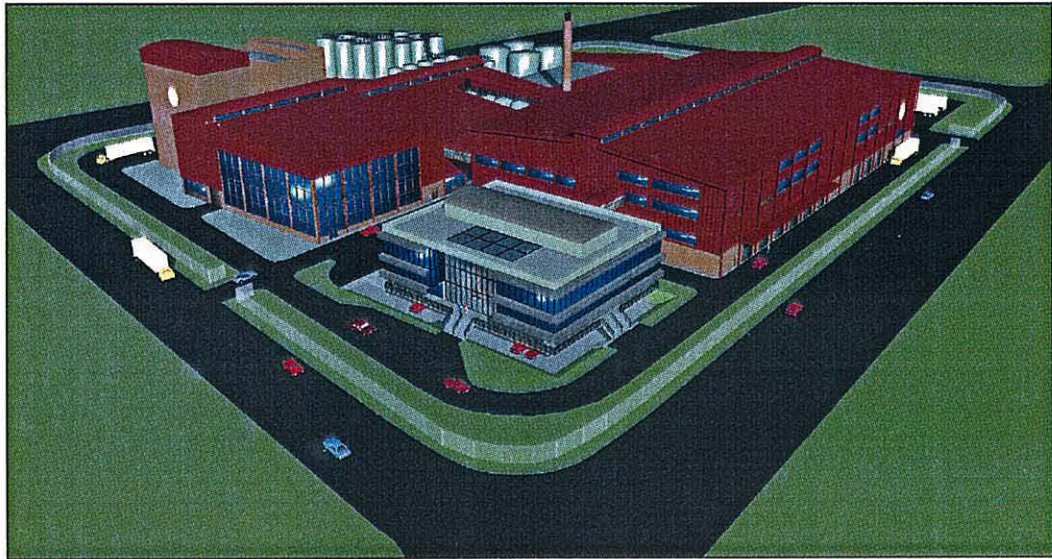


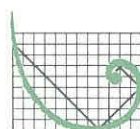
San Miguel Brewery Hong Kong Limited



Environmental Impact Assessment  
of Proposed Brewery at Yuen Long:  
*Environmental Monitoring and Audit  
Manual*

November 1995

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San Miguel Brewery Hong Kong Limited

Environmental Impact Assessment  
of Proposed Brewery at  
Yuen Long: *Environmental  
Monitoring and Audit Manual*

November 1995

Reference C1214\Issue 3

For and on behalf of ERM Hong Kong

Approved by: 

Position: Technical Director

Date: 22 November 1995

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# **1 INTRODUCTION**

## **1.1 BACKGROUND**

San Miguel Brewery Hong Kong Limited (SMHK) propose to relocate and expand its existing facilities at Sham Tseng to a new site at the Yuen Long Industrial Estate. ERM Hong Kong were commissioned by SMHK in August 1994 to undertake an Environmental Impact Assessment (EIA) for the proposed relocation.

The construction work for the new Brewery is scheduled to commence in December 1994 with the plant fully operational by 1 July 1996. As part of the Environmental Impact Assessment (EIA) study, an Environmental Monitoring and Audit Manual (EM&A Manual), which covers all the necessary monitoring and auditing requirements and mitigation measures associated with the construction and operational phases of the project, is required.

## **1.2 OBJECTIVES OF THE EM&A MANUAL**

The objectives of the EM&A Manual for the proposed Brewery include the following:

- to provide a data base against which any short or long term environmental impacts of the project could be determined;
- to provide an early indication should any of the environmental control measures or practices fail to achieve the acceptable standards;
- to monitor the performance of the project and the effectiveness of mitigation measures;
- to verify the environmental impacts predicted in the EIA study;
- to determine project compliance with regulatory requirements, standards and government policies;
- to take remedial action if unexpected problems or unacceptable impacts arise; and
- to provide data to enable an environmental audit.

## **1.3 THE EM&A MANUAL**

This EM&A Manual is designed to provide information, guidance and instruction to site staff charged with environmental responsibilities and those undertaking environmental monitoring work.

The Manual will cover the environmental monitoring and audit (EM&A) requirements for construction and operational phases of the new Brewery. It provides comprehensive details of the water and noise monitoring requirements and mitigation measures proposed in the EIA report. No air monitoring is considered necessary. The Trigger/Action/Target (TAT) levels are defined and the appropriate actions outlined in an action plan. Environmental complaint procedures and reporting procedures are also provided.

#### 1.4

#### *ORGANISATION OF THE EM&A MANUAL*

The remainder of the EM&A Manual is organised as follows:

- *Section 2* details the principle findings of the EIA
- *Section 3* summarises the mitigation measures recommended in the EIA
- *Section 4* presents the proposed project organisation for the Environmental Monitoring and Audit programme.
- *Section 5* details the environmental monitoring requirements
- *Section 6* summarises the proposed environmental complaints procedures
- *Section 7* details the reporting requirements
- *Section 8* gives the environmental audit requirements

## 2.1

## INTRODUCTION

The new San Miguel Brewery (SMB) with an area of around 4 hectares, is to be sited in Section L of Yuen Long Town Lot No 313, inside the Yuen Long Industrial Estate. The site location and its surrounding environment are shown in *Figure 2.1a*.

The new brewery will be designed for an annual target production capacity of 1 million hectolitres (hl) (Phase 1), expandable to 1.5 million hl in the future if so required (Phase 2). *Figure 2.1b* shows the layout of the new brewery. The site is divided into four main areas; namely, the process building, packaging building, administration building and the ancillary buildings.

*Brewing and Packaging* are the two main stages involved in the production of beer. Main raw materials used for the brewing operations are water, malt, rice and hops. The brewing process involves the following major operations:

- wort production and treatment;
- fermentation; and
- beer storage and conditioning.

Bright beer produced is either bottled, canned or kegged.

In general the accompanying EIA has shown that environmental impacts of the proposed Brewery will not be significant and the new technology and design philosophy employed will represent a considerable improvement over current operations at Sham Tseng. This section summarises the impacts and recommended mitigation measures.

## 2.2

## WATER QUALITY

## 2.2.1

*Construction Phase*

The construction of the new brewery is not envisaged to have any water quality impacts provided that proper site management and good housekeeping practices are implemented.

## 2.2.2

*Operational Phase*

The operation of the Brewery will generate large volume of effluent, in the region of 1120 to 1360 m<sup>3</sup> per day (1680 to 2000 m<sup>3</sup> per day for Phase 2). Consultation with the Drainage Services Department (DSD) and the Hong Kong Industrial Estate Corporation confirmed that there is adequate

sewerage infrastructure to accept the effluent load from both Phase 1 and 2 of the new Brewery. However, DSD recommended that buffer tanks should be used to regulate peak flow conditions so as to prevent overloading of the sewerage system. SMHK's on-site biological wastewater treatment plant will be equipped with a buffer tank that will be used for this purpose.

The proposed brewery has been designed to function at a very low water consumption to beer ratio. A water conservation and recycling programme will further reduce overall water consumption.

Effluent from the brewery plant will be treated to well below the required discharge limit, as stipulated in the *Technical Memorandum on Effluents Standards* (TM) at an on-site biological wastewater treatment plant where high levels of suspended solids, Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) are to be treated. Special operational considerations during the operational phase have been recommended including the implementation of a water conservation programme to reduce water consumption and wastewater generation.

A water quality monitoring programme will be required as a check on the performance of the plant, particularly in the early months of operation, and to ensure compliance with the discharge standards.

## 2.3 AIR QUALITY

### 2.3.1 Construction Phase

The impacts arising from the construction activities are not expected to be extensive. The level of activities and size of works area are small in scale. In addition the air sensitive receivers (ASRs) (see *Figure 2.3a*) are screened by topographic features (eg Chu Wong Ling) and structures. The predicted dust levels at these ASRs are much reduced by dilution and screening by structures and terrain. Dust impacts during construction in the surrounding area have been shown to be within acceptable levels.

### 2.3.2 Operational Phase

The impact from various operation activities differ in extent. The major source of aerial emissions is from the boiler chimney. The predicted cumulative NO<sub>2</sub> and SO<sub>2</sub> concentrations at ASRs are within the respective *Air Quality Objectives* when the San Miguel Brewery development is on line and operating at full capacity. San Miguel have received approval to build a stack to a regulation height of 48.5m, since it has been shown that there are minimal impacts to ASRs using a 30m stack, the higher stack built will have even less of an impact to the surrounding ASRs. Biogas produced as a by-product from the on-site biological wastewater treatment plant will be utilised beneficially as a supplementary fuel for the boiler. This will reduce the light diesel oil consumption and the pollutant emissions from the boilers. Minor emissions from the flaring of biogas at the wastewater treatment plant may occur occasionally.



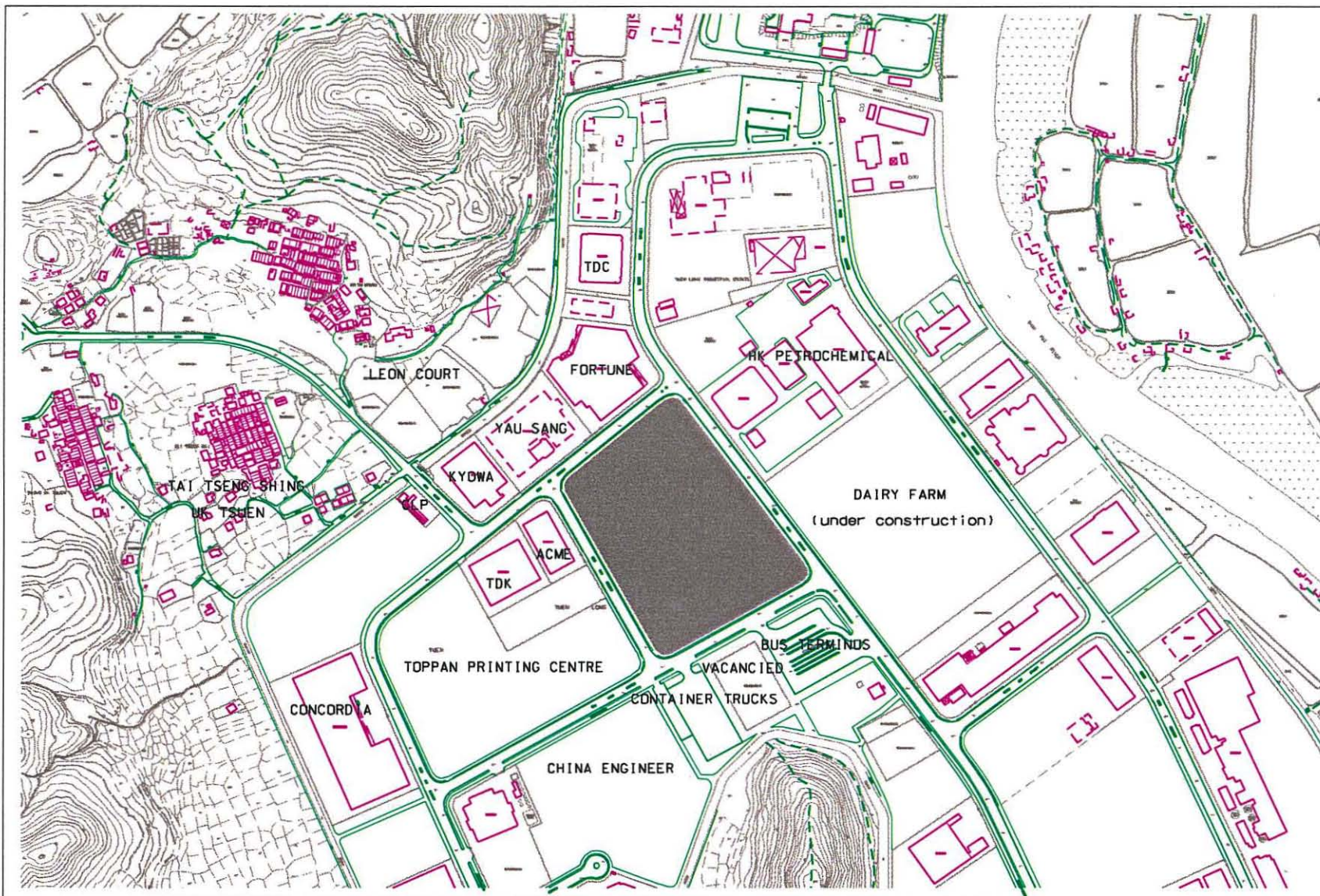


Figure 2.1a Site Location and Surrounding Environment

Date : 4 November 1994

Drawing no.: ERM/HK/GIS/C1214/001

Prepared by : GIS & Mapping, ERM

Base map : 1:1 000 topo. LANDS DEPT.

KEY

 SMB WORK SITE

**ERM Hong Kong**

5, 10-11 th Floor  
Hecny Tower  
9 Chatham Road  
Tsimshatsui, Kowloon  
Hong Kong





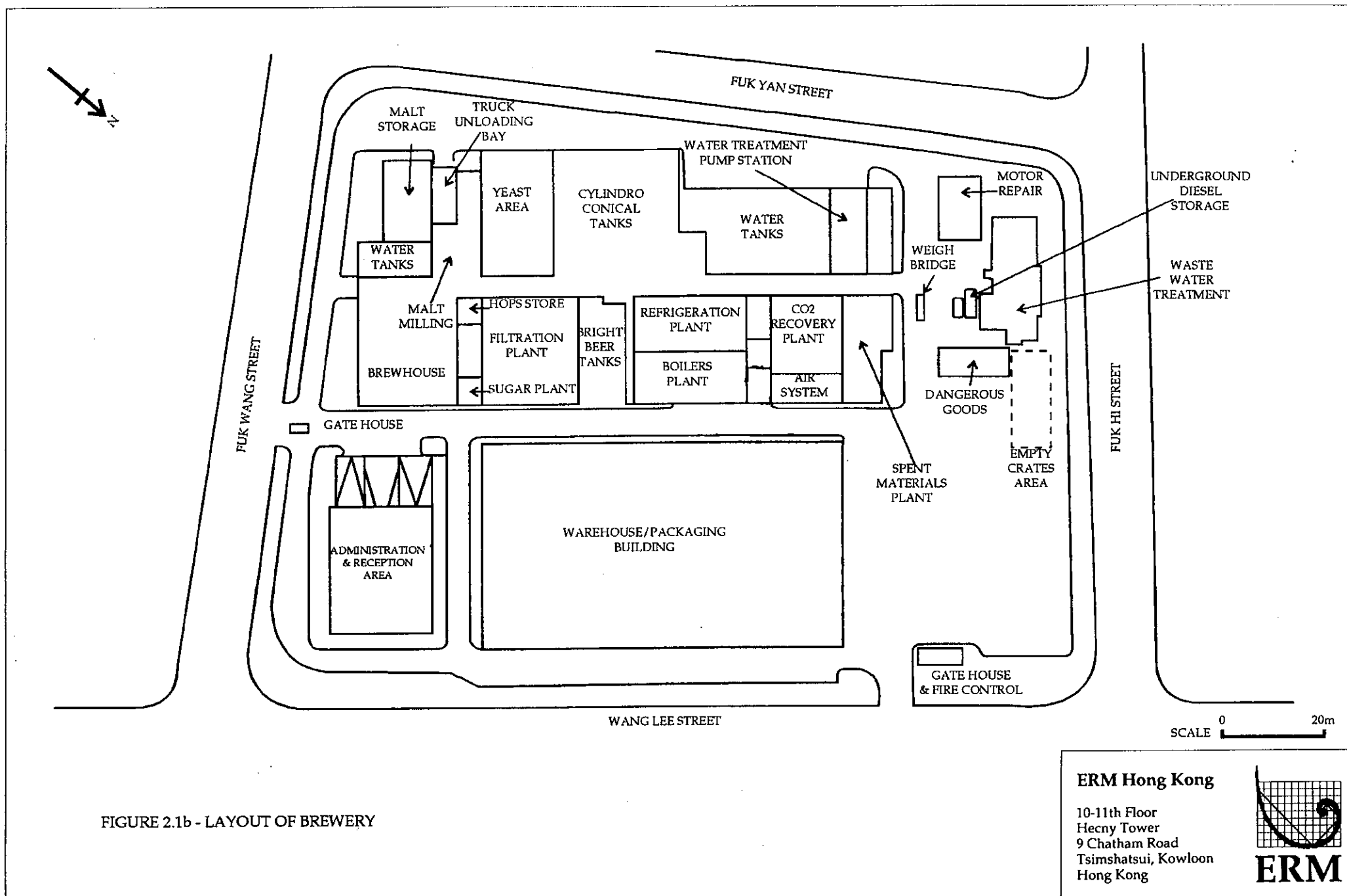


FIGURE 2.1b - LAYOUT OF BREWERY

ERM Hong Kong

10-11th Floor  
Hecny Tower  
9 Chatham Road  
Tsimshatsui, Kowloon  
Hong Kong





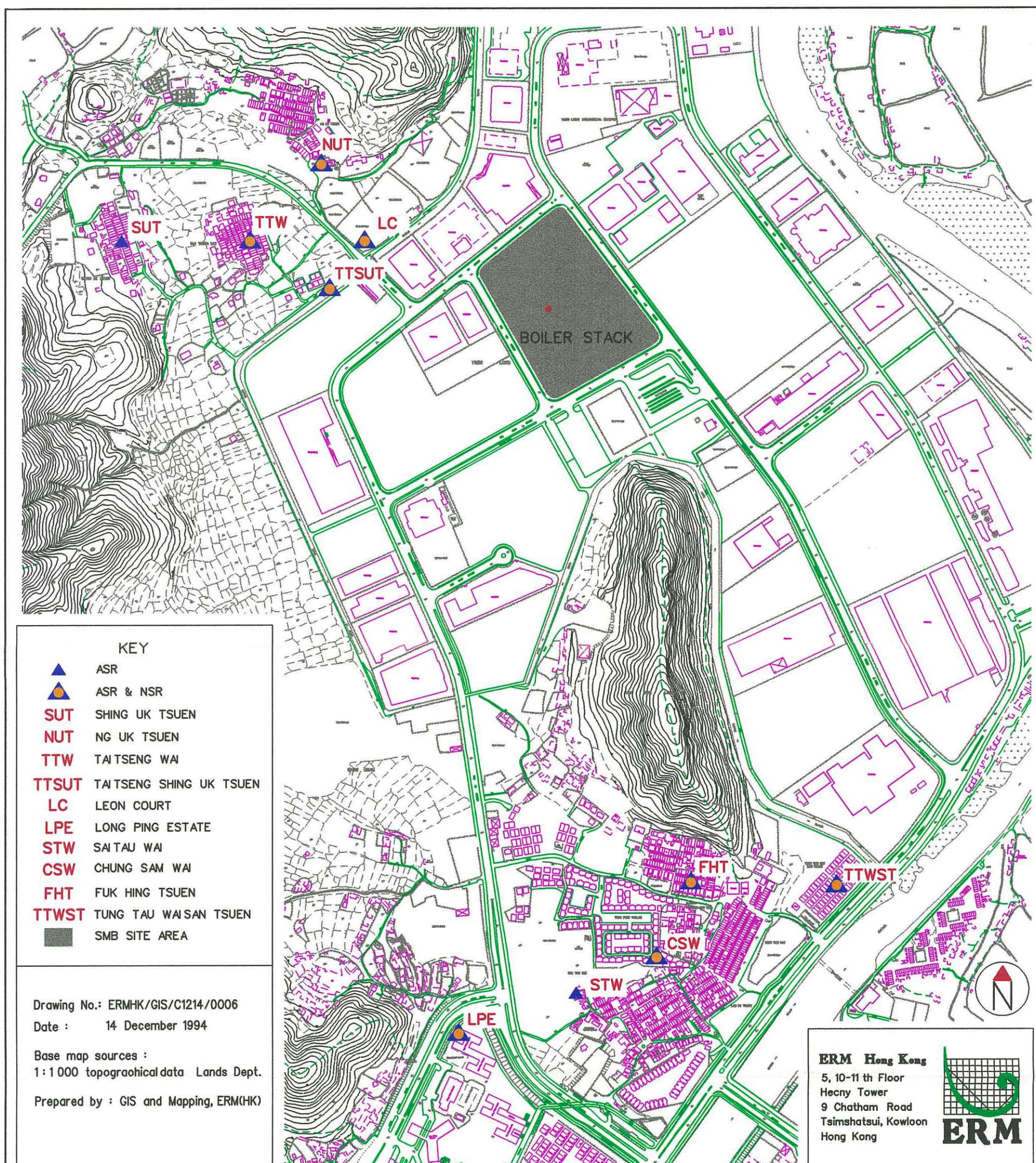


Figure 2.3a Locations of Air and Noise Sensitive Receivers



Odour nuisance has been an environmental concern at the existing Sham Tseng Brewery and has been extensively investigated at the new plant. Odour impact from wastewater treatment is minimized by the selection of an anaerobic treatment method. The impact is further reduced since the equalisation tank, which is the major odour source, will be covered and that the removal of sludge from the wastewater treatment plant will be an enclosed operation.

The expected residual odour sources mainly arise from the spent materials. The predicted odour levels for spent yeast and spent grain disposal are within the EPD's criteria of 5 odour units at ASRs. Odour impacts are not expected to be significant based on this assessment. Residual impacts can be minimised by the proposed good housekeeping practices.

## 2.4 NOISE

### 2.4.1 Construction Phase

The noise assessment has indicated that it is unlikely that daytime construction (0700–1900) activities will be capable of generating significant impacts at nearby noise sensitive receivers (NSRs) (see Figure 2.3a). As a result, no mitigation measures have been recommended for daytime construction activities. If it becomes necessary for SMHK to apply for construction activities to continue into restricted hours, however, exceedances have been predicted and mitigation measures would be necessary for the Contractor to be eligible for a *Construction Noise Permit* (CNP).

Recommended mitigation measures, including reduction in plant teams, use of noise barriers and use of on-site noise management have been shown to reduce these impacts at nearby NSRs. In addition, if construction activities are proposed for restricted hours, noise monitoring should be carried out at nearby NSRs.

### 2.4.2 Operation Phase

The noise assessment has indicated that unmitigated equipment operating within the brewing facility is unlikely to be capable of generating significant impacts at nearby NSRs.

Road traffic will be capable of generating significant impacts at nearby NSRs if allowed to travel exclusively on Fuk Hai Street. In addition, it is probable that equipment operating within the facility will breach the *Noise at Work* regulation limits if left untreated, although it is anticipated that some noisy internal areas will be unoccupied.

As a result, it is recommended that road traffic use Wang Lee Street rather than Fuk Hai Street and equipment within the facility be analysed during the later design stages to specify appropriate mitigation.

It is recommended that all rooms within the facility that are likely to be occupied on a day to day basis should be monitored at commissioning and every 6 months thereafter to determine if machinery is in need of maintenance or additional silencing.

If Wang Lee Street rather than Fuk Hai Street is used for peak hour truck transport, no operational noise monitoring is recommended. However, if Fuk Hai Street is to be employed rather than Wang Lee Street, then monitoring at the nearby NSRs is recommended.

## 2.5

### WASTE MANAGEMENT

Solid wastes will be generated during the construction and operation phases of the facility. Biodegradable and inert fractions of the construction waste should be collected and disposed of separately. Main types of waste generated during daily operation of the facility are waste oil, yeast, spent grain, glass/cans, filter aid and wet sludge from wastewater treatment process etc. Initially these wastes are to be reused and recycled as much as possible, and potential for further improvement will be reviewed on a regular basis. When disposal is unavoidable, transportation, handling and storage procedures should meet strict performance requirements to ensure that all waste is eventually disposed of in an environmentally acceptable manner.

No significant environmental impact is envisaged during both the construction and operation phases providing that proper waste management and good housekeeping practices, as recommended in the EIA are implemented.

## 2.6

### HEALTH AND SAFETY

The assessment has examined all the dangerous chemicals proposed to be stored and used on-site, and have recommended health and safety precautionary measures to be observed when working with the chemicals.

Only liquefied petroleum gas (LPG) is proposed to be stored in quantities that would constitute a notifiable gas installation. An application for construction approval from the *Gas Authority* is required. For the quantities of LPG planned the *Gas Authority* needs to accept that the site complies with the *Coordinating Committee on land use planning and control in the vicinity of Potentially Hazardous Installations' (CCPHI) Risk Guidelines*. In the unlikely event that demonstration of this is required, due to the relatively small quantities to be stored, it is expected that the site will comply in full with the regulations and that this could be demonstrated quite easily.

Due to the relatively small quantities of the other chemicals proposed to be stored on-site, any risks to life posed to off-site personnel are expected to be acceptable.

The transport and traffic assessment has indicated that the expected traffic flows from the construction and operation of the proposed San Miguel Brewery should not lead to significant impacts to the flow of traffic on the roads within the Yuen Long Industrial Estate. The sole exception to this conclusion is for the transport of over-sized loads during the construction stage for which road closures will be necessary; however, if special consideration is given to this operation (the police being notified and operation carried out during evening or night-time hours), the projected impact to the road system should be insignificant.

The new brewery development on the currently vacant site overgrown with common grass species is expected to have minimal ecological impact. There will be no visual/Fung Shui intrusion to the nearby low-rise villages as the existing buildings/structures in the industrial estate and the hill mounts surrounding the site provide effective visual screening. The view of the brewery from distant high-rise residential blocks will blend in with the existing industrial character surrounding the site and additional visual intrusion is not expected.

It is concluded that with implementation of the proposed mitigation measures, environmental impacts from the construction and operation of the proposed new San Miguel Brewery in Yuen Long will not be significant. Considerable effort has been made by the environmental and design teams to further minimize residual environmental impacts and reduce overall water and energy requirements during the detailed design process. In environmental terms the new Brewery in Yuen Long will provide significant benefits over current operations at Sham Tseng.



The environmental mitigation measures recommended in the EIA study are included as follows for easy reference.

### 3.1 CONSTRUCTION PHASE

#### 3.1.1 Water Quality

Construction site discharges into the nearby river bodies or foul sewer are controlled under the *Water Pollution Control Ordinance* (WPCO) and thus valid WPCO licences are required. Mitigation measures should also be in accordance with those listed in the *Practice Note for Professional Persons – Construction Site Drainage* (ProPECC PN1/94). The following provides a guideline on the standard measures which should be enforced.

##### *Site runoff*

All site construction runoff should be controlled and treated to prevent runoff with high level of suspended solids (SS). The following measures should be considered:

- the boundaries of earthworks should be marked and surrounded by dykes or embankments for flood protection as necessary;
- temporary ditches such as channels, earth bunds or sand bag barriers should be provided to facilitate runoff discharge into the stormwater drains, via a silt retention pond;
- permanent drainage channels should also incorporate sediment basins or traps and baffles to enhance deposition;
- sediment traps and channels must be regularly cleaned and maintained by the contractor. Daily inspections of such facilities should be required of the Contractor;
- perimeter channels should be provided at the site boundary to intercept storm runoff from offsite. These channels should be constructed in advance of site formation works and earthworks;
- all traps (temporary or permanent) should also incorporate oil and grease removal facilities;
- manholes should be adequately covered or temporarily sealed;
- all drainage facilities must be adequate for the controlled release of storm flows;

- open stockpiles should be covered with tarpaulin or similar fabric to prevent washing away;
- exposed soil areas should be minimised to reduce the potential for increased siltation and contamination of runoff;
- final surfaces of earthworks should be well compacted and subsequent permanent works should be performed as soon as possible; and
- construction programmes should be scheduled between September and April whenever possible to minimize soil erosion during the rainy season;

#### *Wastewater from Construction Activities*

- Water used for water testing, boring, drilling works and precast concrete casting should be recirculated/reused as far as practicable;
- Online standby sump pumps should be provided to prevent wastewater overflow from water recycling systems; and
- Washwater from wheel washing facilities should have sand or silt removed before discharging into stormwater drains; the area between site exit and public road should be paved with backfill to prevent site runoff from flowing on to the public road.

#### *Debris and Litter*

The contractors should ensure that site management is optimised and that any solid materials, litter or wastes are prevented from entering surface waters.

#### *Oils and Solvents*

All fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. Oil leakage or spillage should be contained and cleaned up immediately.

Vehicle and plant servicing areas, vehicle wash bays and lubrication bays should be located within roofed areas where possible. Drainage should be connected to local sewer via oil interceptor.

#### *Sewage*

Sewage from toilets should be discharged into foul sewer which leads to the Yuen Long Sewage Treatment Works. Grease traps should be installed for discharges from drainage from basins, sinks and floor drains. Chemical toilets can be used if local sewer is not available.

### 3.1.2

#### *Air Quality*

To minimize any dust nuisance, the following dust control measures are recommended:

- stockpiles of excavated materials should be enclosed on three sides with walls extending above the pile;
- water spray facilities should be provided and used for damping the stockpile materials;
- on-site unpaved roads that are frequently used should be regularly compacted and the road surface should be kept clear of loose material. Water spraying should also be used to control dust; and
- wheel-wash troughs and hoses should be provided at traffic exits from the site to minimise the quantity of material deposited on public roads.

### 3.1.3

#### *Noise*

As no exceedances of the normal daytime noise criteria (0700–1900, Monday through Saturday), percussive and non-percussive, have been predicted, no mitigation measures are recommended for these activities. If it becomes necessary for SMHK to apply for construction activities to continue into restricted hours, however, exceedances of the restricted hours criteria have been predicted to occur at all of the assessed NSRs and mitigation measures would be necessary in order for the Contractor to be eligible for a CNP.

The general approach to mitigation has been to recommend three key measures in addition to general good site practice; these are: noise barriers, quiet plant or reduced plant teams and on-site noise management.

As a general rule, good site practice can reduce the impact of a construction site's activities on nearby NSRs. To provide significant noise reduction on site, the following measures should be followed during each phase of construction:

- only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;
- machines and plant (such as trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- plant known to emit noise strongly in one direction, should, where possible, be orientated so that the noise is directed away from nearby NSRs;
- silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction programme;

- mobile plant should be sited as far away from NSRs as possible; and
- material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.

In addition to these measures, specific mitigation measures for each of the construction activities assessed above are recommended below. It should be understood that these mitigation measures are only for works during evening or public holiday (0700–2300, including Sundays); night-time working (2300–0700) is not recommended for any activity due to the prohibitive quantity of noise mitigation which would be necessary to comply with the NCO.

#### *Site Clearance*

The most significant predicted noise impacts for this operation are at the NSRs to the north and west of the site; no exceedances of the evening noise criterion have been predicted for the southern NSRs. At Leon Court, noise levels have been predicted to exceed the evening noise criterion by approximately 4 dB(A) for unmitigated activities. Three methods of achieving compliance with the NCO are as follows:

- limit activities to the use of 2 excavators, during any 30 minute period; or
- limit activities to the use of 1 bulldozer, during any 30 minute period; or
- limit activities to the use of 1 bulldozer and 1 excavator, during any 30 minute period and place a 3 m noise barrier as close as possible to the working area (within 10 m), between the powered mechanical equipment (PME) and the NSRs to the north of the site.

Each of the above will reduce total site sound power level by at least 5 dB(A).

#### *Excavation*

As above, the most significant predicted noise impacts for this operation are at northern NSRs (Leon Court), where exceedances of the evening criterion would be approximately 7 dB(A) for unmitigated activities. To achieve a reduction of 7 dB(A), it is recommended that operations be limited to the use of one full excavators (or two mini excavators) and one truck (total site sound power level of 115 dB(A)), which would reduce the total site sound power level by 8 dB(A).

#### *Piling*

Percussive piling activities are not allowed, by law, to operate outside of normal daytime working hours (0700–1900, Monday through Saturday). As a result, no restricted hours percussive piling will be admissible.

## *Building Superstructure Construction*

The most significant predicted noise impacts for this operation are at Leon Court, where exceedances of the evening criterion would be approximately 9 dB(A) for unmitigated activities. To reduce impacts, it is recommended that operations be constrained to the use of cranes and hand tools (no concreting activities). This restriction would reduce total site sound power levels to 118 dB(A) (reduction of 7 dB(A)). This reduction in total site sound power level would be adequate for the southern NSRs (Fuk Hing Tsuen, Ting Tau Wai, etc); however, an additional 2 dB(A) would be necessary to reduce impacts at the northern NSRs. This could be achieved by limiting the number of mobile cranes to two units operational at any one time.

In addition to the above mitigation measures, if work is carried into restricted hours, it is recommended that a noise monitoring programme be undertaken at the nearby NSRs to ensure that the appropriate criteria are met.

### **3.1.4**      *Waste Management*

#### *On site storage and transport*

A primary responsibility of San Miguel is to ensure that no wastes from the site escape or are deposited into the surrounding area. A second aim should be to ensure that all wastes are properly disposed of once they leave the site. A number of steps can be taken to help ensure these responsibilities are met, where practical.

- A reputable waste contractor with proven standards for environmental hygiene should be chosen to manage the site's waste. Such a contractor will be to some extent self-regulating, and will ensure that waste materials are properly managed on site and disposed of off site.
- Waste should only be handled once. For example, a skip which is filled on site and cranked directly onto the back of a truck would be preferable to having waste transferred from site skip (or ground) into a truck via crane. This helps prevent waste from being blown or dispersed into the surrounding area.
- Ensure that skips provided are properly sized and regularly serviced, and are strategically located on the site. Covered skips would be an advantage.
- Locate smaller covered bins for any organic and food waste at points throughout the site. These have the advantage of being convenient for the use of construction employees, as well as preventing water from seeping in and leachate from seeping out which could contaminate surrounding areas. Organic food wastes should also be collected frequently (separately if necessary) at least 3 times per week.



Surveys of San Miguel's existing operations at Sham Tseng indicate these points are currently fulfilled in general and it is recommended these measures are implemented at the outset in Yuen Long.

In addition, on-site measures may be implemented which promote the proper disposal of wastes once off site. For example having separate skips for inert (rubble, sand, stone, etc) and non-inert (wood, organics, etc) wastes would help ensure that the former are taken to public dumps, while the latter are properly disposed of at controlled landfills. Since waste brought to public dumps will not be charged as are those brought to landfill, separating waste can also help to reduce waste management costs.

#### *Waste Reduction*

While proper disposal is a requirement in Hong Kong, there is some opportunity for San Miguel to go beyond compliance through waste minimisation. As well as reducing indirect environmental impacts and saving resources, waste minimisation and recycling are potential money saving techniques. Possible measures during construction are limited but include:

- Utilise any excavated materials on site such that borrow and fills can balance each other.
- Require that the construction contractor uses durable steel instead of disposable wood for formwork, as far as is practical. However, the one-off nature of any formwork applications for the brewery construction may complicate this.
- Simple good housekeeping.

## **3.2 OPERATIONAL PHASE**

### **3.2.1 Water Quality**

The operation of the brewery as envisaged generates large volumes of effluent. Although adequate sewerage infrastructure is available, DSD recommended the use of buffer tanks to regulate peak flow conditions so as to prevent overloading of the sewerage system. SMHK's on-site biological wastewater treatment plant will be equipped with a buffer tank that will be used for this purpose.

Mitigation in the form of effluent treatment in the proposed purpose designed water treatment plant is considered adequate. However, considerations should be given to the following points to ensure that the plant operates in a satisfactory and effective manner:

## *Operational Considerations*

Although the Upflow Anaerobic Sludge Blanket (UASB) process is a well proven technology with high loading capacity and less sludge production than other wastewater treatment systems for treating brewery waste, some operational conditions should be closely controlled in order to achieve a performance efficiency and to ensure smooth and uninterrupted service. Some of the important conditions should be considered:

### *Commissioning*

- The loading conditions should be strictly controlled during the commissioning.
- Sufficient time allowance should be given to meet the operation schedule of the plant.
- Experienced staff should be employed during commissioning and knowledgeable resident staff be available for troubleshooting in the early stage of plant operation.
- Payment schedule to vendor should be carefully considered so that certain amount of the payment can be retained over and beyond the initial commissioning.

### *Granular Sludge Floating*

- The integration of internal recycling pumping device is recommended to prevent sludge floating during non-brewing days <sup>(1)</sup>.

### *Disposal of Excess Sludge*

Excess sludges should be withdrawn from the reactor at one-half the height of the reactor where there are more flocculent sludges than granular sludges. These sludges, of high methanogenic activity, are very useful in the start-up of new reactors, potential purchasers are widely available in Europe and Asia to accept these sludge.

### *Methane*

The biogas produced from the reactor comprises between 25-40% of carbon dioxide, 60-75% of methane, and trace amount of hydrogen sulphide. Methane will be utilised as fuel gas for the boilers.

### *Dedicated Environmental Team*

The UASB will require well trained and experienced operators to ensure smooth and uninterrupted service. A full time dedicated staff fully

<sup>(1)</sup> The Consultants have subsequently been advised that recycling is included in the system.

conservant in the operation of the treatment plant is recommended to run the plant in an effective manner.

- *Technical Laboratory*

San Miguel are to set up its own technical laboratory equipped with the appropriate facilities to carry out analytical work on site to avoid delays in sampling and reporting. Results will be readily available to on-site staff so that appropriate action can be taken promptly.

- *Water Conservation Measures*

The new brewery will have a fixed water supply allocation. A water management study <sup>(1)</sup> was undertaken to examine the possible water conservation measures. The recommendations of this study are currently being further considered to determine their respective practicality. It is recommended that the opportunity of water conservation measures be explored on a regular basis throughout the operational phase of the plant. Water conservation measures to minimise the water consumptions at the plant include:

- *Use of Air Blast Coolers*

Water is conventionally used to cool the refrigeration systems through evaporative condensers. These could be replaced by dry air blast coolers which pass air over a coil to effect the required heat transfer from the refrigerant.

- *Grey Water System*

A substantial volume of water used within the plant can be reused without excessive treatment. Potential sources of water supply include:

- floor washings from selected areas;
- brewing water filter plant backwashes;
- activated carbon filter backwashes;
- crate washings
- rinse water from clean/non-returnable bottles; and
- boiler feed water exchange plant.

The wastewater from these sources can undergo simple treatment to remove the solids and small amount of organic matter and dissolved minerals. The grey water can be screened and dosed with chemicals. The treated grey water can then be suitable for re-use for non-critical applications such as cleaning of external keg, flushing of sanitary toilets, irrigation, vehicle and floor washings and external crate washing.

<sup>(1)</sup> San Miguel Brewery Hong Kong Limited - Yuen Long Brewery Water Management Study by Ove Arup & Partners, September 1994

- *Rainwater Collection*

A rainwater collection scheme is proposed to collect rainwater from the roofs of the administration building, the packaging hall, and the production block. While rainfall varies from year to year, based on past statistics on the rainfall in Hong Kong, it is estimated that 20,700 m<sup>3</sup> of rainwater can be collected from the roof areas. Rainwater can be stored at the grey water storage tank.

- *Reject Full Goods Recycling*

The possibility of recycling filter bleeds and reject full goods should be considered to reduce the effluent load and overall water consumption.

- *Reuse of Spent Grain Press Liquor*

Brew extract which is lost with the spent grains can be reclaimed in a press, autolysed and returned to the wort kettle. The estimated reduction in water consumption is reported to be around 10%.

- *Design Considerations*

The practicality of water conservation is being considered by SMHK as an integral part of the design process. Practical measures will be implemented to ensure that consideration is given to water conservation throughout the design stage. These include:

- setting of target water consumptions;
- nominated personnel with specific responsibility and authority to consider water conservation measures throughout the design stage;
- incorporation of water recycling option into the equipment specification;
- water consumption guarantees; and
- careful equipment selection.

### 3.2.2

#### *Air Quality*

The following measures are recommended to reduce the air quality impacts in respect of odours during the operational phase of the brewery:

- washing and cleaning of the disposal area after discharge of spent grain to remove accidental spills of material and regular collection to prevent aging of spent grain;
- minimize the exposed area of disposal materials to air, ie if practical use a direct link from storage tank to truck;
- transportation of spent materials in enclosed containers; and
- installation of condenser in spent material drying plant to condense volatile organic compounds (VOC) and odorous compounds.

*Equipment and Machinery*

- All external plant should be rated and tested for tonal, intermittent or impulsive noise characteristics. Each piece of equipment should have a sound power level such that when all items are operating simultaneously, the applicable noise criteria are not breached at the nearby NSRs.
- All internal plant and equipment should meet the *Noise at Work* regulation limits such that any room occupied on a day to day basis does not have a reverberant sound pressure level in excess of 85 dB(A) when measured at 1 m from any single piece of equipment.
- Reverberant noise measurements should be taken during the commissioning stage to determine if an exceedance of the *Noise at Work* regulation is likely under normal operating conditions. This is particularly important for the packaging building where noise levels are close to the 85dB limit are expected and workers will be exposed to noise for long periods, ie their full working day.

If noise levels exceed the *Noise at Work* regulation by more than 10 dB(A) in the following areas, it is thought that this level of exceedance can be mitigated through the following techniques:

*For rooms:*

- acoustic tiling/plaster for walls and ceilings;
- suspended acoustic baffles;

*For individual pieces of equipment:*

- silencers;
- acoustic shrouds/enclosures;
- acoustic lagging; and,
- double-skinned walls or ductwork.
- An additional study should be carried out once specific noise data is known to specify which mitigation technique should be used for which locations and which specific pieces of plant.

*Noise Monitoring*

Noise monitoring should be carried out in the following areas at commissioning and once every 6 months thereafter, in order to determine if machine maintenance or additional silencing is necessary:

- the bottling room;
- the canning room;
- the keg washing area;
- the compressor for ammonia; and



the compressor for CO<sub>2</sub>.

#### *Road Traffic*

To reduce noise levels at nearby NSRs it is recommended that truck traffic should be routed through Wang Lee Street (the street to the east of the site) rather than Fuk Hai Street.

### 3.2.4

#### *Waste Management*

##### *On site management of wastes*

As with construction wastes, San Miguel is responsible for ensuring that operational wastes are dealt with in an acceptable manner. Operational wastes can be managed properly through many of the same techniques as construction waste.

Choosing a waste contractor with proven high environmental health standards will help ensure that wastes are properly managed during the operational phase. However, inspection and audits should from time to time be conducted by San Miguel staff to ensure that wastes are being properly managed and disposed of on and off site.

It is also noted that San Miguel propose that lidded or enclosed waste skips of the type that can be hauled directly onto a collection vehicle being used of odorous wastes. Using roll-on roll-off compacting containers would also help reduce the space required for mixed waste storage, and ensure that waste is handled only once.

Spent yeast is to be dried on site prior to either sale or disposal.

Waste oil produced from equipment cleaning and lubrication are not recommended to be disposed in landfill site. These waste may be able to be processed in other treatment facilities such as the Chemical Waste Treatment Centre (CWTC). However, the appropriate licences must be obtained before discharge and transportation should be carried out by a licensed contractor. Any chemical wastes produced will be handled according to the *Code of Practice on the packaging, labelling and storage of Chemical Wastes*. In addition, any empty containers which had previously contained chemical waste will be collected by licensed contractors and sent to landfill for co-disposal.

##### *Potential for waste reduction*

While it is prudent to ensure that all wastes meet the requirement for disposal to landfill (should the need arise), it is of course more desirable to avoid their disposal all together. Minimising waste for disposal has numerous benefits, including:

- reducing the collection fee paid to waste contractors who (implicitly or explicitly) charge on a per tonne basis;

- avoiding the future cost of the planned landfill charge, which may eventually cost San Miguel and additional \$40 to 80 per tonne of waste; and
- improving public relations, and serving as a solid example of San Miguel's environmental policy.

The large scale nature of San Miguel's activities produce several homogenous waste streams which may have potential for recycling.

San Miguel has stated its intention to sell as much waste material for reuse or recycling, thus reducing the amount that is sent to landfill. Plans include:

- Selling as much general waste (paper, metals, etc) to recyclers. Given that a thriving market for recovered materials does exist in Hong Kong. There may be significant scope for reducing the amount of office paper, glass, aluminum, and other metals sent for disposal. Sale of reject aluminum cans and sheets from the capping plant may be especially lucrative given the current high market price for non ferrous metals, though it is doubtful if any price would be paid for glass cullet. High quality office paper can also be sold though, as with all other materials, buyers demand clean and uncontaminated materials. Source separation would be an advantage.
- Selling the spent grains as animal feed (assuming a market could be found) though this material would also be a suitable input for a composting operation.
- Selling dried yeast to the food industry.
- Selling/reusing the sludge from the proposed anaerobic effluent treatment system. After stabilisation for removal of residual volatile fatty acids, the sludge can be composted and used for landscaping or agricultural soil conditioner. In addition, the granular sludge produced by upflow reactors have good settling ability and high methanogenic activity. These sludge can be used to start up other anaerobic reactors. *Euro Mark Technologies Ltd*, the effluent treatment plant designers, has offered to take back the sludge for this purpose. In Europe, there is a market of this sludge, while *Biotim*, *Biothane* and similar companies are other possible purchasers.
- Selling of waste oils to oil recycling industries.

## 4.1

## CONSTRUCTION PHASE

The proposed environmental management organisation for the construction phase and the various interfaces for the environmental monitoring and audit of the project are illustrated in *Figure 4.1a* and *Figure 4.1b*. The charts show the relation between the various responsible parties and their overall responsibilities with respect to environmental compliance. These general relationships will apply during both the construction and operation phases of the project.

The Engineer's Representative (ER) for individual contracts will have the overall responsibility to monitor the performance of contractor(s) in complying with environmental requirements and to follow up with the day-to-day environmental monitoring activities. Proposed roles and responsibilities of the relevant parties relating to environmental issues are described below.

- Engineer's Representative (ER)
  - to implement environmental requirements and to monitor contractor performance;
  - to ensure rapid transmission of monitoring results and reports;
  - to check compliance of environmental monitoring data with agreed trigger/action/target levels;
  - to instruct the Contractor to take appropriate action in the event of exceedances or complaints;
  - to ensure that mitigation measures which have been agreed are implemented and operating effectively; and
  - to inform the Environmental Consultant in the event of an exceedance of the recommended level.
- Contractor
  - to ensure that construction works are carried out in such a manner as to minimise adverse impacts to the environment;
  - to take any practicable means that may be necessary to abate pollution caused by his action to the environment;
  - to implement the mitigation measures as required and as instructed by the individual ER; and

- to report to the ER all remedial action taken.

Monitoring Laboratory

- to carry out environmental monitoring;
- to prepare monitoring report; and
- to notify the ER immediately in the event of exceedances.

Environmental Consultant

- to review and verify information available in records developed through the monitoring programme;
- to identify specific issues of non-compliance and recommendations to meet them;
- to check effectiveness of mitigatory measures;
- to review the need for other mitigatory measures; and
- to inform EPD in the event of an exceedance of the recommended level.

## 4.2

### *OPERATIONAL PHASE*

The Plant Manager will have the overall responsibility to monitor the plant's environmental performance and to ensure compliance with statutory requirements. Detailed roles and responsibilities of other relevant parties relating to environmental issues are described below:

Environmental Manager

- to implement environmental requirements and monitor the environmental performance of the plant;
- to check compliance with environmental regulatory requirements; and
- to inform EPD in the event of an exceedance of the recommended level.

Operator of Wastewater Treatment Plant

- to take appropriate action in the event of incompliances or complaints; and;
- to ensure that mitigation measures which have been designed for are implemented and operating effectively.

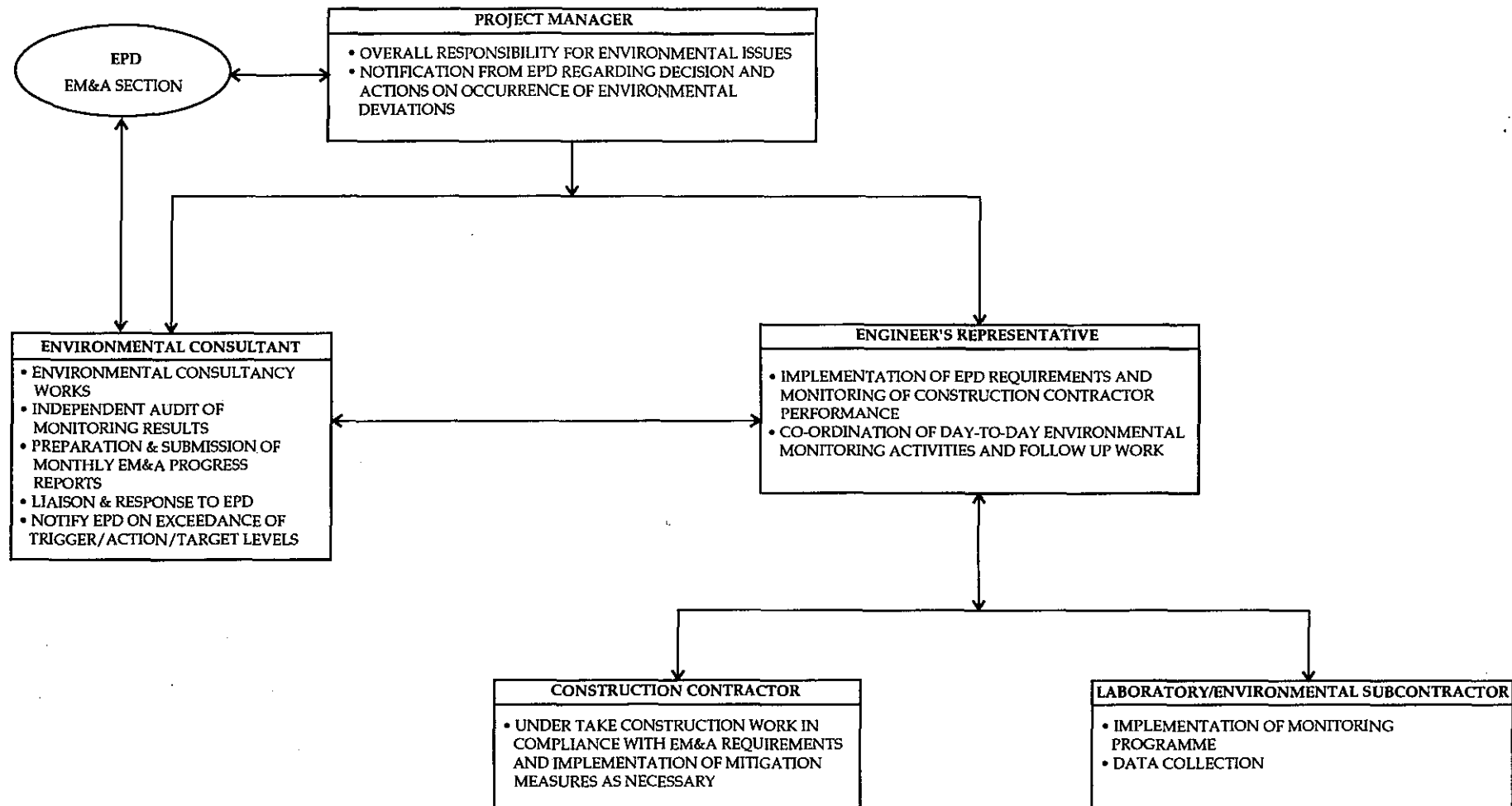


FIGURE 4.1a - ORGANISATION CHART FOR ENVIRONMENTAL MONITORING AND AUDIT - CONSTRUCTION PHASE

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Hong Kong





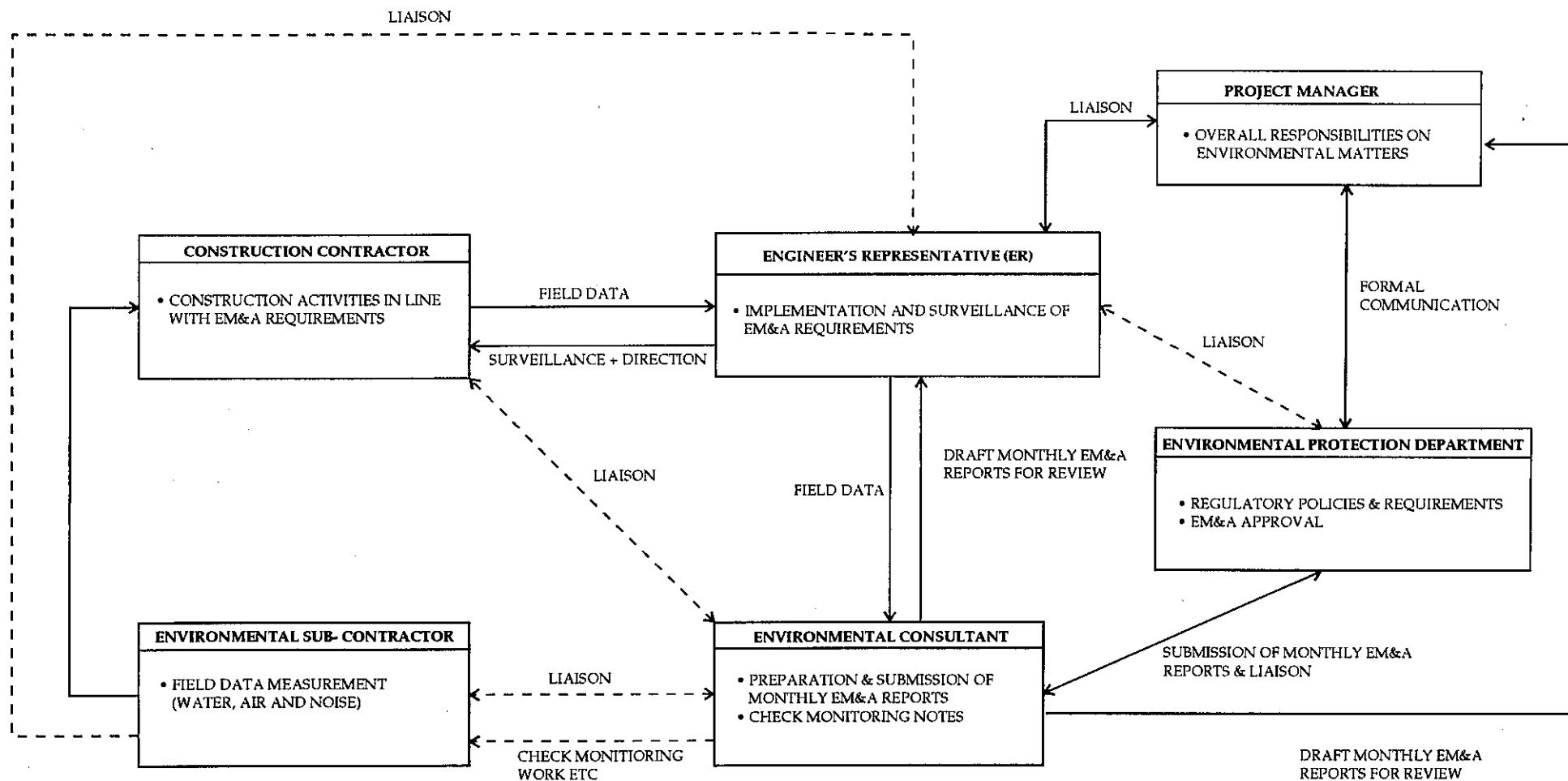


FIGURE 4.1b - INTERFACE OF ENVIRONMENTAL MONITORING AND AUDIT - CONSTRUCTION PHASE

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Hong Kong



- Monitoring Laboratory

- to carry out environmental monitoring;
- to prepare monitoring report; and
- to notify the Environmental Manager immediately in the event of an exceedance.

- Environmental Consultant

- to review and verify information available in records developed through the monitoring programme;
- to identify specific issues of non-compliance and recommendations to meet them;
- to check the effectiveness of mitigatory measures; and
- to review the need for other mitigatory measures.

This section details the environmental monitoring requirements during the construction and operation period.

## 5.1 CONSTRUCTION PHASE

A flow chart on environmental monitoring and any subsequent action to be taken in the event of an exceedance is illustrated in *Figure 5.1a*.

### 5.1.1 Water Quality Monitoring

No monitoring or auditing requirements are recommended during the construction phase provided that appropriate mitigation measures described previously are observed.

### 5.1.2 Dust Monitoring

No monitoring or auditing requirements are recommended during the construction phase provided that appropriate mitigation measures described previously are observed.

### 5.1.3 Noise Monitoring

Noise levels are not envisaged to exceed the recommended noise level during daytime hours (0700–1900) and hence no noise monitoring is recommended. However, if works during restricted hours are necessary then mitigation will also be necessary. In this case, weekly noise measurements during the restricted hours are recommended as a compliance check. Monitoring methodologies, equipment and locations are described in the sections below, and an action plan is given along with a list of possible mitigation measures that could be adopted if required.

#### *Objectives*

The objectives of noise monitoring, if construction works proceed into restricted hours, include the following:

- to establish the pre-existing baseline noise climate at Noise Sensitive Receivers (NSRs), against which any short or long term noise impacts can be judged;
- to provide an early indication if any of the noise mitigation measures specified for the construction phase are failing to achieve the acceptable standards; and
- to provide data to enable an environmental audit of the construction of the new brewery.

## *Methodology*

Construction noise levels would be determined by carrying out measurements at the monitoring locations if works proceed into restricted hours. Noise measurements will be made in terms of the A-weighted equivalent continuous sound pressure level ( $L_{Aeq}$ ) measured with an integrating sound level meter set to "fast" response. Such measurements will be made over a 30 minute period to give six consecutive  $L_{Aeq, 5 \text{ min}}$  readings, which will be used to calculate the  $L_{Aeq, 30 \text{ min}}$  value.

Where a measurement is to be carried out at a building, the assessment point would normally be at a position 1 m from the exterior of the building facade, but may be at any other point considered appropriate by EPD. Where a measurement is to be made of noise being received at a place other than a building, the assessment point would be at a position 1.2 m above the ground in free-field.

The following procedures should be adopted for all noise monitoring, either of baseline noise levels or of construction noise.

- Immediately prior to and following each measurement the accuracy of the sound level meter should be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. If the calibration levels before and after the measurement differ by more than 1.0 dB the measurement should be repeated to obtain a reliable result.
- Measurements should be recorded to the nearest 0.1 dB, with values of 0.05 being rounded up.
- Weather conditions, including a measurement of wind speed, should be recorded for each measurement. Where the steady wind speed exceeds 5 m/s, or gusts are above 10 m/s, or in the presence of fog or rain, measurements should be treated as invalid, and repeated in more appropriate conditions.
- Noise monitoring data should be recorded in a format as given in *Table 5.1a*.

### *Baseline Monitoring*

Baseline ambient noise levels should be measured on a weekday, over 24 continuous hours, at each monitoring location when no construction activities are taking place. The survey period should be selected so as to avoid any unusual activity in the area. Measurements of the  $L_{eq}$ ,  $L_{90}$  and  $L_{10}$  noise levels shall be made, over 30 minute periods, for the whole of the 24 hour survey.

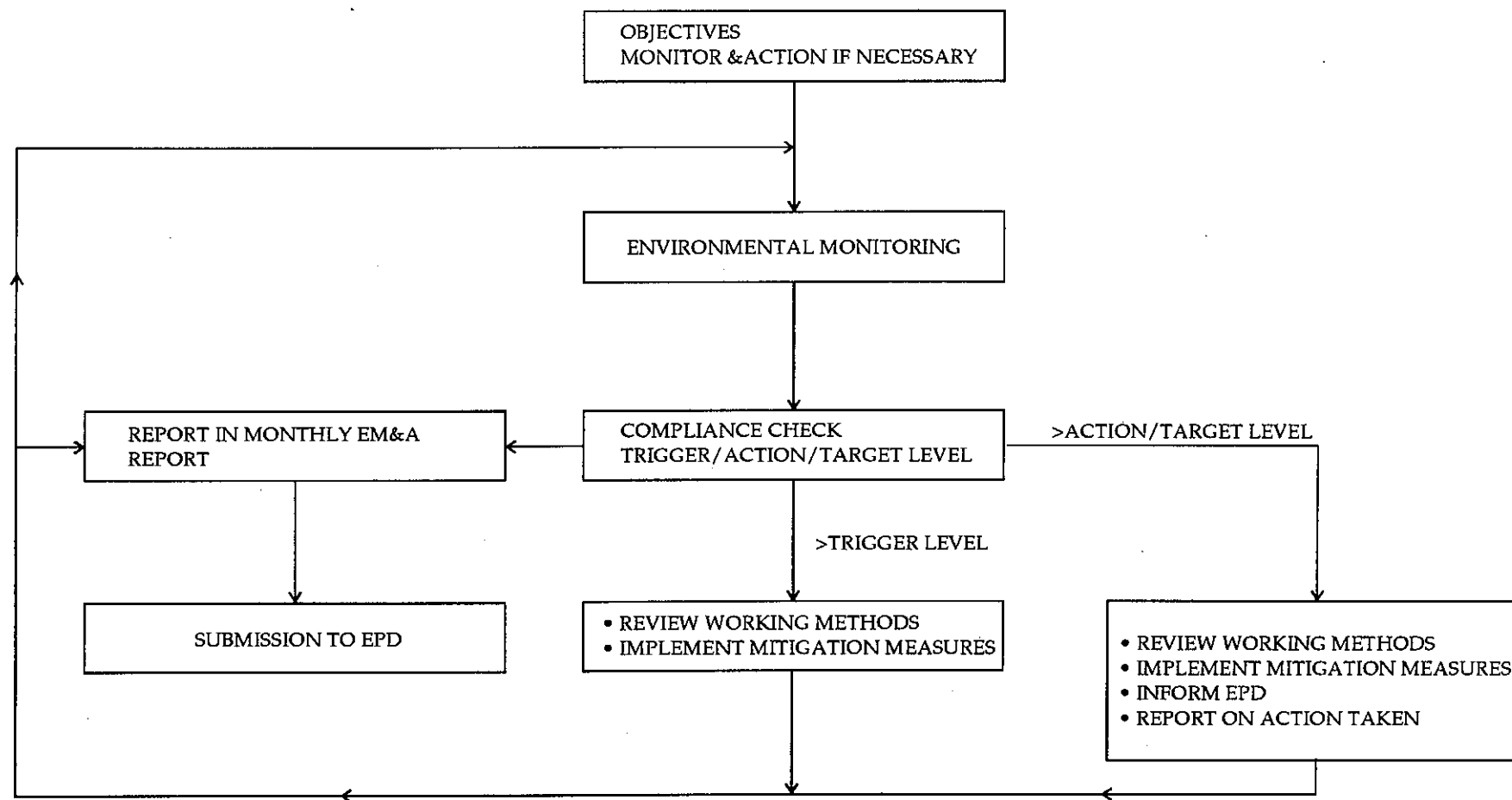


FIGURE 5.1a - ENVIRONMENTAL MONITORING CHECKS PROCEDURES

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### *Impact Monitoring*

During restricted construction working hours (ie at times other than those considered above), monitoring of  $L_{eq(5min)}$  noise levels should be carried out at the listed NSRs, for three consecutive 5 minute periods, in each restricted period (ie daytime (Sundays and holidays only) evening or nighttime), once a week.

Where a measurement includes a period of a typical background noise it shall be considered invalid, discarded and the measurement repeated.

**Table 5.1a**     *Data Sheet for Noise Monitoring*

<hr/>			
Monitoring Location and reference			
<hr/>			
Date and day			
Personnel reference			
Weather conditions (general)			
Wind Speed – average/peak (m/s)			
Calibration before measurement			
Calibration after measurement			
Start and finish time of measurement			
Duration of measurement			
$L_{90}$ level			
$L_{10}$ level			
$L_{eq}$ level			
Principal Noise Sources			
Other comments			
<hr/>			
	Name & Designation	Signature	Date
Field Operation :	_____	_____	_____
Lab. Staff :	_____	_____	_____
Checked by :	_____	_____	_____

### *Equipment*

Prior to the commencement of the construction works, a calibrated sound level meter with appropriate calibrator should be supplied to the site. The calibration should be carried by an accredited laboratory. The meter should comply with the *International Electrotechnical Commission Publication (IEC) 651:1979 (type 1)* and *804:1985 (type 1)* specification as referred to in the *Technical Memorandum to the Noise Control Ordinance*. The sound level meter should be supplied and used with the manufacturers recommended wind

shield, and a suitable tripod. All instruments should be available before construction work commences.

An IEC 651:1979 and 804:1985 type 1 pistonphone calibrator should be supplied, for routine calibration checking on site.

A calibrated wind speed anemometer should also be supplied, for the measurement of wind speeds during noise monitoring periods.

The equipment should be kept in a good state of repair in accordance with the manufacturers recommendations.

#### *Monitoring Locations*

Noise monitoring should be carried out at the following locations, as shown in *Figure 5.1b*:

- Leon Court;
- Tai Tseng Shing Uk Tsuen; and
- Fuk Hing Tsuen.

Noise measurements should be made 1 m from the nearest part of the building facade, and at a height above ground that has the clearest view of the area of construction activity. For future reference, the measurement location should be photographed and carefully noted in a log.

#### *Trigger/Action/Target Level*

The noise monitoring data should be checked against the trigger/action/target levels as agreed with EPD and as defined below:

The *trigger* and *action* levels for construction noise monitoring are based on monitored levels as well as complaints that might have been received from the local NSRs, as follows:

- *Trigger* level – Receipt of a single documented complaint of construction noise level.
- *Action* level – Receipt of more than one documented complaint of construction noise in any two week period.

The *target levels* for construction noise, measured at the facade of any NSR, are as in *Table 5.1b*.



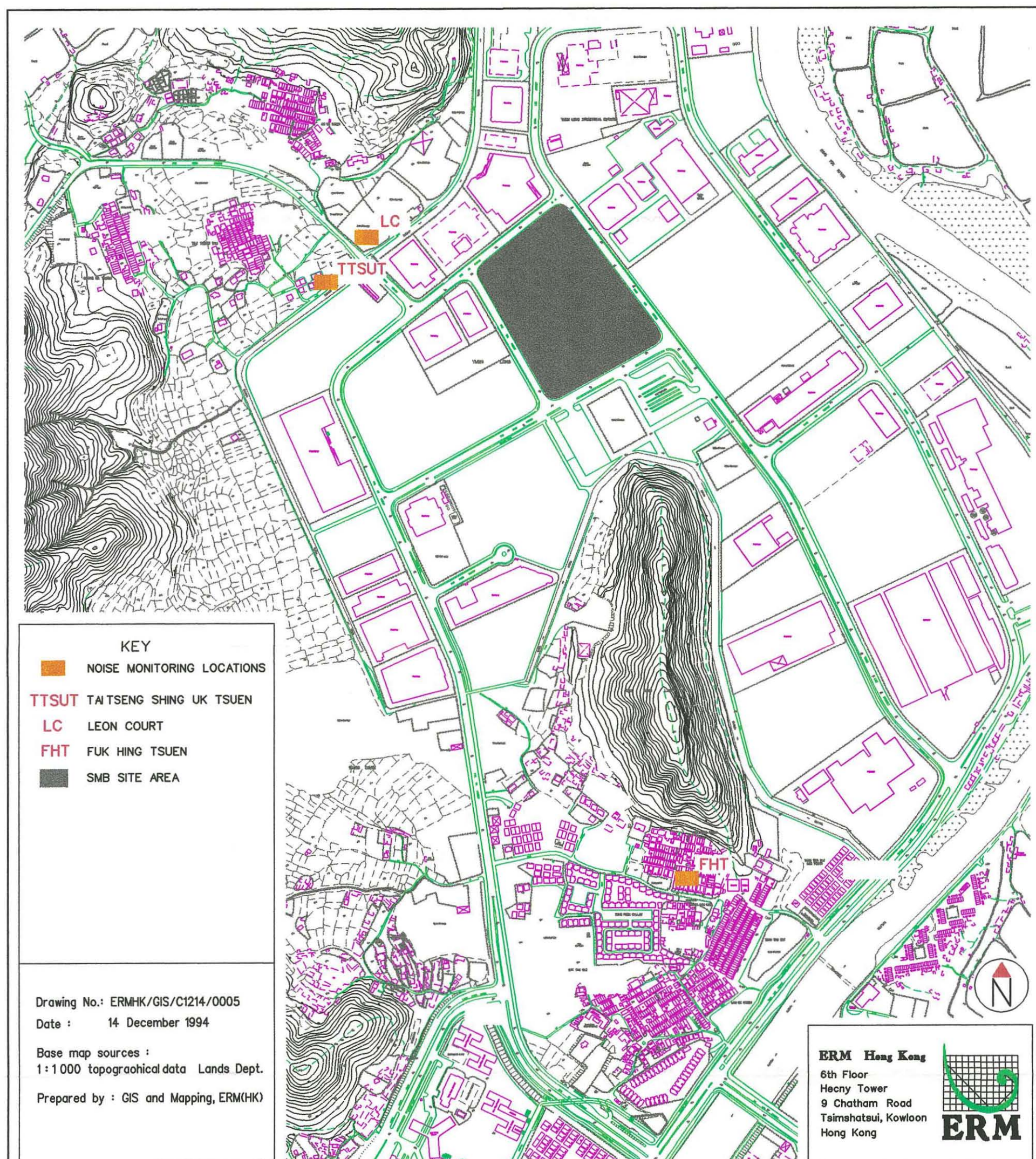


Figure 5.1 b Noise Monitoring Locations



**Table 5.1b Construction Noise Target Levels**

Time Period	Noise Level (dB)
Daytime (0700 to 1900), Monday through Saturday excluding Public Holidays	$L_{Aeq,30\ min}$ 75
All evenings (1900 to 2300)	$L_{Aeq,5\ min}$ 60 / 65
General holidays (including all Sundays) during the daytime and evening (0700 to 2300)	$L_{Aeq,5\ min}$ 60 / 65
All night time periods (2300 to 0700)	$L_{Aeq,5\ min}$ 45 / 50

The first number refers to the level applicable to an NSR with an Area Sensitivity Rating (ASR) of 'A', while the second number refers to the level applicable to an NSR with an ASR of 'B'.

#### *Action Plan*

An action plan which outlines details of appropriate responsibilities by relevant parties in the event of exceedance of the recommended trigger/action/target levels is given in *Table 5.1c*.

**Table 5.1c Action Plan for Noise**

Event	Action	
	Engineer	Contractor
Exceedance of Trigger Level	<ul style="list-style-type: none"> <li>• Notify Contractor</li> <li>• Conduct noise measurements</li> <li>• Investigate noisy operations</li> </ul>	<p>Discuss with the Engineer remedial actions required.</p> <p>Rectify any unacceptable practice to the approval of the Engineer.</p> <p>Consider changes to working methods.</p>
Exceedance of Action Level	<ul style="list-style-type: none"> <li>• Notify Contractor</li> <li>• Analyse noise measurements</li> <li>• Require Contractor to propose measures for the analysed noise problem</li> <li>• Increase monitoring frequency to check mitigation effectiveness</li> </ul>	<p>Submit proposals within 3 working days to the Engineer for remedial actions to reduce noise exposure.</p> <p>Amend proposals if required by the Engineer.</p> <p>Implement immediately the agreed proposals.</p>
Exceedance of Target Level	<ul style="list-style-type: none"> <li>• Notify Contractor</li> <li>• Require Contractor to implement mitigation measures</li> <li>• Increase monitoring frequency to check mitigation effectiveness</li> </ul>	<p>Take immediate action to avoid further exceedance.</p> <p>Submit a further proposal for remedial actions to the Engineer immediately.</p> <p>Implement immediately the agreed proposals.</p> <p>Resubmit proposals if problem still not resolved.</p>

## **5.2**

### **OPERATIONAL PHASE**

### 5.2.1

#### *Water Quality*

Water quality monitoring will be necessary as a check on the performance of the wastewater treatment system and on the compliance of the effluent within the discharge standards for the foul sewer as stipulated by EPD.

Sample analysis of COD, BOD and total suspended solids should be carried out on a daily basis during initial operations. The monitoring frequency and requirements should be reviewed after the first month of operation and revised as necessary in the light of the performance of the plant in consultation with EPD. Sampling locations should be located before the point of discharge and at a location agreed with EPD. *Table 5.2a* presents the recommended monitoring requirements for the plant, which should be reviewed on a regular basis. Ongoing monitoring results can serve as a basis for determining future or new monitoring requirements.

### 5.2.2

#### *Air Quality*

No special air quality monitoring is required provided that daily record of fuel consumption, review of operating methods, regular checking and maintenance of control equipments are presumed at the plant.

Although the new brewery will not give rise to significant odour impacts offsite, regular checking is required. Plant managers should be assigned for regular odour patrols, monitoring on the operation practices and checking on the efficiency of mitigation measures. Special attention and detailed investigation would be required in the event complaints are received to rectify the adverse odour impacts.

### 5.2.3

#### *Noise*

Environmental noise monitoring is considered necessary to validate noise prediction by direct noise measurement; to check compliance with the statutory noise criterion of  $L_{A,Ep,d}$  85 dB and should be performed at least once, in the following areas at commissioning and once every 6 months thereafter, in order to determine if machine maintenance or additional silencing is necessary:

- the bottling room;
- the canning room;
- the keg washing area;
- the compressor for ammonia; and
- the compressor for CO<sub>2</sub>.

**Table 5.2a**     **Water Quality Monitoring Programme for Operational Phase**

Measurement Details	Description
Measurement Method	Analytical methods as listed in the Technical Memorandum
Locations	Before point of discharge, to be agreed with EPD.
Limits	TM limits
Continuous Monitoring*	Frequency
	Hourly
	<i>Measuring Parameters</i>
	Flowrate
	pH
	Temperature
Performance Monitoring*	Frequency
	Daily
	<i>Measuring Parameters</i>
	BOD
	COD
	Suspended Solids Levels
Compliance Monitoring*	Frequency
	Monthly
	<i>Measuring Parameters</i>
	pH
	Temperature
	Suspended solids
	Settleable solids
	BOD
	COD
	Oil and grease
	Iron, Boron, Barium, Mercury, Cadmium,
	Copper, Nickel, Chromium, Zinc, Silver,
	Cyanide, Phenols, Sulphide
	Total Nitrogen, Total Phosphorus
	Surfactants

Note: \* Monitoring requirements should be reviewed when monitoring results are available.

In the event that a complaint whether direct or indirect is received, the Engineer's Representative (ER) should be informed immediately so that the appropriate action can be taken.

The ER should undertake the following steps to rectify the situation:

- identify the source(s) of impacts;
- take the necessary actions to mitigate the situation;
- undertake monitoring with respect to air, noise or water;
- check compliance with trigger/action/target levels and environmental regulations;
- if monitoring results show exceedances, repeat review procedures, identify possible areas of improvement and check procedures;
- document all complaints in the monthly EM&A report to EPD and include details of mitigation measures taken and the additional monitoring results for the period; and
- where possible, prepare a formal reply to complaints to notify the concerned person(s) that the appropriate action has been taken.

*Figure 6a* illustrates the recommended procedures in the event of complaints.

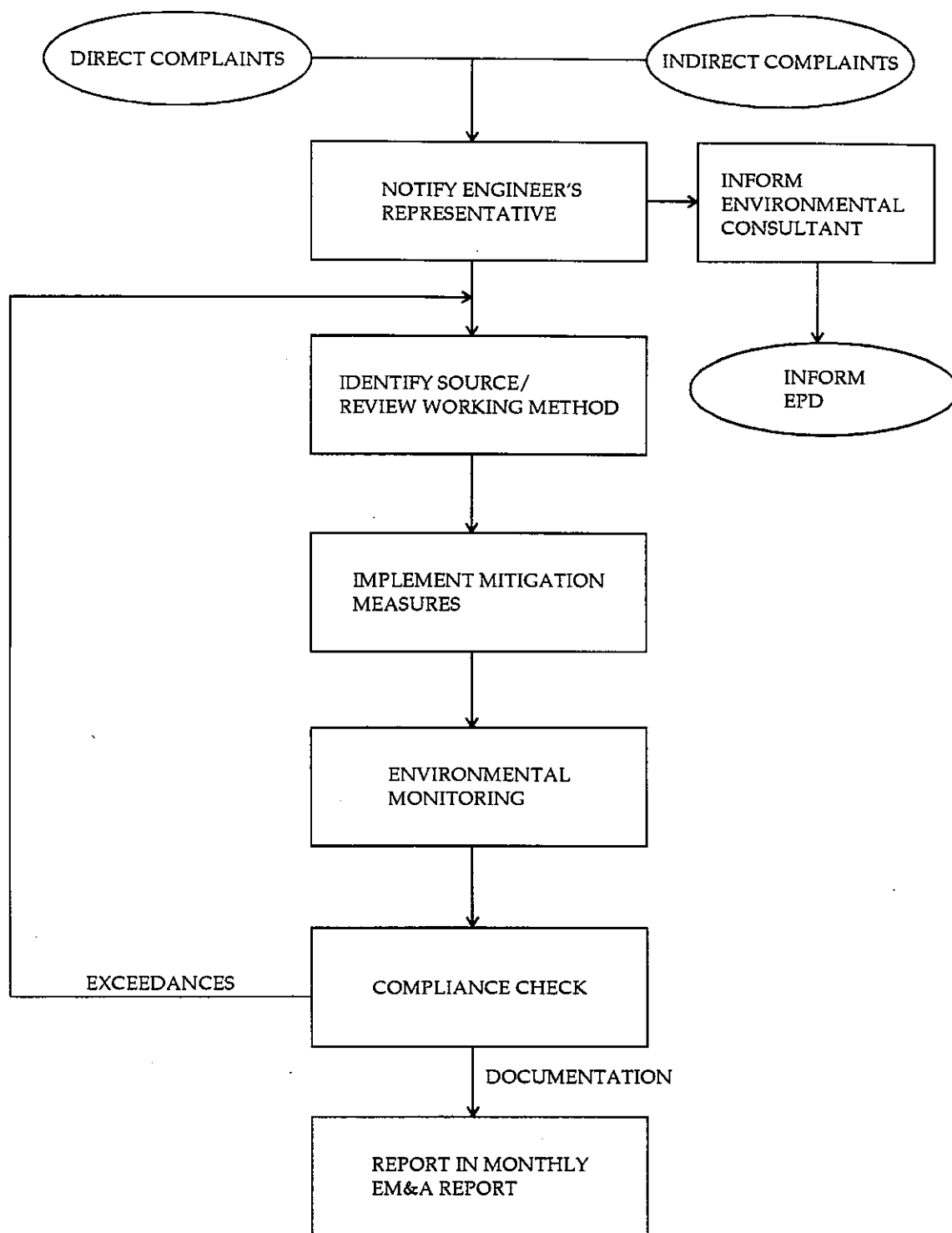


FIGURE 6a - COMPLAINTS HANDLING PROCEDURE

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Hong Kong



## **7 REPORT PROCEDURES**

### **7.1 INTRODUCTION**

The environmental performance of the plant during the construction and operational phases should be reported to EPD on a regular basis.

### **7.2 MONITORING RESULTS**

Monitoring data shall be reported on record sheets and should contain the following information:

- sampling points
- sampling depths
- sampling parameter
- number of measurement
- weather condition
- brief description of the activities (eg position of dredging operations, brewing processes)
- trigger/action/target level or regulatory requirements
- checks on compliance

### **7.3 ENVIRONMENTAL EXCEEDANCES**

For environmental exceedance, in addition to notifying the contractor (during construction phase) or the operator of the wastewater treatment plant (during operational phase) immediately and repeating monitoring, EPD should be also be informed where appropriate. Action(s) taken should be reported in a regular progress report, to be agreed with EPD.

### **7.4 REPORTING**

The reports should include monitoring data, audit/review of the environmental monitoring data to ensure compliance with regulatory requirements, policies and standards and any remedial works taken/required in the event of an exceedance.

An EM&A progress report for the construction phase should be prepared and submitted to EPD monthly in an agreed format (printed and/or magnetic media form). The report should include the following:

- summary of major points;
- summary of the construction activities for the month;
- monitoring data;
- audit/review of the monitoring results;
- compliance check and report on exceedances;

- remedial measures adopted to restore the adverse condition;
- record of complaints and remedial measures;
- forecast of work programme and monitoring schedule;
- environmental complaints and handling;
- proposals for changes to monitoring requirements, as appropriate; and
- comments and conclusions.

Similarly for the operational phase, quarterly environmental performance reports should be submitted to EPD and should be made available for public access.

Environmental auditing is recommended to test the adequacy of the overall environmental management systems and the effectiveness of the environmental monitoring programme adopted.

These environmental audits should be carried out by an independent body on a regular basis. The audit should cover the following:

- review and verify information available in records developed through the monitoring programme;
- identify specific issues of non-compliance and recommendations to meet them; and
- check the effectiveness of mitigatory measures and review the need for other mitigatory measures.

In addition, audit of environmental complaints handling procedures should also be carried out to verify that complaints are properly channelled and addressed.