELH 2010)

Table 2: Schedule of the sampling program

Day	Date	Activities	Notes
1	Thursday, 3 November 2016	<ul style="list-style-type: none"> ▪ Environment team travel to Kuala Tanjung ▪ Kick-off meeting ▪ Preparation 	Kick-off meeting conducted between PTHI, DAP and PHG
2	Friday, 4 November 2016	<ul style="list-style-type: none"> ▪ Ambient air sampling at AQ-1 ▪ Groundwater sampling at GWQ-1 and GWQ-2 ▪ Freshwater quality sampling at FWQ-2 (Sono River) 	<ul style="list-style-type: none"> ▪ GWQ-1 is a bore-well inside DAP plant area ▪ GWQ-2 is a dug-well in a residential area just outside DAP plant area ▪ Sono River is not actually a flowing river but resembles more of a swamp which flows occasionally
3	Saturday, 5 November 2016	<ul style="list-style-type: none"> ▪ Freshwater quality sampling at FWQ-3 (Rindam River) ▪ Ambient air sampling at AQ-2 	Environment team attempted to collect seawater sample but sampling was aborted due to bad weather
4	Sunday, 6 November 2016	<ul style="list-style-type: none"> ▪ Noise monitoring at N1 	
5	Monday, 7 November 2016	<ul style="list-style-type: none"> ▪ Seawater sampling at SWQ1-4 ▪ Freshwater sampling at FWQ-4 (Padang River) ▪ Noise monitoring at N-2 	<ul style="list-style-type: none"> ▪ Additional freshwater sampling was conducted at Padang River
6	Tuesday, 8 November 2016	<ul style="list-style-type: none"> ▪ Marine team travel to Kuala Tanjung ▪ Marine team coordination meeting ▪ Marine Habitat sampling at point 1, 3,6, 9 and 11 ▪ Land Based Survey for the Marine Community at Kuala Indah and Kuala Tanjung 	<ul style="list-style-type: none"> ▪ Coordination meeting conducted between PTHI, DAP and PHG ▪ Marine sampling point 1,3,6, 9 was conducted, and the depth of that area is typically not different the range is 6-25feet and the substrate is cover by clay with silty waters ▪ Point 11 has a deeper depth than the other point, the depth is above 49feet ▪ All waters condition on the sampling point 1,3,6,9, and 11 has a poor visibility ▪ Met some fishermen near the fishing ground. ▪ Interviewed an exporter's middle man and some fishermen ▪ Marine commodities that were found are Pomfret Fish (Ikan Bawal), Sharks (Hiu), Squids (Cumi), Stingrays (Pari), Long Jawed Mackerel (Ikan Kembung) ▪ Fishermen in Kuala Tanjung and Kuala Indah mostly caught their fish near Berhalia Island which is far away from the plant

Day	Date	Activities	Notes
7	Wednesday, 9 November 2016	<ul style="list-style-type: none"> ▪ Marine Habitat sampling at point 5,6,12,10 ▪ Land Based Survey for the Marine Community at Kuala Separi 	<ul style="list-style-type: none"> ▪ Marine sampling at point 5 and 6 is skipped because has a same condition with point 8 & 9 ▪ Depth water on this area is 12-25feet ▪ Sampling point 12 and 10 on the right side of jetty ▪ Point 12 is the depth area, but the condition underwater is the same, with poor visibility ▪ Different commodities were found in Kuala Separi such as Blue Swimming Crab and Clams ▪ Many Blue Swimming Crabs and Clams were caught near the Jetty of PT.DAP
8	Thursday, 10 November 2016	<ul style="list-style-type: none"> ▪ Marine habitat sampling at point 2, 4, 7 ▪ Land Based Survey for the Marine Community at Kuala Separi Pagurawan 	<ul style="list-style-type: none"> ▪ Marine habitat took a sample of sediment on this sampling point ▪ Pagurawan marine commodities were dominated with anchovy fish (ikanteri) and other dried fish
9	Friday, 11 November 2016	Closing meeting	<ul style="list-style-type: none"> ▪ Packing some clams for samples to find information on the toxins in the water.

Figures 2 and 3 show different moments of the sampling campaigns for environmental parameters and marine habitat. All the samples were sent to Intertek Laboratory in Jakarta for analysis.

Figure 2: Environmental team sampling



Groundwater sampling



Ambient air sampling



Seawater sampling



Freshwater sampling



Noise level measurement



Noise level measurement

Figure 3: Marine team sampling



Marine sampling preparation



Substrate condition



Transect line



Depth and visibility



Interview with fishermen



Local fish commodities

Sampling site conditions (e.g., weather conditions, characteristics of the site) could, to a certain degree, affect laboratory analyses results. Therefore, during sampling, and as much as possible, all relevant information was recorded. These data are summarized in Table 3.

Table 3: Sample site conditions

No.	Sampling Site Code	Weather Conditions	Site Description	Existing Activities
Seawater				
1	SWQ-1	Partly cloudy	Located ± 300 m from Rindam River mouth	-
2	SWQ-2	Partly cloudy	Located ± 100 m west of jetty and ± 200 m from DAP sheet pile at shore	-
3	SWQ-3	Partly cloudy	Located ± 500 m east of jetty and ± 200 m from DAP sheet pile at shore	-
4	SWQ-4	Partly cloudy	Located $\pm 2,000$ m from DAP sheet pile at shore, at the end of jetty	A number of fishermen boat
Freshwater				
1	FWQ-1		Not sampled. No stream/channel was identified.	
2	FWQ-2	Partly cloudy	Located near the road. Water was sampled from a channel which at the time does not represent flowing river.	Light traffic at adjacent road
3	FWQ-3	Light shower	Located at a road bridge over Rindam River. Water was sampled during low tide condition.	Light traffic at adjacent road
4	FWQ-4	Partly cloudy	Located at a road bridge over Padang River. Water was sampled during low tide condition.	Light traffic at adjacent road. Light traffic of boats.
Groundwater				
1	GWQ-1	Light shower	Located inside plant. Sample taken from a bore-well.	-
2	GWQ-2	Partly cloudy	Located at a residential area just outside plant. Sample taken from a dug-well	-
Ambient air				
1	AQ-1	Cloudy, light to heavy shower, strong wind	Located at a field inside plant.	Very light traffic
2	AQ-2	Cloudy, light to heavy shower	Located just outside plant	Light traffic
Noise				
1	N-1	Cloudy, light shower	Located at a field inside plant (same location as AQ1)	
2	N-2	Partly cloudy	Located at a residential area just outside plant	
Marine habitat				
1	1	Partly cloudy	Located near ± 300 m land and ± 300 m from left of jetty	
2	3	Partly cloudy	Located form ± 700 m land and ± 300 m left side of jetty	

No.	Sampling Site Code	Weather Conditions	Site Description	Existing Activities
3	6	Partly cloudy	Located ± 1500 m from land and ± 300 m from left side of jetty	Few fishermen boats
4	9	Partly cloudy	Located near the end of jetty and ± 300 m from left side of jetty	Few fishermen boats
5	5	Partly cloudy	Located from ± 1500 m and ± 700 m from left side of jetty	Few fishermen boat traffic here
6	8	Partly cloudy	Located near the end of jetty and ± 300 m from left side of jetty	Few fishermen boats
7	11	Light Shower	Located ± 2500 m from land and ± 300 m from left side the end of jetty	Big vessel and local fishermen boat routes
8	12	Partly cloudy to light rain	Located ± 2500 m from land and ± 300 m from right side the end of jetty	Big vessel and local fishermen boat routes, a number fishermen boat fishing here
9	10	Partly cloudy to light rain	Located near the end of jetty and ± 300 m from right side of jetty	
10	7	Partly cloudy	Located ± 1500 m from land and ± 300 m from left side of jetty	Few fishermen boats
11	4	Partly cloudy to light shower	Located near ± 700 m land and ± 300 m from right of jetty	
12	2	Partly cloudy to light shower	Located form ± 300 m land and ± 300 m right side of jetty	

5. Results and discussion

5.1 Freshwater

As previously mentioned, a total of three freshwater samples were collected from streams and/or water bodies around the plant. The laboratory results are presented in the following table.

Table 4: Freshwater quality laboratory results

No.	Parameter	Unit	Threshold ¹	Threshold ²	Threshold ³	Result	
						FWQ-2*	FWQ -3* (Rindam River)
Physical tests							
1	pH (Field)	S.U.	6-9			7.65	7.42
2	Temperature	°C	3 degree deviation from natural condition			29.4	26.8
							27.9

No.	Parameter	Unit	Threshold ¹	Threshold ²	Threshold ³	Result		
						FWQ-2*	FWQ -3* (Rindam River)	FWQ -4 (Padang River)
3	Total Suspended Solids, TSS	NTU	50		6	123	57	
Anions								
1	Fluoride, F ⁻	mg/L	1.5		0.37	0.90	0.08	
2	Chloride, Cl ⁻	mg/L	-	860	230	3,580	3,600	7.9
3	Cyanide (Total), CN ⁻	mg/L	0.02	0.022	0.0052	<0.005	<0.005	<0.005
4	Sulphide as H ₂ S	mg/L	0.002		0.002	<0.002	<0.002	<0.002
Nutrients								
1	Nitrate, NO ₃ -N	mg/L	10		0.444	0.271	0.836	
2	Nitrite, NO ₂ -N	mg/L	0.06		<0.001	0.127	0.010	
3	Total Phosphorus as P	mg/L	0.2		1.22	0.226	0.214	
Dissolved Metals								
1	Arsenic, As	mg/L	1	0.34	0.15	0.0044	0.0013	0.0011
2	Boron, B	mg/L	1		0.98	1.00	0.10	
3	Cadmium, Cd	mg/L	0.01	0.0018	0.00072	0.0002	<0.0001	0.0002
4	Chromium Hexavalent, Cr ⁶⁺	mg/L	0.05	0.57	0.074	<0.002	<0.002	<0.002
5	Cobalt, Co	mg/L	0.2		<0.001	<0.001	<0.001	
6	Copper, Cu	mg/L	0.02		<0.001	<0.001	<0.001	
7	Lead, Pb	mg/L	0.03	0.065	0.0025	<0.001	<0.001	<0.001
8	Mercury, Hg	mg/L	0.002	0.0014	0.00077	<0.00005	0.00147	<0.00005
9	Selenium, Se	mg/L	0.05		<0.0005	<0.0005	0.0006	
10	Zinc, Zn	mg/L	0.05	0.12	0.12	0.032	0.026	0.024
Microbiology								
1	Faecal coliforms	cell/100ml	1,000		770	105	236	
Miscellaneous								
1	Biochemical Oxygen Demand, BOD ₅	mg/L	3		23	18	3	
2	Chemical Oxygen Demand, COD	mg/L	25		79	61	9	
3	Dissolved Oxygen, DO (Field)	mg/L	4		6.65	6.05	5.88	
4	Chlorine, Cl ₂	mg/L	0.03	0.019	0.011	<0.01	<0.01	<0.01

No.	Parameter	Unit	Threshold ¹	Threshold ²	Threshold ³	Result		
						FWQ-2*	FWQ -3* (Rindam River)	FWQ -4 (Padang River)
5	Oil & Grease	mg/L	1,000		<1	<1	<1	<1
6	Surfactants, MBAS	mg/L	200		<0.01	<0.01	<0.01	<0.01
7	Total Phenols	mg/L	1		<0.001	<0.001	<0.001	<0.001
8	BHCs	µg/L	210		<0.001	<0.001	<0.001	<0.001
9	Endrin	µg/L	4	0.086	0.036	<0.001	<0.001	<0.001
10	p,p-DDD	µg/L	-		<0.001	<0.001	<0.001	<0.001
11	p,p-DDE	µg/L	-		<0.001	<0.001	<0.001	<0.001
12	p,p-DDT	µg/L	2		<0.001	<0.001	<0.001	<0.001

¹ Government Regulation No. 82/2001 regarding Management of Water Quality and Water Pollution Control, Class II

² IFC General EHS Guidelines. Source: National Recommended Water Quality Criteria – Aquatic Life Criteria Table for Freshwater Criterion Maximum Concentration (CMC), US EPA, 2004

³ IFC General EHS Guidelines. Source: National Recommended Water Quality Criteria – Aquatic Life Criteria Table for Freshwater Criterion Continuous Concentration (CCC), 2004

* Sites are located in the inter-tidal area where influence of tidal effect are higher compared to FWQ-4 which has a higher freshwater flow

5.1.1 Physical parameters

Total Suspended Solids (TSS) values are high at FWQ-3 and FWQ-4 with both values exceeding the maximum threshold value of 50 mg/L. The fact that TSS value in FWQ-3 is higher than in FWQ-4 is probably due to the heavy rain that occurred the night prior to sampling on FWQ-3. Because the sampling occurred during the rainy season, high levels of sediments in freshwater bodies are to be expected.

5.1.2 Nutrients

Results for total phosphorus (P) show values that are higher than the maximum threshold (0.015 mg/L), with FWQ-3 concentration being slightly higher than that at FWQ-4. This high concentration of phosphorus is likely due to the presence of plantations upstream of both Rindam and Padang River, with large segments of the rivers having plantations on one or both river banks. The application of fertilizers at these plantations may explain the high concentration of phosphorus at the freshwater sampling sites. Also, the fact that sampling was conducted in the rainy season where heavy rain occurred just the night prior to sampling may contribute to these high concentrations.

5.1.3 Other parameters

Coliforms

All the values recorded for fecal coliforms are lower than the maximum threshold, with FWQ-2 showing the smallest value.

BOD₅ and COD

Both BOD₅ and COD concentration values indicate the amount of organic compounds present in water. BOD₅ and COD concentration at both FWQ-2 and FWQ-3 are higher than the maximum threshold values. Concentration of both parameters at FWQ-4 was lower than the maximum threshold values. Like with TSS, the higher BOD₅ and COD concentration at FWQ-3 relative to FWQ-4 is probably due to the preceding rainfall event that occurred prior to sampling at Rindam River. Recent rains and subsequent runoff can potentially affect the transfer of pollutants from the soil surface to water bodies (Bae, 2013).

5.1.4 Comparison with IFC EHS Guidelines

The freshwater quality laboratory results in Table 4 also presents a number of threshold values derived from IFC General Environmental, Health, and Safety (EHS) Guidelines. All the parameters with corresponding IFC guideline values show values that are lower than the maximum threshold values for both Criterion Maximum Concentration (CMC¹) and Criterion Continuous Concentration (CCC²).

5.1.5 Comparison with previous data

The following table present a comparison between results from primary sampling conducted for this study (November 2016) with existing freshwater quality data from samples collected circa September 2010.

Table 5: Freshwater quality laboratory results from September 2010 and November 2016 sampling

No.	Parameter	Unit	Threshold ¹	Result		
				September 2010		November 2016
				KA-1 (Besar River)	KA-2 (Rindam River)	FWQ -3 (Rindam River)
Physical tests						
1	pH (Field)	S.U.	6-9	7.23	6.74	7.42
2	Total Suspended Solids, TSS	NTU	50	68	100	123
Anions						
1	Sulphide as H ₂ S	mg/L	0.002	0.008	<0.002	
Nutrients						
1	Nitrate, NO ₃ -N	mg/L	10	0.08	0.271	
2	Nitrite, NO ₂ -N	mg/L	0.06	1.18	0.127	
3	Total Phosphorus as P	mg/L	0.2	0.32	0.226	

¹ CMC refers to maximum concentration of a particular chemical in water in which aquatic organisms can be exposed to acutely without causing adverse effect

² CMC refers to maximum concentration of a particular chemical in water in which aquatic organisms can be exposed to indefinitely without causing adverse effect

No.	Parameter	Unit	Threshold ¹	Result		
				September 2010		November 2016
				KA-1 (Besar River)	KA-2 (Rindam River)	FWQ -3 (Rindam River)
Dissolved Metals						
1	Zinc, Zn	mg/L	0.05	0.05		0.026
Miscellaneous						
1	Biochemical Oxygen Demand, BOD ₅	mg/L	3	2.84	69	18
2	Chemical Oxygen Demand, COD	mg/L	25	5	165	61
3	Dissolved Oxygen, DO (Field)	mg/L	4	5.68	7.31	6.05
4	Oil & Grease	mg/L	1,000	19		<1

¹ Government Regulation No. 82/2001 regarding Management of Water Quality and Water Pollution Control, Class II

Results for physical parameters (pH, TSS and DO) show very similar values for the two sampling dates. BOD₅ and COD values were significant higher in 2010 than 2016 values. These higher values could be due to a number of reasons, including preceding rain events and differences in activities present upstream of sampling point, or differences in method of field sampling and quality control measures taken.

5.2 Groundwater

As mentioned in previous sections, a total of two groundwater samples were collected from wells in and around the plant. The laboratory results are presented in the following table.

Table 6: Groundwater quality laboratory result

No.	Parameter	Unit	Threshold ¹	Result	
				GWQ-1 (Inside plant)	GWQ -2 (Residential area)
Physical tests					
1	Colour	Pt/Co	-	<5	15
2	Odour (Field)	-	-	Odorless	Odorless
3	pH (Field)	S.U.	6.5 - 9.0	7.58	7.15
4	Taste (Field)	-	-	Tasteless	Tasteless
5	Temperature	°C	3 degree deviation from natural condition	36.8	27.2
6	Total Dissolved Solids, TDS	mg/L	1,500	572	614
7	Total Hardness as CaCO ₃	mg/L	500	38.1	197
8	Turbidity	NTU	25	21.4	7.9
Anions					
1	Chloride, Cl ⁻	mg/L	600	15.5	189
2	Cyanide (Total), CN ⁻	mg/L	0.1	<0.005	<0.005

No.	Parameter	Unit	Threshold ¹	Result	
				GWQ-1 (Inside plant)	GWQ -2 (Residential area)
3	Fluoride, F ⁻	mg/L	1.5	1.53	0.15
4	Sulphate, SO ₄ ²⁻	mg/L	400	<2	37
Nutrients					
1	Nitrite, NO ₂ -N	mg/L	1	0.519	0.002
2	Nitrate, NO ₃ -N	mg/L	10	4.49	1.75
Dissolved Metals					
1	Arsenic, As	mg/L	0.05	<0.0005	<0.0005
2	Cadmium, Cd	mg/L	0.005	<0.0001	<0.0001
3	Chromium Hexavalent, Cr ⁶⁺	mg/L	0.05	<0.002	<0.002
4	Iron, Fe	mg/L	1	0.068	0.302
5	Lead, Pb	mg/L	0.05	<0.001	<0.001
6	Manganese, Mn	mg/L	0.5	0.004	0.270
7	Mercury, Hg	mg/L	0.001	<0.00005	<0.00005
8	Selenium, Se	mg/L	0.01	<0.0005	<0.0005
9	Zinc, Zn	mg/L	15	<0.005	<0.005
Miscellaneous					
1	Total Organic Matter, KMnO ₄	mg/L	10	2	7
Polycyclic Aromatic Hydrocarbons, PAHs					
1	Benzo (a) pyrene	µg/L	0.01	<0.1	<0.1
Pesticides					
1	Aldrin	µg/L	0.7	<0.001	<0.001
2	Dieldrin	µg/L	0.7	<0.001	<0.001
3	Hexachlorobenzene (HCB)	µg/L	0.01	<0.01	<0.01
4	Heptachlor Epoxide	µg/L	3	<0.001	<0.001
5	Heptachlor	µg/L	3	<0.001	<0.001
6	Lindane	µg/L	4	<4	<4
7	Metoxychlor	µg/L	100	<0.2	<0.2
8	p,p-DDD	µg/L	-	<0.001	<0.001
9	p,p-DDE	µg/L	-	<0.001	<0.001
10	p,p-DDT	µg/L	30	<0.001	<0.001
Acidic Pesticides					
1	2,4-D	µg/L	100	<0.1	<0.1
Volatile Organic Compounds, VOCs*					
1	Benzene	µg/L	10	<0.001	<0.001
2	1,2-Dichloroethene	µg/L	10	<1	<1
3	1,1-Dichloroethene	µg/L	0.3	<0.5	<0.5
4	Chloroform	µg/L	30	<1	<1
1	Semi Volatile Organic Compounds,				

No.	Parameter	Unit	Threshold ¹	Result	
				GWQ-1 (Inside plant)	GWQ -2 (Residential area)
SVOCs*					
2	2,4,6-trichlorophenol	µg/L	10	<10	<10
3	Pentachlorophenol	µg/L	10	<0.5	<0.5
Radionuclide					
1	Gross A	Bq/L	0.1	<0.05	<0.05
2	Gross B	Bq/L	1	<0.1	0.2

¹ Regulation of Minister of Health No. 416/1990 regarding Requirements and Control of Water Quality, Appendix II

5.2.1 Physical parameters

All of the laboratory results for physical parameter show values that comply with the threshold values. TDS concentrations range from 572 to 614 mg/L (with a maximum threshold value of 1,500 mg/L) while total hardness value range from 38.1 to 197 mg/L (with a maximum threshold value of 500 mg/L).

5.2.2 Nutrients

All analyzed nutrient values are lower than the maximum threshold values with values at GWQ-2 (located in residential area) recording lower concentration than those at GWQ-1 (inside the plant). Nitrite concentrations range from 0.002 to 0.519 mg/L (with a maximum threshold value of 1 mg/L) while nitrate concentration range from 1.75 to 4.49 mg/L (with a maximum threshold value of 10 mg/L).

5.2.3 Other parameters

Fluoride

The presence of fluoride in groundwater can be due to natural or anthropogenic causes, or a combination of both. The weathering and leaching of fluoride-bearing minerals from rocks and sediments, and infiltration of rainfall, can contribute to increases of fluoride concentration in groundwater (Jha et al. 2013).

Laboratory results show that fluoride (F⁻) concentration at GWQ-1 is 1.53 mg/L which is slightly higher than the maximum threshold value of 1.5 mg/L.

Volatile and Semi-Volatile Organic Compounds

All values for Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs) parameters are below the analysis detection limit.

5.2.4 Comparison with previous data

The following table present a comparison between results from primary sampling conducted for this study (November 2016) with existing groundwater quality data from samples collected circa October 2010.

Table 7 Groundwater quality laboratory result from October 2010 and November 2016 sampling.

No.	Parameter	Unit	Threshold ¹	Result			
				Residential Area		Plant Area	
				SG (October 2010)	GWQ -2 (November 2016)	SB (October 2010)	GWQ-1 (November 2016)
Physical tests							
1	Colour	Pt/Co	-	4.2	15	3.2	<5
2	Odour (Field)	-	-	odourless	Odorless	odourless	Odorless
3	pH (Field)	S.U.	6.5 - 9.0	6.8	7.15	7.7	7.58
4	Taste (Field)	-	-	tasteless	Tasteless	tasteless	Tasteless
5	Temperature	°C	3 degree deviation from natural condition	29	27.2	29	36.8
6	Total Dissolved Solids, TDS	mg/L	1,500	290	614	530	572
7	Total Hardness as CaCO ₃	mg/L	500	80	197	60	38.1
8	Turbidity	NTU	25	10	7.9	0.2	21.4
Anions							
1	Chloride, Cl ⁻	mg/L	600	25.6	189	9.7	15.5
2	Sulphate, SO ₄ ²⁻	mg/L	400	5	37	25	<2
Nutrients							
1	Nitrite, NO ₂ -N	mg/L	1	0.17	0.519	0	0.002
2	Nitrate, NO ₃ -N	mg/L	10	3.4	4.49	1.3	1.75
Dissolved Metals							
1	Lead, Pb	mg/L	0.05	0	<0.001	0	<0.001
2	Zinc, Zn	mg/L	15	0.02	<0.005	0.06	<0.005
Miscellaneous							
1	Total Organic Matter, KMnO ₄	mg/L	10	10.7	2	9.8	7

¹ Regulation of Minister of Health No. 416/1990 regarding Requirements and Control of Water Quality, Appendix II

In general, values for anions and nutrients from 2016 are higher than values from 2010. The higher values may be affected by a number of reasons including changes in environmental conditions, or differences in method of field sampling and quality control measures taken. That being said, all of the values presented still meet the threshold values set in the relevant regulation.

5.3 Seawater

As mentioned in previous sections, a total of four seawater samples were collected from areas around the plant's jetty. The laboratory results are presented in the following table.

Table 8 Seawater quality laboratory result.

No.	Parameter	Unit	Threshold ¹	Threshold ²	Threshold ³	Result			
						SWQ-1	SWQ-2	SWQ-3	SWQ-4
Physical tests									
1	Brightness (Field)	m	>5			<1	<1	<1	1
2	Floating Matter (Field)	-	None			none	none	present	none
3	Odour (Field)	-	Odourless			Odorless	Odorless	Odorless	Odorless
4	Oil Film (Field)	-	None			None	None	present	None
5	pH (Field)	S.U.	7-8.5			7.70	7.82	7.87	8.03
6	Salinity (Field)	g/L	Natural			25.1	28.0	28.5	29.0
7	Temperature	°C	Natural			29.1	29.4	29.1	29.6
8	Total Suspended Solids, TSS	mg/L	20			103	56	60	6
9	Turbidity (Field)	NTU	<5			98.0	59.0	61.0	8.9
Anions									
1	Cyanide (Total), CN ⁻	mg/L	0.5			<0.005	<0.005	<0.005	<0.005
2	Sulphide as H ₂ S	mg/L	0.01	-	0.002	<0.002	<0.002	<0.002	<0.002
Nutrients									
1	Total Ammonia, NH ₃ -N	mg/L	0.3			<0.02	<0.02	<0.02	<0.02
2	Nitrate, NO ₃ -N	mg/L	0.008			0.041	0.020	0.010	0.005
3	Total Phosphorus as P	mg/L	0.015			0.080	0.078	0.085	0.030
Dissolved Metals									
1	Arsenic, As	mg/L	0.012	0.069	0.036	0.0012	0.0011	0.0012	0.0013
2	Cadmium, Cd	mg/L	0.001	0.033	0.0079	<0.0001	<0.0001	<0.0001	<0.0001
3	Chromium Hexavalent, Cr ⁶⁺	mg/L	0.005			<0.002	<0.002	<0.002	<0.002
4	Copper, Cu	mg/L	0.008	0.0048	0.0031	<0.001	<0.001	<0.001	<0.001
5	Lead, Pb	mg/L	0.008	0.21	0.0081	<0.001	<0.001	<0.001	<0.001

No.	Parameter	Unit	Threshold ¹	Threshold ²	Threshold ³	Result			
						SWQ-1	SWQ-2	SWQ-3	SWQ-4
6	Mercury, Hg	mg/L	0.001	0.0018	0.00094	<0.00005	<0.00005	<0.00005	<0.00005
7	Nickel, Ni	mg/L	0.05	0.074	0.0082	<0.001	<0.001	<0.001	<0.001
8	Zinc, Zn	mg/L	0.05	0.09	0.081	<0.005	<0.005	<0.005	<0.005
Microbiology									
1	Total Coliforms	MPN/100ml	1,000			27	5	>1600	3
Miscellaneous									
1	Biochemical Oxygen Demand, BOD ₅	mg/L	20			3	<2	<2	<2
4	Dissolved Oxygen, DO (Field)	mg/L	>5			4.30	5.34	4.47	4.33
5	Oil & Grease	mg/L	1			<1	1	<1	<1
6	Surfactants, MBAS	mg/L	1			<0.01	<0.01	<0.01	<0.01
7	Total Phenols	mg/L	0.002			<0.001	<0.001	<0.001	<0.001
8	Radionuclide								
	• Gross A	Bq/L	4			<0.05	<0.05	<0.05	<0.05
	• Gross B	Bq/L	4			0.5	<0.1	<0.1	<0.1
Organics Tests									
1	OC-Pesticides	µg/L	0.01			<0.01	<0.01	<0.01	<0.01
2	Polycyclic Aromatic Hydrocarbons, PAHs	µg/L	3			<0.1	<0.1	<0.1	<0.1
3	Polychlorinated Biphenyls, PCBs	µg/L	0.01	-	0.03	<0.01	<0.01	<0.01	<0.01
4	Tributyl Tin, TBT (as Organotin)	µg Sn/L	0.01	0.42	0.0074	<0.01	<0.01	<0.01	<0.01

¹ Decree of Minister of Environment No.51/2004 regarding Threshold Values for Seawater Quality, Appendix III

² IFC General EHS Guidelines. Source: National Recommended Water Quality Criteria – Aquatic Life Criteria Table for Saltwater Criterion Maximum Concentration (CMC)

³ IFC General EHS Guidelines. Source: National Recommended Water Quality Criteria – Aquatic Life Criteria Table for Saltwater Criterion Continuous Concentration (CCC)

5.3.1 Physical parameters

The laboratory data shows that all of the sampling points show brightness values that are less than the minimum threshold values set by the regulation. These low brightness values are corroborated by the high turbidity values at all points and high TSS concentrations at most points. SWQ-4, which is located $\pm 2,000$ m off shore, is the only point which show TSS value lower than the maximum threshold value of 20 mg/L (although turbidity at that point is still above the maximum threshold value). All other points, which are located close to the mouth of Rindam River and Padang River, show high values of both TSS and turbidity. SWQ-1, which is the point closest to the two rivers, shows the highest value, indicating that both these rivers are the main contributor for the suspended solids.

5.3.2 Nutrients

All of the laboratory analysis for total phosphorus (P) show values that are higher than the maximum threshold value of 0.015 mg/L (values range from 0.030 to 0.085 mg/L). These high values seem to concur with the relatively high concentrations of phosphorus at both Rindam and Padang River which empties to the seawater sampling areas.

Most of nitrite concentrations are also higher than the maximum threshold value of 0.008 mg/L (values range from 0.005 to 0.041 mg/L). These values can be related to the readings of nitrate concentration at both Rindam and Padang River which range from 0.271 to 0.836 mg/L.

5.3.3 Dissolved metals

All of the laboratory results for dissolved metals show values that are lower than the maximum threshold values. Most of the parameters show values that are even lower than the analysis detection limit with the exception of arsenic where values range from 0.0011 to 0.0013 mg/L. These readings of arsenic however may be due to natural processes. Under natural condition, arsenic concentration is usually less than 0.004 mg/L (Smedley & Kinniburgh, 2002).

5.3.4 Other parameters

Dissolved Oxygen

Most of the laboratory analysis for dissolved oxygen (DO) show values that are slightly lower than the minimum threshold values of 5 mg/L, with the exception of data at SWQ-2.

Organics

All of the laboratory analysis for total phenols, as well as other organic parameters (PAHs, PCB and TBT), show values that are lower than the detection limit as well as the maximum threshold values. The same is found for values of Organochlorine Pesticides (OCP).

5.3.5 Comparison with IFC Guidelines

The seawater quality laboratory results in Table 8 also presents a number of threshold values derived from IFC General Environmental, Health, and Safety (EHS) Guidelines. It can be concluded that most of the parameters which have corresponding IFC guideline values show values that are lower than the maximum threshold values for both Criterion Maximum Concentration (CMC) and Maximum Continuous Concentration (CCC).

5.3.6 Comparison with previous data

The following table present a comparison between results from primary sampling conducted for this study (November 2016) with existing seawater quality data from samples collected circa October 2010.

Table 9 Seawater quality laboratory result from October 2010 and November 2016 sampling.

No.	Parameter	Unit	Threshold ¹	Result						
				October 2010			November 2016			
				1 (10 m in front of pier)	2 (20 m to right of pier)	3 (20 m left of pier)	SWQ-1	SWQ-2	SWQ-3	SWQ-4
Physical tests										
1	Odour (Field)	-	Odourless	Odourless	Odourless	Odourless	Odorless	Odorless	Odorless	Odorless
2	Oil Film (Field)	-	None	Present	Present	Present	None	None	present	None
3	pH (Field)	S.U.	7-8.5	8.33	8.27	8.39	7.70	7.82	7.87	8.03
4	Salinity (Field)	g/L	Natural	27.4	26.9	27.2	25.1	28.0	28.5	29.0
5	Temperature	°C	Natural	30.8	32.5	32.1	29.1	29.4	29.1	29.6
6	Total Suspended Solids, TSS	mg/L	20	66.15	63.10	51.26	103	56	60	6
7	Turbidity (Field)	NTU	<5	28.7	28.1	26.5	98.0	59.0	61.0	8.9
Anions										
1	Sulphide as H ₂ S	mg/L	0.01	0.003	0.005	0.004	<0.002	<0.002	<0.002	<0.002
Nutrients										
1	Total Ammonia, NH ₃ -N	mg/L	0.3	0.12	0.18	0.16	<0.02	<0.02	<0.02	<0.02
Dissolved Metals										
1	Cadmium, Cd	mg/L	0.001	0.01	0.01	0.02	<0.0001	<0.0001	<0.0001	<0.0001
2	Copper, Cu	mg/L	0.008	0.20	0.26	0.25	<0.001	<0.001	<0.001	<0.001
3	Lead, Pb	mg/L	0.008	0.03	0.02	0.03	<0.001	<0.001	<0.001	<0.001
4	Mercury, Hg	mg/L	0.001	<0.001	<0.001	<0.001	<0.00005	<0.00005	<0.00005	<0.00005
5	Zinc, Zn	mg/L	0.05	0.04	0.06	0.06	<0.005	<0.005	<0.005	<0.005

No.	Parameter	Unit	Threshold ¹	October 2010			Result			
							November 2016			
				1 (10 m in front of pier)	2 (20 m to right of pier)	3 (20 m left of pier)	SWQ-1	SWQ-2	SWQ-3	SWQ-4
Miscellaneous										
1	Oil & Grease	mg/L	1	<0.001	<0.001	<0.001	<1	1	<1	<1
2	Total Phenols	mg/L	0.002	0.002	0.002	0.001	<0.001	<0.001	<0.001	<0.001

¹ Decree of Minister of Environment No.51/2004 regarding Threshold Values for Seawater Quality, Appendix III

From the table it is observable that both measurement periods show TSS and turbidity values that are higher than the maximum threshold values. Turbidity values in 2016 measurement are in general higher than turbidity values in 2010 measurement (with the exception of value at SWQ-4). The higher turbidity values may be due to a number of reasons which could include weather at the time of sampling, changes in land cover and/or activities in upstream areas, as well as differences in method of field sampling and quality control measures taken.

The table also shows that a number of dissolved metals parameters in 2010 measurement exceeded the maximum threshold values. As with turbidity, the high concentration could be a result of changes in activities in upstream areas which affects input into the sea. It could also be brought about by differences in method of field sampling and quality control measures taken.

5.4 Ambient air

As mentioned in previous section, ambient air monitoring was conducted at two sampling points within and around the plant site. The laboratory results are presented in the following table.

Table 10: Ambient air quality laboratory result

No.	Parameter	Unit	Result			
			Threshold ¹	Threshold ²	AQ-1 (Plant area)	AQ-2 (Residential area)
Ambient Sampling Condition						
1	Temperature	°C	-		24.0-30.7	24.5-27.5
2	Duration of Sampling	Hours	-		24	24
3	Pressure	mmHg	-		755.6-757.9	756.3-758.1
4	Humidity	%	-		78.0-94.7	81.4-97.1
5	Wind Speed	m/S	-		1.1-5.7	0.4-1.9
6	Dominant Wind Direction from	-	-		West	West
7	Weather	-	-		Rainy	Cloudy
Ambient Air Tests						
1	Carbon Monoxide, CO	µg/Nm ³	30,000		<0.001	<0.001
2	Hydrocarbon, HC	µg/Nm ³	160		<5	<5
3	Lead, Pb	µg/Nm ³	2		0.003	0.011
4	Nitrogen Dioxide, NO ₂ (24 Hours)	µg/Nm ³	400		<5	<5
5	Oxidant, O ₃ (1 Hour)	µg/Nm ³	-		<20	<20
6	Sulfur Dioxide, SO ₂ (24 Hours)	µg/Nm ³	900	20	<20	<20
7	Total Suspended Particulates, TSP	µg/Nm ³	230		37.4	41.4
8	Particulates <10µm, PM ₁₀	µg/Nm ³	150	50	19.6	30.0
9	Particulates <2.5µm, PM _{2.5}	µg/Nm ³	160	25	10.8	17.6

¹ Government Regulation No. 41/1999 regarding Air Pollution Control

² IFC General EHS Guidelines. Source: Air Quality Guidelines Global Update, World Health Organization (WHO), 2005

From the above table it is observable that all test values are below the maximum threshold values stated in national regulation as well as in IFC guidelines. These include concentration for gaseous as well as

particulate parameters. In general, particulate concentrations in AQ-2 (residential area close to road) are slightly higher than those in AQ-1, which is probably due to particulate generated by traffic. It is worth noting however, that sampling at both sampling points were conducted during wet season with significant amount of rain and as a result, the values are expectedly low. For a more comprehensive assessment on the baseline condition, it is recommended to conduct a second round of sampling to cover condition during the dry season when the concentration for both gaseous and particulate parameters could be higher.

A comparison between laboratory results from October 2010 and November 2016 sampling period is presented in the following table.

Table 11: Ambient air quality laboratory result from October 2010 and November 2016 sampling

No.	Parameter	Unit	Threshold ¹	Result			AQ-1 (Plant area)	AQ-2 (Residential area)
				October 2010	November 2016	3 (Residential area)		
Ambient Air Tests								
1	Nitrogen Dioxide, NO ₂ (24 Hours)	µg/Nm ³	400	75.6	42.3	20.6	<5	<5
2	Sulfur Dioxide, SO ₂ (24 Hours)	µg/Nm ³	900	35	29.8	17.9	<20	<20
3	Total Suspended Particulates, TSP	µg/Nm ³	230	130	125	120	37.4	41.4

¹ Government Regulation No. 41/1999 1999 regarding Air Pollution Control

From the table above it can be seen that all values presented are lower than the corresponding threshold values. The fact that October results are higher than November results may be caused by differences in climatic conditions during sampling, as well as method and equipment used for sampling.

5.5 Noise

As mentioned in previous section, a total of two noise level measurements were conducted inside and outside of the plant area. The measurement results are presented in the following table.

Table 12: Noise measurement results

No.	Parameter	Unit	Result			
			Plant area		Residential area	
			Threshold ¹	N-1	Threshold ²	N-2
Ambient Sampling Condition						
1	Temperature	°C	25.1-30.0		24.9-32.1	
2	Duration of Sampling	Hours		24		24
3	Pressure	mmHg	757.4-758.4		757.7-758.3	
4	Humidity	%	86.9-94.5		68.3-91.3	
5	Wind Speed	m/S	1.2-4.2		0.5-2.5	
6	Dominant Wind Direction from	-	West		West	
7	Weather	-	Clear		Clear	
Noise Tests						
1	Day time noise (07:00-22:00), Leq	dBA	70	63.2	55	59.04
2	Night time noise (22:00-07:00), Leq	dBA	70	51.2	45	53.81
3	Day-night noise (24 hours), Leq	dBA		47.0		58.4
4	Background noise, L ₉₀	dBA		36.9		42.5

¹ IFC General EHS Guidelines. Source: Guidelines for community noise, World Health Organization (WHO), 1999 for industrial area

² IFC General EHS Guidelines. Source: Guidelines for community noise, World Health Organization (WHO), 1999 for residential area

Noise levels inside the plant (N-1) comply with the WHO guidelines. With day time noise of 63.2 dBA and night time noise of 51.2 dBA, the values are lower than the maximum threshold value of 70 dBA. However, it should be noted that the plant is not in operational phase and thus the noise level is lower than it could have been. Also, the electricity for office and maintenance activities, which is supplied by an on-site diesel generator, is only operated intermittently.

The noise level in the residential area (N-2) exceeds the guideline values for both day time and night time measurement. The measurement point is located ± 900 m west of neighboring plant (PT. Multimas Nabati Asahan), ± 2.2 km west of a seaport construction site, and ± 2.5 km west of PT. Inalum (an aluminum processing plant). Considering the distances from the measurement point to other plants, it is unlikely that the operation of these plants is the main contributing factor to the noise recorded at N-2. It is likely that the road traffic is the more significant source of noise.

A comparison between laboratory results from October 2010 and November 2016 sampling period is presented in the following table.

Table 13: Noise measurement result from October 2010 and November 2016 sampling

No.	Parameter	Unit	Threshold ¹	Result		
				October 2010		
				1 (Plant area, front of office)	2 (Plant area, security guard post)	3 (Residential area)
1	Noise	dBA	70 ²	76.10	56.30	47.0
		dBA	55 ³		59.20	58.4

¹ Decree of Minister of Environment No.48/1996 regarding Noise Threshold Values

² Threshold value for industrial area

³ Threshold value for residential area

From the above table it can be seen that in general noise measurement result in October 2010 are higher than results from November 2016. Noise level inside plant area in 2010 exceeded the maximum threshold value of 70 dBA while noise level in 2016 is lower than the threshold value. Noise level in residential area from the two measurement period seems to show values that do not differ significantly.

5.6 Sediments

Marine sediments were collected as an additional parameter at one sampling site. The laboratory results of the single collected sample are presented in the following table.

Table 14: Sediment quality laboratory results

No.	Parameter	Unit	Threshold ¹		Result
			ISQG ² -Low	ISQG-High	
Physical Tests					
1	Paste pH 1:5 in water	S.U.			7.87
Anions and Nutrients Water Leachable 1:5					
2	Total Ammonia, NH ₃ -N	mg/kg			9.2
3	Nitrate, NO ₃ -N	mg/kg			1.49
4	Total Phosphorus, T-PO ₄	mg/kg			800
5	Sulphate, SO ₄	mg/kg			5.750
6	Total Cyanide, CN	mg/kg			0.109
Total Metals					
1	Arsenic, As	mg/dry kg	20	70	7.5
2	Barium, Ba	mg/dry kg			60.6
3	Boron, B	mg/dry kg			34
4	Cadmium, Cd	mg/dry kg	1.5	10	0.18
5	Chromium Hexavalent, Cr ⁶⁺	mg/kg			<0.08
6	Cobalt, Co	mg/dry kg			5.4
7	Copper, Cu	mg/dry kg	65	270	12.6
8	Iron, Fe	mg/dry kg			17300

No.	Parameter	Unit	Threshold ¹		Result
			ISQG ² -Low	ISQG-High	
9	Lead, Pb	mg/dry kg	50	220	27.6
10	Manganese, Mn	mg/dry kg			932
11	Nickel, Ni	mg/dry kg	21	52	9.8
12	Selenium, Se	mg/dry kg			0.8
13	Silver, Ag	mg/dry kg	1	3.7	0.02
14	Tin, Sn	mg/dry kg			3.3
15	Zinc, Zn	mg/dry kg	200	410	75
Miscellaneous					
1	Total Phenols	mg/kg			<0.025
2	Total Organic Carbon, TOC	% dry			1.91

¹ Australian and New Zealand Guidelines for Fresh and Marine Water Quality

² ISQG = Interim Sediment Quality Guideline

As mentioned in ANZECC/ARMCANZ (2000), the ISQG-Low and High values correspond to the Effects Range Low (ERL) and Effect Range Median (ERM). In Long et al. (1995) it is stated that values lower than ERL indicates minimal effects range of aquatic toxicity, values between ERL and ERM represent a possible-effect range within which effects would occasionally occur, while values higher than ERM represent probable-effects range within which effects would frequently occur.

From the above table, it is observable that all of the analysis results are below the ISQG-Low value (when they are available). This would mean that at least for some parameters, the existing concentration would have minimal effects on sediment ecological health. It is also observable that the phosphorus concentration in the sediment is much higher than concentration of ammonia and nitrate, which is in line with seawater quality data.

5.7 Plankton

A total of four plankton samples were collected from areas around the plant's jetty at the same points where seawater samples were collected. The laboratory results (identification) are presented in the following table.

Table 15 Plankton identification result.

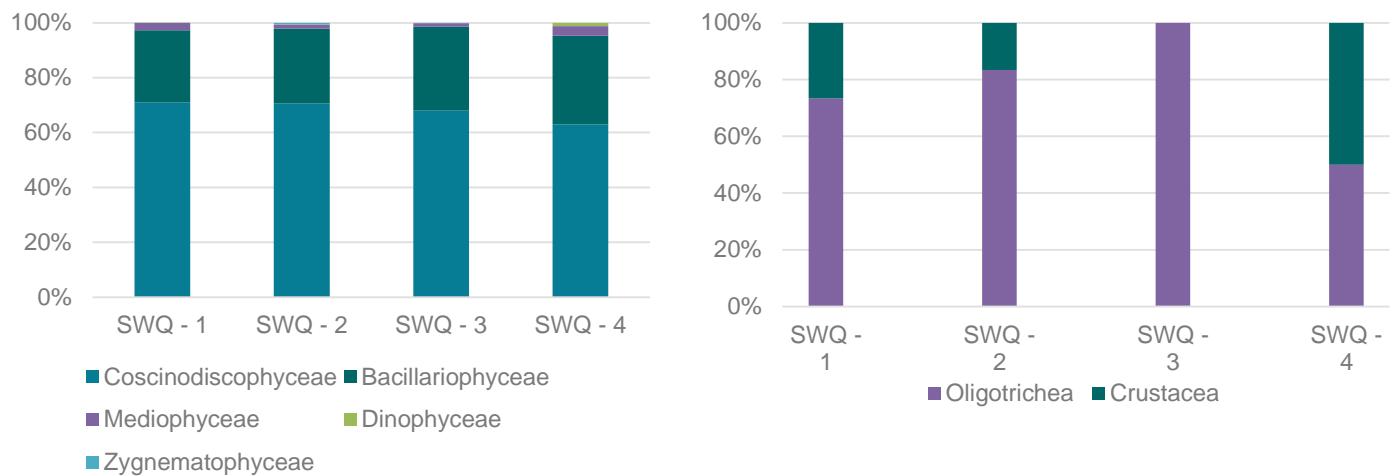
No.	Species Name	Unit	Result*					
			SWQ-1	SWQ-2	SWQ-3	SWQ-4		
Phytoplankton								
BACILLARIOPHYCEAE								
1	<i>Asterionella</i> sp.	Cell/m ³	356,250	175,000	456,250	181,250		
2	<i>Bacteriastrum</i> sp.	Cell/m ³	493,750	625,000	237,500	181,250		
3	<i>Cerataulina</i> sp.	Cell/m ³	87,500	68,750	37,500	31,250		
4	<i>Navicula</i> sp.	Cell/m ³	6,250	18,750	18,750	12,500		
5	<i>Nitzschia</i> sp.	Cell/m ³	75,000	62,500	62,500	12,500		
6	<i>Pinnularia</i> sp.	Cell/m ³	-	6,250	-	-		
7	<i>Pleurosigma</i> sp.	Cell/m ³	87,500	56,250	43,750	12,500		
8	<i>Thalassionema</i> sp.	Cell/m ³	412,500	468,750	62,500	237,500		

No.	Species Name	Unit	Result*			
			SWQ-1	SWQ-2	SWQ-3	SWQ-4
9	<i>Thalassiotrix sp.</i>	Cell/m ³	437,500	706,250	31,250	318,750
10	<i>Triceratium sp.</i>	Cell/m ³	6250	-	6,250	6,250
COSCINODISCOPHYCEAE						
1	<i>Chaetoceros sp.</i>	Cell/m ³	4,906,250	5,368,750	1,943,750	1,618,750
2	<i>Corethron sp.</i>	Cell/m ³	-	12,500	-	-
3	<i>Coscinodiscus sp.</i>	Cell/m ³	81,250	37,500	25,000	93,750
4	<i>Guinardia sp.</i>	Cell/m ³	-	12,500	-	-
5	<i>Hemiaulus sp.</i>	Cell/m ³	150,000	56,250	93,750	143,750
6	<i>Rhizosolenia sp.</i>	Cell/m ³	125,000	137,500	31,250	68,750
7	<i>Stephanopyxis sp.</i>	Cell/m ³	62,500	50,000	25,000	12,500
DINOPHYCEAE						
1	<i>Ceratium sp.</i>	Cell/m ³	6,250	6250	-	12500
2	<i>Dinophysis sp.</i>	Cell/m ³	-	-	-	25000
3	<i>Peridinium sp.</i>	Cell/m ³	-	6,250	-	-
MEDIOPHYCEAE						
1	<i>Biddulphia sp.</i>	Cell/m ³	50,000	50,000	6,250	12,500
2	<i>Climacodium sp.</i>	Cell/m ³	62,500	-	-	-
3	<i>Eucampia sp.</i>	Cell/m ³	62,500	62,500	18,750	81,250
4	<i>Planktoniella sp.</i>	Cell/m ³	18,750	6,250	6,250	-
5	<i>Streptotheca sp.</i>	Cell/m ³	6,250	6,250	6,250	12,500
ZYGNEMATOPHYCEAE						
1	<i>Closterium sp.</i>	Cell/m ³	-	6,250	6,250	-
2	<i>Spirogyra sp.</i>	Cell/m ³	-	31,250	-	-
Total Taxa (s)			20	24	19	19
Abundance			Cell/m ³	7,493,750	8,037,500	3,118,750
Diversity Index				1.46	1.36	1.44
Equitability Index				0.49	0.43	0.49
Dominance Index				0.44	0.46	0.42
Zooplankton						
CRUSTASEA						
1	<i>Nauplius sp.</i>	Cell/m ³	2,000	500	-	500
OLIGOTRICHEA						
1	<i>Epiploctis sp.</i>	Cell/m ³	3,000	1,000	-	-
2	<i>Eutintinnus sp.</i>	Cell/m ³	-	1,000	500	-
3	<i>Tintinnopsis sp.</i>	Cell/m ³	2,500	500	-	500
Total Taxa (s)				3	4	1
Abundance			Cell/m ³	7,500	3,000	500
Diversity Index				1.09	1.33	0.00
						0.69

No.	Species Name	Unit	Result*					
			SWQ-1	SWQ-2	SWQ-3	SWQ-4		
Equitability Index				0.99	0.96	0.00		
Dominance Index				0.34	0.28	1.00		
0.50								

*Results are discussed separately under section 5.7

Figure 4: Composition of identified phytoplankton and zooplankton species



Phytoplankton

Zooplankton

For phytoplankton communities, values presented in Table 17 (indexes) differs quite significantly with those from data collected in 2010, as evident in the Table 17 and Figure 5. Although the number of identified taxa is more or less the same, the abundance differs significantly, with the 2016 data recording values as much as 10 times the values in 2010. These values also in turn affect the diversity indexes in both measurement, in which the 2010 data show higher diversity and lower dominance. These differences may be due to a number of factors such as differences in nutrient input, as well as method and timing of sampling.

Table 16: Phytoplankton data comparison

Parameter	Unit	2016	2010
Total taxa		19-24	19
Abundance	Cell/m ³	3-8 million	±700,000
Diversity index		1.36-1.79	±2.9
Equitability index		0.43-0.61	±0.9
Dominance index		0.31-0.44	±0.05

Figure 5: Phytoplankton abundance comparison



5.8 Marine habitat

As mentioned in previous sections, marine habitat for coral reef and reef fish monitoring was conducted at 12 sampling points within and around the Jetty area but point 5 and 6 were not collected because it has been represented by point 8 and 9. The field monitoring results are presented in the following table.

Table 17: Marine habitat results

No.	Parameter	Unit	Threshold ¹	Result each Point											
				1	2	3	4	5	6	7	8	9	10	11	12
Physical condition															
1	Visibility underwater (Field)	m	>10	<1	<1	<1	<1	-	-	<1	<1	<1	<1	<1	<1
2	Coral living (Field)	% cover	50%-75%	100% Silt	100% Silt	100% Silt	100% Silt	-	-	100% Silt					
3	Reef Fish Abundance (Field)	Species	>50 species	lack of visibility	lack of visibility	lack of visibility	lack of visibility	-	-	lack of visibility					
4	Temperature (Field)	°C	28-30	28	28	29	28	-	-	28	28	29	28	29	30
5	pH (Field)	S.U.	7-8.5	7.70-8.03	7.70-8.03	7.70-8.03	7.70-8.03	-	-	7.70-8.03	7.70-8.03	7.70-8.03	7.70-8.03	7.70-8.03	7.70-8.03
6	Salinity (Field)	g/L	33-34	28.0	28.0	28.5	29.0	-	-	29	28	28.5	29	28	29
7	Total Suspended Solids, TSS	mg/L	20	56-60	56-60	56-60	56-60	-	-	56-60	56-60	56-60	56-60	56-60	56-60
8	Turbidity (Field)	NTU	<5	59.0-61.0	59.0-61.0	59.0-61.0	59.0-61.0	-	-	59.0-61.0	59.0-61.0	59.0-61.0	59.0-61.0	8.9	8.9

¹ Decree of Minister of Environment No.51/2004 regarding Threshold Values for Seawater Quality, Appendix III. The TSS, Salinity, pH, and Turbidity is range of average result from seawater laboratory result table

Substrate condition at most sampling locations is covered by 100% in silt. There is no sight of the coral living community on the sampling locations. Another supporting parameters for coral reef suitable habitat such as brightness (from the seawater quality table), salinity, total suspended solids, and turbidity are all higher than standard of suitable coral reef to live in these locations, that's why only silt substrate appeared in this sampling location area.

Underwater visibility was quite poor with turbidity values recorded between 59-61 NTU well above the threshold of 5 NTU limit. TSS is also well above 20mg/L threshold limit, recorded between 56-60 mg/l. This condition creates a lack of visibility for reef fish survey. The underwater visibility was less than 1m and therefore quite difficult for a visual survey of reef fish communities. Besides the lack of underwater visibility, reef fish are generally supported by coral reef. In this location however there was very little coral reef available and little chance for reef fish to be living in the area.

There are two potential sources of the substrate conditions indicated by this result: the first is accumulation from river runoff from the left side of the DAP plant, and the second one is the waste activity from the plant factory area in the right-side DAP plant. The characteristic of the silt substrate that was collected is slick and covered in an oily layer. The sediment analysis indicates total metals are below the ISQG-Low value (where available). This would mean that minimal metal material has dissolved in the substrate area at this sampling location (a conclusion reinforced by the lack of metals found in the tissue analysis of the clam).



6. Conclusions and recommendations

6.1 Conclusions

Freshwater samples collected from Rindam and Padang River recorded high concentration of phosphorus which exceeded the maximum threshold value. This high concentration of phosphorus is probably due to the recent rains and the presence of plantations upstream of both Rindam and Padang River, with large segments of the rivers having plantations on one or both river banks.

BOD₅ and COD concentration at Rindam River were higher than the maximum threshold values while concentrations of both parameters at Padang River are lower than the maximum threshold values. The higher BOD₅ and COD concentration at Rindam River relative to Padang River is probably due to the preceding rainfall event that occurred prior to sampling at Rindam River.

Fluoride concentration at GWQ-1 (inside plant) is measured at 1.53 mg/L which is slightly higher than the maximum threshold value of 1.5 mg/L.

High levels of sediments and turbidity were observed in the marine waters around the Project. Most of seawater sampling sites recorded TSS and turbidity values that are higher than the corresponding maximum threshold values. All of the seawater sampling data for phosphorus and most of the data for nitrate concentration show values that are higher than the corresponding maximum threshold values.

The marine substrate at sampling locations was covered 100% by silt and no living coral was found. There was no sight of reef fish due to lack of underwater visibility and zero percent cover of life coral or other marine habitats such as seagrass beds.

In terms of air quality, all test values for both gaseous and particulate matters in ambient air measurement are below the maximum threshold values. Noise levels inside the plant (N-1) have comply with the WHO guidelines for industrial area, while the noise level in the residential area (N-2) exceed the guideline values for both day time and night time measurement.

6.2 Recommendations

- Continue any existing environmental management and monitoring activities as operation begins;
- For marine habitat, focus on management and monitoring waste disposal and sediment patterns; and
- For a more comprehensive and IFC compliant assessment on the baseline conditions, it will be necessary to conduct a second round of sampling during the dry season. This will provide a complete view of the sea conditions when there is not heavy runoff and turbulent surf. It will identify the surface water conditions without the effects of runoff and dilution. And finally, for the air sampling, additional sampling in dry season will ensure that both gaseous and particulate parameters are representative of the operating conditions.

References

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Appendix A – Laboratory analysis certificates



ENVIRONMENTAL TEST REPORT

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Lipi Building, 3rd floor
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Bogor, 16002
INDONESIA

Job Number : **EV161859-Rev01**
Customer Ref : **4305/IUS-EV/X/2016**
Project Name : **Environmental Monitoring**

Number of samples : **13**

Date received : **09-Nov-2016**
Date reported : **25-Nov-2016**

Approved Signature for:


Reginald C. de Wit
Manager Environmental Services

All work is performed in accordance with Intertek Standard Terms and Conditions of work <http://www.intertek.com/terms/>

This report relates specifically to the sample(s) tested in so far as that the sample(s) is truly representative of the sample source as received.

This report was prepared solely for the use of the client named in this report. PT Intertek Utama Services accepts no responsibility for any loss, damage or liability suffered by any third party as a result of any reliance upon or use of this report.

DO NOT PHOTOCOPY

SAMPLE INFORMATION

Job Number : EV161859-Rev01
 Customer : PT. Hatfield Indonesia
 Project Name : Environmental Monitoring
 Customer Ref : 4305/IUS-EV/X/2016

No.	Laboratory Sample I.D.	Customer Sample I.D.	Sample Matrix	Date Sampled	Time Sampled	Date Received	Sampled By	Coordinates
1	EV161859-1	SWQ - 1	Seawater	07-Nov-16	08:19	09-Nov-16	Lukman, Fauz, Hamzah	N: 030° 22' 51.0" E: 099° 25' 45.1"
2	EV161859-2	SWQ - 2	Seawater	07-Nov-16	08:08	09-Nov-16	Lukman, Fauz, Hamzah	N: 030° 22' 44.3" E: 099° 26' 26.7"
3	EV161859-3	SWQ - 3	Seawater	07-Nov-16	07:13	09-Nov-16	Lukman, Fauz, Hamzah	N: 030° 22' 34.8" E: 099° 26' 25.5"
4	EV161859-4	SWQ - 4	Seawater	07-Nov-16	07:42	09-Nov-16	Lukman, Fauz, Hamzah	N: 030° 23' 51.0" E: 099° 26' 55.8"
5	EV161859-5	FWQ - 2	River Water	04-Nov-16	11:35	09-Nov-16	Lukman, Fauz, Hamzah	N: 030° 22' 05.7" E: 099° 25' 40.8"
6	EV161859-6	FWQ - 3	River Water	05-Nov-16	06:53	09-Nov-16	Lukman, Fauz, Hamzah	N: 030° 22' 14.4" E: 099° 25' 17.8"
7	EV161859-7	FWQ - 4	River Water	07-Nov-16	08:53	09-Nov-16	Lukman, Fauz, Hamzah	N: 030° 22' 26.8" E: 099° 24' 45.6"
8	EV161859-8	GWQ - 1	Ground Water	04-Nov-16	10:00	09-Nov-16	Lukman, Fauz, Hamzah	N: 030° 22' 33.99" E: 099° 25' 44.3"
9	EV161859-9	GWQ - 2	Ground Water	04-Nov-16	10:51	09-Nov-16	Lukman, Fauz, Hamzah	N: 030° 22' 01.9" E: 099° 25' 55.8"
10	EV161859-10	AQ - 1	Ambient Air	04-Nov-16	10:20	09-Nov-16	Lukman, Fauz, Hamzah	N: 030° 22' 33.0" E: 099° 25' 47.8"
11	EV161859-11	AQ - 2	Ambient Air	05-Nov-16	12:00	09-Nov-16	Lukman, Fauz, Hamzah	N: 030° 22' 04.4" E: 099° 25' 48.6"
12	EV161859-12	N - 1	Noise	06-Nov-16	06:15	09-Nov-16	Lukman, Fauz, Hamzah	N: 030° 22' 33.0" E: 099° 25' 47.8"
13	EV161859-13	N - 2	Noise	07-Nov-16	06:30	09-Nov-16	Lukman, Fauz, Hamzah	N: 030° 22' 04.5" E: 099° 25' 46.2"

Notes:

N.A = Not Analyzed

ND= Not Detected

I.S = Insufficient Sample

* = Non Accredited Test

** = Subcontracted Test

1) = Field Measurement

2) = Field Measurement by Customer

L.N.R= Listed but Not Received

Job Number : EV161859-Rev01
 Customer : PT. Hatfield Indonesia
 Project Name : Environmental Monitoring
 Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :			EV161859-1	EV161859-2
Customer Sample I.D :			SWQ - 1	SWQ - 2
Date Sampled :			07-Nov-16	07-Nov-16
Sample Matrix :			Seawater	Seawater
No.	Test Description	Units	Regulatory Limit	Results
Physical Tests				
1	Brightness (Field)	m	>3	<1
2	Floating Matter (Field)	-	-	none
3	Odor (Lab)*	-	Odorless	Odorless
4	Oil Film (Field)	-	None	None
5	pH (Field)	S.U.	7.0-8.5	7.93
6	pH (Lab)	S.U.	7.0-8.5	7.70
7	Salinity (Field)	g/L	Natural	25.1
8	Temperature (Field)*	°C	3 deviation	29.1
9	Total Suspended Solids, TSS	mg/L	20	103
10	Turbidity (Field)	NTU	<5	38.8
11	Turbidity (Lab)	NTU	<5	98.0
Anions				
1	Cyanide (Total), CN ⁻	mg/L	0.5	<0.005
2	Sulphide as H ₂ S	mg/L	0.01	<0.002
Nutrients				
1	Total Ammonia, NH ₃ -N	mg/L	0.3	<0.02
2	Nitrate, NO ₃ -N	mg/L	0.041	0.020
3	Total Phosphorus as P	mg/L	0.015	0.080
Dissolved Metals				
1	Arsenic, As	mg/L	0.012	0.0012
2	Cadmium, Cd	mg/L	0.001	<0.0001
3	Chromium Hexavalent, Cr ⁶⁺	mg/L	0.005	<0.002
4	Copper, Cu	mg/L	0.008	<0.001
5	Lead, Pb	mg/L	0.008	<0.001
6	Mercury, Hg	mg/L	0.001	<0.00005
7	Nickel, Ni	mg/L	0.05	<0.001
8	Zinc, Zn	mg/L	0.05	<0.005
Microbiology				
1	Total Coliforms	MPN/100ml	1000	27
2	Salmonella	cell/100ml	-	ND

Job Number : EV161859-Rev01
 Customer : PT. Hatfield Indonesia
 Project Name : Environmental Monitoring
 Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :			EV161859-1	EV161859-2
Customer Sample I.D :			SWQ - 1	SWQ - 2
Date Sampled :			07-Nov-16	07-Nov-16
Sample Matrix :			Seawater	Seawater
No.	Test Description	Units	Regulatory Limit	Results
Miscellaneous				
1	Biochemical Oxygen Demand, BOD ₅	mg/L	20	3 <2
2	Dissolved Oxygen, DO (Field)	mg/L	>5	4.30 5.34
3	Oil & Grease	mg/L	1	<1 1
4	Surfactants, MBAS	mg/L	-	<0.01 <0.01
5	Total Phenols	mg/L	0.002	<0.001 <0.001
Organics Tests				
1	OC-Pesticides	ug/L	-	<0.02 <0.02
2	Polycyclic Aromatic Hydrocarbons, PAHs	µg/L	0.003	<0.1 <0.1
3	Polychlorinated Biphenyls, PCBs	µg/L	0.01	<0.01 <0.01
4	Tributyl Tin, TBT (as Organotins)	µg Sn/L	0.01	<0.01 <0.01
Radioactivity**				
1	Gross A	Bq/L	-	<0.05 <0.05
2	Gross B	Bq/L	-	0.5 <0.1
PLANKTON**				
1. PHYTOPLANKTON				
BACILLARIOPHYCEAE				
1	Asterionella sp.	Cell/m ³	-	356250 175000
2	Bacteriadrum sp.	Cell/m ³	-	493750 625000
3	Cerataulina sp.	Cell/m ³	-	87500 68750
4	Navicula sp.	Cell/m ³	-	6250 18750
5	Nitzschia sp.	Cell/m ³	-	75000 62500
6	Pinnularia sp.	Cell/m ³	-	- 6250
7	Pleurosigma sp.	Cell/m ³	-	87500 56250
8	Thalassionema sp.	Cell/m ³	-	412500 468750
9	Thalassiotrix sp.	Cell/m ³	-	437500 706250
10	Triceratium sp.	Cell/m ³	-	6250 -
COSCINODISCOPHYCEAE				
1	Chaetoceros sp.	Cell/m ³	-	4906250 5368750
2	Corethron sp.	Cell/m ³	-	- 12500

Job Number : EV161859-Rev01
 Customer : PT. Hatfield Indonesia
 Project Name : Environmental Monitoring
 Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :				EV161859-1	EV161859-2
Customer Sample I.D :				SWQ - 1	SWQ - 2
Date Sampled :				07-Nov-16	07-Nov-16
Sample Matrix :				Seawater	Seawater
No.	Test Description	Units	Regulatory Limit	Results	Results
3	<i>Coscinodiscus</i> sp.	Cell/m ³	-	81250	37500
4	<i>Guinardia</i> sp.	Cell/m ³	-	-	12500
5	<i>Hemiaulus</i> sp.	Cell/m ³	-	150000	56250
6	<i>Rhizosolenia</i> sp.	Cell/m ³	-	125000	137500
7	<i>Stephanopyxis</i> sp.	Cell/m ³	-	62500	50000
	DINOPHYCEAE				
1	<i>Ceratium</i> sp.	Cell/m ³	-	6250	6250
2	<i>Dinophysis</i> sp.	Cell/m ³	-	-	-
3	<i>Peridinium</i> sp.	Cell/m ³	-	-	6250
	MEDIOPHYCEAE				
1	<i>Biddulphia</i> sp.	Cell/m ³	-	50000	50000
2	<i>Climacodium</i> sp.	Cell/m ³	-	62500	-
3	<i>Eucampia</i> sp.	Cell/m ³	-	62500	62500
4	<i>Planktoniella</i> sp.	Cell/m ³	-	18750	6250
5	<i>Streptotheca</i> sp.	Cell/m ³	-	6250	6250
6					
	ZYGNEMATOPHYCEAE				
1	<i>Closterium</i> sp.	Cell/m ³	-	-	6250
2	<i>Spirogyra</i> sp.	Cell/m ³	-	-	31250
	Total Taxa (s)			20	24
	Abundance	Cell/m ³	-	7493750	8037500
	Diversity Index			1.46	1.36
	Equitability Index			0.49	0.43
	Dominance Index			0.44	0.46
	2.ZOOPLANKTON				
	CRUSTACEA				
1	<i>Nauplius</i> sp.	Ind/m ³	-	2000	500
	OLIGOTRICHEA				
1	<i>Epiplocyliis</i> sp.	Ind/m ³	-	3000	1000
2	<i>Eutintinnus</i> sp.	Ind/m ³	-	-	1000
3	<i>Tintinnopsis</i> sp.	Ind/m ³	-	2500	500

Job Number : EV161859-Rev01
Customer : PT. Hatfield Indonesia
Project Name : Environmental Monitoring
Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :	EV161859-1		EV161859-2		
Customer Sample I.D :	SWQ - 1		SWQ - 2		
Date Sampled :	07-Nov-16		07-Nov-16		
Sample Matrix :	Seawater		Seawater		
No.	Test Description	Units	Regulatory Limit	Results	Results
	Total Taxa (s)			3	4
	Abundance	Ind/m ³	-	7500	3000
	Diversity Index			1.09	1.33
	Equitability Index			0.99	0.96
	Dominance Index			0.34	0.28

Note: Refer to QA/QC – Accuracy page for list of analytical methods used
Regulatory Limit Based on KepmenLH No.51 Tahun 2004, Attached III

Job Number : EV161859-Rev01
 Customer : PT. Hatfield Indonesia
 Project Name : Environmental Monitoring
 Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :				EV161859-3	EV161859-4
Customer Sample I.D :				SWQ - 3	SWQ - 4
Date Sampled :				07-Nov-16	07-Nov-16
Sample Matrix :				Seawater	Seawater
No.	Test Description	Units	Regulatory Limit	Results	Results
Physical Tests					
1	Brightness (Field)	m	>3	<1	1
2	Floating Matter (Field)	-	-	Present	none
3	Odor (Lab)*	-	Odorless	Odorless	Odorless
4	Oil Film (Field)	-	None	Present	None
5	pH (Field)	S.U.	7.0-8.5	7.94	8.13
6	pH (Lab)	S.U.	7.0-8.5	7.87	8.03
7	Salinity (Field)	g/L	Natural	28.5	29.0
8	Temperature (Field)*	°C	3 deviation	29.1	29.6
9	Total Suspended Solids, TSS	mg/L	20	60	6
10	Turbidity (Field)	NTU	<5	63.0	3.5
11	Turbidity (Lab)	NTU	<5	61.0	8.9
Anions					
1	Cyanide (Total), CN ⁻	mg/L	0.5	<0.005	<0.005
2	Sulphide as H ₂ S	mg/L	0.01	<0.002	<0.002
Nutrients					
1	Total Ammonia, NH ₃ -N	mg/L	0.3	<0.02	<0.02
2	Nitrate, NO ₃ -N	mg/L	0.041	0.005	
3	Total Phosphorus as P	mg/L	0.015	0.085	0.030
Dissolved Metals					
1	Arsenic, As	mg/L	0.012	0.0012	0.0013
2	Cadmium, Cd	mg/L	0.001	<0.0001	<0.0001
3	Chromium Hexavalent, Cr ⁶⁺	mg/L	0.005	<0.002	<0.002
4	Copper, Cu	mg/L	0.008	<0.001	<0.001
5	Lead, Pb	mg/L	0.008	<0.001	<0.001
6	Mercury, Hg	mg/L	0.001	<0.00005	<0.00005
7	Nickel, Ni	mg/L	0.05	<0.001	<0.001
8	Zinc, Zn	mg/L	0.05	<0.005	<0.005
Microbiology					
1	Total Coliforms	MPN/100ml	1000	>1600	3
2	Salmonella	cell/100ml	-	ND	ND

Job Number : EV161859-Rev01
 Customer : PT. Hatfield Indonesia
 Project Name : Environmental Monitoring
 Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :				EV161859-3	EV161859-4
Customer Sample I.D :				SWQ - 3	SWQ - 4
Date Sampled :				07-Nov-16	07-Nov-16
Sample Matrix :				Seawater	Seawater
No.	Test Description	Units	Regulatory Limit	Results	Results
	Miscellaneous				
1	Biochemical Oxygen Demand, BOD ₅	mg/L	20	<2	<2
2	Dissolved Oxygen, DO (Field)	mg/L	>5	4.47	4.33
3	Oil & Grease	mg/L	1	<1	<1
4	Surfactants, MBAS	mg/L	-	<0.01	<0.01
5	Total Phenols	mg/L	0.002	<0.001	<0.001
	Organics Tests				
1	OC-Pesticides	ug/L	-	<0.02	<0.02
2	Polycyclic Aromatic Hydrocarbons, PAHs	µg/L	0.003	<0.1	<0.1
3	Polychlorinated Biphenyls, PCBs	µg/L	0.01	<0.01	<0.01
4	Tributyl Tin, TBT (as Organotins)	µg Sn/L	0.01	<0.01	<0.01
	Radioactivity**				
1	Gross A	Bq/L	-	<0.05	<0.05
2	Gross B	Bq/L	-	<0.1	<0.1
	PLANKTON**				
	1. PHYTOPLANKTON				
	BACILLARIOPHYCEAE				
1	Asterionella sp.	Cell/m ³	-	456250	181250
2	Bacteriadrum sp.	Cell/m ³	-	237500	181250
3	Cerataulina sp.	Cell/m ³	-	37500	31250
4	Navicula sp.	Cell/m ³	-	18750	12500
5	Nitzschia sp.	Cell/m ³	-	62500	12500
6	Pinnularia sp.	Cell/m ³	-	-	-
7	Pleurosigma sp.	Cell/m ³	-	43750	12500
8	Thalassionema sp.	Cell/m ³	-	62500	237500
9	Thalassiotrix sp.	Cell/m ³	-	31250	318750
10	Triceratium sp.	Cell/m ³	-	6250	6250
	COSCINODISCOPHYCEAE				
1	Chaetoceros sp.	Cell/m ³	-	1943750	1618750
2	Corethron sp.	Cell/m ³	-	-	-

Job Number : EV161859-Rev01
Customer : PT. Hatfield Indonesia
Project Name : Environmental Monitoring
Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :				EV161859-3	EV161859-4
Customer Sample I.D :				SWQ - 3	SWQ - 4
Date Sampled :				07-Nov-16	07-Nov-16
Sample Matrix :				Seawater	Seawater
No.	Test Description	Units	Regulatory Limit	Results	Results
3	<i>Coscinodiscus sp.</i>	Cell/m ³	-	25000	93750
4	<i>Guinardia sp.</i>	Cell/m ³	-	-	-
5	<i>Hemiaulus sp.</i>	Cell/m ³	-	93750	143750
6	<i>Rhizosolenia sp.</i>	Cell/m ³	-	31250	68750
7	<i>Stephanopyxis sp.</i>	Cell/m ³	-	25000	12500
	DINOPHYCEAE				
1	<i>Ceratium sp.</i>	Cell/m ³	-	-	12500
2	<i>Dinophysis sp.</i>	Cell/m ³	-	-	25000
3	<i>Peridinium sp.</i>	Cell/m ³	-	-	-
	MEDIOPHYCEAE				
1	<i>Biddulphia sp.</i>	Cell/m ³	-	6250	12500
2	<i>Climacodium sp.</i>	Cell/m ³	-	-	-
3	<i>Eucampia sp.</i>	Cell/m ³	-	18750	81250
4	<i>Planktoniella sp.</i>	Cell/m ³	-	6250	-
5	<i>Streptotheca sp.</i>	Cell/m ³	-	6250	12500
6					
	ZYGNEMATOPHYCEAE				
1	<i>Cladophora sp.</i>	Cell/m ³	-	6250	-
2	<i>Spirogyra sp.</i>	Cell/m ³	-	-	-
	Total Taxa (s)			19	19
	Abundance	Cell/m ³	-	3118750	3075000
	Diversity Index			1.44	1.79
	Equitability Index			0.49	0.61
	Dominance Index			0.42	0.31
	2.ZOOPLANKTON				
	CRUSTACEA				
1	<i>Nauplius sp.</i>	Ind/m ³	-	-	500
	OLIGOTRICHEA				
1	<i>Epiploctis sp.</i>	Ind/m ³	-	-	-
2	<i>Eutintinnus sp.</i>	Ind/m ³	-	500	-
3	<i>Tintinnopsis sp.</i>	Ind/m ³	-	-	500

Job Number : EV161859-Rev01
Customer : PT. Hatfield Indonesia
Project Name : Environmental Monitoring
Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :				EV161859-3	EV161859-4
Customer Sample I.D :				SWQ - 3	SWQ - 4
Date Sampled :				07-Nov-16	07-Nov-16
Sample Matrix :				Seawater	Seawater
No.	Test Description	Units	Regulatory Limit	Results	Results
	Total Taxa (s)			1	2
	Abundance	Ind/m ³	-	500	1000
	Diversity Index			0.00	0.69
	Equitability Index			0.00	1.00
	Dominance Index			1.00	0.50

Note: Refer to QA/QC – Accuracy page for list of analytical methods used
Regulatory Limit Based on KepmenLH No.51 Tahun 2004, Attached III

Job Number : EV161859-Rev01
Customer : PT. Hatfield Indonesia
Project Name : Environmental Monitoring
Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :				EV161859-5	EV161859-6
Customer Sample I.D :				FWQ - 2	FWQ - 3
Date Sampled :				04-Nov-16	05-Nov-16
Sample Matrix :				River Water	River Water
No.	Test Description	Units	Regulatory Limit	Results	Results
Physical Tests					
1	pH (Field)	S.U.	6 - 9	7.17	6.39
2	pH (Lab)	S.U.	6 - 9	7.65	7.42
3	Temperature (Field)*	°C	deviasi 3	29.4	26.8
4	Total Dissolved Solids, TDS	mg/L	1000	7610	7550
5	Total Suspended Solids, TSS	mg/L	50	6	123
Anions					
1	Chloride, Cl ⁻	mg/L	-	3580	3600
2	Cyanide (Total), CN ⁻	mg/L	0.02	<0.005	<0.005
3	Fluoride, F ⁻	mg/L	1.5	0.37	0.90
4	Sulphide as H ₂ S	mg/L	0.002	<0.002	<0.002
Nutrients					
1	Nitrate, NO ₃ -N	mg/L	-	0.444	0.271
2	Nitrite, NO ₂ -N	mg/L	-	<0.001	0.127
3	Total Phosphorus as P	mg/L	0.2	1.22	0.226
Dissolved Metals					
1	Arsenic, As	mg/L	1	0.0044	0.0013
2	Boron, B	mg/L	1	0.98	1.00
3	Cadmium, Cd	mg/L	0.01	0.0002	<0.0001
4	Chromium Hexavalent, Cr ⁶⁺	mg/L	0.05	<0.002	<0.002
5	Cobalt, Co	mg/L	0.2	<0.001	<0.001
6	Copper, Cu	mg/L	0.02	<0.001	<0.001
7	Lead, Pb	mg/L	0.03	<0.001	<0.001
8	Mercury, Hg	mg/L	0.002	<0.00005	0.00147
9	Selenium, Se	mg/L	0.05	<0.0005	<0.0005
10	Zinc, Zn	mg/L	0.05	0.032	0.026
Microbiology					
1	Fecal Coliforms	MPN/100ml	-	770	105
2	Total Coliforms	MPN/100ml	5000	>12100	3850
Miscellaneous					
1	Biochemical Oxygen Demand, BOD ₅	mg/L	3	23	18
2	Chemical Oxygen Demand, COD	mg/L	25	79	61
3	Chlorine, Cl ₂ (Lab)	mg/L	0.03	<0.01	<0.01

Job Number : EV161859-Rev01
 Customer : PT. Hatfield Indonesia
 Project Name : Environmental Monitoring
 Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :				EV161859-5	EV161859-6
Customer Sample I.D :				FWQ - 2	FWQ - 3
Date Sampled :				04-Nov-16	05-Nov-16
Sample Matrix :				River Water	River Water
No.	Test Description	Units	Regulatory Limit	Results	Results
4	Dissolved Oxygen, DO (Field)	mg/L	4	6.65	6.05
5	Oil & Grease	mg/L	1000	<1	<1
6	Surfactants, MBAS	mg/L	-	<0.01	<0.01
7	Total Phenols	mg/L	1	<0.001	<0.001
Pesticides in water					
1	BHCs	µg/L	210	<0.001	<0.001
2	Endrin	µg/L	-	<0.001	<0.001
3	p,p-DDD	µg/L	-	<0.001	<0.001
4	p,p-DDE	µg/L	-	<0.001	<0.001
5	p,p-DDT	µg/L	2	<0.001	<0.001
Radioactivity**					
1	Gross A	Bq/L	0.1	<0.05	<0.05
2	Gross B	Bq/L	1	<0.1	<0.1

Note: Refer to QA/QC – Accuracy page for list of analytical methods used
 Regulatory Limit Based on PP No. 82 / 2001, Class II

Job Number : EV161859-Rev01
Customer : PT. Hatfield Indonesia
Project Name : Environmental Monitoring
Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :				EV161859-7
Customer Sample I.D :				FWQ - 4
Date Sampled :				07-Nov-16
Sample Matrix :				River Water
No.	Test Description	Units	Regulatory Limit	Results
Physical Tests				
1	pH (Field)	S.U.	6 - 9	7.47
2	pH (Lab)	S.U.	6 - 9	7.48
3	Temperature (Field)*	°C	deviasi 3	27.9
4	Total Dissolved Solids, TDS	mg/L	1000	74
5	Total Suspended Solids, TSS	mg/L	50	57
Anions				
1	Chloride, Cl ⁻	mg/L	-	7.9
2	Cyanide (Total), CN ⁻	mg/L	0.02	<0.005
3	Fluoride, F ⁻	mg/L	1.5	0.08
4	Sulphide as H ₂ S	mg/L	0.002	<0.002
Nutrients				
1	Nitrate, NO ₃ -N	mg/L	-	0.836
2	Nitrite, NO ₂ -N	mg/L	-	0.010
3	Total Phosphorus as P	mg/L	0.2	0.214
Dissolved Metals				
1	Arsenic, As	mg/L	1	0.0011
2	Boron, B	mg/L	1	0.10
3	Cadmium, Cd	mg/L	0.01	0.0002
4	Chromium Hexavalent, Cr ⁶⁺	mg/L	0.05	<0.002
5	Cobalt, Co	mg/L	0.2	<0.001
6	Copper, Cu	mg/L	0.02	<0.001
7	Lead, Pb	mg/L	0.03	<0.001
8	Mercury, Hg	mg/L	0.002	<0.00005
9	Selenium, Se	mg/L	0.05	0.0006
10	Zinc, Zn	mg/L	0.05	0.024
Microbiology				
1	Fecal Coliforms	MPN/100ml	-	236
2	Total Coliforms	MPN/100ml	5000	>12100
Miscellaneous				
1	Biochemical Oxygen Demand, BOD ₅	mg/L	3	3
2	Chemical Oxygen Demand, COD	mg/L	25	9
3	Chlorine, Cl ₂ (Lab)	mg/L	0.03	<0.01

Job Number : EV161859-Rev01
Customer : PT. Hatfield Indonesia
Project Name : Environmental Monitoring
Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :				EV161859-7
Customer Sample I.D :				FWQ - 4
Date Sampled :				07-Nov-16
Sample Matrix :				River Water
No.	Test Description	Units	Regulatory Limit	Results
4	Dissolved Oxygen, DO (Field)	mg/L	4	5.88
5	Oil & Grease	mg/L	1000	<1
6	Surfactants, MBAS	mg/L	-	<0.01
7	Total Phenols	mg/L	1	<0.001
Pesticides in water				
1	BHCs	µg/L	210	<0.001
2	Endrin	µg/L	-	<0.001
3	p,p-DDD	µg/L	-	<0.001
4	p,p-DDE	µg/L	-	<0.001
5	p,p-DDT	µg/L	2	<0.001
Radioactivity**				
1	Gross A	Bq/L	0.1	<0.05
2	Gross B	Bq/L	1	<0.1

Note: Refer to QA/QC – Accuracy page for list of analytical methods used
Regulatory Limit Based on PP No. 82 / 2001, Class II

Job Number : EV161859-Rev01
 Customer : PT. Hatfield Indonesia
 Project Name : Environmental Monitoring
 Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :				EV161859-8	EV161859-9
Customer Sample I.D :				GWQ - 1	GWQ - 2
Date Sampled :				04-Nov-16	04-Nov-16
Sample Matrix :				Ground Water	Ground Water
No.	Test Description	Units	Regulatory Limit	Results	Results
Physical Tests					
1	Colour	Pt/Co	-	<5	15
2	Odor (Field)*	-	-	Odorless	Odorless
3	pH (Field)	S.U.	6.5 - 9.0	7.15	5.95
4	pH (Lab)	S.U.	6.5 - 9.0	7.58	7.15
5	Taste (Field)*	-	-	Tasteless	Tasteless
6	Temperature (Field)*	°C	-	36.8	27.2
7	Total Dissolved Solids, TDS	mg/L	1500	572	614
8	Total Hardness as CaCO ₃	mg/L	500	38.1	197
9	Turbidity (Lab)	NTU	25	21.4	7.9
Anions					
1	Chloride, Cl ⁻	mg/L	600	15.5	189
2	Cyanide (Total), CN ⁻	mg/L	0.1	<0.005	<0.005
3	Fluoride, F ⁻	mg/L	1.5	1.53	0.15
4	Sulphate, SO ₄ ²⁻	mg/L	400	<2	37
Nutrients					
1	Nitrate, NO ₃ -N	mg/L	-	4.49	1.75
2	Nitrite, NO ₂ -N	mg/L	1	0.519	0.002
Dissolved Metals					
1	Arsenic, As	mg/L	0.05	<0.0005	<0.0005
2	Cadmium, Cd	mg/L	-	<0.0001	<0.0001
3	Chromium Hexavalent, Cr ⁶⁺	mg/L	0.05	<0.002	<0.002
4	Iron, Fe	mg/L	1	0.068	0.302
5	Lead, Pb	mg/L	0.5	<0.001	<0.001
6	Manganese, Mn	mg/L	0.5	0.004	0.270
7	Mercury, Hg	mg/L	0.001	<0.00005	<0.00005
8	Selenium, Se	mg/L	-	<0.0005	<0.0005
9	Zinc, Zn	mg/L	15	<0.005	<0.005
Microbiology					
1	Total Coliforms	MPN/100ml	0	285	>2420
Miscellaneous					
1	Surfactants, MBAS	mg/L	-	<0.01	<0.01
2	Total Organic Matter, KMnO ₄	mg/L	-	2	7

Job Number : EV161859-Rev01
 Customer : PT. Hatfield Indonesia
 Project Name : Environmental Monitoring
 Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :				EV161859-8	EV161859-9
Customer Sample I.D :				GWQ - 1	GWQ - 2
Date Sampled :				04-Nov-16	04-Nov-16
Sample Matrix :				Ground Water	Ground Water
No.	Test Description	Units	Regulatory Limit	Results	Results
	Polycyclic Aromatic Hydrocabons (PAHs)*				
1	Benzo (a) pyrene	µg/L	-	<0.1	<0.1
	Pesticides in water				
1	2,4-Dichlorophenoxyacetic acid (2,4-D)	µg/L		<0.1	<0.1
2	Aldrin	µg/L	-	<0.001	<0.001
3	Dieldrin	µg/L	-	<0.001	<0.001
4	Hexachlorobenzene (HCB)	µg/L	-	<4	<4
5	Heptachlor Epoxide	µg/L	-	<0.001	<0.001
6	Heptachlor	µg/L	-	<0.001	<0.001
7	Lindane	µg/L	-	<4	<4
8	Metoxychlor	µg/L	-	<0.2	<0.2
9	p,p-DDD	µg/L	-	<0.001	<0.001
10	p,p-DDE	µg/L	-	<0.001	<0.001
11	p,p-DDT	µg/L	-	<0.001	<0.001
	Semi Volatile Organic Compounds, SVOCs*				
1	2,4,6-trichlorophenol	µg/L	-	<10	<10
2	Pentachlorophenol	µg/L	-	<20	<20
	Volatile Organic Compounds, VOCs**				
1	1,1-Dichloroethane	µg/L	-	<1	<1
2	1,2-dichloroethane	µg/L	-	<1	<1
3	Benzene	mg/L	-	<0.001	<0.001
4	Chloroform	µg/L	-	<1	<1
	Radioactivity**				
1	Gross A	Bq/L	-	<0.05	<0.05
2	Gross B	Bq/L	-	<0.1	0.2

Note: Refer to QA/QC – Accuracy page for list of analytical methods used
 Regulatory Limit Based on PERMENKES No 416/1990 Appendix II

Job Number : EV161859-Rev01
Customer : PT. Hatfield Indonesia
Project Name : Environmental Monitoring
Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :				EV161859-10	EV161859-11
Customer Sample I.D :				AQ - 1	AQ - 2
Date Sampled :				04-Nov-16	05-Nov-16
Sample Matrix :				Ambient Air	Ambient Air
No.	Test Description	Units	Regulatory Limit	Results	Results
Ambient Sampling Condition					
1	Temperature	°C	-	24.0-30.7	24.5-27.5
2	Duration of Sampling	Hours	-	24	24
3	Pressure	mmHg	-	755.6-757.9	756.3-758.1
4	Humidity	%	-	78.0-94.7	81.4-97.1
5	Wind Speed	m/S	-	1.1-5.7	0.4-1.9
6	Dominant Wind Direction from	-	-	West	West
7	Weather	-	-	Rainny	Cloudy
Ambient Air Tests					
1	Cobalt, Co	µg/Nm³	-	<0.001	<0.001
2	Lead, Pb	µg/Nm³	2	0.003	0.011
3	Nitrogen Dioxide, NO₂ (24 Hours)	µg/Nm³	400	<5	<5
4	Oxidant, O₃ (1 Hour)	µg/Nm³	-	<20	<20
5	Sulfur Dioxide, SO₂(24 Hours)	µg/Nm³	900	<20	<20
6	Total Suspended Particulates, TSP	µg/Nm³	230	37.4	41.4
7	Particulates <10µm, PM ₁₀	µg/Nm³	150	19.6	30.0
8	Particulates <2.5µm, PM _{2.5}	µg/Nm³	160	10.8	17.6
9	Total Hydrocarbons, HC*	µg/Nm³	-	<5	<5

Note: Refer to QA/QC – Accuracy page for list of analytical methods used
 Regulatory Limit Based on PP No. 41/1999

Job Number : EV161859-Rev01
Customer : PT. Hatfield Indonesia
Project Name : Environmental Monitoring
Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :		EV161859-12		EV161859-13
Customer Sample I.D :		N - 1		N - 2
Date Sampled :		06-Nov-16		07-Nov-16
Sample Matrix :		Noise		Noise
No.	Test Description	Units	Results	Results
Ambient Sampling Condition				
1	Temperature	°C	25.1-30.0	24.9-32.1
2	Duration of Sampling	Hours	24	24
3	Pressure	mmHg	757.4-758.4	757.7-758.3
4	Humidity	%	86.9-94.5	68.3-91.3
5	Wind Speed	m/S	1.2-4.2	0.5-2.5
6	Dominant Wind Direction from	-	West	West
7	Weather	-	Clear	Clear
Ambient Air Tests				
1	Noise, L _{DN} (Day-Night)	dBA	47.0	58.4

Note: Refer to QA/QC – Accuracy page for list of analytical methods used

Job Number : EV161859-Rev01
Customer : PT. Hatfield Indonesia
Project Name : Environmental Monitoring
Customer Ref : 4305/IUS-EV/X/2016

Laboratory Sample I.D :		EV161859-12	EV161859-13
Customer Sample I.D :		N - 1	N - 2
Date Sampled :		06-Nov-16	07-Nov-16
Sample Matrix :		Noise	Noise
No.	Test Description	Units	Results
	Noise 24 Hours		
1	Day time Noise (07.00 : 22.00), Leq	dBA	63.2
2	Night time Noise (22.00 : 07.00), Leq	dBA	51.2
3	Background Noise, L10	dBA	66.4
4	Background Noise, L90	dBA	36.9
			42.5

Note: Refer to QA/QC – Accuracy page for list of analytical methods used

QUALITY CONTROL - PRECISION

Job Number : EV161859-Rev01
 Customer : PT. Hatfield Indonesia
 Project Name : Environmental Monitoring
 Customer Ref : 4305/IUS-EV/X/2016

No	Description	Units	Laboratory Replicate		% RPD
			EV161859-9	EV161859-9 Duplicate	
Physical Tests					
1	Colour	Pt/Co	15	15	0.0%
2	Odor (Lab)*	-	Odorless	-	-
3	pH (Lab)	S.U.	7.15	7.17	0.3%
4	Taste (Field)*	-	Tasteless	-	-
5	Temperature (Field)*	°C	27.2	-	-
6	Total Dissolved Solids, TDS	mg/L	614	616	0.3%
7	Total Hardness as CaCO ₃	mg/L	197	193	1.8%
8	Turbidity (Lab)	NTU	7.9	7.9	0.0%
Anions					
1	Chloride, Cl ⁻	mg/L	189	189	0.0%
2	Cyanide (Total), CN ⁻	mg/L	<0.005	<0.005	-
3	Fluoride, F ⁻	mg/L	0.15	0.16	7.3%
4	Sulphate, SO ₄ ²⁻	mg/L	37	37	0.0%
Nutrients					
1	Nitrate, NO ₃ -N	mg/L	1.75	1.75	0.0%
2	Nitrite, NO ₂ -N	mg/L	0.002	0.002	0.0%
Dissolved Metals					
1	Arsenic, As	mg/L	<0.0005	<0.0005	-
2	Cadmium, Cd	mg/L	<0.0001	<0.0001	-
3	Chromium Hexavalent, Cr ⁶⁺	mg/L	<0.002	<0.002	-
4	Iron, Fe	mg/L	0.302	0.301	0.3%
5	Lead, Pb	mg/L	<0.001	<0.001	-
6	Manganese, Mn	mg/L	0.270	0.265	1.7%
7	Mercury, Hg	mg/L	<0.00005	<0.00005	-
8	Selenium, Se	mg/L	<0.0005	<0.0005	-
9	Zinc, Zn	mg/L	<0.005	<0.005	-
Microbiology					
1	Total Coliforms	MPN/100ml	>2420	-	-
Miscellaneous					
1	Surfactants, MBAS	mg/L	<0.01	<0.01	-
2	Total Organic Matter, KMnO ₄	mg/L	7	8	4.3%



QUALITY CONTROL - PRECISION

Job Number : EV161859-Rev01
 Customer : PT. Hatfield Indonesia
 Project Name : Environmental Monitoring
 Customer Ref : 4305/IUS-EV/X/2016

No	Description	Units	Laboratory Replicate		% RPD
			EV161859-9	EV161859-9 Duplicate	
	Polycyclic Aromatic Hydrocabons (PAHs)*				
1	Benzo (a) pyrene	µg/L	<0.1	-	-
	Pesticides in water				
1	Aldrin	µg/L	<0.001	-	-
2	Dieldrin	µg/L	<0.001	-	-
3	Hexachlorobenzene (HCB)	µg/L	<4	-	-
4	Heptachlor Epoxide	µg/L	<0.001	-	-
5	Heptachlor	µg/L	<0.001	-	-
6	Lindane	µg/L	<4	-	-
7	Metoxychlor	µg/L	<0.2	-	-
8	p,p-DDD	µg/L	<0.001	-	-
9	p,p-DDE	µg/L	<0.001	-	-
10	p,p-DDT	µg/L	<0.001	-	-
	Semi Volatile Organic Compounds, SVOCs*				
1	2,4,6-trichlorophenol	µg/L	<10	-	-
2	Pentachlorophenol	µg/L	<20	-	-

QUALITY CONTROL - ACCURACY

Job Number : EV161859-Rev01
Customer : PT. Hatfield Indonesia
Project Name : Environmental Monitoring
Customer Ref : 4305/IUS-EV/X/2016

No	Description	Method	Units	Limit of Reporting	Reference Material		% Recovery
					Expected Value	Result	
Physical Tests							
1	Brightness (Field)	-	m	1	-	-	-
2	Colour	APHA 2120 C	Pt/Co	5	35	34	98%
3	Odor (Lab)*	APHA 2150 B	-	-	-	-	-
4	pH (Lab)	APHA 4500-HB	S.U.	-	6.31	6.31	100%
5	Temperature (Field)*	APHA 2550 B	°C	-	-	-	-
6	Total Dissolved Solids, TDS	APHA 2540 C	mg/L	1	247	250	101%
7	Total Hardness as CaCO ₃	APHA 2340 B	mg/L	0.5	358	356	99%
8	Total Suspended Solids, TSS	APHA 2540 D	mg/L	1	42.1	40	95%
9	Turbidity (Lab)	APHA 2130 B	NTU	0.5	11.1	10.9	98%
Anions							
1	Chloride, Cl ⁻	APHA 4110 B	mg/L	0.5	11.3	11.2	99%
2	Cyanide (Total), CN ⁻	APHA4500CN C,E	mg/L	0.005	0.984	0.911	93%
3	Fluoride, F ⁻	APHA 4110 B	mg/L	0.02	6.83	6.66	98%
4	Sulphate, SO ₄ ²⁻	APHA 4110 B	mg/L	2	6.95	7	95%
5	Sulphide as H ₂ S	APHA 4500-S2 G	mg/L	0.002	-	-	-
Nutrients							
1	Total Ammonia, NH ₃ -N	APHA 4500NH3 D	mg/L	0.02	13.5	13.1	97%
2	Nitrate, NO ₃ -N	APHA 4110 B	mg/L	0.005	14.9	15.2	102%
3	Nitrite, NO ₂ -N	APHA 4500NO2 B	mg/L	0.001	2.63	2.64	100%
4	Total Phosphorus as P	APHA 4500P E	mg/L	0.005	2.67	2.70	101%
Dissolved Metals							
1	Arsenic, As	APHA 3125 B	mg/L	0.0005	0.136	0.131	96%
2	Boron, B	APHA 3125 B	mg/L	0.01	0.95	1.0	105%
3	Cadmium, Cd	APHA 3125 B	mg/L	0.0001	0.424	0.391	92%
4	Chromium Hexavalent, Cr ⁶⁺	APHA 3500-Cr B	mg/L	0.002	0.709	0.737	104%
5	Cobalt, Co	APHA 3125 B	mg/L	0.001	0.516	0.538	104%
6	Copper, Cu	APHA 3125 B	mg/L	0.001	0.242	0.245	101%
7	Iron, Fe	APHA 3125 B	mg/L	0.005	1.66	1.80	109%
8	Lead, Pb	APHA 3125 B	mg/L	0.001	0.812	0.771	95%
9	Manganese, Mn	APHA 3125 B	mg/L	0.001	0.911	0.906	99%
10	Mercury, Hg	USEPA 245.7	mg/L	0.00005	0.0147	0.0151	103%
11	Nickel, Ni	APHA 3125 B	mg/L	0.001	0.521	0.511	98%
12	Selenium, Se	APHA 3125 B	mg/L	0.0005	0.776	0.713	92%

QUALITY CONTROL - ACCURACY

Job Number : EV161859-Rev01
 Customer : PT. Hatfield Indonesia
 Project Name : Environmental Monitoring
 Customer Ref : 4305/IUS-EV/X/2016

No	Description	Method	Units	Limit of Reporting	Reference Material		% Recovery
					Expected Value	Result	
13	Zinc, Zn	APHA 3125 B	mg/L	0.005	0.885	0.882	100%
Microbiology							
1	Total Coliforms	APHA 9223	MPN/100ml	1	-	-	-
Miscellaneous							
1	Biochemical Oxygen Demand, BOD ₅	APHA 5210 B	mg/L	2	66.8	69	103%
2	Chemical Oxygen Demand, COD	APHA 5220 C	mg/L	2	108	112	104%
3	Chlorine, Cl ₂ (Lab)	APHA 4500-Cl I	mg/L	0.01	-	-	-
4	Dissolved Oxygen, DO (Field)	APHA 2520 B	mg/L	-	-	-	-
5	Oil & Grease	APHA 5520 B	mg/L	1	106	101	95%
6	Surfactants, MBAS	APHA 5540 C	mg/L	0.01	0.61	0.60	98%
7	Total Phenols	USEPA 9065	mg/L	0.001	0.741	0.720	97%
Pesticides in water							
1	Aldrin	USEPA 8270C	µg/L	0.001	-	-	-
2	Dieldrin	USEPA 8270C	µg/L	0.001	-	-	-
3	Hexachlorobenzene (HCB)	USEPA 8270B	µg/L	4	-	-	-
4	Heptachlor Epoxide	USEPA 8270C	µg/L	0.001	-	-	-
5	Heptachlor	USEPA 8270C	µg/L	0.001	-	-	-
6	Lindane	USEPA 8270B	µg/L	4	-	-	-
7	Metoxychlor	USEPA 8270C	µg/L	0.2	-	-	-
8	p,p-DDD	USEPA 8270C	µg/L	0.001	-	-	-
9	p,p-DDE	USEPA 8270C	µg/L	0.001	-	-	-
10	p,p-DDT	USEPA 8270C	µg/L	0.001	-	-	-
Semi Volatile Organic Compounds, SVOCs*							
1	2,4,6-trichlorophenol	USEPA 8270B	µg/L	10	-	-	-
2	Pentachlorophenol	USEPA 8270B	µg/L	20	-	-	-

ENVIRONMENTAL TEST REPORT

Mr. Joshua Partogi
PT. Hatfield Indonesia
Lipi Building, 3rd floor
Jl. Ir. H. Juanda No. 18
Bogor, 16002
INDONESIA

Job Number : EV161876-Rev01
Customer Ref : 4410/IUS-EV/XI/2016
Project Name : Environmental Monitoring

Number of samples : 2

Date received : 14-Nov-2016
Date reported : 02-Des-2016

Approved Signature for:


Reginald C. de Wit
Manager Environmental Services

All work is performed in accordance with Intertek Standard Terms and Conditions of work <http://www.intertek.com/terms/>

This report relates specifically to the sample(s) tested in so far as that the sample(s) is truly representative of the sample source as received.

This report was prepared solely for the use of the client named in this report. PT Intertek Utama Services accepts no responsibility for any loss, damage or liability suffered by any third party as a result of any reliance upon or use of this report.

DO NOT PHOTOCOPY

SAMPLE INFORMATION

Job Number : EV161876-Rev01
Customer : PT. Hatfield Indonesia
Project Name : Environmental Monitoring
Customer Ref : 4410/IUS-EV/XI/2016

No.	Laboratory Sample I.D.	Customer Sample I.D.	Sample Matrix	Date Sampled	Time Sampled	Date Received	Sampled By	Coordinates	
1	EV161876-1	Kerang	Scallop	-	-	14-Nov-16	Customer	-	-
2	EV161876-2	Sediment	Sediment	-	-	14-Nov-16	Customer	-	-

Notes:

N.A = Not Analyzed

ND= Not Detected

I.S = Insufficient Sample

* = Non Accredited Test

** = Subcontracted Test

1) = Field Measurement

2) = Field Measurement by Customer

L.N.R= Listed but Not Received

Job Number : EV161876-Rev01
Customer : PT. Hatfield Indonesia
Project Name : Environmental Monitoring
Customer Ref : 4410/IUS-EV/XI/2016

Laboratory Sample I.D :		EV161876-1	
Customer Sample I.D :		Kerang	
Date Sampled :		-	
Sample Matrix :		Scallop	
No.	Test Description	Units	Results
	Metals		
1	Arsenic, As	mg/wet kg	0.83
2	Cadmium, Cd	mg/wet kg	0.099
3	Copper, Cu	mg/wet kg	14.6
4	Lead, Pb	mg/wet kg	0.13
5	Magnesium, Mg	mg/wet kg	303
6	Mercury, Hg	mg/wet kg	0.007
7	Nickel, Ni	mg/wet kg	0.04
8	Potassium, K	mg/wet kg	1540
9	Zinc, Zn	mg/wet kg	10.4

Note: Refer to QA/QC – Accuracy page for list of analytical methods used
Regulatory Limit Based on KepMenLH 51 (2004)

Job Number : EV161876-Rev01
Customer : PT. Hatfield Indonesia
Project Name : Environmental Monitoring
Customer Ref : 4410/IUS-EV/XI/2016

Laboratory Sample I.D :		EV161876-2	
Customer Sample I.D :		Sediment	
Date Sampled :		-	
Sample Matrix :		Sediment	
No.	Test Description	Units	Results
Physical Tests			
1	Paste pH 1:5 in water	S.U.	7.87
Anions			
1	Cyanide (Total), CN ⁻	mg/dry kg	0.109
2	Total Phosphorus as P	mg/dry kg	800
Anions (Water Leachable 1:5)			
1	Sulphate, SO ₄ ²⁻	mg/dry kg	5750
Nutrients Water Leachable 1:5			
1	Total Ammonia, NH ₃ -N	mg/dry kg	32.0
2	Nitrate, NO ₃ -N	mg/dry kg	2.56
Total Metals			
1	Arsenic, As	mg/dry kg	7.5
2	Barium, Ba	mg/dry kg	60.6
3	Boron, B	mg/dry kg	34
4	Cadmium, Cd	mg/dry kg	0.18
5	Chromium Hexavalent, Cr ⁶⁺	mg/dry kg	<0.08
6	Cobalt, Co	mg/dry kg	5.4
7	Copper, Cu	mg/dry kg	12.6
8	Iron, Fe	mg/dry kg	17300
9	Lead, Pb	mg/dry kg	27.6
10	Manganese, Mn	mg/dry kg	932
11	Nickel, Ni	mg/dry kg	9.8
12	Selenium, Se	mg/dry kg	0.8
13	Silver, Ag	mg/dry kg	0.02
14	Tin, Sn	mg/dry kg	3.3
15	Zinc, Zn	mg/dry kg	75
Miscellaneous			
1	Total Phenols	mg/dry kg	<0.025
2	Total Organic Carbon, TOC	% dry	1.91

Note: Refer to QA/QC – Accuracy page for list of analytical methods used
 Regulatory Limit Based on KepMenLH 51 (2004)

QUALITY CONTROL - PRECISION

Job Number : EV161876-Rev01
Customer : PT. Hatfield Indonesia
Project Name : Environmental Monitoring
Customer Ref : 4410/IUS-EV/XI/2016

No	Description	Units	Laboratory Replicate		% RPD
			EV161876-1	EV161876-1 Duplicate	
Metals					
1	Arsenic, As	mg/wet kg	0.83	0.93	11.4%
2	Cadmium, Cd	mg/wet kg	0.099	0.103	4.0%
3	Copper, Cu	mg/wet kg	14.6	16.3	11.0%
4	Lead, Pb	mg/wet kg	0.13	0.15	14.3%
5	Magnesium, Mg	mg/wet kg	303	313	3.4%
6	Mercury, Hg	mg/wet kg	0.007	0.007	0.0%
7	Nickel, Ni	mg/wet kg	0.04	0.04	0.0%
8	Potassium, K	mg/wet kg	1540	1600	3.8%
9	Zinc, Zn	mg/wet kg	10.4	10.7	2.9%

QUALITY CONTROL - PRECISION

Job Number : EV161876-Rev01
 Customer : PT. Hatfield Indonesia
 Project Name : Environmental Monitoring
 Customer Ref : 4410/IUS-EV/XI/2016

No	Description	Units	Laboratory Replicate		% RPD
			EV161876-2	EV161876-2 Duplicate	
Physical Tests					
1	Paste pH 1:5 in water	S.U.	7.87	7.85	0.3%
Anions					
1	Cyanide (Total), CN ⁻	mg/dry kg	0.109	0.115	5.4%
2	Total Phosphorus as P	mg/dry kg	800	800	0.0%
Anions (Water Leachable 1:5)					
1	Sulphate, SO ₄ ²⁻	mg/dry kg	5750	5730	0.3%
Nutrients Water Leachable 1:5					
1	Total Ammonia, NH ₃ -N	mg/dry kg	32.0	32.0	0.0%
2	Nitrate, NO ₃ -N	mg/dry kg	2.56	2.57	0.7%
Total Metals					
1	Arsenic, As	mg/dry kg	7.5	7.1	5.5%
2	Barium, Ba	mg/dry kg	60.6	59.3	2.2%
3	Boron, B	mg/dry kg	34	37	8.5%
4	Cadmium, Cd	mg/dry kg	0.18	0.20	10.5%
5	Chromium Hexavalent, Cr ⁶⁺	mg/dry kg	<0.08	<0.08	-
6	Cobalt, Co	mg/dry kg	5.4	5.4	0.0%
7	Copper, Cu	mg/dry kg	12.6	12.1	4.0%
8	Iron, Fe	mg/dry kg	17300	16800	3.2%
9	Lead, Pb	mg/dry kg	27.6	27.4	0.7%
10	Manganese, Mn	mg/dry kg	932	915	1.9%
11	Nickel, Ni	mg/dry kg	9.8	9.8	0.0%
12	Selenium, Se	mg/dry kg	0.8	0.8	0.0%
13	Silver, Ag	mg/dry kg	<0.02	<0.02	-
14	Tin, Sn	mg/dry kg	3.3	3.5	5.9%
15	Zinc, Zn	mg/dry kg	75	76	1.3%
Miscellaneous					
1	Total Phenols	mg/ kg	<0.025	<0.025	-
2	Total Organic Carbon, TOC	% dry	1.91	1.92	0.5%

QUALITY CONTROL - ACCURACY

Job Number : EV161876-Rev01
 Customer : PT. Hatfield Indonesia
 Project Name : Environmental Monitoring
 Customer Ref : 4410/IUS-EV/XI/2016

No	Description	Method	Units	Limit of Reporting	Reference Material		% Recovery
					Expected Value	Result	
Anions							
1	Cyanide (Total), CN ⁻	APHA4500CN C,E	mg/dry kg	0.025	74.6	70.4	94%
2	Total Phosphorus as P	In House-XRF	mg/dry kg	10	300	300	100%
Anions (Water Leachable 1:5)							
1	Sulphate, SO ₄ ²⁻	APHA 4500 SO4 E	mg/dry kg	10	393	363	92%
Metals in Tissue							
1	Arsenic, As		mg/wet kg	0.01	6.8	6.37	94%
2	Cadmium, Cd	USEPA 200.3	mg/wet kg	0.001	0.306	0.287	94%
3	Copper, Cu	USEPA 200.3	mg/wet kg	0.01	15.9	15.0	94%
4	Lead, Pb	USEPA 200.3	mg/wet kg	0.01	0.416	0.38	91%
5	Magnesium, Mg	USEPA 200.3	mg/wet kg	0.5	-	-	-
6	Nickel, Ni	USEPA 200.3	mg/wet kg	0.01	1.36	1.36	100%
7	Zinc, Zn	USEPA 200.3	mg/wet kg	0.05	52.2	47.1	90%
Total Metals							
1	Arsenic, As	USEPA 3050B/APHA 3125B	mg/dry kg	0.1	221	230	104%
2	Barium, Ba	USEPA 3050B/APHA 3125B	mg/dry kg	0.2	428	437	102%
3	Boron, B	USEPA 3050B/APHA 3125B	mg/dry kg	2	79.5	85	107%
4	Cadmium, Cd	USEPA 3050B/APHA 3125B	mg/dry kg	0.02	126	124	98%
5	Cobalt, Co	USEPA 3050B/APHA 3125B	mg/dry kg	0.2	198	199	101%
6	Copper, Cu	USEPA 3050B/APHA 3125B	mg/dry kg	0.2	83.3	89.2	107%
7	Iron, Fe	USEPA 3050B/APHA 3125B	mg/dry kg	1	14600	14800	101%
8	Lead, Pb	USEPA 3050B/APHA 3125B	mg/dry kg	0.2	76.9	80.2	104%
9	Manganese, Mn	USEPA 3050B/APHA 3125B	mg/dry kg	0.2	452	468	104%
10	Nickel, Ni	USEPA 3050B/APHA 3125B	mg/dry kg	0.2	178	183	103%
11	Selenium, Se	USEPA 3050B/APHA 3125B	mg/dry kg	0.1	111	111	100%
12	Silver, Ag	USEPA 3050B/APHA 3125B	mg/dry kg	0.02	65.7	64.4	98%
13	Tin, Sn	USEPA 3050B/APHA 3125B	mg/dry kg	0.2	88.5	95.6	108%
14	Zinc, Zn	USEPA 3050B/APHA 3125B	mg/dry kg	1	338	348	103%
Miscellaneous							
1	Total Organic Carbon, TOC	USEPA NCEA-C-1282	% dry	0.01	4760	3960	83%