ASB Biodiesel (Hong Kong) Limited

EMERGENCY RESPONSE PLAN

EP-319/2009/C

Development of a Biodiesel Plant at Tseung Kwan O Industrial Estate

Version 1: 30 December 2013

22 Chun Wang Street, Tseung Kwan O Industrial Estate, New Territories, Hong Kong

TABLE OF CONTENTS

		Page
SECTION 1	INTRODUCTION	1
SECTION 2	PROCESS DESCRIPTIONS	2
2.1	BIODIESEL PRODUCTION	2-1
2.2	GREASE TRAP WASTE AND WASTEWATER TREATMENT	2-3
SECTION 3	EMERGENCY RESPONSE PLAN	3
3.1	OVERALL OPERATIONAL CONTROL OF THE BIODIESEL PLANT – PROCESS CONTROL SYSTEM	3-1
3.2	LOADING/UNLOADING OPERATIONS	3-3
3.3	TRANSFER OPERATION	3-4
3.4	TANK FARMS	3-4
3.5	PROCESSING OPERATIONS	3-5
SECTION 4	CONTACT INFORMATION	4
SECTION 5	TRAINING, TESTING AND REVISION OF THE PLAN	5
5.1	TRAINING & TESTING	5-1
5.2	REVISION	5-1

APPENDICS

A	**Biodiesel Production Process**
B	**Wastewater Treatment Process**
C	**Master Layout Plan and Section** **Tank Farms Layout Plan, Tank List and Bund Area Calculations**
D	**Foul Drainage System**
E	**Storm Water Drainage System**
F	**Trouble Shooting for Anaerobic Treatment**
G	**Trouble Shooting for Aerobic Treatment**
H	**Possible Events of the Grease Trap Waste Treatment and the Wastewater Treatment Processes**

TABLE / FIGURE

		Page
Figure 2-1	Block flow diagram of Grease Trap Waste (GTW) Pre-treatment Process	2-3
Table 2-2	Summary of Process Waste/Product of the Biodiesel Production and GTW and Wastewater Treatment	2-6
Table 3-1	Summary of the volume of the tanks and bund storage capacities	3-4

SECTION 1 INTRODUCTION

This plan stipulates the actions to be taken covering incidents during loading/unloading operation, transfer operations, storage farm operations and processing operations. The plan applies to all the staff in the biodiesel plant at the Tseung Kwan O Industrial Estate (TKOIE) where chemical and materials are transported, purchased, stored, handled, or used, including vehicles of visitors or suppliers who bring the chemicals and raw materials into the biodiesel plant that are potentially hazardous.

The biodiesel plant will be constituted by two major processes – (1) biodiesel production and (2) the grease trap waste (GTW) and wastewater treatment. When the biodiesel plant is in operation, there will be several types of products and by-products being generated and required to be disposed of at designated facilities e.g. landfills. However, it is unlikely but possible that the processes of the biodiesel production, the GTW and the wastewater treatment might be interrupted by the incidents such as power interruption will adversely affect and upset these processes.

This plan summarizes possible disposal outlet for wastes generated from the biodiesel production, the GTW and wastewater treatment depending on the quality and quantity of the waste. Also, it summarizes the operational procedures for the possible incidents interrupting the operations of the biodiesel plant.

SECTION 2 PROCESS DESCRIPTIONS

The biodiesel plant consists of 2 parts of the operation: 1) biodiesel production & 2) grease trap waste and wastewater treatment.

2.1 BIODIESEL PRODUCTION

The process can be divided in two main parts:
1. Esterification and transesterification of the raw material to biodiesel
2. By-product preparation

The following sections describe the process steps of the biodiesel production. (See Appendix A)

Detail description

The feedstock for biodiesel production will be used cooking oil (UCO) , grease trap oil (GTO), palm oil fatty acid distillate (PFAD) and tallow.

Raw materials with high content of free fatty acids (palm oil fatty acids, grease trap oil) can be directly transferred into methyl ester by esterification using high-pressure, high-temperature reaction conditions without catalyst. The so-formed methyl ester has a certain content of free fatty acids, which can be processed in the following esterification step.

The raw materials with a certain content of free fatty acids as well as fatty acids recycled from the by-product acidification and the oil phase from the high pressure esterification are transferred to the esterification stage. Fatty acids are esterified with methanol under acidic conditions and ambient pressure in a batch process. The oil phase is transferred to the transesterification discontinuously. This step requires a catalyst which makes the transesterification reaction possible under moderate temperatures and normal pressure. The catalyst – a mixture of potassium hydroxide (KOH) and methanol – is prepared in a separate mixing station (solid potassium hydroxide is dissolved in methanol with a certain ratio).

The transesterification process is a two-step process. After dosing methanol and the catalyst the triglycerides are transformed to biodiesel and glycerine. Due to the density difference the glycerine together with the catalyst and the excessive methanol separates from the biodiesel phase and can be discharged to the by-product preparation line. The biodiesel phase of the first reaction step remains in the transesterification vessel and again methanol and the catalyst are dosed to the

vessel. With this technology a sufficiently high degree of transesterification is achieved. The glycerine phase is again discharged to the by-product preparation line.

The methyl ester phase contains certain amounts of methanol, catalyst (mainly in form of soaps) and water. The catalyst is removed from the methyl ester phase by several washing steps (the aqueous phase is discharged to the by-product preparation line). The methyl ester phase after the last washing step contains low volatile high boiling contaminants as well as volatile substances such as water and methanol. The volatile substances are removed in the flash column (degasser), the low volatile high boiling substances are removed in the distillation unit. The distillate represents the high quality methyl ester and is transferred to the biodiesel quality tank, and later, to the biodiesel storage tanks.

The volatile substances from the degasser are transferred to the by-product preparation line. The low volatile high boiling substances, namely bioheating oil (BHO), are discharged to a storage tank. They can be further used as heating oil for an oil burner (e.g. thermal oil boiler) and will be used to provide process heat in the plant.

The glycerine phase from the transesterification and the aqueous phases of the methyl ester purification are processed together with the aqueous phase of the esterification in the acidification vessel. In this process step the potassium hydroxide and the potassium soaps are transformed with sulfuric acid to potassium sulfate, glycerine phase and fatty acid phase. The potassium sulfate is a solid phase, the methyl ester forms together with the fatty acids the fatty acid phase, which has a low solubility in the glycerine phase at acidic conditions. This three phase mixture can be separated by the means of a tricanter (continuous operation as well as the acidification). As mentioned above, the fatty acid phase is reused in the esterification unit (increasing the biodiesel output of the process). The generated potassium sulfate is discharged via a screw conveyor to a container as pasty fertilizer. The acidic glycerine phase from the tricanter is neutralized with the basic catalyst in the neutralization tank. The thereby generated potassium sulfate is filtrated off and discharged back to acidification tank. The filtered neutralized glycerine phase is distilled. In the column methanol and water are separated from the glycerine. A second column separates water and methanol.

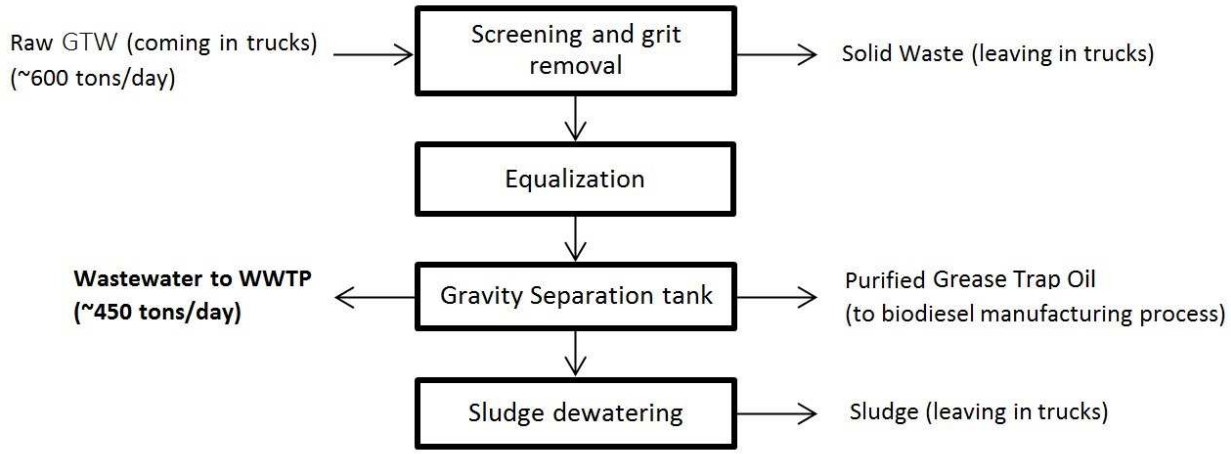
The recovered methanol and water are recycled and reused in the process. The crude glycerine (80% glycerine) is discharged to the storage tank.

2.2 Grease Trap Waste and Wastewater Treatment

Grease Trap Waste Treatment

Grease trap waste (GTW) treatment process is designed to separate oil, wastewater and sludge mixture in the raw GTW. The following figure shows the block flow diagram of the process:

Figure 2-1 Block flow diagram of Grease Trap Waste (GTW) Pre-treatment Process



The external GTW collectors will deliver and unload the GTW at the Grease Trap Waste Screening Room (GTWSR) where the GTW is screened and removed of grit. In order to reduce the potential problems of clogging of oil at the pipelines, heating coils are equipped.

In the second process, the GTW goes through a process called equalization to provide a buffering volume for overcoming the operational problems caused by variations of flow and characteristics of wastewater. The preliminary treated GTW from the first process is led into and retained in buffer tanks for a period of time where the process of equalization occurs.

Gravity Separation is the most important step in the treatment process, which aims for oil-water separation and solids settling. The tank is designed to separate the three layers in the raw GTW: (i) oil layer at the top, (ii) wastewater at the middle and (iii) sludge at the bottom. Firstly, the GTW from the buffer tank is pumped into the separation tank. Inside the tank, a skimmer is installed to remove the treated GTW at the top layer. The wastewater layer at the middle of the separation tank will be pumped to the wastewater treatment plant. It is estimated that the wastewater capacity is around 450 tons/day. The sludge, which is at the bottom layer, with be

collected using a sludge scraper and is pumped out from the bottom of the tank for sludge treatment.

In the final process of sludge dewatering, centrifuges are installed to dewater the sludge collected at the bottom of separation tank. The dewatered sludge will then be delivered to landfill by trucks.

WASTEWATER TREATMENT

Wastewater treatment process comprises I) Pre-treatment, II) Anaerobic Treatment III) Aerobic Treatment IV) Biogas Treatment V) Off Gas Treatment and VI) Sludge Treatment. The process flow diagram is presented in Appendix B

I) Pre-treatment

Wastewater from the production site will be flowing to an influent pit by gravity for collection to remove big solid particles and then will be pumped to an oil-water separator. The oil-water separator is used for free oil removal and the wastewater will flow into the buffer tank by gravity after wastewater undergoes oil removal. The buffer tank is to equalize water quality and flow fluctuation. After the wastewater is equalized in the buffer tank, it will be pumped to the Dissolved Air Floatation Unit (DAF) from buffer tank for further removing total suspended solids (TSS) and oil in wastewater.

II) Anaerobic Treatment

The wastewater will be treated anaerobically in a two stage anaerobic process. In the first stage (Pre Acidification Tank) the wastewater is partly pre-acidified. In the second stage (IC reactor) the organic pollutants of the wastewater are converted into the biogas.

III) Aerobic Treatment

After anaerobic treatment, the wastewater will flow to an activated sludge system for further removal of remained biodegradable chemical oxygen demand (COD). Activated sludge system consists of an aeration tank and a secondary clarifier.

IV) Biogas Treatment

In the IC reactor the by-product, namely the biogas, is produced. The amount of the

biogas produced depends on the COD-load applied to the IC reactors. The higher the COD-load is, the higher the biogas production will be. The biogas will be collected in the degassing tank on top of the IC reactor for gas water separation. The IC reactor and the biogas treatment facilities are closed system.

The biogas is burnt either in the process boiler system or the flare without emission to surroundings.

V) Off Gas Treatment

Odorous components like hydrogen sulphite (H_2S) may be released from the wastewater treatment plant (WWTP). Therefore top of the tanks in pre-treatment units and aeration tank are continuously ventilated. The off gas will be sent to a scrubber for odor removal.

VI) Sludge treatment

Sludge will be collected from the secondary clarifier and the DAF. The sludge discharged from secondary clarifier and the DAF has low dry matter content. To increase the dry matter content of the sludge, the sludge has to be further dewatered by mechanical dewatering equipment.

Table 2-2 Summary of Process Waste/Product of the Biodiesel Production and GTW and Wastewater Treatment

Process	Type of Waste/ Product	Physical state of Waste/ Product	Quantity generated/ treated (ton/day)	Fate
Biodiesel Production	Biodiesel	Liquid	303	Export
Biodiesel Production	Bioheating Oil	Liquid	27	Export/Internal Use
Biodiesel Production	Fertilizer Pasty	Solid	7	Selling for chemical, pharmaceutical and other industrial applications
Biodiesel Production	Glycerine (80%)	Liquid	21	
GTWSR	Screened waste	Solid, solid content at least 30%	5.5	Landfill
Fat Preparation	Screened waste			
Anaerobic and Aerobic Treatment	Biogas	Gas	Unknown	Internal Use
Anaerobic and Aerobic Treatment	Treated effluent	Liquid	515	Government Sewer
Sludge Dewatering	Dewatered Sludge	Solid, solid content at least 30%	1.3	Landfill

SECTION 3 EMERGENCY RESPONSE PLAN

This section details the plan which will be developed to handle any risk on-site and off-site due to any incident at the facility during the biodiesel production, loading/unloading operations, transfer operations, storage tank farm operations and processing operations.

3.1 Overall Operational Control of the Biodiesel Production – Process Control System

The Process Control System (PCS) is used for monitoring and controlling the whole biodiesel production process (incl. utility plants and tank farm) by an abstract graphical representation of the plant itself. This graphic representation is made by process pictures which are showing all controllable equipment of the biodiesel plant. All important process conditions are checked permanently and are visualized on a computer screen so that the operator can watch and adjust the process parameters.

PCS is a hot standby system of following hardware:

- PCS server chapters with Raid 0 hard drive redundancy located in the switch room in a computer cabinet
- clients with LCD monitor in the control room
- printer
- data storage
- remote maintenance system (by modem or internet)

The main functions of PCS are:

- process pictures (abstract graphic representation of the biodiesel plant)
- automatic logic program
- controlling the process
- safety interlocks
- adaptive control constraint
- alarm routines
- trending
- alarm logging

Generally there are two modes for the control of the Biodiesel process:

Manual mode

This mode allows starting and stopping of all individual plant components. It is possible without major restrictions in the manual operating mode. This mode is normally locked by a password and only can be access by authorized personnel.

Automatic mode

The automatic mode controls the biodiesel production process automatically according to the control program and process parameters. All process parameters can be monitored on process display at control room. Manual intervention is only necessary for start-up or shut-down procedures of process units.

Alarm System

The deviations from normal operation condition are reported by process alarm system. There are two different alarm levels:

- Low priority alarm indicates minor deviation and close monitoring of the process unit is required. Process corrective action will be taken if necessary.

- High priority alarm indicates the deviation of safety relevant process parameters. Shutdown procedures are started automatically.

Plant Emergency Off

Plant emergency shut off can be activated by “emergency switches” which are located in process control room, process building and tank farm areas. The relevant process plant equipment will be shut off by interrupting its power supply and the essential utility system will remain in function.

Protective Shut Down

Protective shut down is controlled by PCS to activate the shut-down procedures of process units. It is activated automatically by either one of the following situations:

- Instrument air supply interruption
- Ventilation system malfunction
- Nitrogen supply interruption
- Temperature high in vent gas
- Fire alarm

3.2 LOADING/UNLOADING OPERATIONS

The following areas involve loading/unloading operation in our plant:

a. Transportation of chemicals, raw materials and product between Tank Farm and Jetty by marine vessels;
b. Transportation of chemicals, raw materials and products between Tank Farm and loading/unloading stations by trucks;
c. Chemicals filling into the chemical tanks at the chemical rooms of the wastewater treatment plant (WWTP) by trucks;
d. GTW reception at loading/unloading stations by trucks

The spillage risks control during loading/unloading operations can be address as follow:

(a) Jetty area

If spillage happens during loading/unloading operation at Jetty area, the floatable oil boom will be laid to surround the affected area. The spilled material will be skimmed back to the GTWSR and reused for biodiesel production.

(b) Loading and Unloading Stations

When chemical unloading at Zone 4C including sulphuric acid, phosphorus acid, diesel and methanol, spillage can be detected by a level sensor which located at the surface drain of the parking slot. The signal will be feedback to control room and terminate operation immediately. The spills are contained in the surface channel which will be cleared and reused to the biodiesel production.

When product loading at Zone 4B including biodiesel, glycerine and BHO, overfill protection system is equipped which interlock with the loading pumps to prevent overfill. Furthermore, the parking slot will be bound by sand bags to prevent any spills to the surface drain. In addition, there is an oil interceptor to trap the oil in case any spills to the surface drain accidentally. The oil interceptor will be regularly cleared and the trapped oil will be reused to biodiesel production via the GTWSR.

(c) Filling the chemical tanks

The storage tanks of ferric chloride and sodium hydroxide are located at the foul drain system which can be diverted to the wastewater treatment plant such that the water quality will not be deteriorated by the spill.

(d) GTW Reception

During the GTW reception, the spill may occur when improper hose connection or the hose breaking. To prevent the GTW spill into the surface drain, sand bags will

be placed to block the drain channel. As mentioned in above item (b), oil interceptor system is equipped to trap the oil in case any spills to the surface drain accidentally. The oil interceptor will be regularly cleared and the trapped oil will be reused to biodiesel production via the GTWSR.

3.3 TRANSFER OPERATION

Watertight design has been adapted for the tailor-made container to store (i) dewatered sludge from the WWTP, (ii) screened waste from the GTWSR, (iii) screened waste from fat preparation, and (iv) fertilizer pasty from the biodiesel production to prevent any leakage during transportation.

The dewatered sludge and screened waste will be stored in the container and disposed of to the designated landfill by licensed contractor. When there is any incident or accident during road transportation, the licensed contractor will inform ASB immediately so that corresponding corrective action can be carried out.

3.4 TANK FARMS

The floors of tank farms are coated with oil- and waterproof, anti-static and acid-resistant coating to minimize leakage out of the farm area. Each tank farm is built with bund wall to surround the tank(s) and to retain potential leakage from the tanks inside the bunds and there are 5 tank farms, namely from tank farms 2A to 2E. (See appendix C). The details are summarized in table 3.

Table 3-1 Summary of the volume of the tanks and bund storage capacities

Tank Farm	No. of tank(s) in tank farm	Volume of largest tank / m^3	**110% Volume of the largest tank / m^3**	Total volume of the tanks / m^3	**20% Total volume of the tanks* / m^3**	**Volume of bund storage capacity / m^3**
2A	14	2561	**2817.1**	13935	**2787**	**5188.7**
2B	1	518	**569.8**	518	**103.6**	**588.0**
2C	2	160	**176**	320	**64**	**226.1**
2D	1	105	**115.5**	105	**21**	**116.5**
2E	2	54	**59.4**	80	**16**	**72.3**

*Refers to “Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes” issued by EPD.

The bunds are built to retain the potential leakage from the tanks and fulfill the requirement of both 110% of the volume of the largest tank and 20% of total volume of the tanks.

Furthermore, leakage detection system is equipped in each of the tank farms which consist of valve pit and level sensor. In normal operation, the valve at valve pit is in close position to avoid any spillage from tank farm(s) to storm water drainage system. In addition, the level sensor detects the spillage which connects to PCS. The signal will be shown and monitored by ASB staff in the Control Room so corresponding corrective action can be carried out. In case of spillage, the spill will be contained at the tank farm. The spilled material will be cleared and returned to the biodiesel production for reuse.

3.5 PROCESSING OPERATIONS

In the processing operations, the emergency response has been taken for the following incident.

3.5.1 Chemical Spillage

Various chemicals are used in the biodiesel plant e.g. polymers for the DAF and dewatering, and acids for the biodiesel production.

In case of chemical spillage, the procedures stipulated in an Emergency Contingency Plan for chemical and material spillage (ECP) will be strictly followed (See also section 3.5.11). Material Safety Data Sheet (MSDS) of the chemicals will be referred prior to handle the chemical spillage. Moreover, relevant training will be given to ASB staff and regular drills of chemical and material spillage handling will be conducted. Furthermore, spent chemical absorbents will be handled in accordance with the Code of Practice on the Package, Labeling and Storage of Chemical Wastes issued by the Environmental Protection Department of the HKSAR Government (EPD).

3.5.2 Sludge Spillage

In case of any sludge or biomass spillage, response team shall wear personal protection equipment to prevent from contact with it.

For spillage of activated sludge from the aeration tank, the spilled sludge must be cleared immediately to avoid to flow to the surface drain which is leading to the government storm water manhole.

In case of spillage of biomass from the IC reactor, the spilled biomass will be surrounded by sand bags and pumped back to the recirculation tank and transferred back to the anaerobic process for treatment.

3.5.3 Pipe Damage and Leakage

The raw materials and chemicals use in biodiesel plant are transferred via pipeline system either in pipe bridges or pipe trench, for which there are numerous pipe works indoor and outdoor.

In case of the damage of the pipeline (e.g. bit by foreign object during typhoon), leakage of liquid or gases will be happened. In this case, the transfer pump will be stopped immediately to ease the leakage situation. Both the closest valves of up- and down-stream have to be closed and isolate the system. The damaged pipes will be fixed or will be replaced if necessary. Depending on the nature and conditions, the spilled materials will be either returned to the biodiesel production process or disposed of by the licenced facility.

3.5.4 Overflow

All the tank farms are surrounded by the bund. Any potential overflow from the tanks will be retained in the bund which is guarded by the isolation valve and level sensor. Under the normal operation, the isolation valves are close to retain any overflow from the tanks within the bund area. In rainy day, the ASB staff will check the tank farms to ensure that there is no spillage from the tanks before the isolation valves will be opened to allow the rainwater flowing to the surface water channels which is leading to sewer discharging to sea. (See appendices D and E)

In case of overflowing from the tanks within the tank farm, the ASB staff will ensure that all the valves shall be closed immediately to prevent any spilled liquid entering surface water channels. Spilled liquid will be cleared by tanker and unloaded back to the appropriate tank depending its nature, quantity and characteristic.

3.5.5 Power Failure

The biodiesel plant is equipped with two emergency fuel powered generators to supply power in the event of a failure of the mains supply.

2 set of emergency generators (250 KVA and 2250 KVA) supply the essential power to the fire services installation only for protection and life safety purposes. Neither the biodiesel production nor the GTW and wastewater treatment can be maintained.

The generators will be fitted with auto-switches which will be automatically activated when power failure. The generator start-up will be complete in less than 1 minute from the power failure occurring.

3.5.6 Blockage of Biodiesel Plant Access Road

ASB will be responsible for the notification of the GTW collection companies. ASB will coordinate in the case of blockage of the biodiesel plant access road by a traffic accident or vehicle breakdown with the Hong Kong Police for traffic direction in this situation.

ASB will continue such notification and coordination until the obstructing vehicles are removed and will immediately notify all mentioned organisations when the blockage to the access road is cleared.

ASB will immediately notify the GTW collection companies when the blockage has been removed.

ASB will agree with the organisations a predetermined arrangement for the temporary diversion of GTW collection companies directly to the designated or alterative disposal facility during an access road blockage.

3.5.7 Fire

A comprehensive fire protection system has been designed in ASB biodiesel plant which is approved by the Fire Service Department (FSD). The whole system includes:

- Automatic Fire Detection and Fire Alarm Systems;
- Sprinkler systems;
- Fire Hydrants and Hoses Reels;
- Seawater Fire Pump System;
- Gas Detection/Extraction System;
- Fixed Foam System;
- Mechanical Ventilation Control System; and
- Portable hand-operated Approved Appliances.

At emergency power failure situation, the fire protection and lighting equipment will still be maintained and emergency team will be trained to manage and coordinate during emergency situation.

All mobile equipment in the biodiesel plant, e.g. forklift, will have a fire extinguisher installed in the cab or at another appropriate position for immediate use by the driver or other staff if the plant catches fire, or if operator is first on the scene of a fire which is safe to tackle with the extinguisher.

3.5.8 Weighbridge Breakdown

The weighbridge system is designed to provide sufficient flexibility that the temporary breakdown of either an IN- or OUT-weighbridge can be adequately handled without any significant adverse impacts on the operation of the biodiesel plant.

In the event of a weighbridge breakdown, traffic will be re-routed to use one of the other weighbridges of the facility. In addition, the following temporary provisions may be implemented to improve traffic flows through the biodiesel plant if problems are experienced with traffic queuing as a result of a weighbridge breakdown:

- for example the GTW collection tanker of known tare weight, may be monitored and manually recorded in sufficient detail to permit subsequent identification and payload calculations to be made at a later time;
- Non-routine deliveries of privately collected waste, e.g. contracted refuse collector, may be charged at a rate computed from the vehicle type and volume using agreed conversion factors; and
- GTW collection tanker may be rejected by ASB until the weighbridge is operational.

3.5.9 Vehicle Breakdown

The design of the biodiesel plant provides two lanes for traffic flows wherever practicable. Hence, the potential for the GTW collection tanker or other vehicle breakdown on-site to completely block and disrupt operations is minimised. Normally, only one lane of a roadway will be blocked allowing use of the other lane to continue. In the event of a blockage, ASB will immediately implement emergency manual traffic control at the scene to manage the traffic circulation with minimal disruption to the transfer operations. Members of staff will be trained to

act as emergency traffic controllers and to handle such situations using standard practices and signaling systems, for example hand signals for traffic management.

If a vehicle breaks down on-site, it will be towed away to a designated area within 30 minutes so as not to impair traffic flow. Removal will occur as soon as it is apparent that repair of the vehicle within a reasonable time span is impossible.

Designated areas will be allocated at the biodiesel plant for vehicles which have broken down and been towed away. It will be the responsibility of the owner to remove any vehicle from the designated areas within 24 hours, after which time impoundment and disposal procedures by ASB may be brought into action, with the owner required to pay the costs.

3.5.10 Uninterruptible Power Supply for Weighbridge Computers

An Uninterruptible Power Supply (UPS) system will be provided to maintain the no-break operation of both our PCS in control room and the weighbridge computers for the period between mains failure and before the stand-by generator taking over the load. The UPS batteries will be rated for 30 minutes continuous operation.

3.5.11 Spillage from GTW collection tanker

Any spillage from the GTW collection tanker anywhere within the biodiesel plant, and particularly at the compactor/tanker interface or in the vicinity of the unloading bays, will be removed as soon as is practical. In addition, any areas which waste can collect or temporarily store will be cleaned at least at the end of every working day.

All staff will be trained in spillage control and good housekeeping measures and to appreciate the importance of these aspects to the efficient and environmentally-acceptable operation of the facility.

As far as is practicable, emergency situations involving the spillage of the GTW, or other materials will be avoided by the following provisions:

- Control of vehicles entering the biodiesel plant;
- Careful inspection of the GTW collection tanker prior to, and during, discharge; and
- Staff Training.

However, procedures will be developed to deal with any spillage of materials of concern with respect to the operation of the facility and the potential risk to health and safety.

ASB will develop an Emergency Contingency Plan (ECP) for chemical and material spillage as part of the emergency response plans for the biodiesel plant. The ECP will identify the following:

- A list of materials of concern which are used in the biodiesel production, GTW and wastewater treatment;
- Guidance on spill response actions, including demarcation, control, clean up and evacuation procedures and lines of reporting;
- Guidance on personal protection measures;
- A list of resources provided for the control and cleanup of spillage with details of their location; and
- A description of required staff training in the response procedures.

Guidance on the ECP will include a step-by-step approach listing appropriate instructions covering:

- Immediate provisions required for supervision of the spill area and for the initial control and minimisation of risks, including rescue of any injured person(s) and determination of the presence of fire, smoke or fumes;
- Notification of supervisory staff and other senior staff;
- Evaluation of the nature of the spill to determine the appropriate response, including the need to wear protective clothing, prevention of further spillage, containment of the spill, notification of FSD or other emergency services, evacuation procedures and cleaning up and remediation of the spill and any contaminated materials;
- Identification of the spilled substance by container labels, shipping papers or vehicle placards;
- Identification of the means necessary to prevent any spilled material from entering the sewer, site drainage system or escaping from the site; and
- Disposal of any contaminated soils and/or absorbent materials.

An incident report will be prepared to record the nature of the spill, any injuries to staff or other persons and the details of the resultant remediation.

All employees will be required to be familiar with the contents of the ECP and will be trained in the manner in which the area of a spill must be secured. In addition, employees who are designated as responsible for containment or for cleaning up

spills will be required to have a minimum of 24 hours of training in safe working procedures for these activities.

3.5.12 Operation during Typhoon Signal No. 3

ASB will continue the normal operation of the facility during the hoisting of the No. 3 typhoon signal. The following actions will be undertaken:

- The emergency procedure for the suspension of marine transportation will be employed;
- All storm and surface water drains, ditches and outfalls will be checked and if necessary cleared of debris, silt and litter; and
- The GTW collection companies delivering the GTW to the biodiesel plant will be informed of any significant changes in the operations of the biodiesel plant.

3.5.13 Operation during Typhoon Signal No. 8

ASB will continue the normal operation of the facility during the hoisting of the No. 8 typhoon signal. The following actions will be undertaken:

- The transfer of containerised waste from the biodiesel plant to the designated or alternative landfill will be eased;
- The transfer of waste to the designated or alternative landfill will resume within 2 hours of the lowering of the No. 8 typhoon signal; and

3.5.14 Operation during Typhoon Signal No. 9 or 10

ASB will notify the GTW collection companies and stop receiving the GTW. The biodiesel production and the GTW and wastewater treatment will be kept in operation.

3.5.15 Plant Closure

If the biodiesel plant has to cease operations during normal operational hours, contingency plans will be made with regards to the diversion of incoming wastes to other facilities. In such an eventuality, the following people and groups will be notified immediately:

- The designated or alternative facility contractor; and
- The GTW collection companies.

3.5.16 Reopening Notification

The people and groups listed above will be notified immediately upon the re-opening of the biodiesel plant.

3.5.17 Emergency Calls

ASB will provide an emergency telephone list located in a prominent position in the office. The list will update the persons of contact and their telephone numbers as appropriate.

3.5.18 Contaminated Water

All contaminated water generated at the Site will be treated at the wastewater treatment plant.

3.5.19 Closure of Designated Landfill

In the event of the closure of the designated Landfill, the transfer operation could be switched to the NENT or SENT Landfill after notification from EPD.

3.5.20 Floods

Contaminated flood water held in bunded areas of the site in excess of the capacity of the WWTP will be pumped and transported by road to a suitable alternative treatment centre for treatment and disposal.

3.5.21 Equipment and Process Unit Failure

In case of the equipment failure in the biodiesel production process, the corresponding equipment will be replaces immediately as the maintenance staff will be 24-hour on-site standby.

In case of the process unit failure, the biodiesel production will be ceased if such unit is the sole unit, e.g. boiler. The raw material can be received up to maximum capacity and then the plant will be closed (see 3.5.15) until the process unit is resumed normal.

For the grease trap waste and wastewater treatment processes, the troubleshooting and scenario are summarized in appendices F, G and H.

SECTION 4 CONTACT INFORMATION

The person(s) below shall be contacted in case of any incidents happened related to:

(I) Biodiesel, GTW and Wastewater Treatment Operation

		Tel no.	Mobile no.
Eddie WONG	Plant Manager	3183 4228	9091 1567
Martin HUI	Production Manager		9866 6333
Stanley KO	Shift Production Supervisor		6013 4562
H. TAKEUCHI	Shift Production Supervisor		9028 0689
Victor WANG	Shift Production Supervisor		9653 3721

(II) Sampling and Analysis

		Tel no.	Mobile no.
Rebecca LAU	Laboratory Manager	3183 4207	9272 0795
Jay LEUNG	Chemist	3183 4211	6199 0296
		3183 4212	

(III) Equipment Maintenance/Failure

		Tel no.	Mobile no.
Sylvia HAR	Engineering Manager	3183 4206	9479 0949
Albert KWAN	Maintenance Manger	3183 4209	9313 6012

(IV) Environmental, Health and Safety

		Tel no.	Mobile no.
Matthew TSE	EHS Officer	3183 4205	9409 0630

Government Authorities/Organizations

Name	Contact no.
Emergency	999
Hong Kong Police, Tseung Kwan O Station	2623 9041
Marine Police Harbour Division	2884 9242
Fire Services Department, Tai Chik Sha Fire Station	2723 8787
Drainage Services Department	2877 0660
Electrical and Mechanical Services Department	2333 3762
Environmental Protection Department	2838 3111
Tseung Kwan O Hospital	2208 0111
Ecospace Limited (Chemical Waste Treatment Facility)	2434 6490

SECTION 5 TRAINING, TESTING AND REVISION OF THE PLAN

5.1 TRAINING & TESTING

All the responsible staff must be trained and should demonstrate the ability of performing the task stated in this plan.

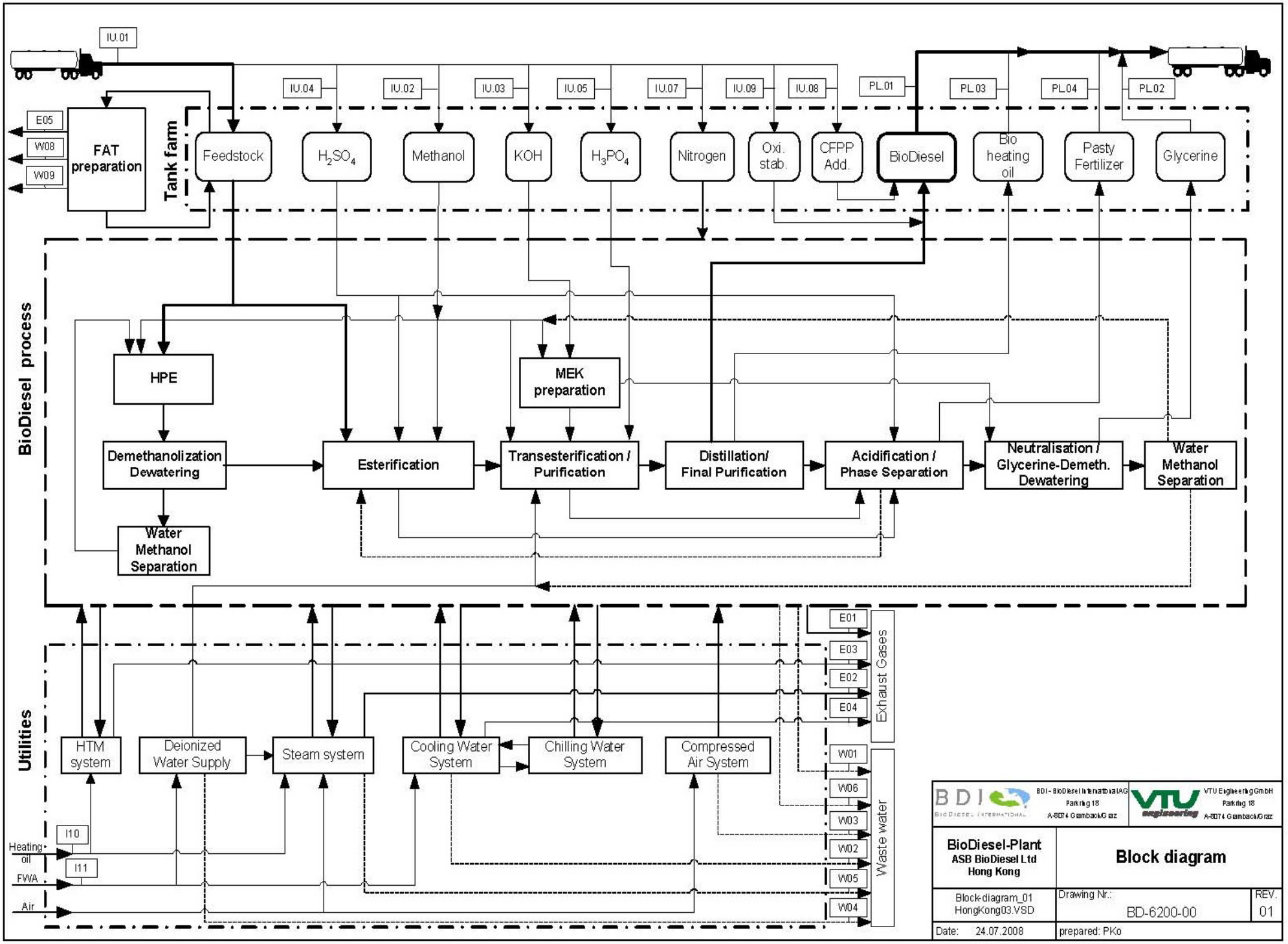
Exercise and drill shall be undertaken in a regular frequency to test the adequacy and effectiveness of this plan in controlled conditions if necessary, and allow the responsible staff to familiarize this plan.

5.2 REVISION

ASB will update this plan if necessary after consultation with the Engineering Department, the Maintenance Department, the Production Department or Senior Management of the Company. Also, the advices from or problems encountered from these departments will be taken into consideration and updated in this plan.

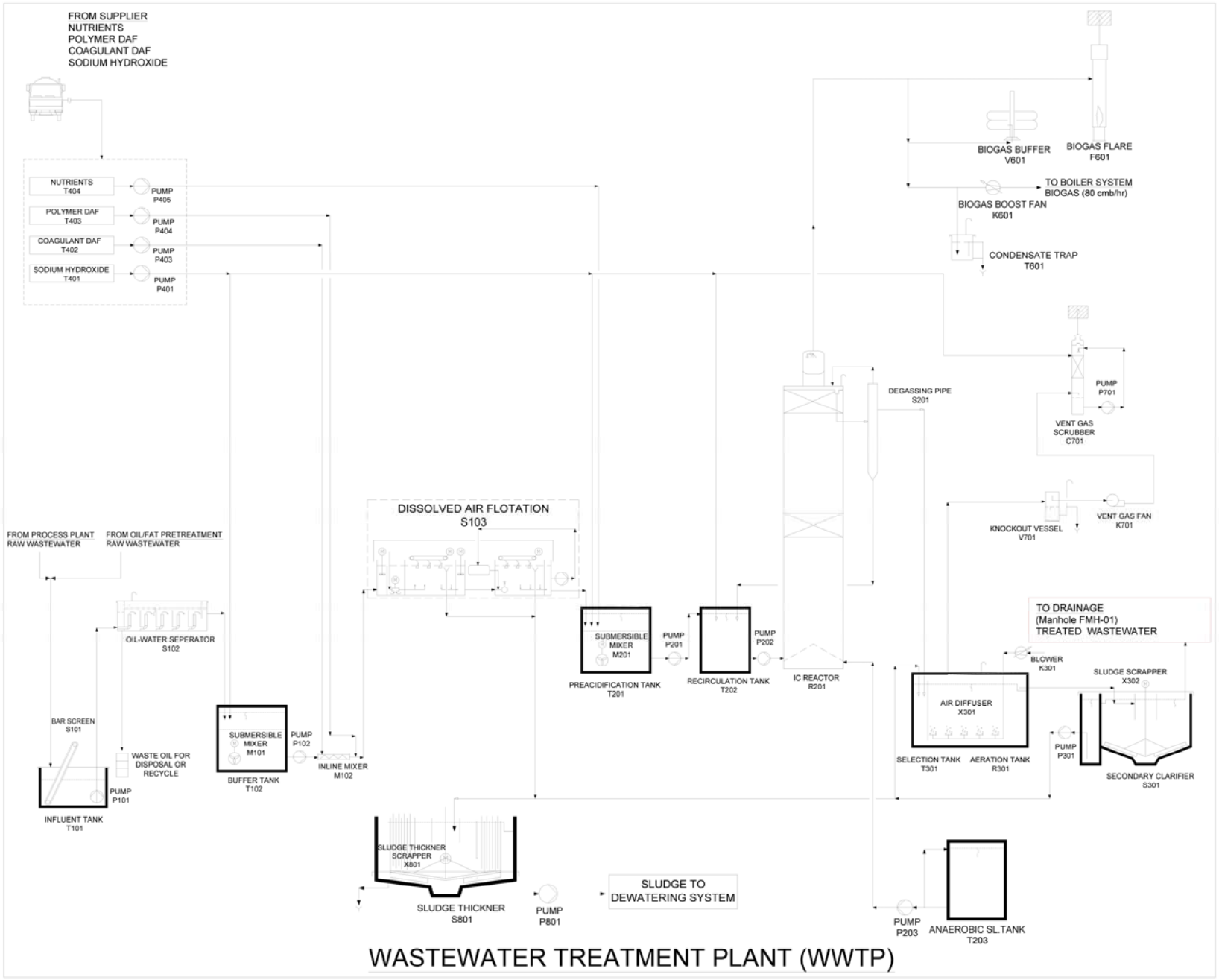
Appendix A

Biodiesel Production Process


IU.01
IU.04
IU.02
IU.03
IU.05
IU.07
IU.09
IU.08
PL.01
PL.03
PL.04
PL.02
E05
W08
W09
FAT preparation
Tank farm
Feedstock
H_2SO_4
Methanol
KOH
H_3PO_4
Nitrogen
Oxi. stab.
CFPP Add.
BioDiesel
Bio heating oil
Pasty Fertilizer
Glycerine
BioDiesel process
HPE
MEK preparation
Demethanolization Dewatering
Esterification
Transesterification / Purification
Distillation/ Final Purification
Acidification / Phase Separation
Neutralisation / Glycerine-Demeth. Dewatering
Water Methanol Separation
Water Methanol Separation
Utilities
HTM system
Deionized Water Supply
Steam system
Cooling Water System
Chilling Water System
Compressed Air System
E01
E03
E02
E04
Exhaust Gases
W01
W06
W03
W02
W05
W04
Waste water
I10
I11
Heating oil
FWA
Air
BDI - BioDiesel International AG
Parkring 18
A-8074 Grambach/Graz
VTU Engineering GmbH
Parkring 18
A-8074 Grambach/Graz
BioDiesel-Plant
ASB BioDiesel Ltd
Hong Kong
Block diagram
Block-diagram_01 HongKong03.VSD
Drawing Nr.:
BD-6200-00
REV.
01
Date: 24.07.2008
prepared: PKo

Appendix B

Wastewater Treatment Process



WASTEWATER TREATMENT PLANT (WWTP)

B. D. REF. NO. BD 2/3090/08 (P)
F.S.D. REF. NO. FP 8/28984

NOTES
DO NOT SCALE DRAWING, FIGURED DIMENSIONS ARE TO BE FOLLOWED
READ THIS DRAWING IN CONNECTION WITH GENERAL ARCHITECTURAL PLANS, STRUCTURAL PLANS, AND OTHER RELATED DRAWINGS, THE ARCHITECT SHALL BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCY FOUND THEREIN.

REVISIONS

No	DATE	REMARKS
1	9/7/2013	WPCO License Application Supplement Document

CLIENT :
ASB BIODIESEL (HONG KONG) LIMITED
Office units 2607-2609, 26th Floor, Prosperity Millennia Plaza, 663 King's Road, North Point, Hong Kong TEL: (852) 3741 1640 FAX: (852) 3741 1661

PROJECT MANAGER :
AECOM
8F, Tower 2, Grand Central Plaza, 138 Shatin Rural Committee Road, Shatin, N.T., Hong Kong Tel: 852 3922 9000 Fax: 852 2691 2649 www.aecom.com

ENVIRONMENTAL CONSULTANT :
CINOTECH
Rm 1710, Technology Park, 18 On Lai Street, Shatin, New Territories, Hong Kong Tel: 852 2151 2083 Fax: 852 3107 1388

PROJECT :
Proposed Biodiesel Plant at T.K.O.T. Lot No. 39 S.Q ss.1, ss.2 and the Ext. Thereto, Chun Wang Street, Tseung Kwan O Ind. Estate, Tseung Kwan O, N.T.

TITLE :
Schematic Flow Diagram for Wastewater Treatment Plant

STAMP OF APPROVAL :

DATE :	SCALE :
July 2013	N.T.S.
DRAWN BY :	CHECKED BY :
K.Chan	S.Har

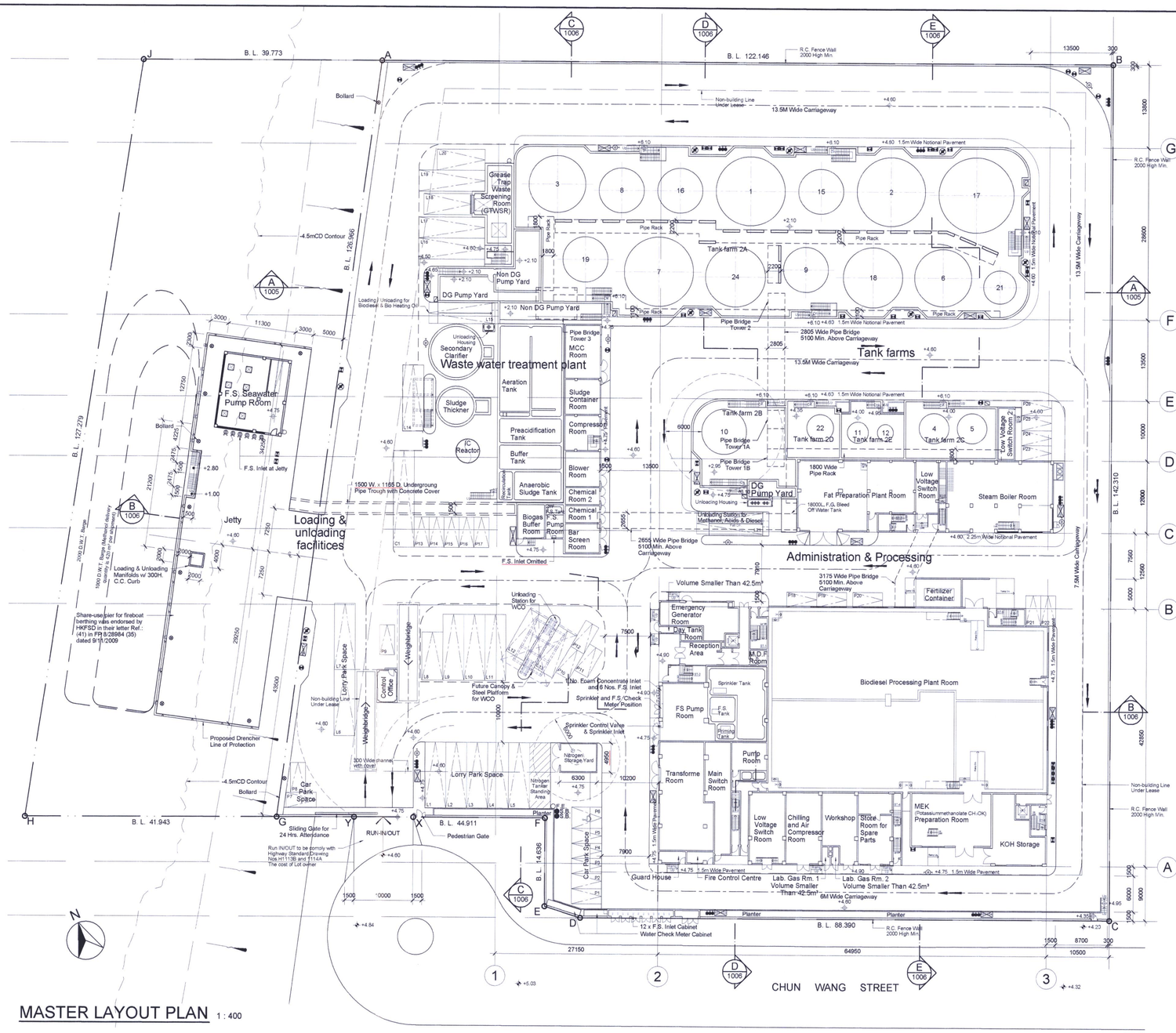
DRAWING NO.
EPD_WPCO_001

JOB NO.

Appendix C

Master Layout Plan and Section

Tank Farms Layout Plan, Tank List and Bund Area Calculations



MASTER LAYOUT PLAN 1 : 400

SECTION A-A 1 : 250

RECEIVED BY
2013 OCT -7 P 2:57
R & D Section
BUILDINGS DEPARTMENT

Note: This plan has been processed on a curtailed check basis under the centralized processing system as promulgated in PNAP ADM-19. The duties of the authorized person, registered structural engineer and/or registered geotechnical engineer concerned as specified under section 4(3)(b) and the provision of section 14(2)(c) of the Buildings Ordinance are of particular relevance in this regard.

B.D. REF. NO. 2/9030/08 (P)
F.S.D. REF. NO. FP 8/28984

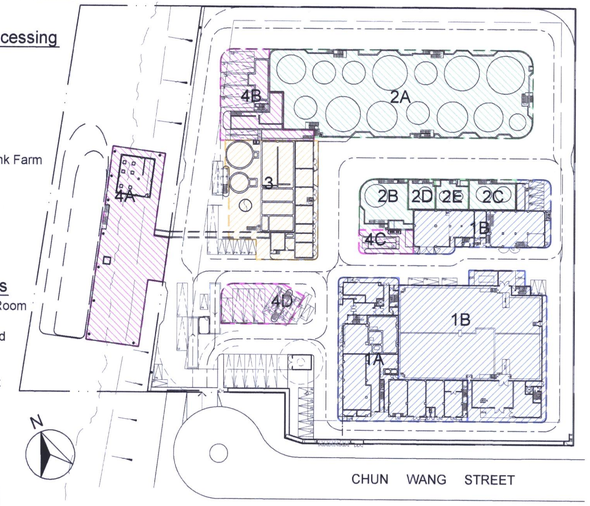
Note :
1. For F.S. installation Legend refer to drawing no. P/3001/G/1001.
2. All underground pipe trough at Emergency Vehicular Access with heavy duty metal grating capable of withstanding 30 tonnes Fire Appliance loading.
3. All equipments at Emergency Vehicular Access can withstanding 30 tonnes Fire Appliance loading.

ZONE 1 - Administration/Processing
- 1A - Administration Building
- 1B - Processing Buildings

ZONE 2 - Tank Farms
- 2A - Waste Grease / Water and Biodiesel Storage Tank Farm
- 2B - Methanol Storage Tank Farm
- 2C - Grease Trap Waste Storage Tank Farm
- 2D - Diesel Oil Storage Tank Farm
- 2E - Acid Storage Tank Farm

ZONE 3 - Waste Water Treatment Plant

ZONE 4 - Loading & Unloading Facilities
- 4A - Jetty and F.S. Seawater Pump Room
- 4B - Grease Trap Waste Screening Room (GTWSR), Pump Yard and Loading & Unloading Station
- 4C - Unloading Station
- 4D - Future Waste Cooking Oil Depot



Plan Approved
CHIK Kin-hang
Senior Building Surveyor
for BUILDING AUTHORITY
28 OCT 2013

ZONING INDEX
1 : 1000

PARKING / LOADING & UNLOADING SPACES SIZE

DISABLE (No. P6)	=	3.5M x 5.0M (MIN. HEAROOM 2.4M)
PRIVATE CAR (No. P1 to P5 & P7 to 26)	=	2.5M x 5.0M (MIN. HEAROOM 2.4M)
LORRY / GOODS (No. L1 to L7, L9 to L11, L14 to L17, L19 & L21)	=	3.5M x 11.0M (MIN. HEAROOM 4.1M)
LORRY / GOODS (No. L8, L12, L13, L18 & L20)	=	3.5M x 7.0M (MIN. HEAROOM 4.1M)
CONTAINER (No. C1)	=	3.5M x 16.0M (MIN. HEAROOM 4.5M)

SETTING-OUT DATA FOR THE LOT

POINT	BEARING D.M.S.	DISTANCE (in meters)	NORTHING	EASTING
T.K.O.T.L. 39 S.Q s.s.1 & EXT. THERETO				
A			816264.795	846675.400
B	112 55 48	122.146	816217.206	845787.894
C	202 55 53	142.310	816086.142	845732.446
D	292 55 48	88.390	816120.580	845651.040
E(chord)	310 16 26	6.265	816124.630	845646.260
F	22 55 16	14.636	816138.110	845651.960
G	292 55 51	44.911	816155.609	845610.599
A	30 41 21	126.966	816264.795	846675.400
Enclosed area 18000.0 m²				
D-E	ANGLE	DISTANCE	NORTHING	EASTING
(Ace=6.362)	34 42 55	10.500	816130.251	845655.129
T.K.O.T.L. 39 S.Q s.s.2 & EXT. THERETO				
J			816280.291	845638.770
A	112 55 48	39.773	816264.795	846675.400
G	210 41 21	126.968	816155.609	845610.598
H	292 55 48	41.943	816171.950	845571.970
J	31 39 25	127.279	816280.291	845638.770
Enclosed area 5140.0 m²				

NOTES:
1. ADEQUATE ROAD MARKINGS TO BE PROVIDED ON THE CARRIAGEWAY.
2. NOTIONAL PAVEMENT OF 1.5M WIDE TO BE MARKED BETWEEN STRUCTURES AND CARRIAGEWAY.
3. "PRIVATE ROAD" SIGNS TO BE ERECTED IN ACCORDANCE WITH THE "CODE OF PRACTIVE FOR PRIVATE ROADS".

THE WORKS SHOWN ON THESE PLANS ARE
TYPE II WORKS
BUILDING
IN RESPECT OF WHICH THE BUILDING AUTHORITY'S CONSENT IS APPLIED FOR

Rev	Revision Date	Purpose of revision	Drawn	Checked	Approved
12	7 Oct. 2013	Identical to F.S.D. Final Accepted Plan and OP Inspection Issue	LCH	PCM	CTS
11	31 May 2013	Final Amendment	LCH	PCM	CTS
10	15 Mar. 2013	Bollard Added	LCH	PCM	CTS
9	15 Jan. 2013	9th Amendment Issue	LCH	PCM	CTS
8	06 Jul. 2012	8th Amendment Issue	LCH	PCM	CTS
7	19 Dec. 2011	7th Amendment Issue	LCH	PCM	CTS
6	19 Jan. 2011	6th Amendment Issue	LCH	PCM	CTS
5	31 Aug. 2010	Amendment Resubmission	LCH	PCM	CTS
4	14 May 2010	General Amended	LCH	PCM	CTS
3	22 Jan. 2010	Generator Room, Day Tank Room, F.S. Control Room & Guard House Relocated and Pipe Bridge Amended	LCH	PCM	CTS
2	17 July 2009	General Amended	LCH	PCM	CTS
1	20 Feb. 2009	B.D. Amendment	LCH	PCM	CTS
0	28 Oct. 2008	B.D. Submission	LCH	PCM	CTS

Client
ASB BIODIESEL (HONG KONG) LIMITED
Office units 2607-2609, 26th Floor, Prosperity Millennia Plaza, 663 King's Road, North Point, Hong Kong
TEL: (852) 3741 1640 FAX: (852) 3741 1661

Civil and Structural Engineer
JACOBS
15th Floor, Cornwall House, Taikoo Place, 979 King's Road, Quarry Bay, Hong Kong
Tel: 852 2880 9788 Fax: 852 2565 5561
www.jacobschina.com.hk

Architect and Authorized Person
T.S. CHU ARCHITECTS LTD.
23/F., Asia Harvest Commercial Centre, 324 Shaukeiwan Road, Hong Kong
Tel.: 2312 2312 Fax.: 2723 3070 E-Mail: tscarchitect@tscal.com.hk
CHU TAK SUM BA(Arch., St.) B.Arch (HK) RIBA FHKIA Authorized Person - Architect Registered Architect

Building Services Engineer
CSA (M&E) Limited
Consulting Engineers
24/F Beverly House, 93-107 Lockhart Road, Wanchai, Hong Kong
TEL: (852) 2838 6436 FAX: (852) 2834 7026

Biodiesel Processing Designer
BDI BIODIESEL INTERNATIONAL
Parkring 18, 8074 Grambach/Graz, Austria
www.bdi-biodiesel.com

Waste Water Treatment Designer
PAQUES
No. 35 JiCheng Innovation Park, Lane 3999 XiuPu Road, Kangqiao Pudong, Shanghai, China 201319
TEL: (86) 21-3825 6068 FAX: (86) 21-3825 6066

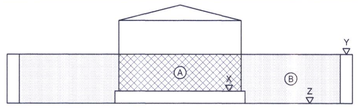
Main Contractor
CHINA HARBOUR ENGINEERING CO. LTD.
19/F., China Harbour Building, 370-374 King's Road, North Point, Hong Kong

Project
Proposed Biodiesel Plant at
T.K.O.T. Lot No. 39 S.Q ss.1, ss.2 and Ext. thereto
Chun Wang Street, Tseung Kwan O Ind. Estate, N.T.

Drawing title
MASTER LAYOUT PLAN AND SECTION

Drawing status: BD SUBMISSION — RECORD PLAN
Scale: 1:400@A1, 1:600@A2, 1:800@A3 — Do not scale
Job no.: -
Client no.: -
Drawing number: P/3001/G/1005
B. D.
Rev: 12

ZONE	X	Y	Z
2A	+2.60mPD	+6.10mPD	+2.10mPD
2B	+3.45mPD	+6.10mPD	+2.95mPD
2C	+4.50mPD	+6.10mPD	+4.00mPD
2D	+4.85mPD	+6.10mPD	+4.35mPD
2E	+4.50mPD	+4.95mPD	+4.00mPD



CONCRETE BUNDWALL CONTAINMENT VOLUME ENCLOSING - ZONE 2A

AREA ENCLOSED BY BUNDWALL - 14 TANKS	= 2192.1 m²	=	BY CADD
AREA OF 14TANKS	= 977.8 m²	=	REFER TANK LIST
AREA OF 22 PIPE RACK WALLS	= 24.5 m²	=	61.28m x 0.4m
AREA ENCLOSED BY BUNDWALL - 14 TANKS - 22 PIPE RACK WALLS	= 1189.8 m²	=	2192.1m² - 977.8m² - 24.5m²
AREA OF ONE TANK (FOR TANK NO. 17)	= 122.7 m²	=	6.25² x pi
HEIGHT OF FOUNDATION	= 0.5 m	=	X - Z
DEPTH OF BUNDWALL	= 4.0 m	=	Y - Z
VOLUME OF ONE TANK - Ⓐ	= 429.5 m³	=	122.7 m² x (Y - X)
VOLUME OF BUND - Ⓑ	= 4759.2 m³	=	1189.8 x (Y - Z)
REQUIRED CAPACITY	= 2817.1 m³	=	2561 m³ x 110%
PROVIDED BUND STORAGE CAPACITY - Ⓐ + Ⓑ	= 5188.7 m³	=	429.5m³ + 4759.2m³
REQUIRED SATISFIED	= 5188.7 m³	>	2817.1 m³

CONCRETE BUNDWALL CONTAINMENT VOLUME ENCLOSING - ZONE 2B

AREA ENCLOSED BY BUNDWALL - 1 TANK	= 149.5 m²	=	BY CADD
AREA OF ONE TANK (FOR TANK NO. 10)	= 44.2 m²	=	3.75² x pi
DEPTH OF BUNDWALL	= 3.15 m	=	Y - Z
VOLUME OF ONE TANK - Ⓐ	= 117.1 m³	=	44.2 m² x (Y - X)
VOLUME OF BUND - Ⓑ	= 470.9 m³	=	149.5 m² x (Y - Z)
REQUIRED CAPACITY	= 569.8 m³	=	518 m³ x 110%
PROVIDED BUND STORAGE CAPACITY - Ⓐ + Ⓑ	= 588.0 m³	=	117.1 m³ + 470.9 m³
REQUIRED SATISFIED	= 588.0 m³	>	569.8 m³

CONCRETE BUNDWALL CONTAINMENT VOLUME ENCLOSING - ZONE 2C

AREA ENCLOSED BY BUNDWALL - 2 TANKS	= 132.0 m²	=	BY CADD
AREA OF 2 TANKS	= 39.3 m²	=	REFER TANK LIST
AREA ENCLOSED BY BUNDWALL - 2 TANKS	= 92.7 m²	=	132.0m² - 39.3m²
AREA OF ONE TANK (FOR TANK NO. 4 OR 5)	= 19.6 m²	=	2.5² x pi
HEIGHT OF FOUNDATION	= 0.5 m	=	X - Z
DEPTH OF BUNDWALL	= 2.1 m	=	Y - Z
VOLUME OF ONE TANK - Ⓐ	= 31.4 m³	=	19.6 m² x (Y - X)
VOLUME OF BUND - Ⓑ	= 194.7 m³	=	92.7 m² x (Y - Z)
REQUIRED CAPACITY	= 176.0 m³	=	160 m³ x 110%
PROVIDED BUND STORAGE CAPACITY - Ⓐ + Ⓑ	= 226.1 m³	=	31.4m³ + 194.7m³
REQUIRED SATISFIED	= 226.1 m³	>	176.0 m³

CONCRETE BUNDWALL CONTAINMENT VOLUME ENCLOSING - ZONE 2D

AREA ENCLOSED BY BUNDWALL - 1 TANK	= 55.2 m²	=	BY CADD
AREA OF ONE TANK (FOR TANK NO. 22)	= 15.9 m²	=	2.25² x pi
DEPTH OF BUNDWALL	= 1.75 m	=	Y - Z
VOLUME OF ONE TANK - Ⓐ	= 19.9 m³	=	15.9 m² x (Y - X)
VOLUME OF BUND - Ⓑ	= 96.6 m³	=	55.2 m² x (Y - Z)
REQUIRED CAPACITY	= 115.5 m³	=	105 m³ x 110%
PROVIDED BUND STORAGE CAPACITY - Ⓐ + Ⓑ	= 116.5 m³	=	19.9 m³ + 96.6 m³
REQUIRED SATISFIED	= 116.5 m³	>	115.5 m³

Zone 2 - Site Coverage & G.F.A. Calculations

Site Coverage and G.F.A. of Tanks:

(Tank Nos. 1-12, 15-19, 21, 22 & 24) = 1092.75m²

Site Coverage and G.F.A. of Staircase at Tank Farms:

2A = 1.10x(2.00+8.65) x 3 + 1.10x(2.00+4.45+4.10) + 1.10x(3.10+4.45+4.10)	=	59.57m²
2B = 1.10x8.20 + 1.10x(6.20+2.85)	=	18.04m²
2C = 1.10x5.85	=	6.44m²
2D = 1.10x5.35	=	5.89m²
2E = 1.10x2.60	=	2.86m²
Total	=	92.80m²

CONCRETE BUNDWALL CONTAINMENT VOLUME ENCLOSING - ZONE 2E

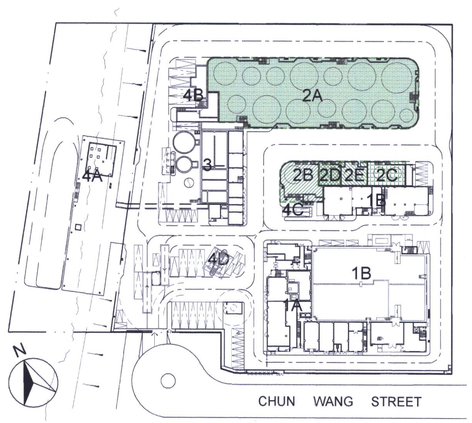
AREA ENCLOSED BY BUNDWALL - 2 TANKS	= 87.2 m²	=	BY CADD
AREA OF 2 TANKS	= 15.6 m²	=	REFER TANK LIST
AREA ENCLOSED BY BUNDWALL - 2 TANKS	= 71.6 m²	=	87.2m² - 15.6m²
AREA OF ONE TANK (FOR TANK NO. 11)	= 9.6 m²	=	1.75² x pi
HEIGHT OF FOUNDATION	= 0.5 m	=	X - Z
DEPTH OF BUNDWALL	= 0.95 m	=	Y - Z
VOLUME OF ONE TANK - Ⓐ	= 4.3 m³	=	9.6 m² x (Y - X)
VOLUME OF BUND - Ⓑ	= 68.0 m³	=	71.6 m² x (Y - Z)
REQUIRED CAPACITY	= 59.4 m³	=	54 m³ x 110%
PROVIDED BUND STORAGE CAPACITY - Ⓐ + Ⓑ	= 72.3 m³	=	4.3m³ + 68.0m³
REQUIRED SATISFIED	= 72.3 m³	>	59.4 m³

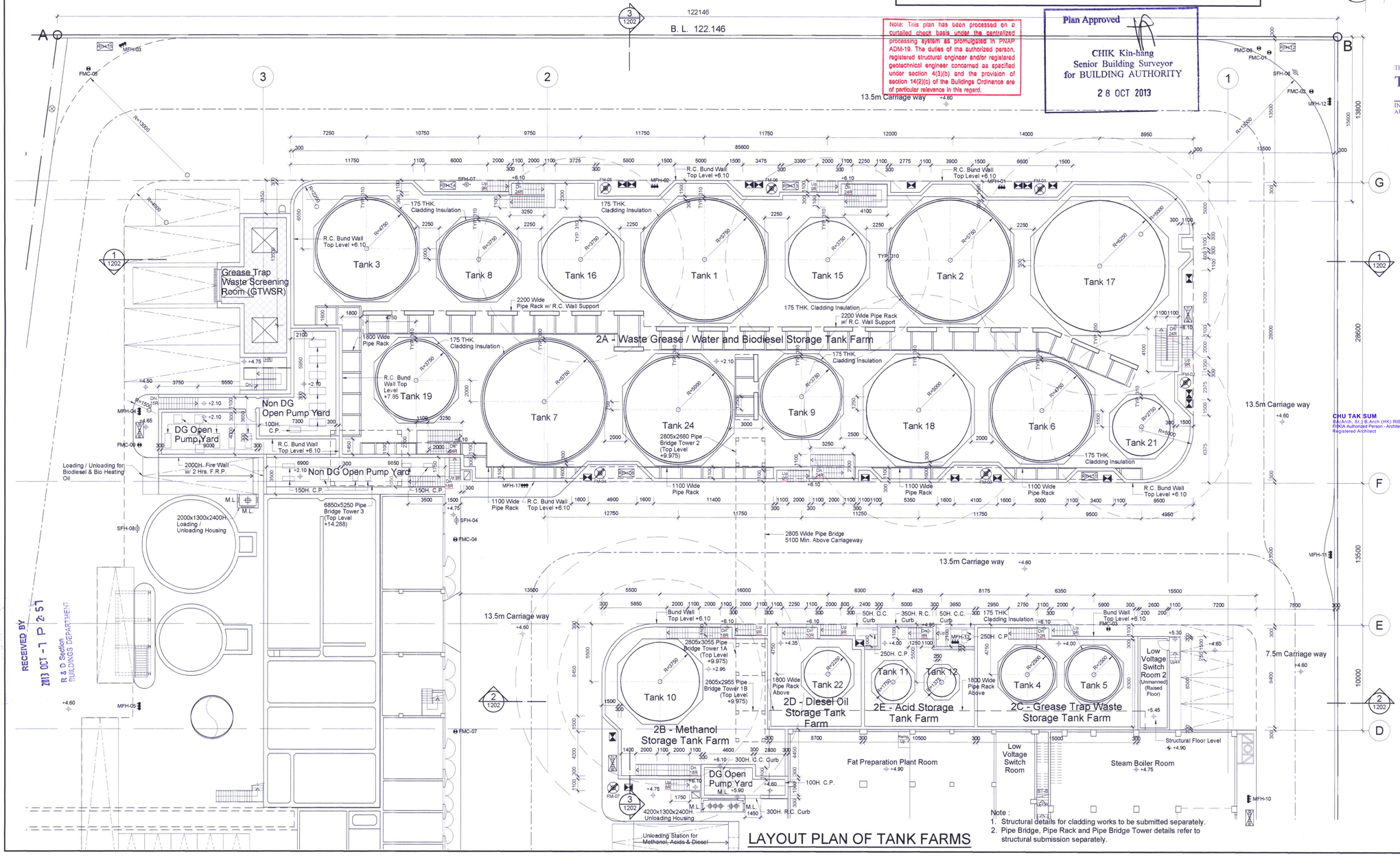
Tank List

Number	Product Name	Height (m)	Diameter (m)	Capacity / Volume(m³)	Tank Area(m²)
	2A - Waste Grease / Water Storage Tank Farm				
1	Used Cooking Oil (UCO),Crude	14.50	11.50	1541	103.87
2	Palm Fatty Acid Distillate (PFAD)	14.50	11.50	1541	103.87
3	Palm Fatty Acid Distillate (PFAD)	14.50	9.50	1048	70.88
6	Used Cooking Oil (UCO), Clean	14.50	9.50	1048	70.88
7	Grease Trap Waste (GTW),Crude Separation	8.20	11.50	920	103.87
8	Tallow (Fat / Oil of Animal Origin), Crude	11.50	7.50	518	44.18
9	Tallow (Fat / Oil of Animal Origin), Clean	11.50	7.50	518	44.18
19	Glycerine	11.50	7.50	518	44.18
24	Dewatered Grease Trap Waste (Lipofit)	15.50	10.00	1240	78.54
	2A - Biodiesel Storage Tank Farm				
15	BioDiesel	11.50	7.50	518	44.18
16	BioDiesel	11.50	7.50	518	44.18
17	BioDiesel	20.50	12.50	2561	122.72
18	BioDiesel	15.50	10.00	1240	78.54
21	Bioheating Oil (BHO)	8.50	5.50	2x103	23.76
	2B - Methanol Storage Tank Farm				
10	Methanol	11.50	7.50	518	44.18
	2C - Grease Trap Waste Storage Tank Farm				
4	Dewatered Grease Trap Waste (Lipofit)	8.00	5.00	160	19.64
5	Dewatered Grease Trap Waste (Lipofit)	8.00	5.00	160	19.64
	2D - Diesel Oil Storage Tank Farm				
22	Diesel Oil	6.50	4.50	105	15.90
	2E - Acid Storage Tank Farm				
11	Sulfuric Acid	5.50	3.50	54	9.62
12	Phosphoric Acid	4.50	2.75	26	5.94
				Total =	1092.75
				(For Site Coverage and G.F.A.)	

Note :
For F.S installation Legend refer to drawing no. P/3001/G/1001

B.D. REF. NO. 2/9030/08 (P)
F.S.D. REF. NO. FP 8/28984





Note :
1. Structural details for cladding works to be submitted separately.
2. Pipe Bridge, Pipe Rack and Pipe Bridge Tower details refer to structural submission separately.

Note: This plan has been processed on a curtailed check basis under the centralized processing system as promulgated in PNAP ADM-19. The duties of the authorized person, registered structural engineer and/or registered geotechnical engineer concerned as specified under section 4(3)(b) and the provision of section 14(2)(c) of the Buildings Ordinance are of particular relevance in this regard.

Plan Approved
CHIK Kin-hang
Senior Building Surveyor
for BUILDING AUTHORITY
28 OCT 2013

RECEIVED BY
2013 OCT -7 P 2:57
R & D Section
BUILDINGS DEPARTMENT

ZONING INDEX

ZONE 2 - TANK FARMS

1 : 1250

THE WORKS SHOWN ON THESE PLANS ARE

TYPE II WORKS

BUILDING

IN RESPECT OF WHICH THE BUILDING AUTHORITY'S CONSENT IS APPLIED FOR

- 2A - Waste Grease / Water Storage and Biodiesel Storage Tank Farm
- 2B - Methanol Storage Tank Farm
- 2C - Grease Trap Waste Storage Tank Farm
- 2D - Diesel Oil Storage Tank Farm
- 2E - Acid Storage Tank House

10	7 Oct. 2013	Identical to F.S.D. Final Accepted Plan and OP Inspection Issue	LCH	PCM	CTS
9	31 May 2013	Final Amendment	LCH	PCM	CTS
8	15 Jan. 2013	9th Amendment Issue	LCH	PCM	CTS
7	06 Jul. 2012	8th Amendment Issue	LCH	PCM	CTS
6	19 Dec. 2011	7th Amendment Issue	LCH	PCM	CTS
5	19 Jan. 2011	6th Amendment Issue	LCH	PCM	CTS
4	31 Aug. 2010	Amendment Resubmission	LCH	PCM	CTS
3	14 May 2010	General Amended	LCH	PCM	CTS
2	17 July 2009	Bund Wall Amended	LCH	PCM	CTS
1	20 Feb. 2009	B.D. Amendment	LCH	PCM	CTS
0	28 Oct. 2008	B.D. Submission	LCH	PCM	CTS

Rev.	Revision Date	Purpose of revision	Drawn	Checked	Approved

Client

ASB BIODIESEL (HONG KONG) LIMITED
Office units 2607-2609, 26th Floor, Prosperity Millennia Plaza, 663 King's Road, North Point, Hong Kong
TEL: (852) 3741 1640 FAX: (852) 3741 1661

Civil and Structural Engineer

JACOBS
15th Floor, Cornwall House, Taikoo Place, 979 King's Road, Quarry Bay, Hong Kong
Tel: 852 2880 9788 Fax: 852 2565 5561
www.jacobschina.com.hk

Architect and Authorized Person

T.S. CHU ARCHITECTS LTD.
22/F., Asia Harvest Commercial Centre, 324 Shaukeiwan Road, Hong Kong
Tel.: 2312 2312 Fax.: 2723 3070 E-Mail: tsarchitect@tsca.com.hk

CHU TAK SUM
BA(Arch., St.) B.Arch (HK) RIBA FHKIA Authorized Person - Architect Registered Architect

Building Services Engineer

CSA (M&E) Limited
Consulting Engineers
24/F Beverly House, 93-107 Lockhart Road, Wanchai, Hong Kong
TEL: (852) 2838 8438 FAX: (852) 2834 7025

Biodiesel Processing Designer

BDI BIODIESEL INTERNATIONAL
Parkring 18, 8074 Grambach/Graz, Austria
www.bdi-biodiesel.com

Waste Water Treatment Designer

PAQUES
No. 36 JuCheng Innovation Park, Lane 3999 XiuPu Road, Kangqiao Pudong, Shanghai, China 201319
TEL: (86) 21-3825 6088 FAX: (86) 21-3825 6066

Main Contractor

CHINA HARBOUR ENGINEERING CO. LTD.
19/F., China Harbour Building, 370-374 King's Road, North Point, Hong Kong

Project

Proposed Biodiesel Plant at
T.K.O.T. Lot No. 39 S.Q ss.1, ss.2 and Ext. thereto
Chun Wang Street, Tseung Kwan O Ind. Estate, N.T.

Drawing title

ZONE 2 - TANK FARMS
LAYOUT PLAN, TANK LIST AND
BUND AREA CALCULATIONS

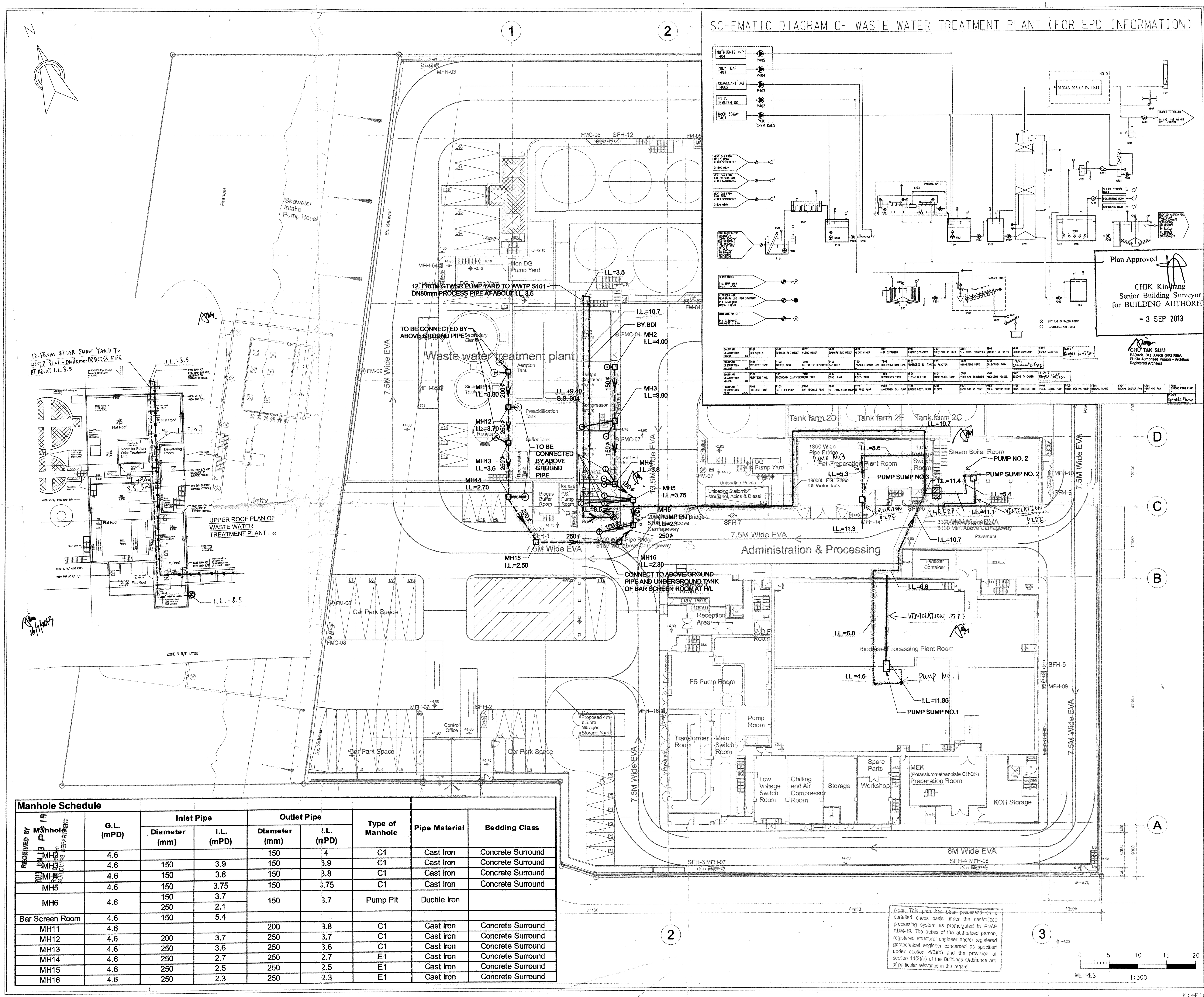
Drawing status: BD SUBMISSION — RECORD PLAN

Scale	1:200@A1, 1:300@A2, 1:400@A3 — Do not scale
Job no.	-
Client no.	-
Drawing number	P/3001/2/1201
Rev	10

B. D.

Appendix D

Foul Drainage System



Manhole Schedule

Manhole	G.L. (mPD)	Inlet Pipe Diameter (mm)	Inlet Pipe I.L. (mPD)	Outlet Pipe Diameter (mm)	Outlet Pipe I.L. (mPD)	Type of Manhole	Pipe Material	Bedding Class
MH2	4.6			150	4	C1	Cast Iron	Concrete Surround
MH3	4.6	150	3.9	150	3.9	C1	Cast Iron	Concrete Surround
MH4	4.6	150	3.8	150	3.8	C1	Cast Iron	Concrete Surround
MH5	4.6	150	3.75	150	3.75	C1	Cast Iron	Concrete Surround
MH6	4.6	150	3.7	150	3.7	Pump Pit	Ductile Iron	
		250	2.1					
Bar Screen Room	4.6	150	5.4					
MH11	4.6			200	3.8	C1	Cast Iron	Concrete Surround
MH12	4.6	200	3.7	250	3.7	C1	Cast Iron	Concrete Surround
MH13	4.6	250	3.6	250	3.6	C1	Cast Iron	Concrete Surround
MH14	4.6	250	2.7	250	2.7	E1	Cast Iron	Concrete Surround
MH15	4.6	250	2.5	250	2.5	E1	Cast Iron	Concrete Surround
MH16	4.6	250	2.3	250	2.3	E1	Cast Iron	Concrete Surround

B.D. REF NO.
F.S.D. REF NO.

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED.
2. ALL LEVEL ARE IN METER PRINCIPLE DATUM (mPD).
3. PUMP WITH CAPACITY OF 10L/S SHALL BE PROVIDED.
4. VENTILATION PIPE TERMINATED AT 2500mm AFFL.

LEGEND:

- PROPOSED SEWERAGE MANHOLE
- PROPOSED 150 DIA. UNDERGROUND D.I. PIPE
- PROPOSED 150 DIA. UNDERGROUND CAST IRON PIPE
- PROPOSED 100 DIA. UNDERGROUND CAST IRON PIPE
- DN65, STAINLESS STEEL 1.4301
- DN32, STAINLESS STEEL 1.4301
- DN40, STAINLESS STEEL 1.4301
- DN100, STAINLESS STEEL 1.4301
- DN80, STAINLESS STEEL 304
- PROPOSED PUMP
- PROPOSED DOWNPIPE
- PROPOSED OTG
- PIPE BREAK POINT

COLOUR CODE:
PURPLE - INDUSTRIAL WASTE
VENTILATION PIPE

Rev.	Description of Revision	Date	Ckd.
A	GENERAL REVISION	JAN 13	BL
B	GENERAL REVISION	JUN 13	BL

THE WORKS SHOWN ON THESE PLANS ARE TYPE II WORK (Drainage (Ind. & Ext. Sewage)) IN RESPECT OF WHICH THE BUILDING AUTHORITY'S CONSENT IS APPLIED FOR

Client
ASB BIODIESEL (HONG KONG) LIMITED

Civil and Structural Engineer
JACOBS

Architect and Authorized Person
T.S. CHU ARCHITECTS LTD.

Building Services Engineer
CSA (M&E) Limited Consulting Engineers

Biodiesel Processing Designer
BDI BIODIESEL INTERNATIONAL

Waste Water Treatment Designer
Natural Solutions PAQUES

Contractor
CHINA HARBOUR ENGINEERING CO. LTD

Drainage Works Designer
MANNINGS (Asia) Consultants Limited

Project
PROPOSED BIODIESEL PLANT AT T.K.O.T. LOT No. 39 S.Q ss.1, ss.2 & EXT. THERETO CHUN WANG STREET, TSEUNG KWAN O IND. ESTATE, KLN.

Title
DRAINAGE LAYOUT PLAN

Drawing No.	Revision
F1005/DR/001 B. D.	B

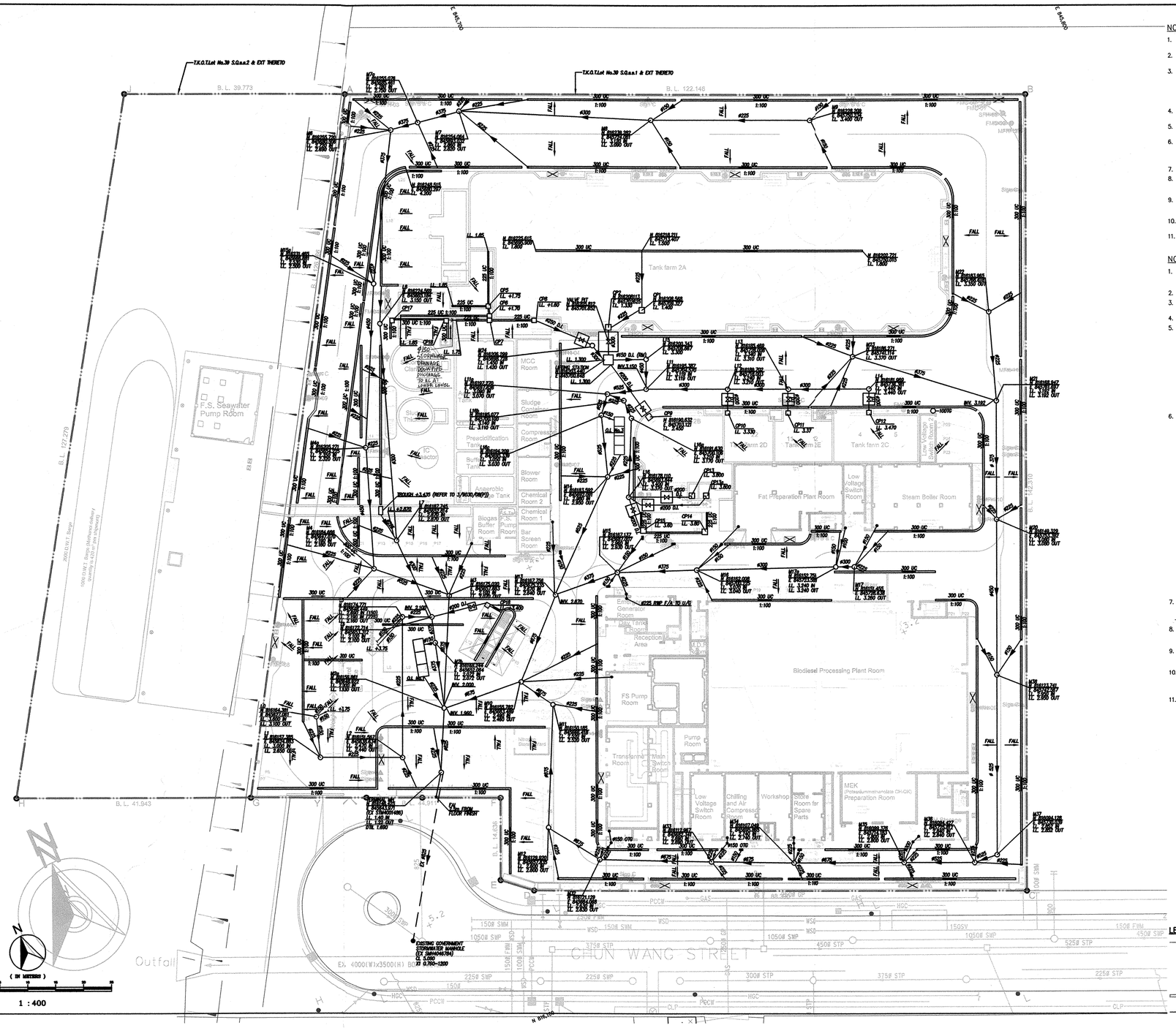
K:\F1005 - Biodiesel Drainage\station\DR-001B.dgn

Appendix E

Storm Water Drainage System

4/9030/08(P) (Pt. II) 1 (5) Set II

B.D. REF. NO.
F.S.D. REF. NO. 4/9030/08 (P)



RECEIVED BY
13 JUN 3 P 3:20
R & D Section
BUILDING DEPARTMENT

L:\ADS\3001 HK Biodiesel TKO\E\Working\Drainage\5th Amendment\D-3001-E-3500.dwg

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE INDICATED. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
2. ALL PRECAST CONCRETE PIPES AND FITTING SHALL COMPLY WITH BS5911 : PART 100.
3. ALL PRECAST CONCRETE PIPES AND FITTINGS SHALL HAVE FLEXIBLE JOINTS OF SPIGOTS AND SOCKET OR REBATED TYPE. THEY SHALL BE DESIGNED TO INCORPORATE AN ELASTOMETRIC RING COMPLYING WITH TYPE D OF BS2494. THE TEST FOR JOINT SHALL COMPLY WITH BS5911 : PART 100 & GENERAL SPECIFICATION FOR CIVIL ENGINEERING WORKS.
4. DIRECTION CHANGE OF CONCRETE PIPELINES SHALL BE MADE AT MANHOLE ONLY.
5. MANHOLE COVERS AND FRAMES WITHIN THE CARRIAGEWAY AND PROPOSED FOOTPATH SHALL BE HEAVY DUTY TYPE UNLESS OTHERWISE INDICATED.
6. ALL DI PIPES AND FITTING SHALL COMPLY WITH BS EN545 & GENERAL SPECIFICATION FOR CIVIL ENGINEERING WORKS. PIPES AND FITTINGS SHALL BE LINED INTERNALLY WITH CEMENT MORTAR AND SHALL BE COATED EXTERNALLY WITH BITUMINOUS COATING.
7. CONCRETE PIPE CLASS (L, M & H) SHOULD REFER TO BS 5911 : PART 100.
8. THE JUNCTION OF A SINGLE BRANCH DRAIN WITH ANOTHER DRAIN AT AN ANGLE OF NOT MORE THAT 45° IN THE DIRECTION OF FLOW MAY BE MADE BY MEANS OF A PURPOSE-MADE PRECAST Y-JUNCTION.
9. GROUND SURFACE PAVING SHALL BE LAID TO FALL AT A GRADIENT OF NOT LESS THAN 1 IN 80 TO A GULLY TRAP OR DRAINAGE CHANNELS CONNECTED TO A SURFACE WATER DRAIN.
10. ENLARGED PLANS AND DETAILS FOR OIL INTERCEPTORS SHOULD REFER TO DRAWING No.D/3001/E/3504.
11. ENLARGED PLANS AND DETAILS FOR LIFTING STATION SHOULD REFER TO DRAWING No.D/3001/E/3504.

NOTES FOR MANHOLE :

1. CONCRETE GRADE :
   40D/20 FOR STRUCTURAL CONCRETE.
   10/20 FOR BLINDING & MASS CONCRETE.
2. ALL GALVANIZED STEEL ITEMS TO BE HOT-DIPPED.
3. MINIMUM COVER TO OUTERMOST REINFORCEMENT TO BE 40mm UNLESS OTHERWISE STATED.
4. RADII AND BENDS FOR REINFORCEMENT TO BE IN ACCORDANCE WITH BS4466.
5. BAR REFERENCING :
   EXAMPLE : 16T32-01-200 ABBRE
   NUMBER OF BARS 16
   TYPE OF STEEL T (REFER TO NOTES 8 & 9)
   DIAMETER OF BARS 32mm.
   MARK NO. (IF REQUIRED) 01
   PITCH OF BARS (IF APPLICABLE) 200mm
   ABBREVIATIONS MAY BE ADDED TO THE STRING:
   B BARS IN BOTTOM OF SLAB
   B1 FIRST LAYER OF BOTTOM REINFORCEMENT
   B2 SECOND LAYER OF BOTTOM REINFORCEMENT (ABOVE B1 LAYER)
   T BARS IN TOP OF SLAB
   T1 FIRST LAYER OF TOP REINFORCEMENT
   T2 SECOND LAYER OF TOP REINFORCEMENT (BELOW T1 LAYER)
6. UNLESS OTHERWISE STATED, ANCHORAGE BOND LENGTHS AND LAP LENGTHS OF REINFORCEMENT SHALL AS BE FOLLOWS:-

CONCRETE GRADE	ANCHORAGE BOND LENGTHS & LAP LENGTHS (MULTIPLES OF BAR DIAMETER)	
	MILD STEEL	HIGH YIELD STEEL
40D/20	31	32

NOTES:-
(A) i) TENSION LAP LENGTHS (DENOTED BY T.L.L.) SHALL BE AT LEAST TO THE ANCHORAGE BOND LENGTH.
ii) WHERE A LAP OCCURS AT THE TOP OF A SECTION AS CAST AND THE MINIMUM COVER IS LESS THAN TWICE THE SIZE OF THE LAPPED REINFORCEMENT, THE REQUIRED LAP LENGTH SHOULD BE MULTIPLIED BY A FACTOR OF 1.4.
iii) WHERE A LAP OCCURS AT THE CORNER OF A SECTION AND THE MINIMUM COVER TO EITHER FACE IS LESS THAN TWICE THE SIZE OF THE LAPPED REINFORCEMENT OR WHERE THE DISTANCE BETWEEN ADJACENT LAPS IS LESS THAN 75mm OR SIX TIMES THE SIZE OF THE LAPPED REINFORCEMENT, WHICHEVER IS THE GREATER, THE REQUIRED LAP LENGTH SHOULD BE MULTIPLIED BY A FACTOR OF 1.4.
iv) IN CASES WHERE BOTH CONDITIONS (ii) AND (iii) APPLY, THE REQUIRED LAP LENGTH SHOULD BE MULTIPLIED BY A FACTOR OF 2.0.
(B) i) NOMINAL LAP FOR DISTRIBUTION BARS SHALL BE 300.
(C) i) LAP LENGTH FOR UNEQUAL SIZE BARS SHALL BE BASED UPON THE SMALLER BAR.

7. ALL CONCRETE WORKS SHALL COMPLY WITH THE CODE OF PRACTICE FOR STRUCTURAL USE OF CONCRETE 2004. ~~RECOMMENDATIONS OF BRITISH STANDARD CODE OF PRACTICE BS3810 THE STRUCTURAL USE OF CONCRETE 1997.~~ 2nd Ed.
8. ALL REINFORCEMENT DENOTED BY MARK R INDICATED PLAIN ROUND BARS TO COMPLY WITH CS2:1995 WITH A CHARACTERISTIC STRENGTH OF 250N/mm².
9. ALL REINFORCEMENT DENOTED BY MARK T INDICATES HOT ROLLED DEFORMED BARS TO COMPLY WITH CS2:1995 WITH A CHARACTERISTIC STRENGTH OF 460N/mm².
10. UNLESS OTHERWISE STATED, ALL CONCRETE SHALL BE DESIGN MIX 40D/20 CONCRETE AND THE GRADE DESIGNATIONS GIVEN ARE THE CHARACTERISTIC CUBE STRENGTH AT 28 DAYS AND THE MAXIMUM AGGREGATE SIZE.
11. THE REACTIVE ALKALI OF CONCRETE EXPRESSED AS THE EQUIVALENT SODIUM OXIDE PER CUBIC METER OF CONCRETE SHOULD NOT EXCEED 3.0 KG WHEN DETERMINED IN ACCORDANCE WITH PNAP 180.

12. MINIMUM GRADIENT FOR PIPES

PIPE DIAMETERS (mm)	GRADIENT
225	1 IN 100
250	1 IN 100
300	1 IN 150
375	1 IN 180
450	1 IN 216
600	1 IN 324
675	1 IN 324
825	1 IN 400

13. DESIGN OF OIL INTERCEPTOR SHALL COMPLY WITH ENVIRONMENTAL PROTECTION DEPARTMENT'S STANDARD.
14. ALL GATE VALVES SHALL BE "CLOSED" AT ALL TIME IN SPITE OF DURING A STORM EVENT. ALL SURFACE RUN-OFF SHALL BE RETAINED INSIDE THE BUNDS. OPERATOR WILL INSPECT THE RETAINED SURFACE RUN-OFF QUALITY PRIOR TO "OPEN" THE VALVES. SUCH OPERATION PROCEDURES SHALL COMPLY WITH THE APPROVED ENVIRONMENTAL IMPACT ASSESSMENT REPORT (REGISTER No. AEIAR-131/2009).
15. THE UPSTREAM INVERT LEVEL OF ALL U-CHANNEL IS 4.3mPD UNLESS OTHERWISE STATED.
16. ALL DRAINAGE U-CHANNEL SHALL BE 300mm WIDTH WITH FALL 1:100 UNLESS OTHERWISE STATED.
17. ALL BRANCH PIPES CONNECTED BETWEEN U-CHANNEL AND MANHOLE SHALL BE 225 DIAMETER CAST IRON PIPE WHICH COMPLY WITH BS437, WITH FLEXIBLE JOINTS TO BS EN887.
18. ALL GULLY PIPE SHALL BE 150mm DIAMETER CAST IRON PIPE WHICH COMPLY WITH BS437, WITH FLEXIBLE JOINTS TO BS EN887.

Plan Approved
CHIK Kin-hang
Senior Building Surveyor
for BUILDING AUTHORITY
- 3 SEP 2013

Note: This plan has been processed on a curtailed check basis under the centralized processing system as promulgated in PNAP ADM-19. The duties of the authorized person, registered structural engineer and/or registered geotechnical engineer concerned as specified under section 4(3)(b) and the provision of section 14(2)(c) of the Buildings Ordinance are of particular relevance in this regard.

LEGEND :

- SITE BOUNDARY
- CATCH PIT
- GULLY (STANDARD HIGHWAY'S DEPARTMENT)
- DRAINAGE MANHOLE
- 300 UC — U-CHANNEL (WITH SIZE AS INDICATED)
- ø300 — STORMWATER DRAINAGE PIPE (WITH DIAMETER AS INDICATED)
- +4.60 — PROPOSED FINISH GROUND LEVEL
- ø150(RM) — RISING MAIN (PN16)
- OIL INTERCEPTOR (WITH 3 COMPARTMENT)
- GATE VALVE PIT

"Statement II : The works shown on these plans are Type II works (External Drainage) in respect of which consent is applied for the purpose of Fast Track consent application under regulation 33 of the Building (Administration) Regulations."

Rev	Revision Date	Purpose of revision	Drawn	Checked	Approved
5	7 JUN 2013	FINAL AMENDMENT TO BD	CCK	CKY	CTS
4	28 JAN 2013	4TH AMENDMENT TO BD	CCK	CKY	CTS
3	27 JUL 2012	3RD AMENDMENT TO BD	-	-	-
2	31 MAR 2011	2ND AMENDMENT TO BD	-	-	-
1	29 OCT 2010	1ST AMENDMENT TO BD	-	-	-
0A	17 FEB 2009	AMENDED TO BD APPROVAL	-	-	-
0	21 JUL 2009	1ST SUBMISSION	-	-	-

Client
ASB BIODIESEL (HONG KONG) LIMITED

Civil and Structural Engineer
JACOBS
15th Floor, Cornwall House, Taikoo Place, 979 King's Road, Quarry Bay, Hong Kong
Tel: 852 2880 9788 Fax: 852 2565 5561
www.jacobschina.com.hk

Architect and Authorized Person
T.S. CHU ARCHITECTS LTD.
22/F., Asia Harvest Commercial Centre, 324 Sheuikwan Road, Hong Kong
Tel.: 2312 2312 Fax.: 2723 3070 E-Mail: tscarchitect@biscali.com.hk
CHU TAK SUM
BA(Arch. St.) B.Arch (HK) RIBA
R100A Authorized Person - Architect
Registered Architect

Building Services Engineer
CSA (M&E) Limited
Consulting Engineers
24/F Beverly House, 93-107 Lockhart Road, Wanchai, Hong Kong
TEL: (852) 2838 8438 FAX: (852) 2834 7025

Biodiesel Processing Designer
BDI BIODIESEL INTERNATIONAL

Waste Water Treatment Designer
Natural Solutions PAQUES

Project
Proposed Biodiesel Plant at
T.K.O.T. Lot No. 39 S.Q ss.1, ss.2 and Ext. thereto
Chun Wang Street, Tseung Kwan O Ind. Estate, Kln.

Drawing title
STORM WATER DRAINAGE LAYOUT PLAN

Drawing status
BD SUBMISSION

Scale	AS SHOWN	Do not scale
Job no.		
Client no.		

Drawing number
D/3001/E/3500 B.D.
Rev 5

Appendix F

Trouble Shooting for Anaerobic Treatment

Trouble Shooting for Anaerobic Treatment

Item	Problem	Result	Action
1	COD Overloading (More than design limit 6000kgCOD/d to IC reactor)	***Short term:*** • Volatile Fatty Acid (VFA) cannot be biodegraded by methanogenic bacteria. • When more VFA accumulated in IC reactor, pH drops. If VFA is more than **10**meq/l and/or pH lower than **6.5** which both harmful to methanogenic bacteria. • Gas production decrease, high COD in the IC effluent; ***Long term:*** • Granular sludge washes out.	• Find out the reason of overloading: High COD concentration in influent or low COD removal in pre-treatment, etc. • Temporarily increase the pH by dosing sodium hydroxide to recirculation tank.
2	pH out of range - influent	• If the influent pH is too high or too low, feed pump will stop automatically. • If influent pH is out of range, slow down the performance of anaerobic system.	• Check the chemical dosing pumps. • Calibrate the pH meter. • Reduce COD loading.
3	. High fat/oil concentration in influent	• Granular sludge cannot attach together and so sludge will wash out easily. • The remaining sludge cannot be capable to treat the influent effectively.	• Find out the reason of high fat/oil: High fat/oil concentration in influent or low removal efficiency in pre-treatment (DAF); • Restart the anaerobic system only if the fat/oil concentration is no more than 50mg/l;

Trouble Shooting for Anaerobic Treatment (cont')

Item	Problem	Result	Action
4	Excessive solids in influent	• Reduce the VSS/TSS ratio in sludge bed and so the remaining sludge cannot capable to treat the influent effectively. (VSS=Volatile Suspended Solids) • Sludge washes out;	• Find out the reason of excess solid: High solid concentration in influent or low removal efficiency in pre-treatment (DAF); • Solids in influent (after pre-treatment) shall will control lower than **600**mg/l • In the worst case temporarily stop pump to recirculation tank.
5	Temperature of influent out of range	• Too low temperature (say less than 30°C) or too high temperature (say higher than 40°C) will decrease the sludge activity and the performance of anaerobic system.	• Check temperature control in pre-treatment system; • Once the temperature is over the range, the anaerobic system should be shut down; • In the worst case, hot/cold water should be added temporary;
6.	Sulphide toxicity	• Higher VFA concentration in the effluent; • Low biogas production because methanogenic activities was decreased.	Increase the pH of the influent by adding sodium hydroxide to prevent the toxicity of undissociated H_2S to methanogenic bacteria.

Trouble Shooting for Anaerobic Treatment (cont')

Item	Problem	Result	Action
7.	Too high inorganic content of the granules	Only a small fraction of the sludge is active organic material. The capacity of the sludge (in kg COD/kg TSS) will be lower. The mixing of the sludge bed will be poor and there is a change of scaling of the sludge bed.	Decrease the pH of the influent keeping in mind the possible problems with sulphide toxicity. Remove a part of the heavy sludge from the bottom section of the reactor.
8	Foam/high level alarm	Foam/high level alarm (on the computer). If this alarm is active it might indicate that the downer is clogged and the recirculation water may flow into the gas line. Visible foam in the gas/water separator on top of the reactor	The pump to the reactor should be stopped automatic. To unclog the downer it must be flushed with nitrogen. By opening the valve on top of the reactor the sprinkler is started and the foam will be destroyed.

Appendix G

Trouble Shooting for Aerobic Treatment

Trouble Shooting for Aerobic Treatment

Item	Problem(s)	Possible Cause(s)	Corrective Action(s)
1	Boiling action/violent turbulence is observed on the water surface of the aeration tank.	Failure of dissolved oxygen (D.O.) sensor caused over-aeration resulting in high D.O. and/or floc shearing.	Check the D.O. sensor. Replace if necessary. Reduce the air flow rate and maintain the D.O. level at 2mg/L.
2	Uneven water aeration pattern is observed.	(I) The diffuser(s) was/were partially plugged; (II) The diffuser(s) was/were damaged.	(I) Increase the airflow vigorously to clear the sludge. If it does not work, isolate and clear the aeration tank to clean or replace the diffuser(s). (II) Repair or replace the diffuser(s).
3	Sour and/or septic odours is smelled and results in low D.O.	(I) Failure of D.O. sensor; (II) Air leaked from the pipes to the surroundings instead of pumping into the wastewater; (III) The program of the PLC was wrongly set; (IV) Malfunction of the valves of the air pipes resulted that the valves could not be opened pneumatically.	(I) Check and calibrate the sensor. Replace if necessary; (II) Check the pipes, joint connection and valves by listening for air leakage or by soap test flanges to see any bubble caused by air leaking. Replace the leaked section of the pipe if necessary; (III) Resume the default setting until the aerobic process approaches normal; (IV) Check the function of valves. Repair or replace if necessary.

Trouble Shooting for Aerobic Treatment (cont')

Item	Problem(s)	Possible Cause(s)	Corrective Action(s)
4	Extra air flow rates are used but have no apparent change in organic loading and it is difficult to maintain adequate D.O. level.	(I) Air leaked from the pipe(s) to the surroundings; (II) Persistent high organic loadings (BOD, COD, Suspended matter, Oil & Grease) from the upstream anaerobic process depleted the oxygen level rapidly.	(I) Check the pipes, joint connection and valves by listening for air leakage or by soap test flanges to see any bubble caused by air leaking. Repair or replace the pipes if necessary. (IIa) If the loadings are greater than 20%, add chemical e.g. ferric chloride ($FeCl_3$) to precipitate the organic matter and increase the rate of sludge wasting. (IIb) Increase the MLSS in the aeration tank by transferring the activated sludge from other transfer station.
5	Blower does not work	(I) The temperature of the motor was too high that the protection circuit was tripped; (II) Fuse was blown; (III) The power supply to the blower was failed that the main switch was tripped. (IV) The belt driving the blower was broken.	(I) Push reset button. (II) Replace the fuse. (III) Request the Electrician to check the power supply and rest the main switch. (IV) Replace the belt.
6	Foaming (I) White, thick, billowing or sudsy foam on aeration tank surface.	(I) Excessive sludge wasting caused low mixed liquor suspended solids (MLSS).	(I) Reduce rate of activated sludge wasting by not more than 10% per day until the process approaches normal.

Trouble Shooting for Aerobic Treatment (cont')

Item	Problem(s)	Possible Cause(s)	Corrective Action(s)
6	Foaming (II) Shiny, dark-tan foam on aeration tank surface. (III) Thick, scummy dark-tan foam on aeration tank surface. (IV) Dark-brown, almost blackish sudsy foam on aeration tank surface. Mixed liquor colour is very dark-brown to almost black. Septic or sour odour from aeration tank is smelled.	(II) The sludge wasting was insufficient that the amount of aged sludge retained in the aeration tank. (III) MLSS of aeration tank was too high that was verified by the internal laboratory testing. (IV) Anaerobic conditions occurred in aeration tank.	(II) Increase rate of activated sludge wasting by not more than 10% per day until the process approaches normal. (III) Increase rate of activated sludge wasting by not more than 10% per day until the process approaches normal. (IV) Clear the aeration tank by tankers and restart up the process.
7	Sludge clumps rising to and dispersing on the surface of the final clarifier	Malfunction of scraper of final clarifier resulted that the sludge could retain in the final clarifier for prolonged period and finally led to denitrification that air bubbles were produced and caused the sludge rising.	Check the motor of the scraper. Repair or replace the motor if necessary. Increase sludge wasting rate by not more than 10% per day to reduce or eliminate level of denitrification.

Appendix H

Possible Events of the Grease Trap Waste Treatment and the Wastewater Treatment Processes

Procedures for Possible Events of the Grease Trap Waste Treatment (GTWT) and the Wastewater Treatment (Anaerobic & Aerobic) Processes

Process			Action
GTWT	**Anaerobic**	**Aerobic**	
Normal operation	Normal operation	Process Failure	- Control the volume of the wastewater portion from the GTW to Anaerobic process; - Clear the Aeration Tank by tankers; - Start up the Aerobic process either by: i. Feed a mixture of wastewater from the Anaerobic process and the wastewater portion from the GTW to incubate activated sludge in the Aeration Tank for 1-2 weeks; or ii. Bring in activated sludge from other wastewater treatment facility for immediate start-up.
Normal operation	Process Failure	Normal operation	- Accept raw GTW until all the GTW storage tanks are full; - Inform the company(ies) of GTW collection tankers that ASB will not receive the GTW; - GTWT process will cease until the Anaerobic process is resumed; - Wastewater portion from the GTWT will be diverted to the Aerobic process directly for treatment before discharging into the final manhole. - Anaerobic process will be initiated by purchasing or sourcing new biomass for the treatment as like the process commissioning of the WWTP.
Process Failure	Normal operation	Normal operation	- Accept raw GTW until all the GTW storage tanks are full; - Inform the company(ies) of GTW collection tankers that ASB will not receive the GTW; - Fix the problems as soon as possible;

Procedures for Possible Events of the GTWT and the Wastewater Treatment (Anaerobic & Aerobic) Processes (cont')

Process			Action
GTWT	**Anaerobic**	**Aerobic**	
Process Failure	Process Failure	Normal operation	- Accept raw GTW until all the GTW storage tanks are full; - Inform the company(ies) of GTW collection tankers that ASB will not receive the GTW; - Fix the problems as soon as possible; - Anaerobic process will be initiated by purchasing or sourcing new biomass for the treatment as like the process commissioning of the WWTP. - Wastewater portion from the GTW will be diverted to the Aerobic process directly for treatment before discharging into the final manhole.
Process Failure	Normal operation	Process Failure	- Accept raw GTW until all the GTW storage tanks are full; - Inform the GTW collection company(ies) of GTW collection tankers that ASB will not receive the GTW; - Clear the Aeration Tank by tankers; - Start up the Aerobic process either by: i. Feed a mixture of wastewater from the Anaerobic process and wastewater portion from the GTW to incubate activated sludge in the Aeration Tank for 1-2 weeks; or ii. Bring in activated sludge from other wastewater treatment facilities for immediate start-up.

Procedures for Possible Events of the GTWT and the Wastewater Treatment (Anaerobic & Aerobic) Processes (cont')

Process			Action
GTWT	**Anaerobic**	**Aerobic**	
Normal operation	Process Failure	Process Failure	- Accept raw GTW until all the GTW storage tanks are full; - Inform the GTW collection company(ies) of GTW collection tankers that ASB will not receive the GTW; - Anaerobic process will be initiated by purchasing or sourcing new biomass for the treatment as like the process commissioning of the WWTP; - Clear the Aeration Tank by tankers; - Start up the Aerobic process either by: i. Feed a mixture of wastewater from the Anaerobic process and wastewater portion from the GTW to incubate activated sludge in the Aeration Tank for 1-2 weeks; or ii. Bring in activated sludge from other wastewater treatment facilities for immediate start-up.
Process Failure	Process Failure	Process Failure	- Accept raw GTW until all the GTW storage tanks are full; - Inform the GTW collection company(ies) of GTW collection tankers that ASB will not receive the GTW; - Fix the problems as soon as possible; - Anaerobic process will be initiated by purchasing or sourcing new biomass for the treatment as like the process commissioning of the WWTP; - Clear the Aeration Tank by tankers; - Start up the Aerobic process either by: i. Feed a mixture of wastewater from the Anaerobic process and wastewater portion from the GTW to incubate activated sludge in the Aeration Tank for 1-2 weeks; or ii. Bring in activated sludge from other wastewater treatment facilities for immediate start-up.