CHAPTER FIVE

Project Description

Chapter 5 PROJECT DESCRIPTION

5.1 INTRODUCTION

This chapter provides an overview of the proposed Project including the overall project concept, the main project activities from construction to operation as well as support ancillary facilities and implementation schedule.

5.2 PROJECT CONCEPT

The goal of this Project is to manage scheduled and municipal wastes using an integrated waste management system that includes the waste collection systems from sources where the wastes will be generated and the transportation system from waste sources to waste management centre. Two (2) type of landfills will be constructed, namely one (1) secure landfill for scheduled wastes and one (1) sanitary landfill for municipal wastes. One (1) combined leachate treatment plant will be constructed to cater for the treatment of the leachate generated from both the secure and sanitary landfills.

Management of these wastes are integrated vertically with the management of waste logistics that provide seamless and functioning capacity as well as capability between waste generation and that of the waste management in the form of waste collection, transportation, storage, treatment and final disposal.

This Samalaju IWMS will cater for the Bintulu Town's demand in the future, taking over the role from the current dumpsite at Tg. Kidurong. In terms of waste management process, the municipal waste from Bintulu Town will be pre-processed at a transfer station (to be constructed by others) prior to landfilling at the Samalaju IWMS. The transfer station is still in planning stage and will be subjected to a separate EIA study.

In principal, the concept for this Samalaju IWMS will be similar to the concept currently applied at the Kuching Integrated Waste Management Park (KIWMP), Mambong, Kuching, except without the incinerator and its ancillary components.

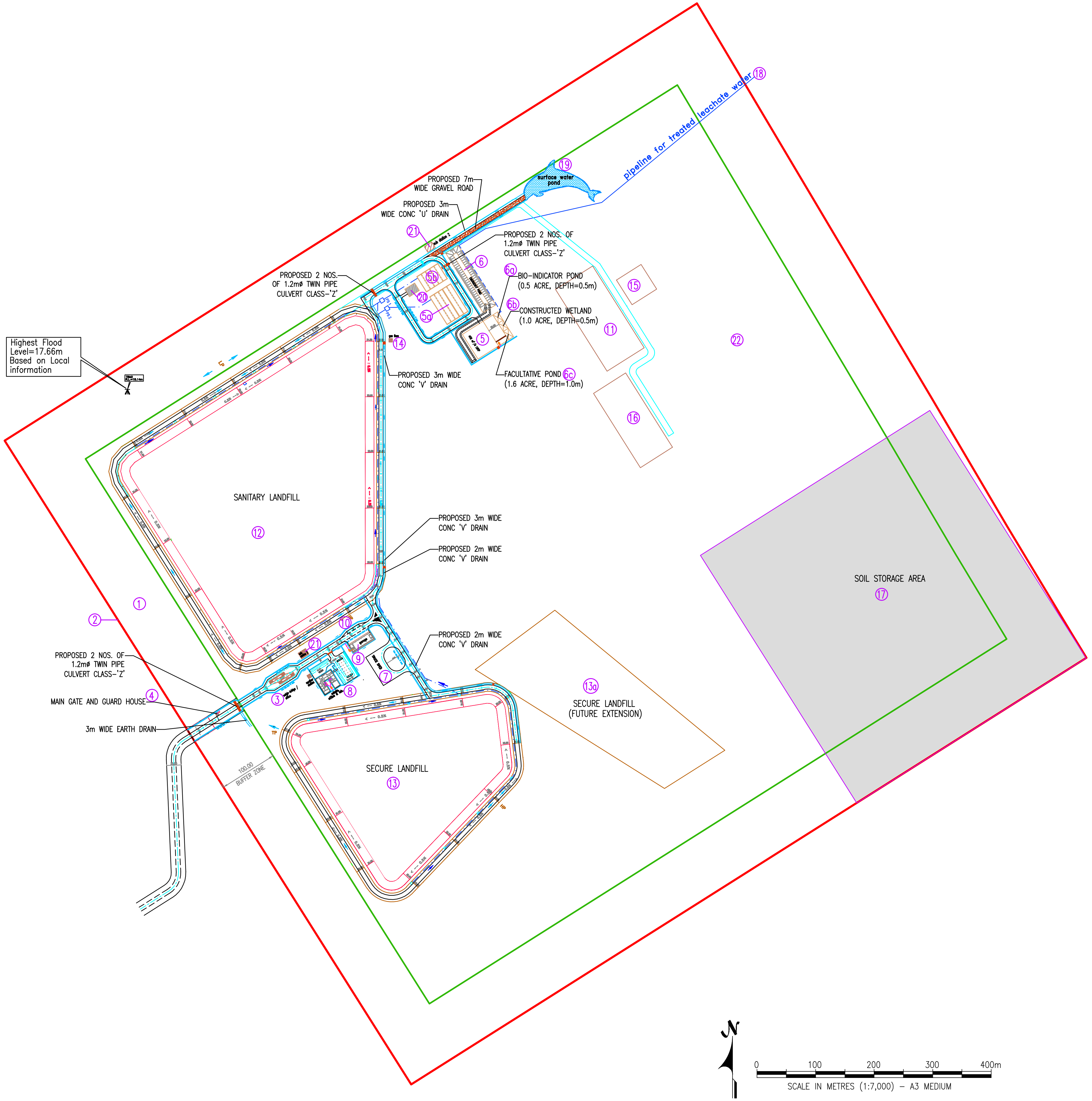
5.3 PROJECT COMPONENT

The Project will consist of a central waste management facility that will be equipped primarily with a Sanitary Landfill, for the reception of municipal wastes from the proposed Samalaju New Township, Bintulu Town and surrounding area service by BDA; one Secure Landfill for scheduled wastes from Samalaju Industrial Park's (SIP) industries; as well as other supporting facilities for the operation of the landfills that include one combined leachate / wastewater treatment plant, maintenance, testing laboratory, administrative buildings, as well as environmental, safety and health systems and provisions. The proposed Project layout plan is shown in **Figure 5.3.1**. The cross sections of the proposed secure (toxic waste and less toxic waste) and sanitary landfills are shown in **Figure 5.3.5**, **Figure 5.3.6** and **Figure 5.3.7**.

The central waste management facility will comprise the following key components:

- Administration office & laboratory;
- Garage / workshop;
- Guard house and weight-bridge;
- One (1) secure landfill for scheduled wastes (subdivided to area for toxic waste and less toxic waste) (see **Figure 5.3.4**);
- One (1) sanitary landfill for domestic wastes;
- One (1) combined leachate wastewater treatment plant (see **Figure 5.3.2**);
- Proposed 300 mm diameter high-density polyethylene (HDPE) discharge pipeline (approximately 1.3 km) to convey treated leachate water from the Project site to the tributary of Sg. Nyalau;
- Sediment / retention ponds for stormwater management;
- Raw leachate storage ponds – roofed;
- Five (5) days capacity emergency retention pond;
- Polishing pond (facultative, wetland and bio-indicator);
- Temporary scheduled waste (SW) storage area / off-site SW storage facility – capacity of 5,000 MT;
- Soil storage area;
- Gas flare station;
- Truck washing bay;
- Truck shed;
- Area for future disposal or recovery plant;
- Stabilisation plant (planned future expansion);
- Access road during construction and operational stages (*EIA will be done by other party*).

SECOND SCHEDULE ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
FOR THE PROPOSED INTEGRATED WASTE MANAGEMENT
SYSTEM (IWMS) IN SAMALAJU, BINTULU, SARAWAK



LEGEND:

- Project Boundary
- (1) Buffer Zone (100m)
- (2) Fencing
- (3) Weighbridge c/w Office
- (4) Guard House
- (5) Leachate Waste Water Treatment Plant (LWWTP)
- (5a) Roofed Pond (Secure LF)
- (5b) Roofed Pond (Sanitary LF)
- (6) Emergency Retention Pond
- (6a) Bio-Indicator Pond (0.5 acre, depth=0.5m)
- (6b) Constructed Wetland (1.0 acre, depth=0.5m)
- (6c) Facultative Pond (1.6 acre, depth=1.0m)
- (7) Truck Shed
- (8) Administration & Laboratory
- (9) Garage / Workshop
- (10) Truck Washing Bay
- (11) Temporary Schedule Waste Storage/ Off-site SW Storage Facility
- (12) Sanitary Landfill
- (13) Secure Landfill
- (13a) Secure Landfill (Future Extension)
- (14) Gas Flare Station (Future)
- (15) Stabilization Plant (Future)
- (16) Area for Future Disposal & Recovery Plant (Sorting/Recovery/Incinerator/Recycling)
- (17) Soil Storage Area
- (18) Proposed Water Way
- (19) Surface Water Pond
- (20) Pump Station
- (21) Sub Station 1 & 2
- (22) Area for Future Use

SOURCE: (Trienekens (Samalaju) Sdn Bhd

PROJECT LAYOUT PLAN

FIGURE: 5.3.1

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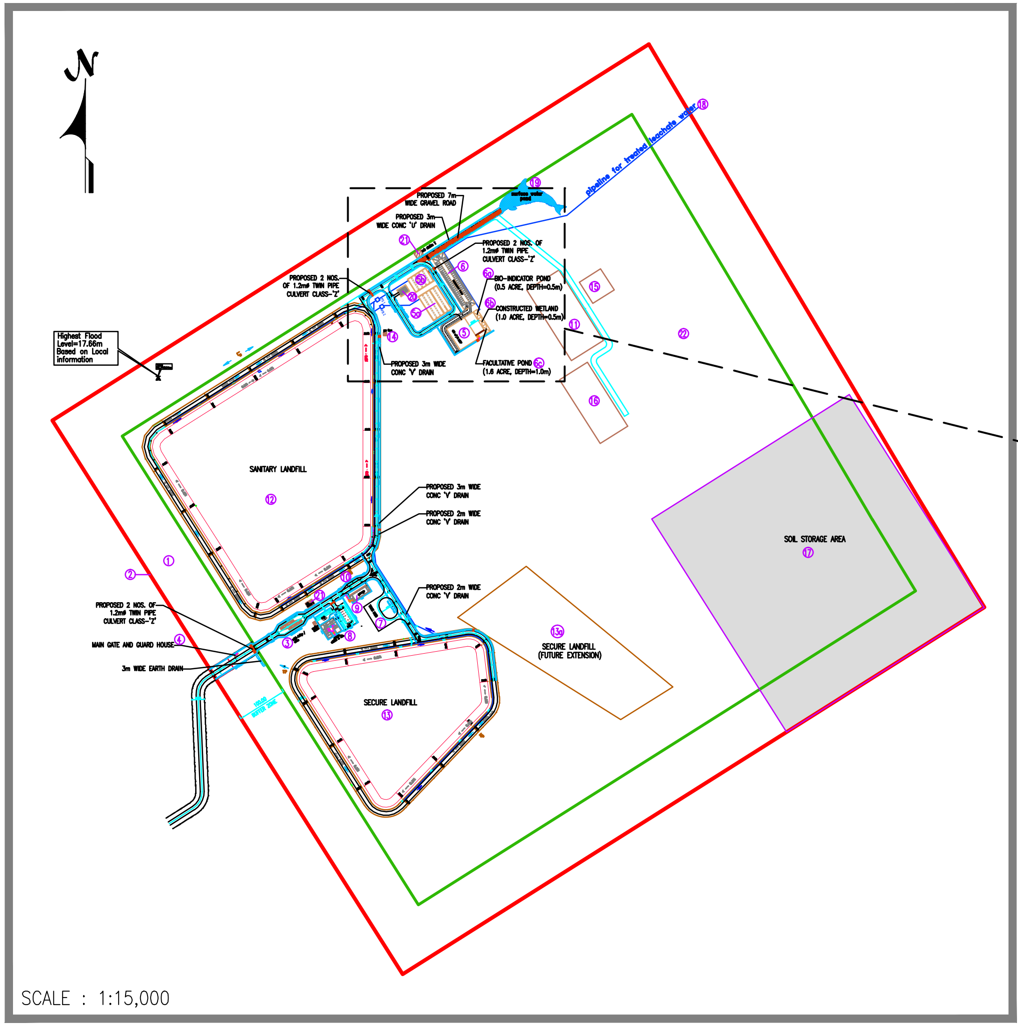
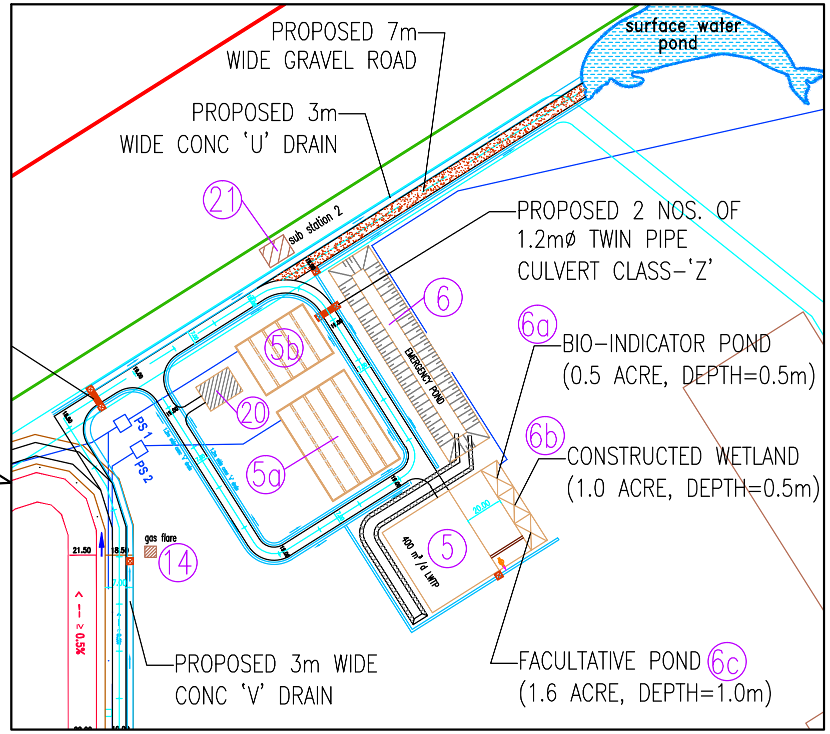
SECOND SCHEDULE ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
FOR THE PROPOSED INTEGRATED WASTE MANAGEMENT
SYSTEM (IWMS) IN SAMALAJU, BINTULU, SARAWAK





LEGEND:

- PROJECT BOUNDARY
- 5 LEACHATE WASTE WATER TREATMENT PLANT (LWWTP)
- 5a ROOFED POND (SECURE LF)
- 5b ROOFED POND (SANITARY LF)
- 6 EMERGENCY RETENTION POND
- 6a BIO-INDICATOR POND (0.5 ACRE, DEPTH=0.5M)
- 6b CONSTRUCTED WETLAND (1.0 ACRES, DEPTH=0.5M)
- 6c FACULTATIVE POND (1.6 ACRE, DEPTH=1.0M)
- 14 GAS FLARE STATION (FUTURE)
- 20 PUMP STATION
- 21 SUB STATION 1 & 2

LEACHATE TREATMENT PLANT LAYOUT PLAN

FIGURE: 5.3.2

SOURCE: [Trienekens (Samalaju) Sdn Bhd

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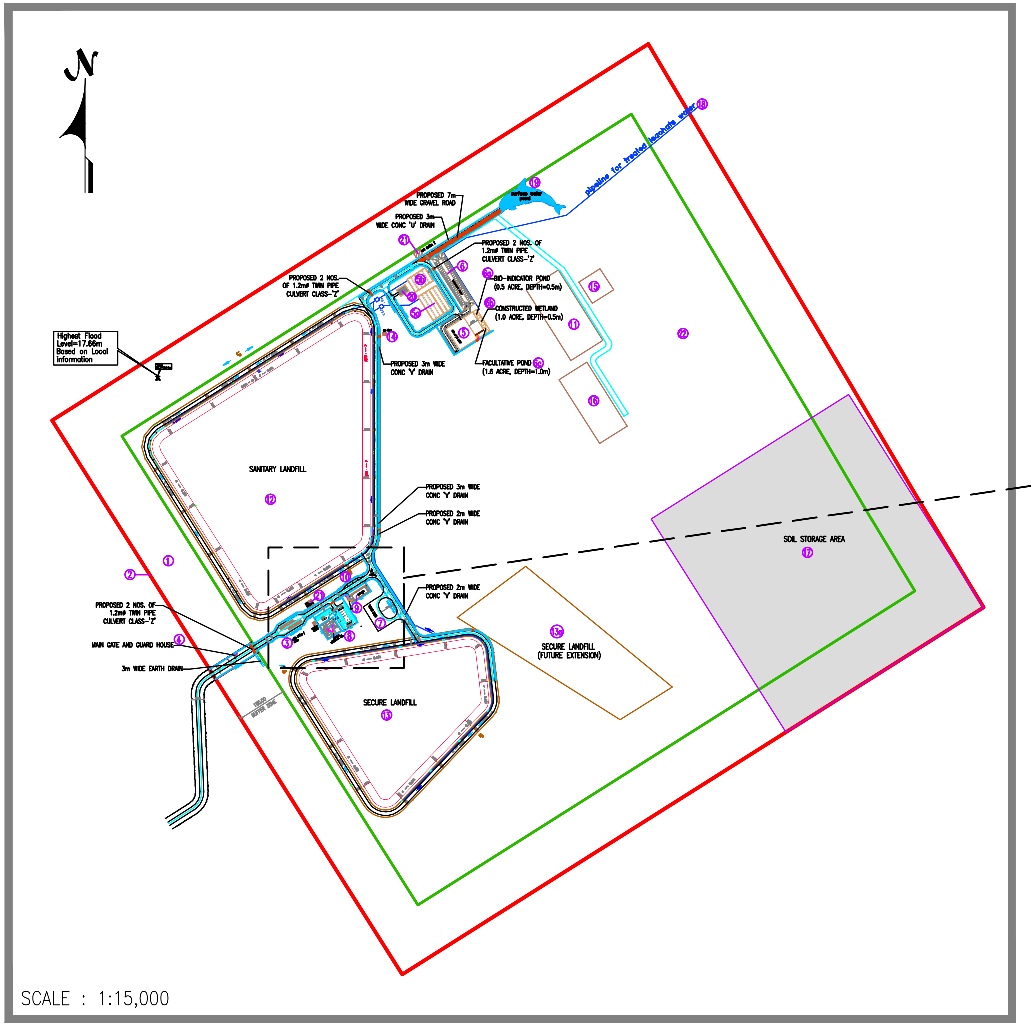
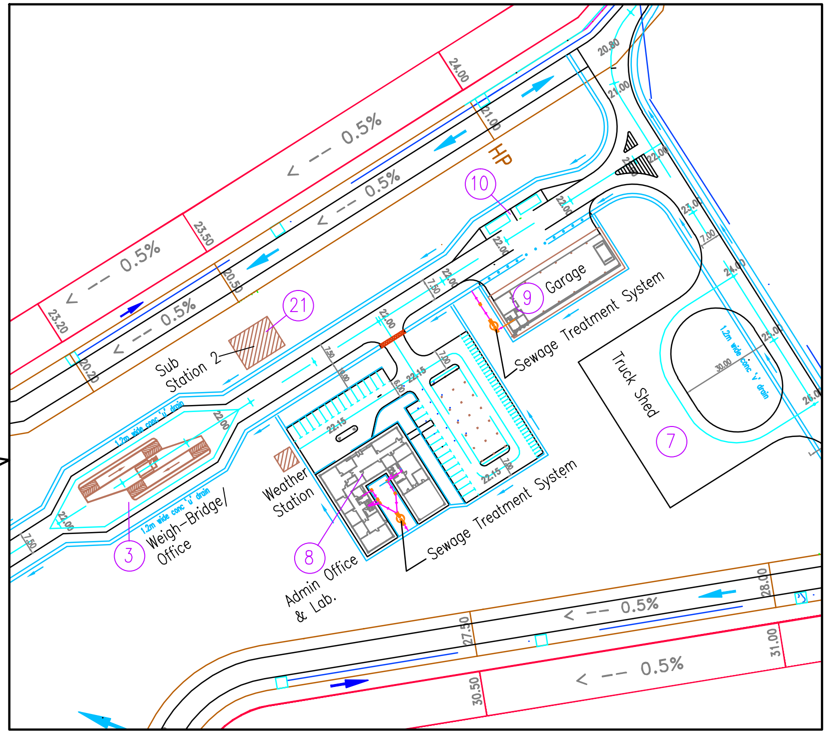
CHEMSAIN KONSULTANT SDN. BHD.

SECOND SCHEDULE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED INTEGRATED WASTE MANAGEMENT SYSTEM (IWMS) IN SAMALAJU, BINTULU, SARAWAK





LEGEND:

- PROJECT BOUNDARY
- (3) WEIGHBRIDGE C/W OFFICE
- (7) TRUCK SHED
- (8) ADMINISTRATION & LABORATORY
- (9) GARAGE / WORKSHOP
- (10) TRUCK WASHING BAY
- (21) SUB STATION 1 & 2

MAIN OFFICE AREA

FIGURE: 5.3.3

SOURCE:[Trienekens (Samalaju) Sdn Bhd

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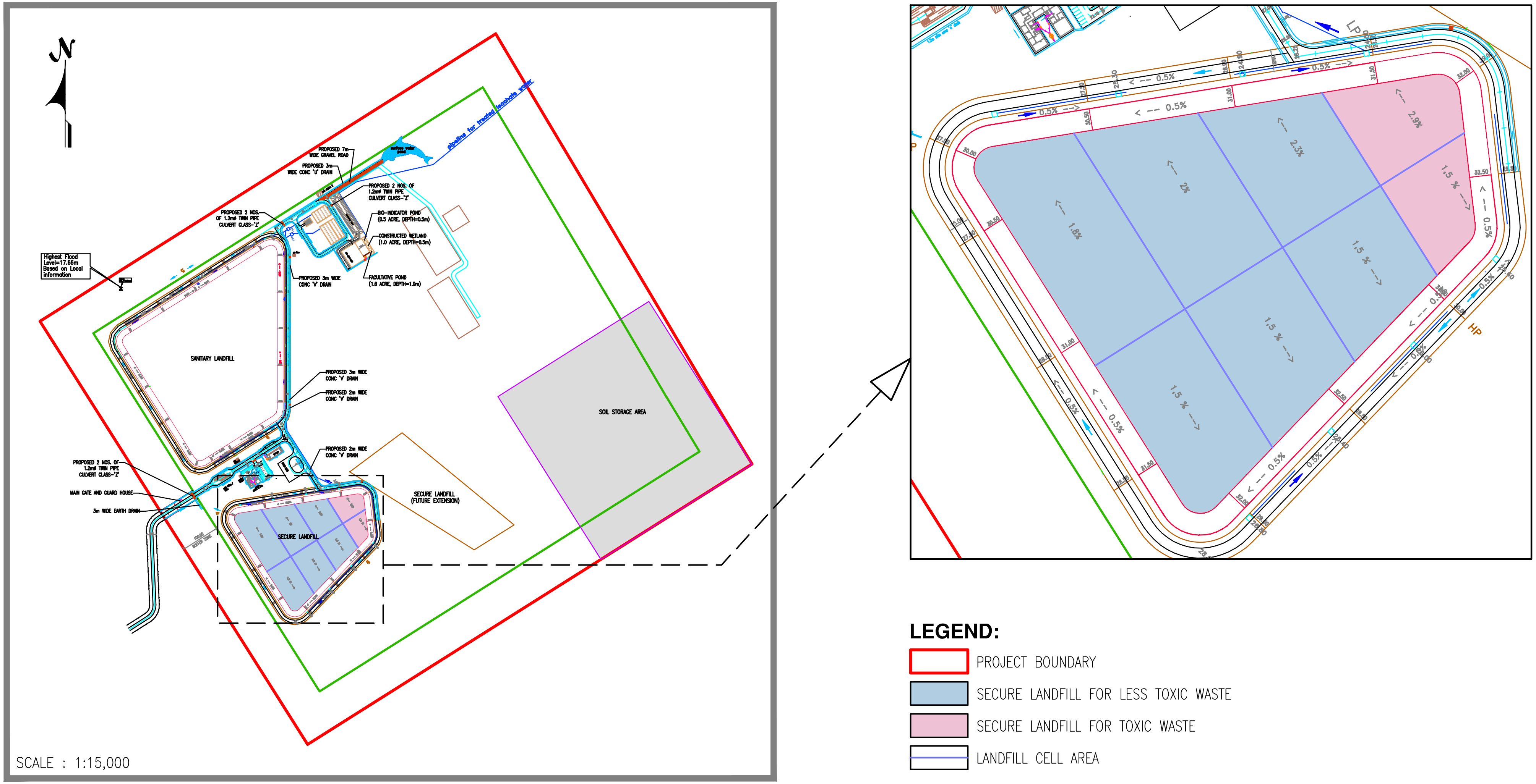


SECURE LANDFILL FOR TOXIC WASTE AND LESS TOXIC WASTE

FIGURE: 5.3.4

SOURCE:[Trienekens (Samalaju) Sdn Bhd

Figure 5.3.5: Cross Section for Secure Landfill (for Toxic Waste)

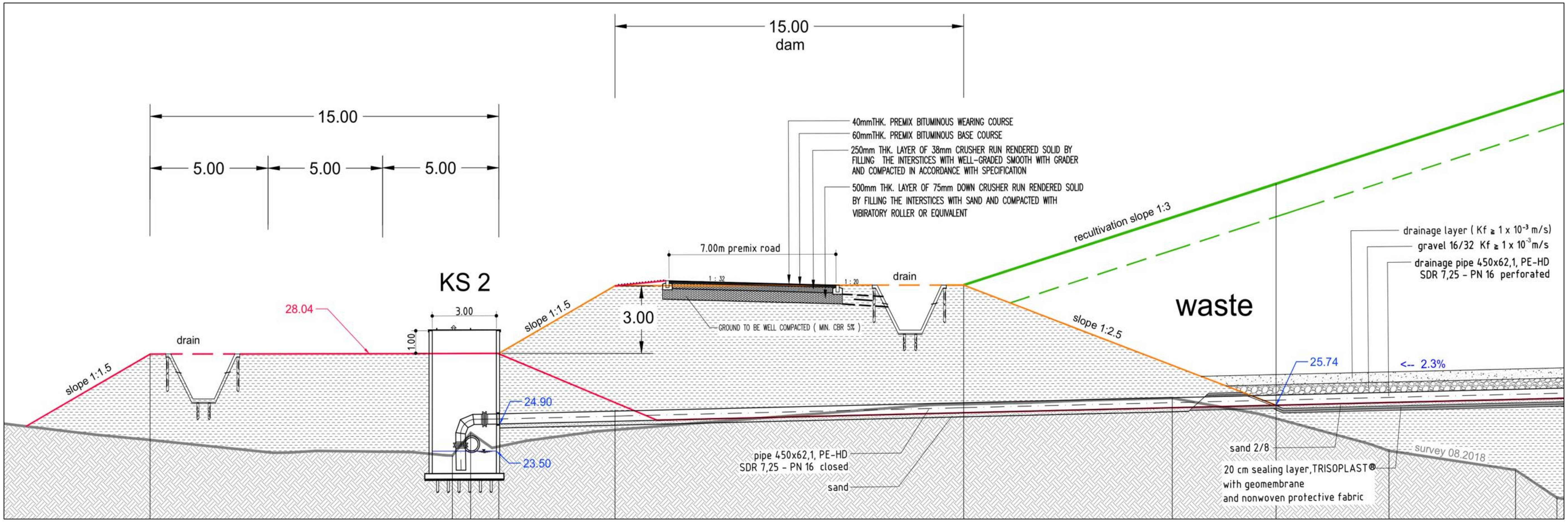


Figure 5.3.6: Cross Section for Secure Landfill (for Less Toxic Waste)

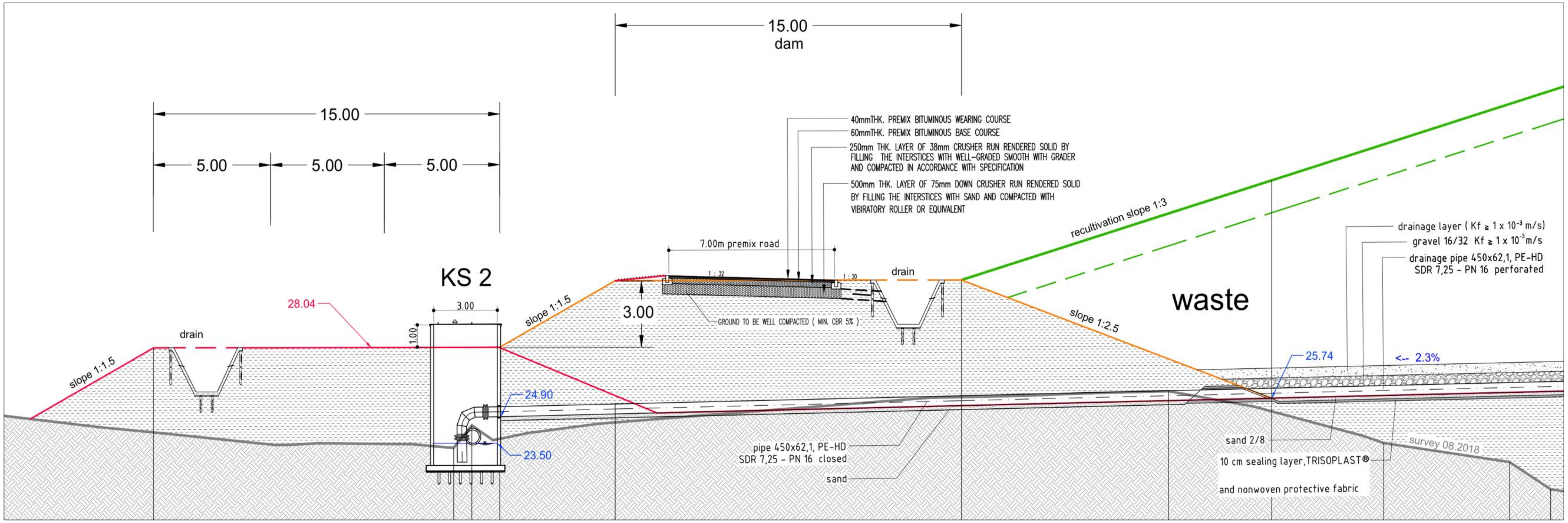
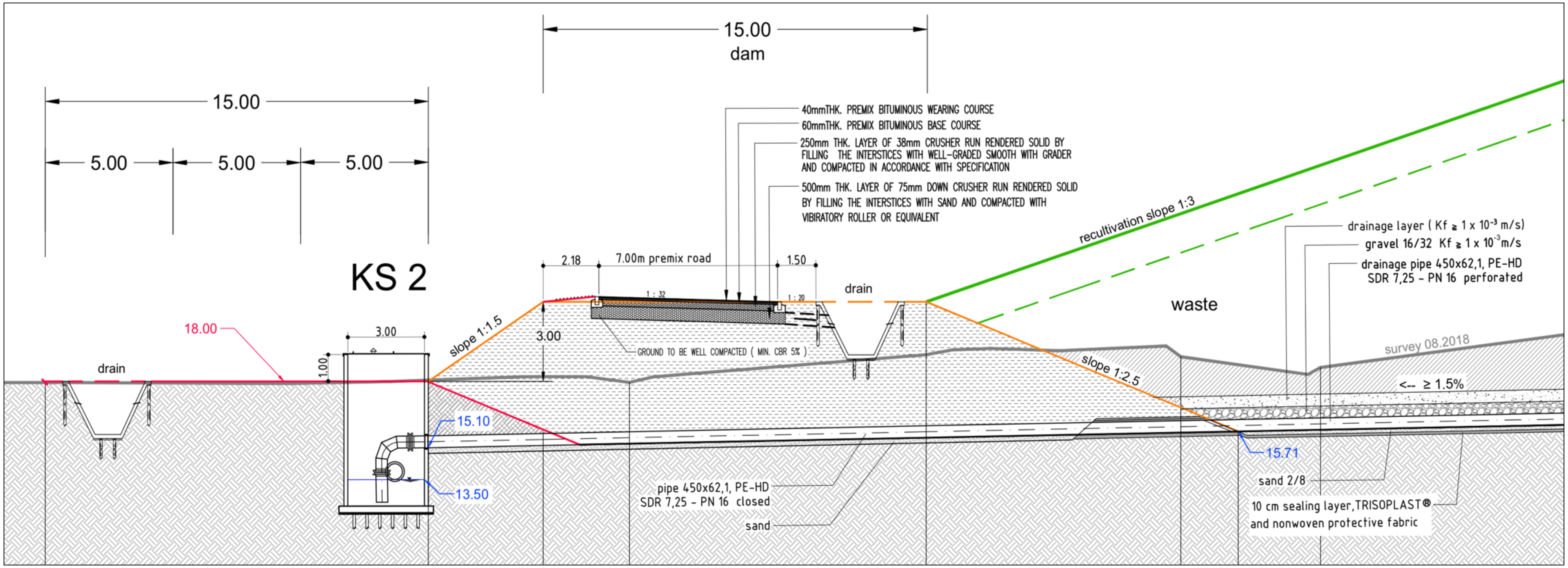


Figure 5.3.7: Cross Section for Sanitary Landfill



5.3.1 BUFFER ZONE

A buffer zone of green area with a width of 100 m from the Project boundary has been allocated. The buffer zone is shown in **Figure 5.3.1**.

5.3.2 SECURE LANDFILL

Based on the layout plan of the proposed landfill that was undertaken, it was found to result in a volumetric capacity (of the landfill) at approximately 1,720,000.00 tonnes (which assuming that scheduled waste entering the landfill shall be solids having density of 2.0 tonnes/m^3, the lifespan of the concept landfill is expected to last up to 57 years). It is possible that, the lifespan of the landfill is more than 57 years should the actual tonnage of wastes disposed is less than the estimated tonnage (see **Table 5.3.2**).

The secure landfill will be subdivided into sections for toxic waste and less toxic waste. The definition for both 'toxic waste' and 'less toxic waste' is defined below. The subdivided area for the toxic waste and less toxic waste at the secure landfill is shown in **Figure 5.3.4**.

<u>Definition of 'Less Toxic Waste'</u>

'*Less toxic wastes*' are scheduled wastes listed under the First Schedule of the Environmental Quality (Scheduled Waste) Regulation 2005 that has the potential to undergo the application for Special Waste Management under Regulation 7 (1) of the same regulation. These wastes, if qualify for special waste management, may have potential recovery value as raw material replacement subject to receiving capacity of recovery facilities

<u>Definition of 'Toxic Waste'</u>

'*Toxic Wastes*' are scheduled wastes listed under the First Schedule of the Environmental Quality (Scheduled Waste) Regulation 2005 that has no potential to undergo the application for Special Waste Management from DOE and has no recovery or reuse potential.

5.3.2.1 Scheduled Waste Sources and Estimated Scheduled Waste Generation Quantity from SIP

The major scheduled waste sources from SIP and its respective generation quantity to the IWMS secure landfill are provided in **Table 5.3.1**.

The major scheduled wastes generated from SIP are ferroalloy slags from the ferroalloy smelting industries and sludge from the polycrystalline silicon plant. The total major scheduled wastes generation from SIP is estimated to be about 30,000 tonnes per year, based on the detailed feasibility study carried out by Trienekens. This conservative estimated figure is based on the fact that most industries currently operating in SIP has submitted applications of special management of their scheduled wastes under Regulation 7(1) of the Environmental Quality (Scheduled Waste) Regulation 2005. Hence, the proposed secure landfill is expected to receive scheduled wastes that cannot be applied or have been rejected under Regulation 7(1).

Table 5.3.1: Summary of Scheduled Waste Generation Capacity in SIP

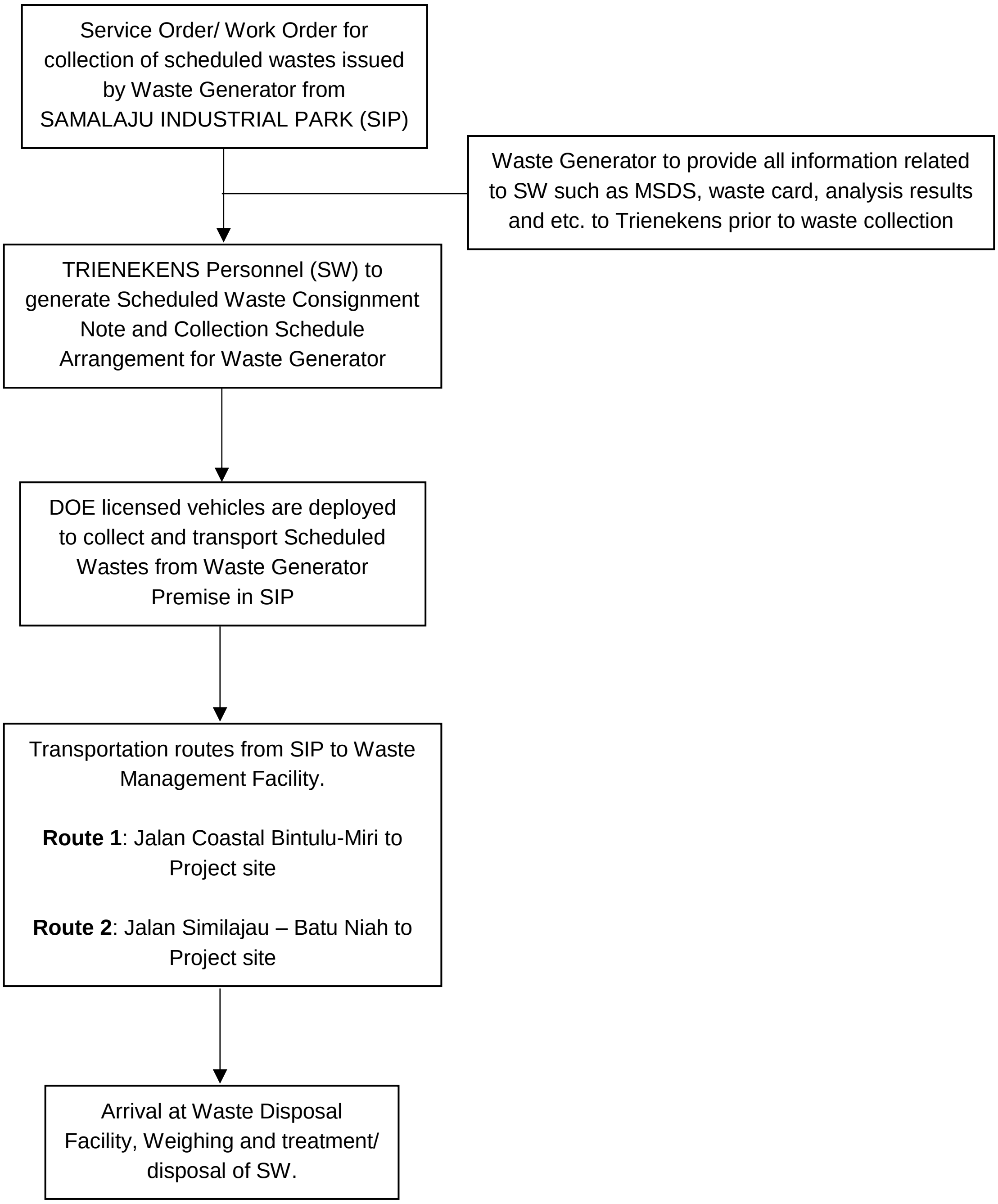
No.	Industries	Scheduled Waste Code	Description	Volume (tonnes/annum)				
				Phase I	Phase II	Phase III	Phase Iv	Phase V
1	OCIM (previously Tokuyama Malaysia)	SW421	Wastewater treatment plant, sludge	8,500	25,500	49,500	73,500	97,500
		SW410	Wastewater treatment plant, used filter press clothes	0.6	1.7	3.4	5.1	6.8
		SW409	Production line of Polycry, used jumbo bags	12	34	68	102	136
		SW409	Production line of Polycry, used chemical/ used oil containers	30	85	170	255	340
2	Pertama Ferroalloys	SW421	Annode slime	5,333.3				
		SW421	$MnCO_3$	0.059				
		SW104	Coal ash residue	3,100				
		SW104	Bag filter dust	12,821				
3	Sakura Ferroalloys	SW409/410/422	Used chemical container	2,000				
		SW305/306/312	Used oil	1,000				
4	Malaysian Phosphate	SW204	TPA/ FPA plant (purification), filter cake	50				
		SW204	Coke plant wastewater treatment plant, filter cake	120				
		SW202	Ammonia plant, waste catalyst (VPSA absorbent)	330				
5	PMB Silicon	SW305/306/312	Used oil	35				
		SW409/410/417	Contaminated containers/spent paints/ oils, etc.	35				
		SW110	Batteries	35				

No.	Industries	Scheduled Waste Code	Description	Volume (tonnes/annum)				
				Phase I	Phase II	Phase III	Phase Iv	Phase V
6	Wenan Steel Mill	SW410	Contaminated with scheduled wastes	0	0	15		
		SW204	Sludge containing chromium	0	0	10		
		SW422	Milling mud	159.7	320	50		
		SW311	Waste of oil or oily sludge	798.3	1,601	2,494		
		SW110	Waste lamp, cartridge	47.9	96	150		
			Total	34,407.86	27,637.70	52,460.40	73,862.10	97,982.80

5.3.2.2 Scheduled Waste Management Process Flow

The proposed process flow of the waste management is shown in **Figure 5.3.8**.

Figure 5.3.8: Process Flow of Waste Management



5.3.2.3 Secure Landfill Cells and Size Area

The overall area allocated for Secure Landfill is approximately 6.1 hectares (61,258 m^2). The volumetric capacity for the Secure Landfill and each cell is as follow:

- » Cell 1 – 4,601 m^2;
- » Cell 2 – 7,442 m^2;
- » Cell 3 – 10,183 m^2;
- » Cell 4 – 11,610 m^2;
- » Cell 5 – 8,925 m^2;
- » Cell 6 – 8,284 m^2;
- » Cell 7 – 6,687 m^2;
- » Cell 8 – 3,526 m^2.

The overall volumetric of the secure landfill capacity has been calculated at 860,000 m^3 and with the generation rate of 30,000 tonne/year. The lifespan for the proposed Secure Landfill is expected to be operational at least 57 years (see **Table 5.3.2**).

Table 5.3.2: Summary of Secure Landfill Lifespan Design Criteria

Criteria	Secure Landfill	Units
Waste Generation Rate	30,000	tonne/year
Waste Bulk Density	2	tonne/m^3
Landfill Capacity	860,000	m^3
	1,720,000	tonne
Landfill Design Lifespan	**57**	**year**

5.3.3 SANITARY LANDFILL

The area designated for municipal waste is approximately 138,123 m^2 (see **Figure 5.3.1**). The sanitary landfill will be equipped with a single liner of 10 cm TRISOPLAST®, a layer of non-woven fabric liner and a final drainage layer of pebbles or single sized granite.

5.3.3.1 Sanitary Landfill Classification

The proposed Project will be designed to Level 4 Sanitary Landfill according to the classification by the Ministry of Housing and Local Government, Malaysia.

The design criteria to be adopted in the Level 4 Landfill are:

- Establishment of sanitary landfill with proper leachate treatment control, collection and treatment facilities;
- With proper landfill gas collection and treatment facilities; and
- Recommended for disposal of waste of 100 metric tonnes per day or more.

5.3.3.2 Sanitary Landfill Cells and Size Area

The overall area allocated for Sanitary Landfill is approximately 14 hectares (138,124 m^2). The volumetric capacity for the Sanitary Landfill and each cell is as follow:

- Total area of Sanitary Landfill (total of 10 cells, degassing system & infrastructure: m^2);

  » Cell 1 – 6,197 m^2;

  » Cell 2.1 – 10,349 m^2;

  » Cell 2.2 – 6,169 m^2;

  » Cell 3 – 15,244 m^2;

  » Cell 4 – 15,240 m^2;

  » Cell 5 – 15,236 m^2;

  » Cell 6 – 13,928 m^2;

  » Cell 7 – 13,915 m^2;

  » Cell 8 – 15,239 m^2;

  » Cell 9 – 15,267 m^2;

  » Cell 10 – 11,340 m^2.

The overall volumetric of sanitary landfill capacity has been calculated at 2,600,000 m^3 and with the generation rate of 1.44 kg/capita/day from 50,000 Samalaju Township Population, including waste from Bintulu Town and the lifespan for the proposed Sanitary Landfill is expected to be operational at least 47 years (see **Table 5.3.3**).

Table 5.3.3: Summary of Sanitary Landfill Lifespan Design Criteria

Criteria	Sanitary Landfill	Units
SIP Population	50,000	capita
Waste Generation Rate	1.44	kg/capita/day
	26,674	tonne/year
Bintulu Town (based on current Tg. Kidurong dumpsite data)	150	tonne/day
	55,571	tonne/year
TOTAL	**82,245**	**tonne/year**
Waste Bulk Density	1.5	tonne/m^3
Landfill Capacity	2,600,000	m^3
	3,900,000	tonne
Landfill Design Lifespan	**47**	**year**

5.3.4 SOIL STORAGE

Excess soil will be stored at the soil storage area for used as the landfill subgrade layer, maintenance & upgrading (sanitary and secure landfills) and for recultivation covering works.

5.3.5 LEACHATE COLLECTION AND TREATMENT

Leachate from the sanitary and secure landfills will collected in sumps and located at or around the landfill facilities then pumped to the leachate storage ponds in the leachate treatment system area. The collection sumps, pumps and transfer pipeline which deliver the leachate to the storage ponds and the leachate treatment plant shall be designed to ensure that the delivery of the leachate volume to the treatment plant is separated from the uncontaminated surface runoff from the non-landfill area. The leachate treatment plant process flow diagram is appended in **Appendix 5.3.1** while the calculation for leachate treatment system is appended in **Appendix 5.3.2**.

5.3.5.1 Leachate Drainage System of the Landfills

The drainage system of the landfill shall be separated into the surface/ stormwater runoff drainage and that of the drainage for leachate from the landfills. The leachate will be collected in a pipe system and transported to the roofed raw leachate storage ponds.

The drainage system shall be generally constructed to occupy the area on top of the base sealing and generally will be constructed to a thickness of 0.5 m layer consisting of primarily washed river gravel with a percolation coefficient of kf > 10^{-3} m/s. The sealed base layer will have a transversal inclination of 3%, sending the leachate to a perforated pipe. The longitudinal inclination of this pipe will be designed to be at 1%.

From this pipe, the leachate is then piped to a main header shaft (KS shaft) which is located outside the sealed landfill area. The KS shafts are connected with each other by a closed leachate collection pipe. These pipes shall be laid inclined in a manner that shall drain the leachate to flow to the pump shaft. From the pump shaft, the leachate is then pump to the roofed raw leachate storage pond (see **Figure 5.3.5**, **Figure 5.3.6** and **Figure 5.3.7**).

5.3.5.2 Raw Leachate Storage Pond

Two (2) leachate storage ponds at the leachate treatment plant will be constructed for flow control and concentration equalisation purpose designed to meet the average daily flow rate of each landfill. The ponds will be used to store the municipal waste leachate and leachate from the secure landfill respectively.

The leachate from the landfills will fluctuate hugely both in terms of the flow rate and characteristics, from dry day to rainy day. During the dry day, the leachate will have a reduced flow rate but very high concentration in terms of BOD and COD, while during rainy days, the situation will be the opposite extreme. Therefore, the storage system for raw leachate from both landfills shall be designed to meet the highest daily flowrate during the rainy day for equalisation pond to equalise the flow rate and characteristics. The leachate storage pond shall comprise of a reinforced concrete structure with structural steel framed metal roof and a system of pumps and sumps. The leachate from the landfills will flow by gravity or by pumps, depending on landfill design, into the raw leachate storage systems. The respective raw leachate storage ponds will be designed with a bund structure of 0.5 m higher than ground level to prevent intrusion of surface runoff into the ponds.

The leachate will be pumped from the respective storage ponds to the leachate treatment plant to treat the specific pollutants. The operation of pump is controlled by level switch, i.e. it is activated during the high level of the ponds and be de-activated during the low level of the ponds. Besides, the level switch in the ponds will provide a high-level alarm to the control room, should the level of the storage ponds reach a critical high level, indicating a possible pump malfunction or excessive flow of incoming raw leachate into the ponds.

5.3.5.3 Leachate Treatment Plant – Process

5.3.5.3.1 Biological Treatment

The leachate that contains high concentration of biodegradable organic usually requires biological treatment process, to treat the BOD and COD content in the wastewater. To treat high ammonium content in the leachate, the nitrification/ denitrification process will be used to remove BOD, COD and nitrogen in a combined anoxic/ aerobic biological system. The biological treatment system comprises of a mixing tank, a pH adjustment tank, an anoxic bio-reactor, an aerobic bio-reactor and a clarifier. The main equipment of the system is anoxic reactor mixer, aerobic reactor mixer, blower, mixed liquor recycle pump, sludge collector and return sludge pump.

The leachate delivered from the leachate storage ponds will be controlled to a set flow rate, then discharge into the mixing tank. A flush mixer will provide the required mixing to homogenise the wastewater.

In the pH adjustment tank, NaOH or H_2SO_4 will be dosed to adjust the pH value of wastewater to the optimum value for nitrification/ denitrification process, i.e. pH 7.2 – 8.0 in the reactor. A pH controller is installed to control the feed of NaOH and H_2SO_4.

The first bio-reactor in the biological process is the anoxic reactor, in which the denitrification bacteria will use the BOD in the leachate as its carbon source to convert the nitrate into nitrogen gas under the very low DO environment.

The anoxic reactor is covered to reduce oxygen transferred from atmosphere into the reactor tank and a submersible mixer is installed in the reactor to completely mix the reactor. The DO value in the reactor is expected to be very low, due to the covered tank, thus DO monitor will not be installed here.

After the anoxic reactor, the leachate will flow into an aerobic reactor. At this stage, a portion of the carbon source in the wastewater should already be assimilated in the anoxic reactor, so in the aerobic reactor, nitrification will proceed more easily to convert the ammonium nitrogen into nitrate. Mixed liquor recycle pumps, one duty and one standby, are installed to recycle the nitrate from the aerobic reactor to the initial anoxic reactor for denitrification.

A pH monitor, DO monitor and temperature monitor will be installed in the aerobic reactor to monitor the value of these parameters. pH will be maintained in the range of 7.5 – 8.0, DO value will be no less than 2.0 ppm, while the temperature will not be less than 30 ºC.

The expected COD removal rate of the biological system will be 80%. After the biological process, the leachate water will flow to a clarifier for solid separation; the overflowed supernatant will then be discharged by gravity to the subsequent chemical treatment unit. The settled sludge will be returned by sludge return pump to the anoxic reactor.

The submersible aerator will be installed in the aerobic reactor to supply the oxygen required for BOD removal and nitrification. The aerator will transfer the oxygen into the water by distributing the air from blower into fine air bubble, and at the same time, the pumping action of aerator will mix the reactor completely.

5.3.5.3.2 Control of pH

The pH value is very important for both the nitrification and denitrification bacteria to live. For nitrification process to take place, the optimal pH range is between 7.5 to 8.6, while 7.0 to 8.0 for denitrification process. The nitrification reaction will reduce the water alkalinity level, in the contradictory, the denitrification reaction will contribute higher alkalinity level into water, thus complicates the balance of alkalinity in the reactor. The pH settling value in the pH adjustment tank will be decided by means of maintaining the pH of the aerobic reactor in the optimal range.

5.3.5.3.3 Control of Recycle Flow Rate

The recycle ratio will influence the efficiency of nitrification and denitrification, i.e. the concentration of ammonium and nitrate nitrogen in the effluent. The required recycle ratio is given by where R= overall recycle ratio,

$$R = \frac{(NH_4^+ \ - N)i \ - (NH_4^+ \ - N)e}{(NO_3^- \ - N)e} - 1$$

where,	R	=	overall recycle ratio
	$(NH_4^+ - N)i$	=	influent ammonium nitrogen
	$(NH_4^+ - N)e$	=	effluent ammonium nitrogen
	$(NO_3^- - N)e$	=	effluent nitrate nitrogen

The flow meter installed on the recycle pipeline will monitor the flow rate of the recycle flow; the ratio can be controlled by adjusting the output of the recycle pump.

5.3.5.3.4 Control of DO

The DO value of the aerobic reactor has to maintain at not less than 2.0 mg/L. The DO in the reactor can be controlled by controlling the air flow rate which supplied to the submersible aerator; the air flow can be monitored in the control room through the flow meter on the air pipeline. The frequency convertor will be installed to control the revolution of blower, i.e. control the air flow rate. By this mean, the DO value can be controlled in the optimal value from the control room.

5.3.5.3.5 Return Sludge

The return sludge flow rate for this system is set to 100%. In order to monitor the return sludge flow, a flow meter will be installed in the return sludge pipeline.

5.3.5.3.6 Extraction of Excess Sludge

The return sludge pump will be used for excess sludge extraction. The extraction will proceed automatically by a pneumatic control valve in which, the actuation of the valve being controlled by a timer.

5.3.5.3.7 Chemical Precipitation (CP)

A chemical precipitation system will be provided for the post-treatment of the organic substance. A similar system will also be provided to serve as pre-treatment system to treat raw leachate from secure landfill before being pumped into mixing tank to mix with the raw leachate generated from sanitary landfill. The chemical precipitation system comprises of a coagulant tank, flocculation tank, clarifier and chemical dosing packages. This function of this process is the removal of COD and heavy metals.

The coagulation tank will be equipped with an agitator to contribute the required mixing of wastewater and dosed chemicals. Caustic is dosed to increase the pH value for heavy metal precipitation. The addition of caustic is controlled by a pH controller in which it will control the actuation of the pneumatic control valve. The caustic shall be recirculated by a centrifugal caustic pump, which will provide the flow velocity of caustic in the pipeline to prevent clogging of the pipeline. Ferric Chloride/ PAC will be dosed in the coagulation tank to coagulate the organic substance residual from the biological treatment as well as fine heavy metals. NaOH is fed into the leachate to make-up the pH drop caused by the addition of Ferric Chloride/ PAC. The dosage of ferric chloride/ PAC will be decided by conducting jar test on the raw leachate and the dosage will be set based on the leachate flow rate. The feeding of coagulant will interlock with the operation of the leachate transfer pump.

A pH controller will be installed in the coagulation tank to control the optimal pH value. Anionic polymer will be dosed in the flocculation tank to produce well settling floc. A gravity clarifier is provided to separate the solid formed in the precipitation/ flocculation units. The supernatant will overflow to a pumping tank for pumping to final polishing unit. The settled sludge will be pumped by sludge pump to the chemical sludge thickener for further treatment.

The expectant COD removal of chemical precipitation is 50% and the heavy metal removal rate is 80%.

<u>Control of Flow</u>

A flow sensor will be provided to detect the flow which coming from the biological treatment system. The action of flow sensor will actuate the operation of the chemical treatment system, including the operation of mixer, dosing pump, sludge collector and sludge pump.

<u>Control of Chemical Dosing</u>

The dosing of Ferric Chloride/ PAC will be controlled by flow sensor in a fixed dosage, which will be decided by conducting a jar test on the leachate. The NaOH dosing pump will be controlled by a pH controller to maintain the optimal pH value for chemical precipitation. Polymer will be dosed in a fixed rate and the operation is controlled by flow sensor.

After flocculation, the flocculated wastewater flows into a clarifier to separate the solid and supernatant. The sludge at the clarifier will settled at the bottom and be collected by sludge collector connected at the central sludge hopper. The supernatant overflow through the overflow weir and discharge to a pumping tank.

5.3.5.3.8 Activated Carbon Adsorption

An activated carbon adsorption system will be provided as a final polishing stage to the treatment process. The system comprises of a pumping tank, sand filter activated carbon absorber and discharge storage tank.

Pumps, one duty and one standby, will be installed to transfer the chemically treated water to activated carbon adsorption system. A level switch installed in the pumping tank will control the operation of pump.

Sand filters will be provided to filter the suspended solid contained in the water and to protect the activated carbon absorber from choked by solid. The operation of sand filter is in alternate mode, i.e. when backwashing of one filter, the other will be put into service to ensure the continuous operation of the system.

Activated Carbon Absorbers are provided to absorb the COD in the feed water. The operation of the absorber is in series to prevent the short circuit break-through of COD.

The backwash water for th sand filter and carbon absorber will be supplied from the discharge storage tank by the backwash pump. The backwash of the system will be carried out manually and as required.

5.3.5.3.9 Sludge Treatment

The sludge treatment system comprises of two unit of sludge thickeners equipped with a sludge collector, one unit of sludge conditioning tank for biological sludge, one unit of filter press, one unit of cake conveyor and one unit of cake bunker.

One unit of sludge thickener is used for chemical sludge thickening, while the other unit is for biological sludge thickening. The supernatant from chemical sludge thickener will flow back to sludge waste leachate storage tank, while the supernatant from the biological sludge thickener will go back to the municipal waste leachate storage tank. The thickener will have a storage capacity of 2 days (at least).

The chemical sludge will be pumped into the filter press directly for dewatering, while the biological sludge will be pumped to sludge conditioning tank first. In the conditioning tank, cationic polymer will be added to improve the dewatering efficiency of the sludge before it is pumped to the filter press. The treatment capacity of the filter press is 2 days of sludge quantity; thus, the operation of filter press will be one day for chemical sludge dewatering and the subsequent day for biological sludge. The cake will be conveyed by belt conveyor for storage in a sludge bunker, and be further disposed in the secure landfill for toxic waste.

Separation and Storage of Sludge

After flocculation, the flocculated wastewater flows into a clarifier to separate the solid and supernatant. In the clarifier, the sludge is settled at the bottom and thickened by the conical hopper. The settled sludge will be extracted by a sludge pump and delivered to the sludge thickener to further thickening and for subsequent sludge treatment. A timer in set time schedule will control the operation of the sludge pump.

The mass balance flow diagram for the leachate treatment system is summarised in **Figure 5.3.9**.

5.3.5.4 Treated Leachate Polishing System

A facultative lagoon followed by a horizontal constructed wetland will be constructed to further polish the treated effluent before it being discharged. A bio-indicator pond will be built to ensure the treated effluent causes no harm to aquatic organism before transferring to Sg. Nyalau.

All the component of the polishing system (facultative pond, constructed wetland and bio-indicator pond) will be lined with impermeable layer to prevent seepage into the soil.

Facultative Pond

The facultative lagoon provides further treatment to the treated effluent and serves as an equalisation basin by moderating incoming treated effluent from the sanitary and secure landfills. This pond is designed to further remove the remaining BOD in the treated leachate. Facultative pond can remove significant amounts of nitrogen and pathogens as a result of the long detention times. Nitrogen removal often ranges from 40 to 95%.

Constructed Wetland

Effluent from the facultative pond will flow to the constructed wetland where further ammoniacal nitrogen removal occurs through nitrification and denitrification processes happening within the wetland.

Constructed wetlands are engineered and managed wetland systems designed to mimic natural wetlands, with the water flowing above the ground surface at shallow depths through a dense growth of emergent wetland plants. Inflow effluent containing particulate and dissolved pollutants slows and spreads through a large area of shallow water with emergent of submerged vegetation. (see **Figure 5.3.10**).

Settable organics are removed through quiescent conditions, deposition and filtration. Attached and suspended microbial growth is responsible for the removal of soluble organics. Nitrogen is most effectively removed in constructed wetlands by nitrification/ denitrification. Ammonium is oxidised by nitrifying bacteria in aerobic zones and nitrate is converted to free nitrogen in the anoxic zone by denitrifying bacteria.

Figure 5.3.9: Leachate Treatment Plant Mass Balance

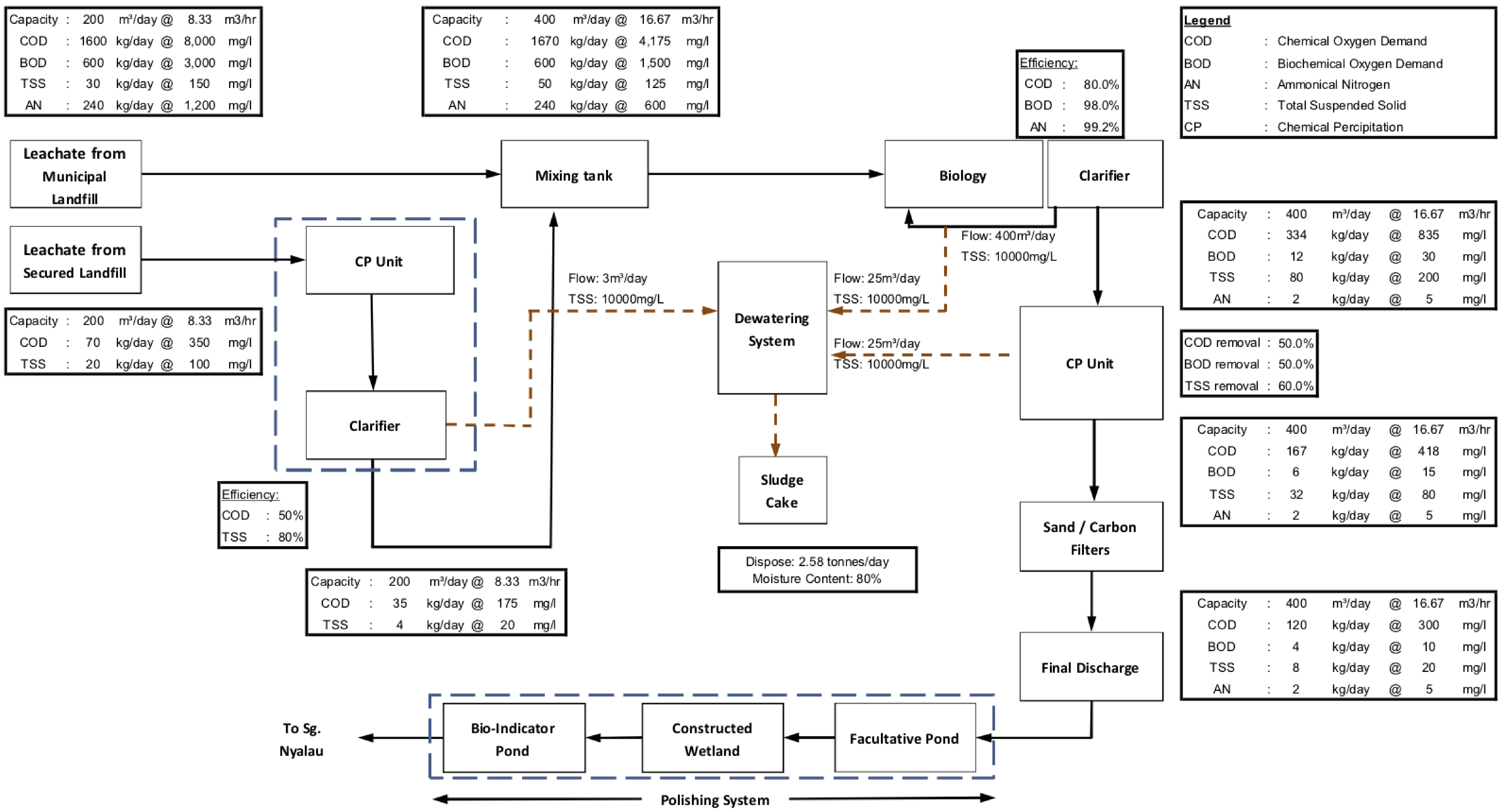
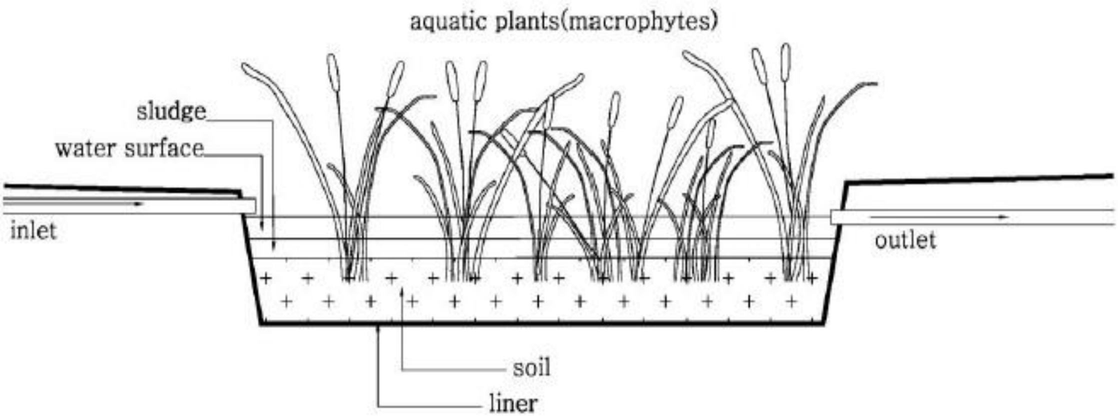


Figure 5.3.10: Typical Cross-Section of a Constructed Wetland



Bio-Indicator Pond

The polished effluent will be stored in a small bio-indicator pond before being pump via the discharge pipe to the tributary of Sg. Nyalau. This pond will be populated with various species of fish to serve as biological indicators.

5.3.5.5 Treated Leachate Discharge Limit

The leachate treatment plant is designed to treat the raw leachate from both the sanitary and secure landfills to meet the standards as in Environmental Quality (Control of Pollution from Solid Waste Transfer Station and Landfill) Regulations 2009, as listed in **Table 5.3.4**.

Table 5.3.4: Acceptable Condition for Treated Leachate Discharge

Parameters	Unit	Standard
Temperature	ºC	40
pH value	-	6 – 9
BOD_5 at 20ºC	mg/L	20
COD	mg/L	400
Suspended Solids	mg/L	50
Ammoniacal nitrogen	mg/L	5
Mercury	mg/L	0.005
Cadmium	mg/L	0.01
Chromium, Hexavalent	mg/L	0.05
Chromium, Trivalent	mg/L	0.20
Arsenic	mg/L	0.05
Cyanide	mg/L	0.05
Lead	mg/L	0.10
Copper	mg/L	0.20
Manganese	mg/L	0.20

Parameters	Unit	Standard
Nickel	mg/L	0.20
Tin	mg/L	2.0
Zinc	mg/L	2.0
Boron	mg/L	1.0
Iron	mg/L	5.0
Silver	mg/L	0.10
Selenium	mg/L	0.02
Barium	mg/L	1.0
Fluoride	mg/L	2.0
Formaldehyde	mg/L	1.0
Phenol	mg/L	0.001
Sulphide	mg/L	0.50
Oil & grease	mg/L	5.0
Colour	ADMI	100

** ADMI – American Dye Manufacture Institute*

5.3.5.6 Emergency Retention Pond

In the unlikely event where the leachate treatment plant system fails, all of the untreated or partially treated leachate will be channelled into an emergency retention pond for temporary storage. **No untreated or partially treated leachate will be released into the environment.**

The pond will provide approximately five (5) days of retention time of average daily flow rate (2,800 m^3). After the system has been restored, the effluent from this storage pond will be diverted back to the treatment plant system for retreatment again.

The emergency retention pond will be lined with an impermeable layer and will be sealed by seamed HDPE thickness of not less than 1.5 mm.

5.3.5.7 Treated Leachate Discharge Point

A 300 mm HDPE discharge pipeline will be constructed to convey the treated leachate effluent from the LTP at the proposed Project site to the tributary of Sg. Nyalau. The proposed discharge point is located approximately 1.3 km east of the Project site.

Based on the hydrology, the area around the proposed Project site will flow into Sg. Similajau which has an active raw water intake point, which is the Similajau raw water intake point. Thus, the discharge pipeline is required to convey the treated effluent to Sg. Nyalau, which don't have any active raw water intake point. This is further discussed in **Section 4.6**.

5.3.6 SAMALAJU SECURE LANDFILL WASTE ADMISSIBILITY

The Samalaju Secure Landfill's waste admissibility for the proposed Project in accordance to DOE's classification is as shown in **Table 5.3.5**.

Table 5.3.5: Scheduled Waste Categories to be Disposed at Samalaju Secure Landfill

Waste Code	Category
SW1	**Metal and metal-bearing wastes**
SW101	Waste containing arsenic or its compound
SW104	Drug, slag dross or ash containing arsenic, mercury, lead, cadmium, chromium, nickel, copper, vanadium, beryllium, antimony, tellurium, thallium or selenium, excluding slag from iron and steel factory
SW105	Galvanic sludges
SW106	Residues from recovery of acid pickling liquor
SW107	Slags from copper processing for further processing or refining containing arsenic, lead or cadmium
SW108	Leaching residues from zinc processing in dust and sludge form
SW2	**Wastes containing principally inorganic constituents which may contain metals and organic materials**
SW201	Asbestos wastes in sludges, dust or fibre forms
SW202	Waste catalysts
SW203	Immobilised scheduled wastes including chemically fixed, encapsulated, solidified or stabilised sludges
SW204	Sludges containing one or several metals including chromium, copper, nickel, zinc, lead, cadmium, aluminium, tin, vanadium and beryllium
SW205	Waste gypsum arising from chemical industry or power plant
SW207	Sludges containing fluoride
SW3	**Wastes containing principally organic constituents which may contain metals and organic materials**
SW302	Flux waste containing mixture of organic acids, solvents or compounds of ammonium chloride
SW303	Adhesive or glue waste containing organic solvents excluding solid polymeric materials
SW304	Press cake from pretreatment of glycerol soap lye
SW316	Acid sludge
SW317	Spent organometallic compounds including tetraethyl lead, tetramethyl lead and organotin compounds
SW319	Waste of phenols or phenols compounds including chlorophenol in the form of liquids or sludges
SW320	Waste containing formaldehyde
SW321	Rubber or latex wastes or sludges containing organic solvents or heavy metals
SW325	Uncured resin waste containing organic solvents or heavy metals including epoxy resin and phenolic resin

Waste Code	Category
SW326	Waste of organic phosphorus compound
SW4	**Wastes which may contain either inorganic or organic constituents**
SW401	Spent alkalis containing heavy metals
SW402	Spent alkalis with pH more or equal to 11.5 which are corrosive or hazardous
SW406	Clinker, slag and ashes from scheduled wastes incinerator
SW411	Spent activated carbon excluding carbon from the treatment of potable water and processes of the food industry and vitamin production
SW412	Sludges containing cyanide
SW413	Spent salt containing cyanide
SW416	Sludges of inks, paints, pigments, lacquer, dye or varnish
SW417	Waste of inks, paints, pigments, lacquer, dye or varnish
SW421	A mixture of scheduled wastes
SW422	A mixture of scheduled and non-scheduled wastes
SW425	Wastes from the production, formulation, trade or use of pesticide, herbicide or biocides.
SW426	Off-specification products from the production, formulation, trade or use of pesticides, herbicides or biocides
SW427	Mineral sludges including calcium hydroxide sludges, phosphating sludges, calcium sulphite sludges and carbonates sludges
SW428	Wastes from wood preserving operation using inorganic salts containing copper, chromium or arsenic of fluoride compounds or using compound containing chlorinated phenol or creosote
SW429	Chemicals that are discarded or off-specification
SW5	**Other wastes**
SW501	Any residues from treatment or recovery of scheduled wastes

5.3.7 WASTE ACCEPTANCE CRITERIA

The Waste Acceptance Criteria (WAC) for the proposed Project for each scheduled waste's parameter criteria are shown in **Table 5.3.6**. Any scheduled waste that can be recovered and/or recycled shall not be accepted for disposal at the secure landfill. Any scheduled waste that are not meeting the WAC of the secure landfill will also be store at the off-site storage prior to transport to KIWMP for disposal.

Table 5.3.6: Waste Acceptance Criteria for Disposal of Scheduled Wastes Direct to Secure Landfill

No.	Parameter	Method	Limit	Unit	Remarks
1	Waste				All scheduled waste must be in solid phase
2	Smell/ Odour				Material should not bear, generate or contains foul smelling components in any form
3	Presence of fumes/ vapour/ gas				Material should not be fuming, generate significant vapour and gases
4	Presence of liquid/ water or moisture content				Materials must not contain free liquid
5	Total solids at 105ºC		>20	%	
6	Total organic carbon	APHA	≤10	%	
7	pH (mixed with distilled water)	APHA	5.5 – 9.0		
8	Conductivity	APHA	0.1	%	
9	Oil & grease	APHA	≤0.5	%	
10	Soluble metals				All soluble metals shall not exceed the specified standard limits
11	**Eluate Characteristics (After TCLP Extraction)**				
11.1	Copper	APHA	100	mg/L	USEPA limit
11.2	Nickel	APHA	100	mg/L	USEPA limit
11.3	Cadmium	APHA	2	mg/L	Standard B limit subject to 100 x dilution
11.4	Zinc	APHA	100	mg/L	Standard B limit subject to 100 x dilution
11.5	Lead	APHA	5	mg/L	Standard B limit subject to 100 x dilution
11.6	Total Chromium	APHA	5	mg/L	USEPA limit

No.	Parameter	Method	Limit	Unit	Remarks
11.7	Arsenic	APHA	5	mg/L	USEPA limit
11.8	Mercury	APHA	0.2	mg/L	USEPA limit
11.9	Chloride	APHA	2	mg/L	
11.10			3,000	%	Drinking water quality subject to 100 x dilution
11.11	Sulphate	APHA	1,500	mg/L	
11.12	Fluoride	APHA	200	mg/L	
11.13	Nitrate	APHA	30	mg/L	
11.14	Total Cyanide	APHA	0.5	mg/L	
11.15	Phenol	APHA	100	mg/L	Standard B limit subject to 100 x dilution
11.16	Ammonium		500	mg/L	
11.17	Polycyclic Aromatic Hydrocarbon (PAH)		1,000	mg/L	
11.18	Chromium VI	APHA	5	mg/L	Standard B limit subject to 100 x dilution
11.19	Boron	APHA	400	mg/L	USEPA limit
11.20	Barium	APHA	100	mg/L	USEPA limit
11.21	Selenium	APHA	1	mg/L	Standard B limit subject to 100 x dilution
11.22	Silver	APHA	5	mg/L	USEPA limit
11.23	Tin	APHA	100	mg/L	Standard B limit subject to 100 x dilution

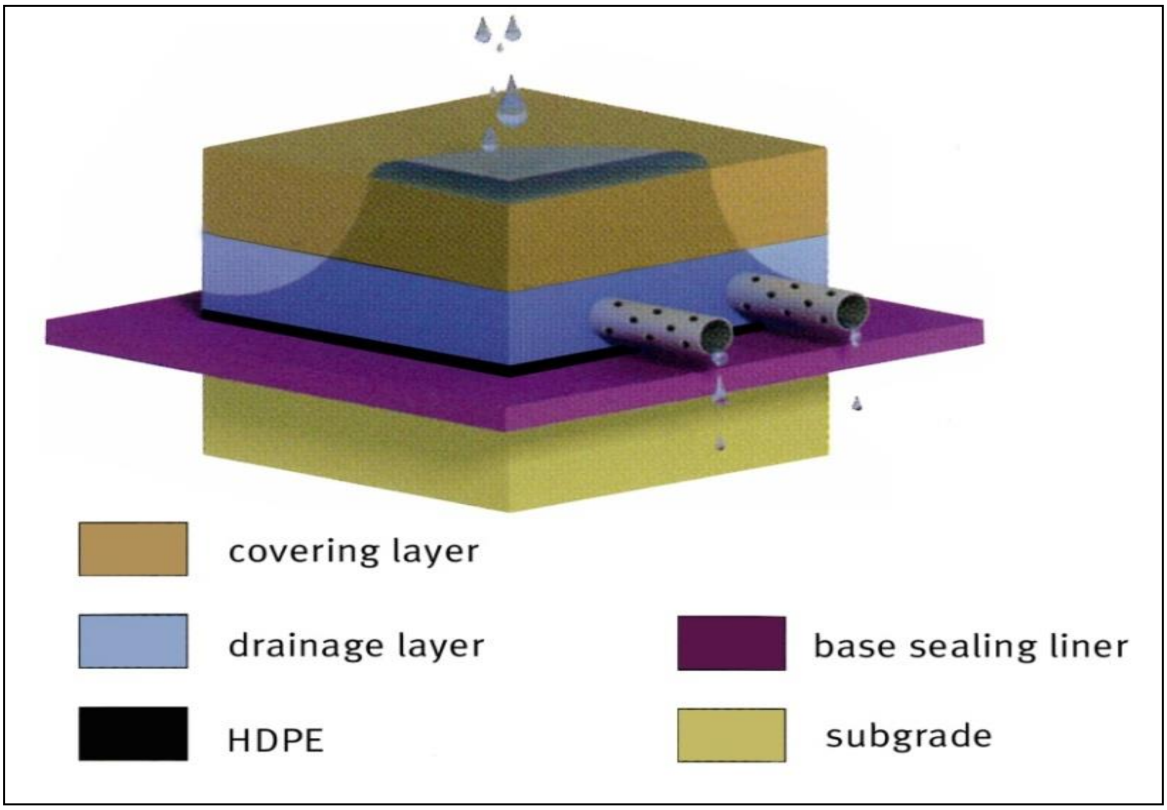
5.3.8 LINERS

The landfill cell liner shall be constructed cell by cell in accordance to the sequences at which the construction of the individual landfill cells progresses.

The sanitary landfill and secure landfill cells for less toxic waste (i.e. slag) will be protected in a multi-layer of liner with a base sealing of 10 cm of TRISOPLAST®, followed by a layer of non-woven fabric liner and a final drainage layer of pebbles or single sized granite.

The secure landfill cells for toxic waste has higher specification, which comprises of double layer lined with a layer of 20 cm of TRISOPLAST® liner, an additional 1.5 mm thickness of HDPE liner, followed by a layer of non-woven fabric liner and a final drainage layer of pebbles or single sized granite.

Figure 5.3.11: Conceptual Double Liner System



TRISOPLAST® seals are highly impermeable in a very small layer thickness (less than 10 cm) as required in European regulations for landfill seals. In many respects, a TRISOPLAST® seal is superior to conventional mineral seals or bentonite mats.

Generally, the liner system shall comprise of the following layers:

- 50 cm filtering layer of percolation coefficient, Kf of at least $2x10^{-3}$ m/s;
- 100 g/m^2 non-woven protective fabric liner;
- 20 cm liner of TRISOPLAST® and a layer of 1.5 mm thick HDPE liner or 10 cm TRISOPLAST®, respectively; and
- Geological barrier (subgrade).

The summary of the proposed liner system is further summarised in **Table 5.3.7**.

Table 5.3.7: Summary of Liner System

Landfill	TRISOPLAST® Liner Thickness (cm)	Non-Woven Fabric Liner	HDPE	Substrate (i.e. pebbles or single sized granite)
Sanitary	**10**	**Yes**	**No**	**Yes**
Secure				
▪ **Toxic waste**	**20**	**Yes**	**Yes**	**Yes**
▪ **Less toxic**	**10**	**Yes**	**No**	**Yes**

5.3.9 STORMWATER DRAINAGE AND SURFACE RUNOFF MANAGEMENT

5.3.9.1 Surface Runoff Collection and Discharge Using Temporary Seal

The landfill facility shall be designed to have an active area kept opened for the purpose of waste dumping and tipping operation, including waste compaction operation. The rest of the inactive waste exposed to rainfall shall be covered with a layer of impervious layer. It is envisaged that this will be only area that shall contribute to the generation of leachate, as all the rest of the inactive cell area, which is sealed at the bottom and in operation, are temporarily covered by using 0.75 m HDPE sheets which have to be welded.

The surface runoff from the inactive area with temporary cover can be sent to the surface water collection system, located at the outer rim of the cells. This runoff is considered to be relatively clean as they do not come in contact with the waste pile. Hence, it does not require to undergo any leachate treatment process.

5.3.9.2 Collection of Surface Water of the Final Seal (Re-Cultivation Surface)

Once a cell is filled to a certain height, the cell shall be recultivated or temporarily closed, which is covering the surface areas where the landfill cells are already at the final designed level (re-cultivation level), with suitable final surface sealing. The final surface sealing system will allow all rainfall precipitation to be diverted to the surface water collection drains, that will finally channel the surface water out of the landfill area. The inclination of the slope will be designed at a gradient of 1:3.

5.3.9.3 Ponds for Stormwater Management

Surface water pond will be located at the northern part of the proposed Project site to cater for stromwater runoff management and retention purposes, prior to discharge into the environment. The location of the surface water pond is shown in **Figure 5.3.1**.

5.3.10 LANDFILL GAS COLLECTION SYSTEM AND FLARING PLANT

5.3.10.1 Gas Collection System

The collection system for landfill gas will comprise of horizontal and vertical collection devices. The horizontal pipes are located in certain distances from each other at 6 m deep inside the waste. The pipes are corrugated, perforated and made from HDPE. The conceptual layout of the landfill gas collection system is as shown in **Figure 5.3.12**.

The horizontal pipes will be connected to a gas ring main via control rectangular shaped RC shafts. Inside the shafts are located valves and gauging ports. The shafts are then covered with a galvanised steel lid. The steel lid is equipped with a gas exhaust hood and a covered manhole.

The gas ring main of DN300 HDPE pipe is located all around the outer rim of the sanitary landfill.

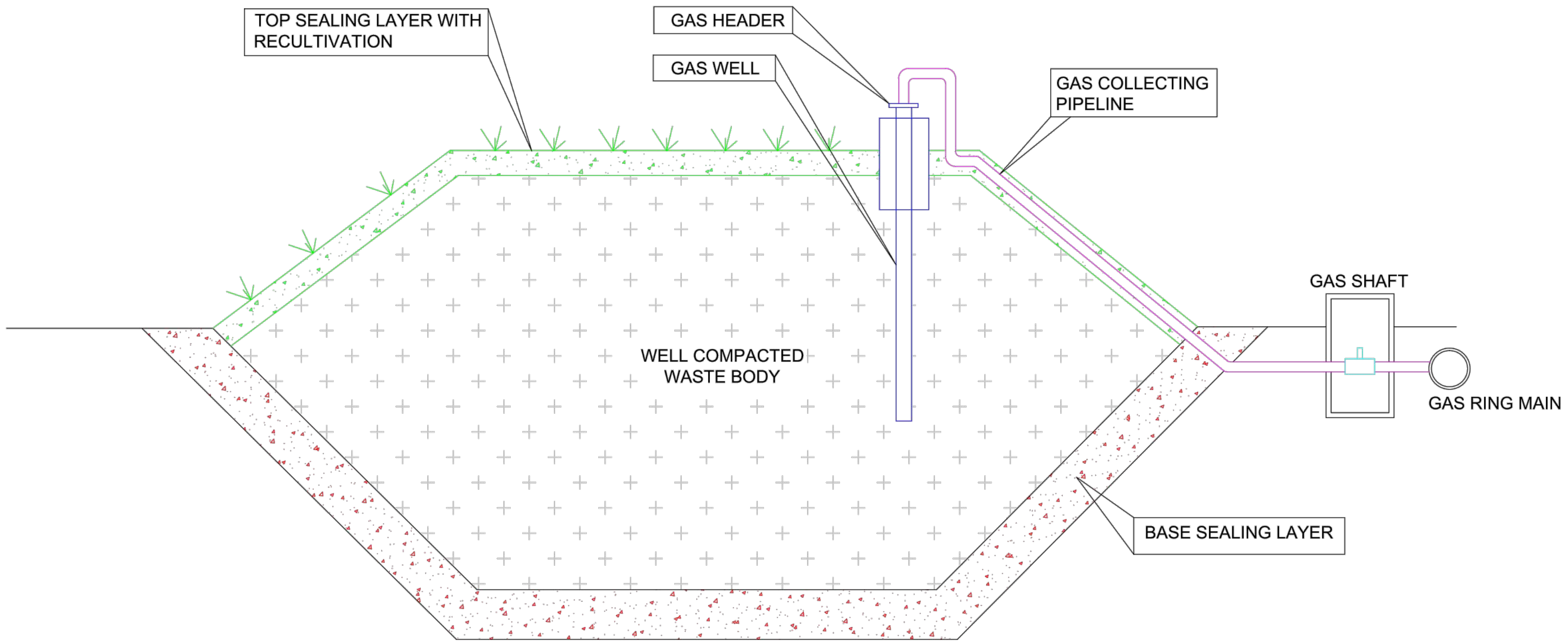
At the end of this pipe, before it joins the suction blower, it enters a condensate trap where all the condensate which is delivered by the gas is separated and discharged to the leachate collection and transportation system.

The gas produced is burned off on this system via a Gas Flaring System or to be utilised as energy (power generation) in future when the quantities is sufficient.

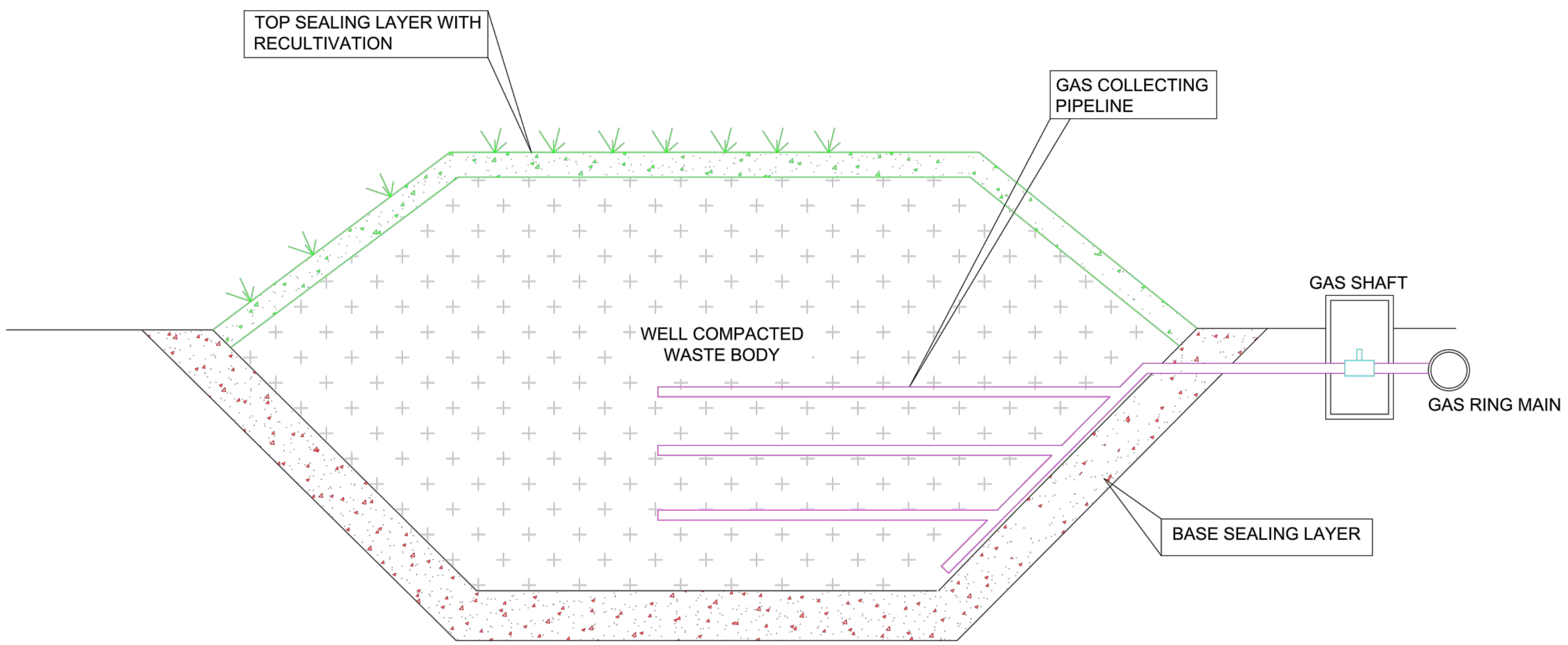
Landfill Gas (LFG) will be gathered from landfills through extraction wells places depending on the size of the landfill. If gas extraction rates do not warrant direct use or electricity generation, the gas will be flared off. The typical design of landfill gas collection system layout is as illustrated in **Figure 5.3.13**.

The sanitary landfill for municipal waste shall be equipped with suitably designed landfill gas extraction system for the purpose of extracting the landfill gas using HDPE pipe. The landfill gas pipes are horizontal gas drains. The LFG will be collected by perforated horizontal pipes which are connected by control shafts with a gas ring main which leads the gas to the final exhaust blower station. The humid LFG is dewatered in condensate shafts. Behind the blower, the LFG can be sent to a flare or used as fuel in a “genset” (motor/ generator) to produce electricity and heat, or to be flared in the flaring tower.

The landfill shall also be equipped with wastewater/ condensate collection, piping, treatment and disposal system.



CONCEPTUAL LAYOUT OF LANDFILL VERTICAL GAS COLLECTION SYSTEM



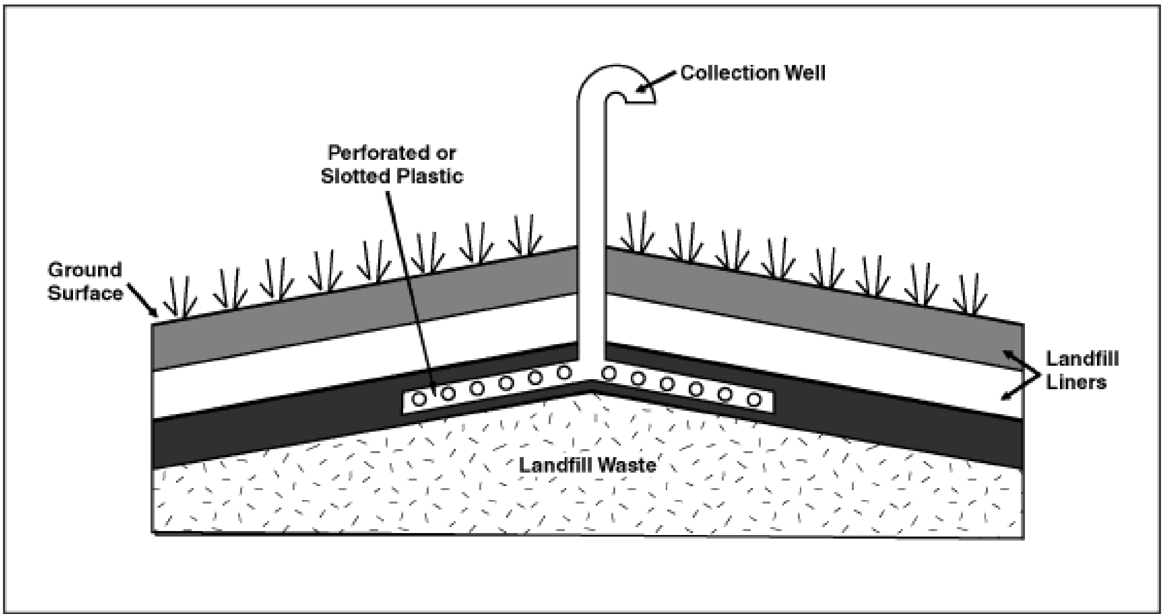
CONCEPTUAL LAYOUT OF LANDFILL HORIZONTAL GAS COLLECTION SYSTEM

SOURCE: [Trienekens (Samalaju) Sdn Bhd

CONCEPTUAL LAYOUT OF LANDFILL GAS COLLECTION SYSTEM

FIGURE: 5.3.12

Figure 5.3.13: General Layout of Landfill Gas Collection System



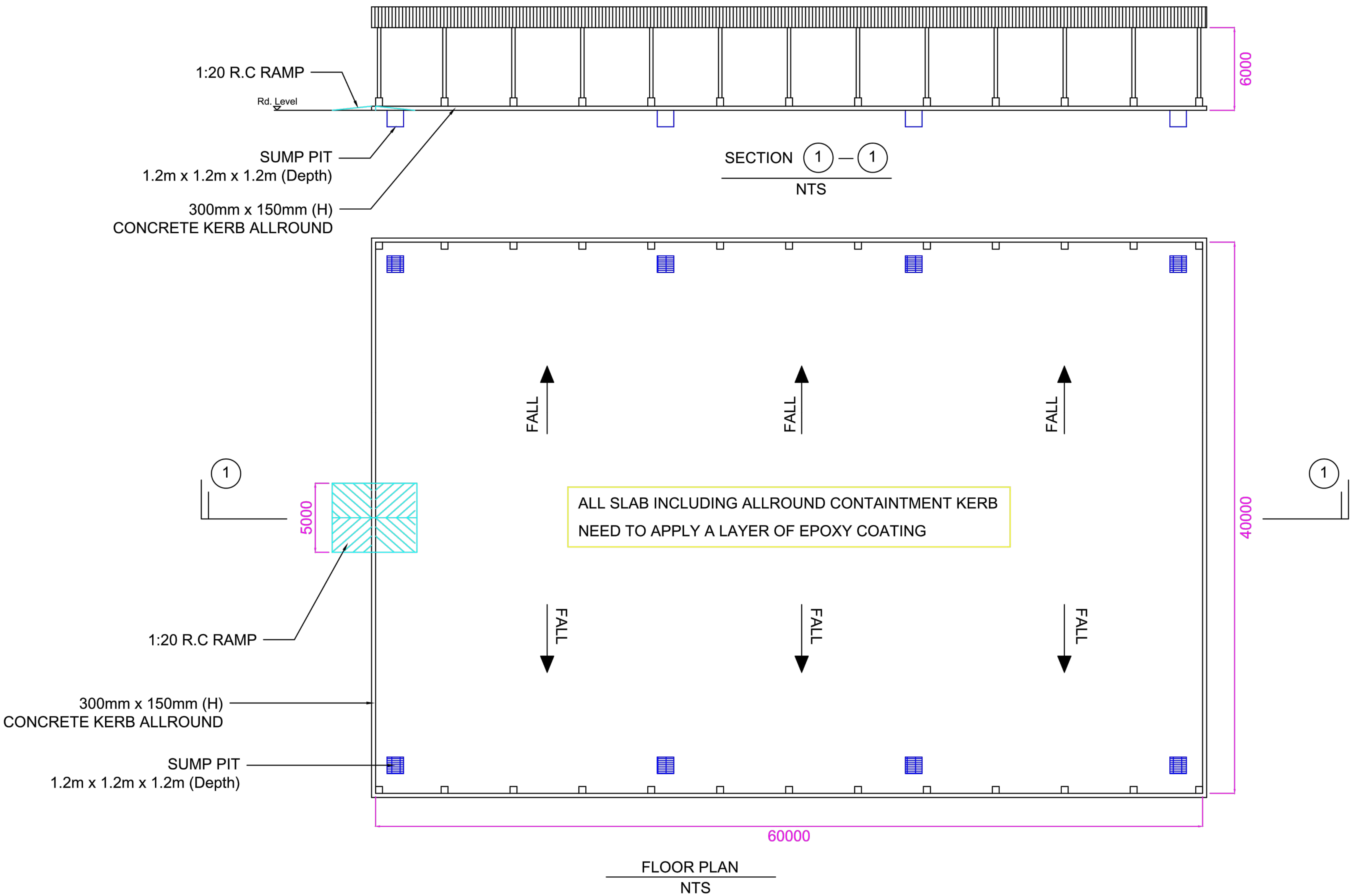
5.3.10.2 Gas Flaring Plant

When organic waste is deposited and remains in the landfill body, micro-organisms decompose these wastes and produce landfill gas which consists primarily of methane and carbon dioxide. This landfill gas can explode if it is appropriately mixed with oxygen from the air and the methane content is between 5% and 15%.

A danger is posed particularly if the landfill gas produced migrates uncontrolled under the ground to buildings where it might increase the volume of gases in rooms or other spaces within the building. This effect is exacerbated in this case by fact that the degassing across the entire landfill area cannot be undertaken through the surface seal. As the embankment areas and its base are not sealed, the gas in the landfill body will move to the border areas of the landfill due to excessive pressure which arises. Apart from the danger of explosion posed by the landfill gas, it also damages plants. For these reasons, it is necessary to degas the landfill after the intermediate cover has been applied.

Sufficient degassing system will be constructed and installed at the early stages of the operation, which required gas drainage trenches, gas pipes with appropriately technical facilities for dewatering the gas and suction blowers.

The gas flaring and the flaring plant will only be constructed after 7 years or when the landfill is matured for gas tapping for reuse of gas as energy.



TEMPORARY SCHEDULE WASTE STORAGE BUILDING - CONCEPTUAL LAYOUT PLAN

TEMPORARY SCHEDULED WASTES STORAGE - CONCEPTUAL LAYOUT PLAN

FIGURE: 5.3.14

SOURCE: [Trienekens (Samalaju) Sdn Bhd

5.3.11 TEMPORARY SCHEDULED WASTE STORAGE AREA / OFF-SITE SW STORAGE FACILITY

The area designated for the temporary scheduled waste storage area is located next to the truck shed and beside the area designated for future expansion. The scheduled waste storage shall be able to handle a maximum capacity of 5,000 MT. It will be designed to a specification of a shaded building, with an appropriately designed flooring, coated with impermeable coating (i.e. epoxy coat). The building shall be bunded to the **maximum 110% of the capacity of the largest container** at this storage area. The conceptual layout plan for the temporary scheduled waste storage area is shown in **Figure 5.3.14**.

The storage area will consist of the following components:

- Approximately 2,400 m^2 (40 m wide x 60 m length) of storage area for 5,000 MT/month of scheduled wastes;
- Drainage, 8 units of sump (1.2 m length, 1.2 m width x 1.2 m depth) and all-round concrete kerb of 0.3 m width x 0.15 m height; and
- Roof over the storage area at 6 m height.

The concept of the storage area for the scheduled wastes has been adopted from the Guidelines for Packaging, Labelling and Storage of Scheduled Wastes in Malaysia (2014). Among the guideline requirements are:

- The storage area of scheduled waste should be designed, constructed and maintained adequately to prevent spillage or leakage of scheduled waste into the environment;
- The storage area should be designed to provide adequate space to store all scheduled wastes generated or managed by the premise. The design capacity should consider the following:
  - Providing 25% extra storage capacity of the actual maximum amount of waste generated; and
  - Storage duration for not more than 180 days pr as prescribed by the DOE.
- The entire storage area must be fenced-in and regarded as restricted area. Adequate signage should be put up clearly and visible with the word “DANGER” and “SCHEDULED WASTES STORAGE”;
- The floor of the storage area and loading and unloading area must be covered with concrete or any suitable lining material, free of cracks and gaps;
- The storage place should be sheltered or roofed or covered with suitable covering material;

- The entire storage area should be surrounded by a concrete dike or other equivalent structure designed to contain any spillage of the waste under the worst-case scenario. The capacity of the containment should be 110% of the largest container stored in the storage area;
- There should not be any opening in the dike to prevent any leakage of waste from the storage area;
- The dike area should be graded to a sump
- The storage area should be properly managed to prevent rain water or surface water from entering the storage area;
- Any surface water run-off should be channelled to a proper drainage system to avoid the water from entering the storage area;
- The loading and unloading area should be designed to contain any spillage;
- The storage area should be equipped with ventilation system for volatile wastes;
- Separate compartments should be provided for different groups of incompatible wastes;
- Storage area should be designed to provide adequate emergency escape route; and
- The storage area should be equipped with firefighting and other emergency response equipment as well as spill kit and comply fully with the requirements of the Fire and Rescue Department of Malaysia.

The scheduled wastes will be stored in the following containers:

- Bunghole drum (steel/ plastic);
- Open top drum (steel/ plastic) with cover and clamp;
- Corrugated box/ carton box/ wooden box;
- Intermediate bulk container; and/or
- Flexible intermediate bulk containers (FIBC)/ jumbo bag/ bulk bag/ polypropylene bag.

The standard packaging specification are as shown in **Table 5.3.8**.

Table 5.3.8: Standard Packaging Specification

Type	Height	Diameter/ Width	Weight/ Volume
Bunghole drum (steel/ plastic)	90 cm	60 cm	200 kg
Intermediate bulk container	117 cm	106 cm	1,040 kg
FIBC/ jumbo bag	100 cm	110 cm	1,000 kg

All waste will be fastened securely on pallets. The pallet size is 1.2 m^2. The number of container/ packaging per pallet is as follows:

- Drum – four (4) drums per pallet; and
- Bag – one (1) bag per pallet.

5.3.12 CAR PARK AND INFRASTRUCTURES

The proposed Project also involved infrastructure development within the Project site such as waster piping, electric and telecommunication cable, street lighting, internal drainage, car parks, truck shed, etc.

5.3.13 LANDSCAPE MANAGEMENT

During the Project operational stage, all cleared area, slopes and water ponds will be landscaped with cover crops and aesthetics plants to minimise erosion within the Project site and to reduce soil loss from the Project site. Area to be landscaped are as below:

- The surrounding of weight-bridge;
- The surrounding of garage/ workshop;
- The surrounding of admin building;
- The surrounding of leachate treatment plant;
- Along the perimeter road within the proposed Project site;
- Along the slope, perimeter of the sanitary landfill;
- Along the slope, perimeter of the secure landfill; and
- Around the surface water pond.

5.4 PROJECT ACTIVITIES

5.4.1 PRE-CONSTRUCTION STAGE

The typical activities during pre-construction stage of the Project are:

1. Boundary survey;
2. Topographical assessment;
3. Soil investigation;
4. Environmental impact assessment;
5. Stakeholder engagement;
6. Finalisation of plant layout and design work; and
7. Agency approvals.

Pre-construction planning will also involve the negotiation of utilities supply, for instance, electricity and water supply with the respective agencies, such as Sarawak Energy Berhad (SEB) and LAKU and infrastructure provision of the area, for instance access roads, streetlights and drainage system with the site development agency, i.e. the Bintulu Development Authority (BDA).

Stakeholder consultation was undertaken as an opportunity to create understanding about the Project among likely affected or interested parties, and to learn how these external parties view the Project and its attendant risks, impacts, opportunities and mitigation measures. The details of the consultation are detailed under **Sections 6.4.8** and **6.4.9**.

5.4.2 CONSTRUCTION AND INSTALLATION STAGE

The construction and installation stage of the Project comprises mainly:

1. Erosion and sedimentation control;
2. Temporary site office;
3. Civil and structural work; and
4. Mechanical (equipment installation) and electrical work.

It is estimated that a maximum of 120 workers, consist of various skilled and semi-skilled workers, will be recruited for the construction of the facility.

5.4.2.1 Civil and Structural Work

Establishment of temporary facilities at site marks the early stage of civil and structural work, and generally involves:

- Establishment of temporary facilities at site;
- Transportation of construction equipment and construction materials;
- Piling, frame work, casting, and building components of the facility; and
- Structural steelwork covers fabrication, erection, painting, sheeting and cladding work for all the building structures.

5.4.2.2 Erosion and Sediment Control

The assessment of the site preparation and earthwork work will be prepared in a separate EIA to be submitted to Natural Resources and Environment Board (NREB), Sarawak for approval. The EIA to be submitted to NREB will provide a detailed account of the potential impacts arising from the site clearing and earthworks activities and recommended mitigation measures. As part of the site clearing and earthwork activities, erosion and sediment control works will also be included. A detailed ESCP will be submitted to the Department of Irrigation and Drainage (DID) for approval prior to the commencement of earthworks.

The main objective of the Erosion and Sediment Control Plan (ESCP) is to minimise erosion and sediment runoff within the Project area. An effective ESCP aims to prevent uncontrollable erosion and minimise the adverse effects of sediment transport from on-site and off-site areas. This can be achieved through proper and systematic planning in implementation of the mitigation measures proposed in the ESCP. The soil erosion and sediment discharged needs to be assessed before development, during construction and post development stages in the Project site.

Specific erosion and sediment best management practices (BMPs) need to be implemented to minimise the impacts of earthwork activities to the environment. These BMPs include:

- Protection of bare slopes as a result of soil removal by means of vegetation;
- Stabilised site access with wash trough installed at the entrance of the Project area;
- Sediment ponds to collect runoff from within the Project area;
- Temporary earth drains to channel runoff into sediment ponds before discharging it into drainage system or any water bodies; and
- Reducing the exposure of soil to vehicle movements by laying crusher run on internal roads, pathways and exposed area.

The proposed BMPs are subjected to change depending on the actual site condition and as the work progresses, more mitigation measures may be applied where or when necessary. The mitigation measures that will be implemented are described in detail in **Chapter 8** and **Chapter 9**.

5.4.2.3 Equipment Installations, Piping and Electrical Works

Mechanical works, equipment installations and electrical works are necessary during the installation of all the facility equipment and components. These will include the necessary piping, electricity and water supply connection with external sources and main water pipe line. The environmental impacts from these activities are not significant although it is necessary to assess the occupational related hazards.

5.4.2.4 Wastes Management

The main types of wastes generated as a result of the Project construction includes the following:

- Construction wastes such as concrete slabs, timber from concrete formwork, boarding and associated timber waste, iron cuttings, scrap steel and off-cuts, concrete reinforcing rods, machine parts, nuts, bolts, plastics from conduits, wire insulations, piping, boxes and packaging materials, used containers and residues/containers from painting. It is recommended that the construction wastes be re-used or recycled where possible.

- Source of domestic/solid wastes from general refuse and site office. Sufficient bins will be provided to collect wastes from the site office and construction site. These wastes will be collected, transported and disposed of at council approved landfill site.

- Scheduled wastes consisting of mainly scheduled waste such as spent oil and grease, lubricants and paint, which usually arise from the maintenance of machinery and equipment and construction works. These wastes will be handled, stored and disposed of in accordance with the Environmental Quality (Scheduled Wastes) Regulations, 2005. The location of the scheduled wastes storage during construction stage has yet to be decided during report writing. This information will be included in the construction EMP.

- Sewage from the on-site construction workers. A packaged activated sludge system (prefabricated modular sewage treatment system) (e.g. POLYPASS®) will be provided for treating the sewage to Standard A of Environmental Quality (Sewage) Regulations, 2009 prior to discharge.

5.4.3 OPERATIONAL STAGE

The proposed Project is expected to be operational in 2021. The proposed leachate treatment plant will operate on a 24-hour basis while the landfill operation will operate on an 8.5-hour per shift, for 2 shifts: 3.00am to 11.30am and 11.30am to 8.00pm.

Workers during the operational stage are likely to reside in the housing estate at the new Samalaju Township, which is earmarked to be located about 9.4 km to the northwest of the Project or at Bintulu Town.

5.4.3.1 Waste Transportation Method and Route

Domestic and scheduled waste will be collected using the collection truck from Samalaju New Township and SIP then directly send to the proposed IWMS facility. Domestic waste will also be collected from Bintulu Town for disposal at this proposed IWMS facility. However, due to its long distance between the proposed site and Bintulu Town, there is a plan to set up a waste transfer station to consolidate waste from multiple collection vehicles into larger, high-volume transfer vehicles for more economical shipment. The plan for the waste transfer station is yet to be confirmed. A separate EIA will be prepared for the Waste Transfer Station and to be submitted to DOE for approval prior to implementation.

In general, the major transportation route to be used during the operational stage, from Samalaju New Township, SIP and Bintulu, is the Bintulu-Miri Coastal Road. The transportation route is shown in **Figure 5.4.1**.

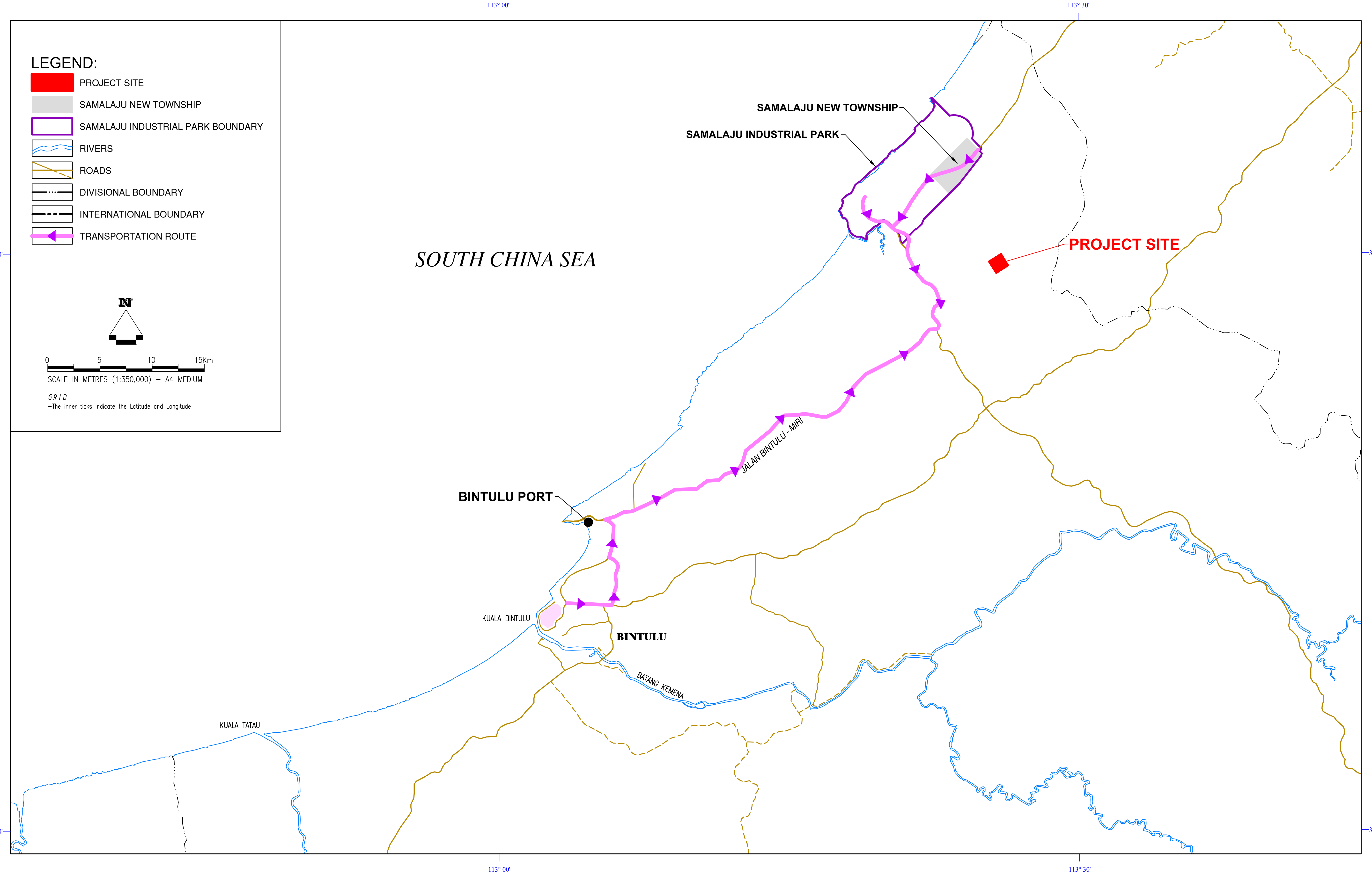
The proposed domestic waste and scheduled waste transportation method and waste handling flow chart is as shown in **Figure 5.4.2**.

5.4.3.2 Landfill Operation

Compactor truck that has collected domestic waste from its designated area will first be weighed at the weight-bridge upon entering the proposed facility to record the initial weight of the collected waste plus the truck's weight. The truck will then proceed to the sanitary landfill to empty the truck of the collected domestic waste. Lastly, the truck will proceed to the weight-bridge to record the final weight of the empty truck. By doing that, the weight of the incoming waste for each truck entering the facility can be recorded.

For scheduled waste, the process is almost similar to the process described above for the domestic waste. However, after the weight of the truck and the scheduled were recorded, the truck will proceed to the temporary SW storage area to unload the collected scheduled waste. The scheduled waste will be first tested for the waste criteria prior to landfilling at the secure landfill.

For the operation of sanitary landfill, there will be bulldozer, excavator and landfill compactor to manage the incoming waste and to properly compact them. Meanwhile for secure landfills, there will be bulldozer and excavator to manage the incoming waste. The compaction process is very crucial in helping to control pest and to minimise the odour from the decomposing waste.



TRANSPORTATION ROUTE TO THE PROJECT SITE

FIGURE: 5.4.1

Figure 5.4.2: Waste Transportation Method and Flow Chart

5.4.3.3 Leachate Treatment Plant (LTP)

During operational stage, the LTP will treat the collected leachate from both the sanitary and secure landfills. The leachate will be treated in a multi-stage process as described in **Section 5.3.4**. The LTP is fully computerised and all stages of the treatment process are continuously monitored. The treated effluent will be made sure that it complies to the regulatory limit prior to discharge out from the Project site.

If the effluent exceeded the regulatory limit, it will be discharged into the emergency pond while investigation will be launched to identify the root cause. Rectification work will be done to ensure all treatment process are functioning properly. Once the rectification work is done, the effluent in the emergency pond will be piped back into the LTP for re-treatment prior to discharge. Effluent that does not meet the regulatory limit will **NOT** be discharged out from the Project site.

5.4.3.4 Temporary Scheduled Waste Storage Area/ Off-site SW Storage Facility

The scheduled waste storage area is a dry process and will mainly involve physical process activities, such as:

- Analysis of the incoming scheduled wastes;
- Manual sorting, packing, labelling and storage of the scheduled wastes;
- Transportation of scheduled wastes (that cannot be disposed at this IWMS, e.g. clinical wastes) from storage facility to the Kuching Integrated Waste Management Park (KIWMP) or to designated recovery plants.

5.4.3.4.1 Collection of Scheduled Waste from Waste Generator

Scheduled waste from waste generator must be properly stored, packaged and labelled as per requirement of the Environmental Quality (Scheduled Wastes) Regulations, 2005 prior to collection by Trienekens.

Drivers and attendants collecting scheduled waste must at all times adhere to the minimum requirements on the use of personal protective equipment (PPE) to avoid any direct contact with the wastes. Minimum PPE that must be donned by the collection team and the supervisor working with scheduled wastes are:

a. Safety boots;

b. Safety gloves;

c. Safety glass; and

d. Approved Coverall.

Before transporting the scheduled waste out from waste generator premise, driver to ensure that appropriate label is pasted onto the appropriate container by the waste generator which includes the date when the waste is first generated, name, address and telephone number of waste generator.

Scheduled wastes will be collected from respective waste generator by prime mover trucks or service truck. The details of the transportation vehicle are tabulated in **Table 5.4.1**. The scheduled waste received will be weighed and recorded, and consignment note filled. The scheduled wastes will then be sent to the Project site.

For clinical waste, when collecting the yellow clinical waste bags from waste generator, the necks of the bags should be positioned to allow access for movement of the bags where necessary. All clinical waste bags should be handled by the neck only. Syringes with needles should be contained in sharp bins.

Table 5.4.1: Transportation Vehicle Details

Type of Vehicle	Vehicle Gross Weight	Capacity	Usage
Prime mover with 40-footer curtain sider trailer	38 Tons	20 tons	For transporting scheduled waste
Service truck	16 Tons	8 Tons	For transporting scheduled waste

Plate 5.1: Prime Mover with Curtain Sider Trailer

Plate 5.2: Service Truck / Rigid Truck

On receiving the scheduled waste, Scheduled Waste Supervisor shall acknowledge reception by completing the relevant portion in the Consignment Note Form (CN Form) to indicate temporary storage at the off-site storage facility.

All incoming scheduled waste container shall be weighed and recorded by Supervisor, Scheduled Waste in Incoming and Outgoing Waste Materials Record appended herewith.

5.4.3.4.2 Sorting, Packing & Labelling of Scheduled Wastes

Sorting

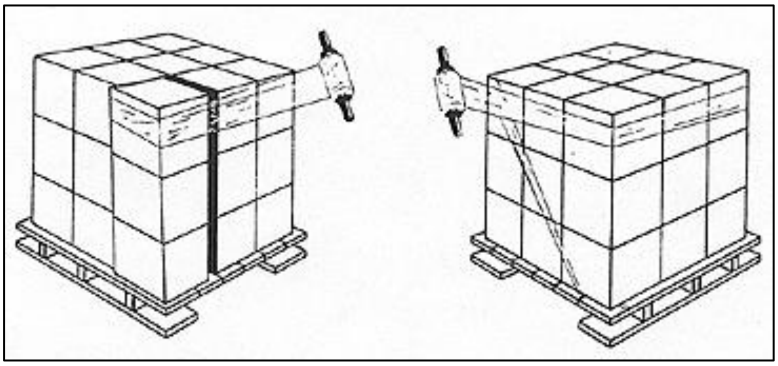
Each scheduled waste will be sorted manually according to its type and size (small, medium, large), and inspected for any spoilt condition. Any scheduled wastes with unacceptable spoilt condition for storing will be kept separately and sent to the Kuching Integrated Waste Management Park (KIWMP) for proper disposal at secure landfill or incinerator. Any oil leakage from drum/barrel will be transferred into proper steel drum/barrel prior to packing and labelling. The broken drum/container will be sent to KIWMP.

When collecting clinical waste from waste generators, a 240 L Mobile Garbage Bin shall be used to contain the sharp bins and yellow clinical waste liners in the licensed vehicle. The clinical waste in 240 L Mobile Garbage Bin shall be located in the proposed Project site in the same compartment as SW410 Contaminated Matters.

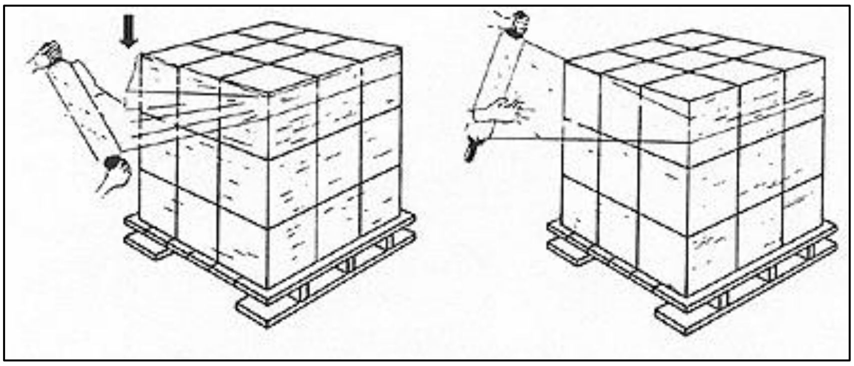
Packing

Solid scheduled waste with no free-flow of liquid generated in small quantity, such as contaminated rags, will be stored in carton box. Bulk of carton box will be wrapped together using clear (non-tinted), linear low-density polyethylene (LLDPE) stretch film. Wastes shall be wrapped separately according to their category for safety reasons as well as to ease the handover process at KIWMP and designated premises for recovery. An example of wrapping method from GOODWEAPPERS® Wrapping Techniques Manual, 1987 is as shown below:

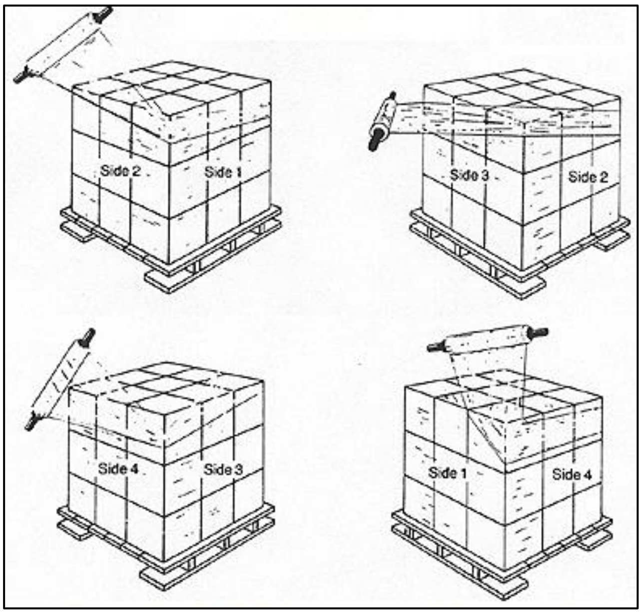
1. Starting with anchoring the narrow widths by either slide the end of the film between two boxes or tie it to the pallet and pull the film up diagonally to band the top.



2. The film will be tightened around the upper portion of the pallet to create a tight, secure band of film. End the wrap by catching the film on the corner, pulling the top hand brake towards the floor or poke fingers through the film.



3. The stretch film will be pulled diagonally across one top corner of the pallet, holding the hand brake closest to the pallet center higher than the hand brake closest to the floor. Once pulled diagonally over the top corner, the higher hand brake will be dipped below the next corner. Raise the roll up over the following corner and dip it below the next corner. Continue the process – each time moving towards the center of the load until the top is completely wrapped.



Drums shall be secured by appropriate plastic wrapping and/or plastic/steel tape or band as shown in **Plate 5.3**.

Plate 5.3: Example of Drums Secured by Plastic Wrapping

Last but not least, dry solid waste with no free flow liquid, e.g. dust or ashes shall be contained in a jumbo bag. These jumbo bags shall be sealed at all times.

<u>Labelling</u>

Each packed scheduled waste will be labelled according to Regulation 10 (Labelling of Scheduled Wastes) of the Environmental Quality (Scheduled Wastes) Regulations, 2005. Labels will be placed on the wrapped scheduled wastes.

5.4.3.4.3 Storage of Scheduled Wastes

All scheduled wastes will be stored according to Regulation 9 (Storage of Scheduled Wastes) of the Environmental Quality (Scheduled Wastes) Regulations, 2005.

Incompatible scheduled wastes will be stored in separate containers, and such containers will be placed in separate secondary containment area. The secondary containment area will be a liquid-tight barrier that is able to contain hazardous materials that are released from a container.

Dry solid waste with no free-flow liquid, e.g. dust or ashes will be contained in a jumbo bag. These jumbo bags will be sealed at all times. Containers containing scheduled wastes will be placed on pallet and stored with a maximum of four (4) drums or one (1) bag per standard pallet. The stacking of pallet without crate storage will not be more than two (2) tiers while the stacking with crate storage will not be more than three (3) tiers. The pallets will be placed in rows by two (2) pallets wide. Drums will be stored vertically and not horizontally for stability. Typical crate storage of scheduled wastes is shown in **Plate 5.4**.

For clinical wastes, a chiller will be provided at the off-site scheduled wastes storage area for the storage of the clinical wastes, temperature to be below 6°C. All clinical wastes will be transported to KIWMP for disposal at the incineration plant.

The proposed facility is designed to store maximum of 5,000 metric tonnes of scheduled wastes at any one time. The proposed storage facility will be constructed to comply to all the requirements under Environmental Quality (Scheduled Wastes) Regulations 2005.

Plate 5.4: Crate Storage of Scheduled Wastes

5.4.3.4.4 Transportation of Scheduled Wastes (to KIWMP)

All scheduled wastes operations and facilities under Trienekens (Sarawak) Sdn Bhd are licensed by the DOE. Trienekens' collection, transportation, treatment and disposal procedures complying with the Environmental Quality (Scheduled Wastes) Regulations, 2005.

For the scheduled wastes that cannot be disposed at the proposed secure landfill, they will be sent to KIWMP for proper disposal (i.e. incinerator). The proposed transportation route from Trienekens (Samalaju) Sdn Bhd to KIWMP is as shown in **Figure 5.4.3**. The scheduled wastes will be transported by prime mover trucks or service truck. The details of the transportation vehicle are as tabulated in **Table 5.4.1**.

The clinical waste in 240 L shall be transported to the disposal facility, Kuching Integrated Waste Management Park, within 48 hours from the date of clinical waste received and stored at the Project site. The Incoming and Outgoing Waste Materials Record shall be updated to state the date of clinical waste transported out from Project site.

Trienekens (Sarawak) Sdn. Bhd. is a licensed transporter by DOE to transport scheduled wastes with license number 004935 (refer to **Appendix 5.4.1**).

5.4.3.4.5 Inventory and Consignment Note

Proper documentation and record of generation and handling of scheduled wastes is important to comply with the Environmental Quality (Scheduled Wastes) Regulations, 2005.

The consignment note used by Trienekens (Sarawak) Sdn Bhd is appended in **Appendix 5.4.2**. The waste generator is required to complete the scheduled waste transport consignment note and acknowledge of handling of scheduled waste. In addition, all incoming and outgoing waste materials shall be recorded in a record sheet (refer **Appendix 5.4.3**). It is to record the updated information on the amount of scheduled wastes delivered to the Project site and transported to KIWMP or other designated recovery sites.

An online inventory and consignment note of the scheduled wastes in the e-Consignment Note system will be made by Trienekens (Samalaju) Sdn Bhd, Bintulu Branch via DOE Malaysia Website, https://eswis.doe.gov.my/. The online application serves as a systematic online storage and retrieval of information to replace existing manual systems. The system covers all scheduled waste transactions and updating the Scheduled Waste Notices, Inventory, and Consideration Notices.

5.4.3.4.6 Scheduled Waste to be Stored at the Temporary Scheduled Waste Storage Area

The proposed scheduled wastes to be stored at the temporary scheduled waste storage area are all the scheduled wastes code listed in the First Schedule Regulation 2 of the Environmental Quality (Scheduled Wastes) Regulations 2005 (see **Appendix 5.4.4**), except for radioactive and explosive waste (SW431).

The list of the scheduled wastes to be disposed at the secure landfill are shown in **Table 5.3.5**. For other scheduled waste that are not to be disposed at the secure landfill, they will be either to be sent for off-site recovery (see **Table 5.4.2**) or to be sent for disposal at the incineration plant at KIWMP (see **Table 5.4.3**).

Table 5.4.2: Scheduled Waste Categories to be Stored at the Temporary Scheduled Waste Storage Area for Off-site Recovery

Waste Code	Category (for off-site recovery)
SW1	**Metal and metal-bearing wastes**
SW102	Waste of lead acid batteries in whole or crushed form
SW103	Waste of batteries containing cadmium (Cd) and nickel (Ni) or mercury (Hg) or lithium (Li)
SW110	Waste from electrical and electronic assemblies containing components such as accumulators, mercury-switches, glass from cathode-ray tubes and other activated glass or polychlorinated biphenyl-capacitors, or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated biphenyl
SW2	**Wastes containing principally inorganic constituents which may contain metals and organic materials**
SW202	Waste catalysts
SW204	Sludges containing one or several metals including chromium, copper, nickel, zinc, lead, cadmium, aluminium, tin, vanadium and beryllium
SW3	**Wastes containing principally organic constituents which may contain metals and organic materials**
SW305	Spent lubricating oil
SW306	Spent hydraulic oil
SW310	Sludge from mineral oil storage tank
SW311	Waste of oil or oily sludge
SW322	Waste of non-halogenated organic solvents
SW323	Waste of halogenated organic solvents
SW327	Waste of thermal fluids (heat transfer) such as ethylene glycol
SW4	**Wastes which may contain either inorganic or organic constituents**
SW409	Disposed containers, bags or equipment contaminated with chemicals, pesticides, mineral oil or scheduled wastes

Table 5.4.3: Scheduled Waste Categories to be Stored at the Temporary Scheduled Waste Storage Area for Disposal at Incineration Plant in KIWMP

Waste Code	Category
SW1	**Metal and metal-bearing wastes**
SW109	Waste containing mercury or its compound
SW2	**Wastes containing principally inorganic constituents which may contain metals and organic materials**
SW206	Spent inorganic acid
SW3	**Wastes containing principally organic constituents which may contain metals and organic materials**
SW301	Spent organic acids with pH less or equal to 2 which are corrosive or hazardous
SW307	Spent mineral oil water emulsion
SW308	Oil tanker sludges
SW309	Oil water mixture such as ballast water
SW312	Oily residue from automotive workshop
SW313	Oil contaminant earth from re-fining of used lubricating oil
SW314	Oil or sludge from oil refinery plant maintenance operation
SW315	Tar or tarry residue from oil refinery or petrochemical plant
SW318	Waste, substances and articles containing or contaminated with polychlorinated biphenyls (PCB) or polychlorinated triphenyls (PCT)
SW324	Waste of halogenated or unhalogenated non-aqueous distillation residues arising from organic solvents recovery process
SW4	**Wastes which may contain either inorganic or organic constituents**
SW403	Discarded drugs containing psychotropic substances or containing substances that are toxic, harmful, carcinogenic, mutagenic or teratogenic
SW404	Pathogenic wastes, clinical wastes or quarantined materials
SW405	Waste arising from the preparation and production of pharmaceutical product
SW407	Waste containing dioxins or furans
SW408	Contaminated soil, debris or matter resulting from cleaning-up of a spill of chemical, mineral oil or scheduled wastes
SW410	Rags, plastics, papers, or filters contaminated with scheduled wastes
SW414	Spent aqueous alkaline solution containing cyanide
SW415	Spent quenching oils containing cyanides
SW418	Discarded or off specification inks, paints, pigments, lacquer, dye or vanish products containing organic solvent
SW419	Spent di-isocyanates and residues of isocyanate compounds excluding solid polymeric material from foam manufacturing process
SW420	Leachate from scheduled waste landfill
SW423	Spent processing solution, discarded photographic chemicals or discarded photographic wastes
SW424	Spent oxidising agent
SW430	Obsolete laboratory chemicals

Waste Code	Category
SW432	Waste containing, consisting of or contaminated with peroxides

5.4.4 ABANDONMENT STAGE

Project abandonment is major projects occurs for a number of unforeseen reasons, for instance political and economic instability as well as technical issues. Abandonment is often typified by termination of construction works and the retraction of workers and machinery from the Project site, permanent closure of the facility and permanent termination of operation of the facility.

In view of the fact that the State is attracting investment into SIP, and also the urgency to find alternative site to replace Tg. Kidurong dumpsite, the abandonment of this Project is highly unlikely. Nonetheless, the EIA will address and outline the requirement should the Project be abandoned during the construction stage or the operational stage.

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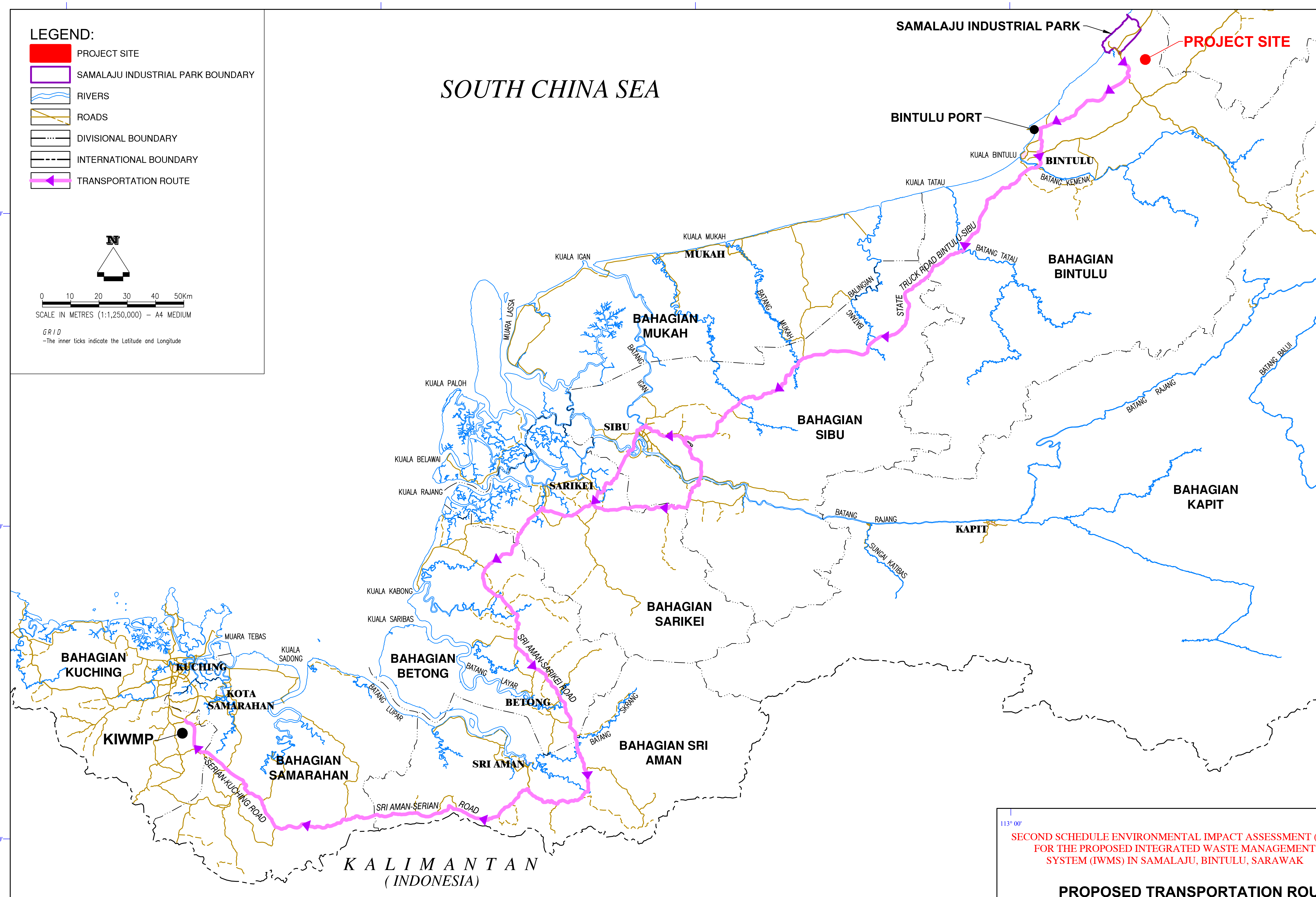


SECOND SCHEDULE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED INTEGRATED WASTE MANAGEMENT SYSTEM (IWMS) IN SAMALAJU, BINTULU, SARAWAK

PROPOSED TRANSPORTATION ROUTE FROM THE PROJECT AREA TO KIWMP

FIGURE: 5.4.3

D:\ACAD\DRAWINGS\EV103\720\720(1)\FIGURES\FIG-543.DWG

5.5 Infrastructural and Utilities Requirements

5.5.1 TRANSPORTATION REQUIREMENTS

During the operational stage, the waste will be transported from the waste generation point/ area to the proposed IWMS by trucks. The major areas to contribute the majority of the wastes are SIP, Samalaju New Township and Bintulu Town. All the trucks will mainly utilise the Bintulu-Miri Coastal Road as the primary transportation route.

5.5.2 POWER REQUIREMENTS

The electricity supply will be tap from the main road of Bintulu-Miri Coastal Road. The power consumption for the leachate treatment plant alone is estimated to be 120,000 KW/hr per month. Meanwhile, the power consumption for the rest of the facilities, i.e. admin building, laboratory, garage, weigh-bridge and street light, are estimated to be about 20,000 KW/hr per month. That makes the total consumption for the proposed Project to be approximately 140,000 KW/hr per month.

5.5.3 WATER REQUIREMENTS

During the operation stage, the proposed Project is expected to use approximately 230 m^3/day. The initial plan is to tap the water supply from the main road of Bintulu-Miri Coastal Road. Alternatively, the Proponent can install groundwater wells within the Project site, to extract groundwater as water supply.

To support Samalaju's rapid growth and the increased need for potable water, the Samalaju Water Treatment Plant (WTP) located at the SIP has been commissioned to serve the communities and industries within Samalaju. This WTP have a designed capacity of about 80 million litres per day (MLD) and is now running at 30 MLD. The first phase of the Samalaju water supply facility consisted of clear water reservoirs, high level water tanks and water distribution system from the treatment plan to the end users.

5.6 ENVIRONMENTAL POLLUTION CONTROLS

5.6.1 EMISSIONS TO AIR

Landfill Gas (LFG) is a natural by-product of the decomposition of organic material in landfill. LFG is composed of roughly 50% of methane, 50% of carbon dioxide and a small amount of non-methane organic compounds.

The sanitary landfill for municipal waste shall be equipped with suitably designed landfill gas extraction system for the purpose of extracting the landfill gas using HDPE pipe. The landfill gas pipes are horizontal and vertical gas drains. The LFG will be collected by perforated horizontal and vertical pipes which are connected by control shafts with a gas ring main which leads the gas to the final exhaust blower station. The humid LFG is dewatered in condensate shafts. Behind the blower, the LFG can be sent to a flare or used as fuel in a “genset” (motor/ generator) to produce electricity and heat, or to be flared in the flaring tower.

The gas flaring and the flaring plant will only be constructed in between 5 to 7 years or when the landfill is matured for gas tapping for reuse of gas as energy.

5.6.2 DISCHARGE TO SURFACE WATER

5.6.2.1 Leachate Treatment Systems

The leachate from the sanitary and secure landfills will be collected and to be treated at the leachate treatment plant. In general, for the treatment of leachate, a biological treatment process will be used to biodegrade the BOD and COD in the first step. In the second step, chemical precipitation is used to further remove the residual COD, which mainly consists of non-biodegradable lignin and humic acid. Finally, activated carbon absorber employed will polish the discharge leachate to be in compliance to the required discharge standards. A facultative pond and a constructed wetland will be installed to further enhance the quality of treated leachate to be discharged.

The leachate treatment system is further described at **Section 5.3.5**.

The influent and treated leachate parameter concentration from the similar project at KIWMP, Mambong is appended in **Appendix 5.6.1**.

5.6.2.1.1 Leachate Treatment Plant Monitoring and Control System

Proper monitoring is essential to ensure that the treatment process applied is satisfactorily controlled so that the desired results are achieved. Some of the value-added benefits obtained through proper monitoring of a treatment programme include:

- Reduced risks associated, with chemical underfeed or overfeed;
- Continuing compliance with environmental regulations;
- Improved quality of plant operation;
- Increased water and energy savings; and
- Improved plant productivity.

The wastewater treatment systems will be monitored by continuous systems employing automatic instrumentation.

5.6.2.1.2 Leachate Treatment Sludge

About 2.58 tonnes/day of sludge (moisture of sludge cake is 80%) will be produced by the leachate treatment plant. After dewatering, the sludge will be transported to the secure landfill for disposal.

5.6.2.2 Sanitary Wastewater

Wastewater such as sewage and domestic sullage arising from the staffs or visitor at the facility is anticipated. Sources will be from the toilets (blackwater) and office (greywater).

During the construction stage, a smaller packaged activated sludge system (prefabricated modular sewage treatment system) (e.g. POLYPASS®) will be installed to treat the sewage discharged from the construction site. The sewage will be treated to the requirement of Standard A of the Environmental Quality (Sewage) Regulations 2009.

During the operational stage, Weida's POLYPASS® packaged activated sludge system (prefabricated modular sewage treatment system) will be utilised for treating the sewage from the Project site. However, the discharge from the sewage treatment system will be further treated using a polishing unit prior to discharge into the environment. The brochure for the POLYPASS® system is appended in **Appendix 5.6.2**.

5.6.3 WASTES MANAGEMENT

The proposed Project will generate both solid and scheduled wastes. Solid wastes will comprise general refuse such as paper, cardboard, stationery, domestic wastes and packaging materials. The estimated total domestic wastes generated from the facility is approximately 70 kg/day, based on 0.7 kg of domestic waste generated by each worker per day.

Garbage bins will be provided in strategic places to collect all the domestic wastes generated from the facility. These domestic wastes will be directly disposed at the sanitary landfill.

All scheduled wastes to be generated from the garage/ workshop, will be handled and stored in accordance with the Environmental Quality (Scheduled Wastes) Regulations, 2005 and the Guidelines for Packaging, Labelling and Storage of Scheduled Waste in Malaysia.

5.6.4 NOISE MANAGEMENT

Leachate treatment plant will generate noise from various sources including hydraulic pumps, generators, noisy pipes and exhaust fans. The proposed control measures below to reduce the noise level has to comply with the Factories and Machinery Act, 1967.

Control measures techniques to reduce, prevent, and control noise include the following:

- Provide adequate hearing protective devices to workers who work in the high noise area;
- Enclose fans, insulate ventilation pipes, and use dampers;
- Selection of low noise prone rotary equipment.

The impact of the operational noise is assessed further discussed in **Chapter 7**.

5.7 PROJECT MANAGEMENT

5.7.1 PROJECT ORGANISATION CHART

This EIA incorporates the development and operational phases of the proposed IWMS facility. The construction phase of the proposed Project will be overseen by the Proponent. The proposed organisation chart during construction stage is shown in **Figure 5.7.1**.

The operation stage of the Project will be fully managed and operated by Trienekens (Samalaju) Sdn Bhd. The proposed organisation chart during the operational stage is as shown on **Figure 5.7.2**.

Figure 5.7.1: Project Organisation Chart during Construction Stage

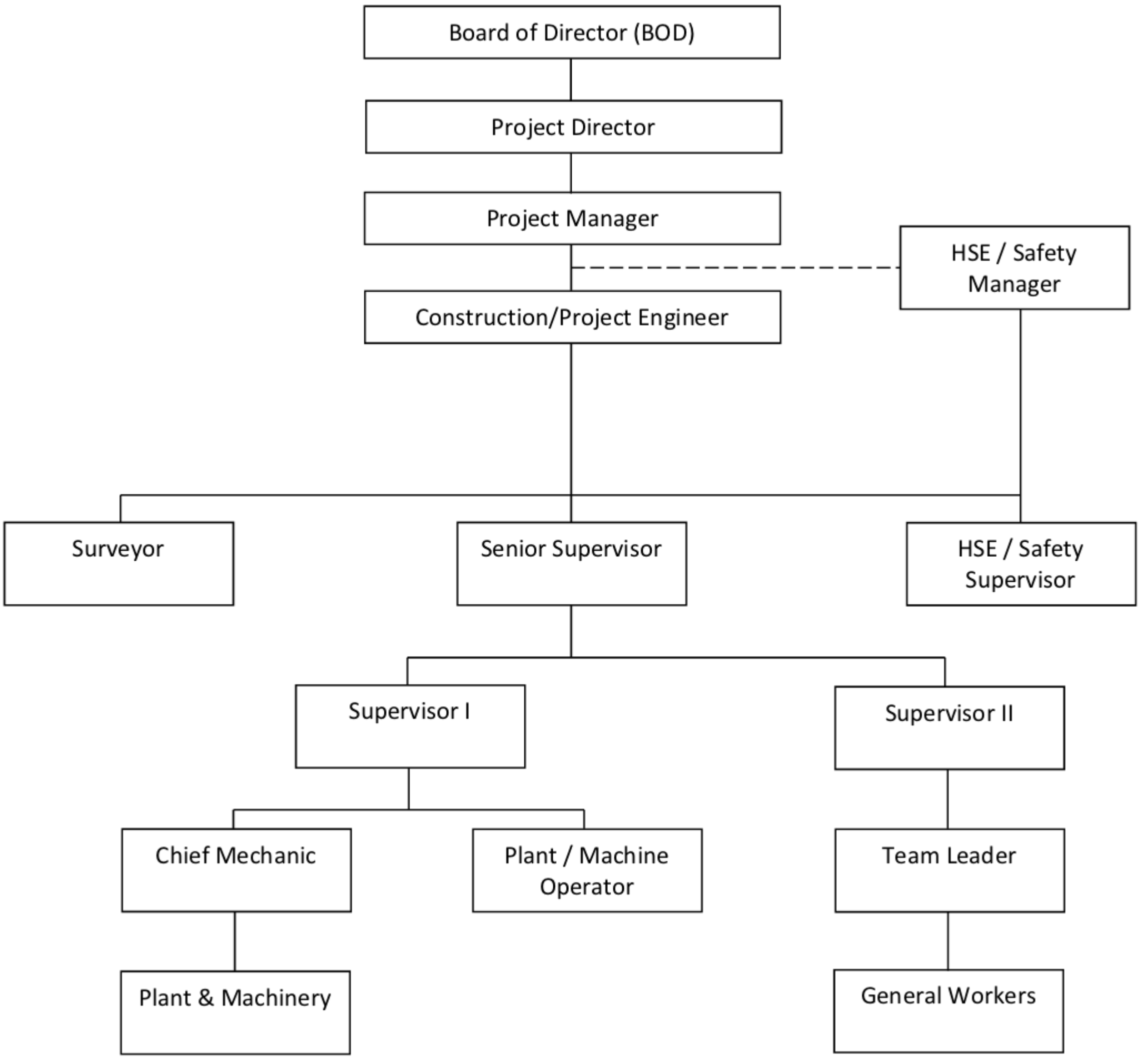
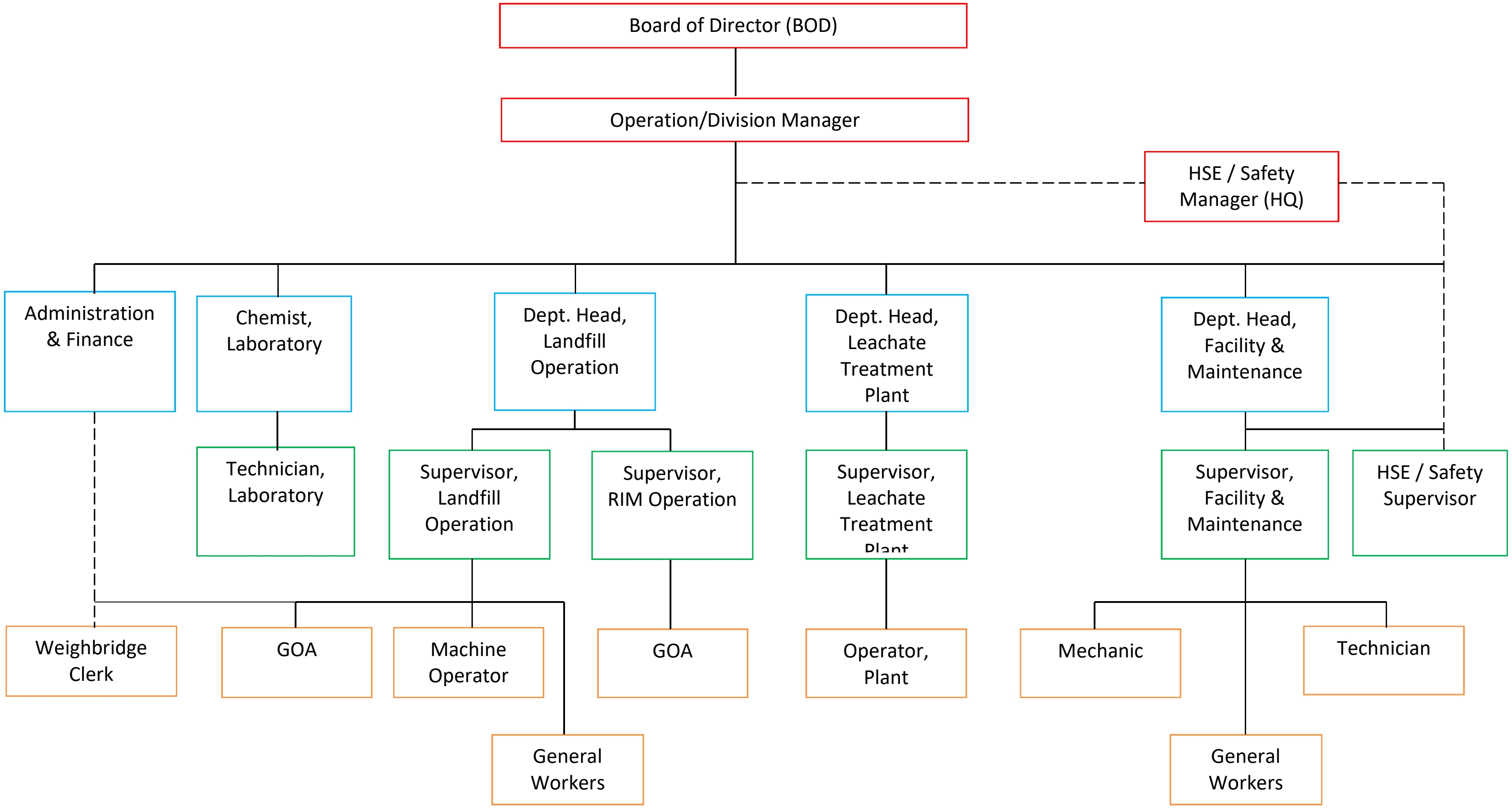


Figure 5.7.2: Project Organisation Chart during Operational Stage



GOA – General Operation Assistant
RIM – Reception, Inventory, Monitoring (Schedule Waste)

5.8 PROJECT IMPLEMENTATION SCHEDULE

The Project will take about twenty-four (24) months to complete. The tentative project implementation schedule for the development of the Project is as shown in **Table 5.8.1**.

Table 5.8.1: Tentative Project Implementation Schedule

Scope	Duration (days)	Week	Month
Design Management			
Engineering design	21	Week 1 – Week 3	1st Month
Infrastructure design	21	Week 4 – Week 6	1st – 2nd Month
Checking of design compliance	21	Week 4 – Week 6	1st – 2nd Month
Submission to local authority	14	Week 7 – Week 8	2nd Month
Preparation of drawings and pricing document	60	Week 9 – Week 16	3rd – 4th Month
Tender exercise	21	Week 17 – Week 19	5th Month
Evaluation, recommendation and approval	60	Week 20 – Week 28	5th – 7th Month
Award contract	14	Week 29 – Week 30	8th Month
Implementation and Construction Phase			
Construction of access to site	42	Week 1 – Week 6	1st – 2nd Month
Site clearing and earthworks	238	Week 3 – Week 36	1st – 9th Month
Building works & leachate wastewater treatment plant	448	Week 13 – Week 76	4th – 19th Month
M&E works	392	Week 25 – Week 80	7th – 20th Month
External works	448	Week 13 – Week 76	4th – 19th Month
Landfill works (sanitary & secure)	420	Week 25 – Week 84	7th – 21st Month
Housekeeping	20	Week 94 – Week 96	24th Month
Inspection/test – commissioning	42	Week 85 – Week 90	22nd – 23rd Month
Demobilisation	14	Week 95 – Week 96	24th Month
Hand over for operation	28	Week 91 – Week 94	23rd – 24th Month

5.9 COMPARISON WITH EXISTING INTEGRATED WASTE MANAGEMENT SYSTEM

The Proponent also operates the Kuching Integrated Waste Management Park (KIWMP) in Mambong, Kuching, Sarawak. The Proponent has had 20 years of experience in waste management industry.

KIWMP is the first integrated waste management park in South East Asia. This state-of-the-art facility was designed to cater for both municipal and scheduled waste, including hazardous and pathological waste. The careful selection of environmental protection equipment and disposal technologies of highest efficiency guarantees all of the facility components are in full compliance with both local and international safety and environmental standards. Preservation of natural resources and immediate as well as long-term protection of the environment are the absis of operations at the KIWMP.

The existing KIWMP in Mambong employs the same landfill design and similar leachate treatment plant design as this proposed Project. The only difference is the exception of the incinerator from this proposed Project.