PROJECT PROFILE FOR PROPOSED SHOOTING RANGE AT PILLAR POINT VALLEY LANDFILL

Prepared for:
Hong Kong Shooting Association

Prepared by:
ENVIRON Hong Kong Limited

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ENVIRON Hong Kong Limited
Room 2310, China Resources Building
26 Harbour Road, Wan Chai, Hong Kong

Tel: (852) 3743 0788

Fax: (852) 3548 6988

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1. Basic Information

1.1 Project Title

1.1.1 The title of this project is “Proposed Shooting Range at Pillar Point Valley Landfill”.

1.2 Purpose and Nature of the Project

1.2.1 Shooting will be one of the games to be included in the 2009 East Asian Games to take place in Hong Kong. A venue for holding shooting event is urgently required to be set up and to be ready for the event.

1.2.2 The venue, apart from being used for the East Asian Games, will also be used as a permanent venue for training and promotion of shooting activity in Hong Kong. Subsequent to the achievement of Hong Kong athlete at the 2005 East Asian Games in Macau, where Hong Kong athlete won a gold medal, it is anticipated that shooting is likely to be the sport at which Hong Kong athletes can do well in international events if regular training program and proper venue were to be provided.

1.2.3 The proposed shooting range will provide facilities for shooting event in the 2009 East Asian Games and as a permanent venue for training and promotion of shooting activity in Hong Kong. The shooting range will allow fire shooting using firearms including air pistol, pistol and rifle.

1.2.4 Ammunition is governed by Firearms and Ammunition Regulations (Cap. 238A). The handling and storage of arm and ammunition in the proposed shooting range would strictly follow the shooting range order approved by the Hong Kong Police. The arm and ammunition store will be designed to fulfill fire safety and other security requirements. The range order proposed for the development will be subject to approval by Commissioner of Police, who is responsible for the regulation of the public safety of firing range under Cap. 238A.

1.3 Name of Project Proponent

1.3.1 The project proponent is the Hong Kong Shooting Association (HKSA). HKSA is the body in charge of organizing the shooting event for the 2009 East Asian Games.

1.4 Location and Scale of Project and History of Site

1.4.1 The proposed shooting range will be sited at the restored Pillar Point Valley Landfill (PPVL) in Tap Shek Kok, Tuen Mun. **Figure 1** showed the location of the subject site for the proposed shooting range. The subject site occupies mainly the PPVL waste area (the entire southern platform on the southern side of Tsing Shan Firing Range) and a part of the waste slope (for management by the project proponent assigned by the Government according to the usual practice).

1.4.2 The subject site is elevated at about +150 mPD and occupies a platform to the south of Castle Peak. The topography is that the eastern, northern and western sides of the subject Site is of higher elevation. An access road, formed as a result of the landfill activity, connects the northern platform of the PPVL and running on the western side of the PPVL to connect to Lung Mun Road (see **Figure 2**). Lung Mun Road is located at about 700m to the south running along the east-west axis and near shore at about +6 mPD. The subject site is isolated from Tuen Mun district to the east by a mountain ridge of up to +330 mPD.

1.4.3 The southern portion of the PPVL will be occupied for the construction and operation of the proposed shooting range. A land license is under preparation for the use of the shooting range. The area for the operation of the shooting range amounts to about 4.4 ha (see "Application Site Boundary" in **Figure 2**). The adjacent slope would be entrusted to the project proponent for management. The total site area including the slope area will amount to about 6.4 ha (see **Figure 2** for the slope). No facilities will be proposed within the slope area. Therefore, the site area excluding the slope will be regarded as the application site. Three types of shooting ranges and associated facilities will be included:

- Two numbers of 10m indoor air pistol shooting ranges each with 30 lanes (1 lane for 1 user);
- One number of 25m pistol outdoor shooting range with a total of 60 lanes (1 lane for 1 user);
- One number of 50m rifle outdoor shooting range with a total of 60 lanes (1 lane for 1 user); and
- an office-cum-clubhouse building and lavatory/beverage house

1.4.4 Pumphouse and transformer room facilities will be constructed at a location between PPVL and the existing EPD's PPVL site office, which is of a separation distance of more than 360m from the application site (see **Figure 2**). No generator set will be provided onsite.

1.4.5 Within the proposed shooting range, there is restriction on types of weapons permitted to be used. Permitted weapons include: air pistol (0.177 inch calibre), pistol (0.22/0.32 inch calibre), rifle (0.22 inch calibre), full bore rifle (7.62 mm calibre). Air pistol will be used inside the indoor shooting range whereas other weapons will be used outdoors in open shooting range. Possible types of shooting positions include standing, kneeling and proneness (shooter lying on the long bench positioned at the shooting location at the raised floor platform). The proposed shooting range will operate from 7:00 a.m. to 10:30 p.m. No night-time operation will be allowed for the proposed shooting range (including open and indoor shooting range facilities).

1.4.6 **Figure 3** showed the layout plan of the proposed shooting range. **Figure 4** showed the ground level layout. All buildings will be of single storey only. Utilities will either be laid on ground or underground (installed by shallow excavation of not more than 300mm and refilling afterwards). No manholes will be provided. In addition to the buildings and utilities, the existing access road will be modified to provide proper access for coach and other smaller vehicles.

1.4.7 PPVL commenced operation to receive waste from 1983 and closed in 1996. The landfill restoration work commenced in 2004 and was completed in 2006. PPVL is now being maintained by the aftercare contractor and will last till 2036 under the management of EPD.

1.5 Number and Types of Designated Projects to be covered by the Project Profile

1.5.1 The proposed shooting range will include 25m shooting range(s) and 50m shooting range(s) which are outdoors in nature. There is only one designated project covered in this Project Profile under Category O5, Part I, Schedule 2 of the EIAO: An open firing range.

1.5.2 Under the EIAO, an Environmental Permit (EP) will be required for the construction and operation of the proposed shooting range (the Project). This Project Profile is prepared for application for approval to apply directly for an EP for the Project under Section 5(11) of the EIAO. It describes the scope of Project, assesses the potential environmental impacts associated with the Project and recommends mitigation measures to minimise the potential environmental impacts. It demonstrates that the potential environmental impacts of the Project and the mitigation measures described in this Project Profile meet the requirements of the Technical Memorandum on EIA Process (EIAO-TM).

1.6 Name and Telephone Number of Contact Person(s)

Name of Contact Person	Position	Telephone Number
Wyman Li	Chairman	2504 8138

2. Outline of Planning and Implementation Programme and Design of the Project

2.1.1 The project will be planned and implemented by the project proponent and its consultants/ contractors. The platform that the proposed shooting range will reside on is within the waste boundary of the PPVL. The platform is mainly bareground and partly covered with grass. The following measures/facilities have been installed at the landfill:

- Platform capping system. Platform capping system includes a proprietary "Barrierdrain" layer which serve dual functions as a drainage layer at the top and a low permeability layer at bottom. It comprises a geotextile layer bonded over the protruding dimples of a 1mm thick linear low density polyethylene (LLDPE) geomembrane. A general cover layer of not less than 850 mm is provided on top and covered with hydroseeding.
- Slope capping system. It consists of a soil cover of not less than 2m thick and suitably landscaped with vegetation.
- Leachate treatment plant. It collects leachate from the landfill and treat it to meet the required discharge standards before discharging into public foul sewer.
- Landfill gas collection system. It is provided to collect landfill gas for energy recovery to generate heat for the leachate treatment plant. A generator consuming landfill gas as fuel to supply electricity for the site in case there is surplus landfill gas is also provided. A flare plant burns excess landfill gas.

2.1.2 The aftercare contractor is responsible for operation and maintenance of the restoration facilities for 30 years under the Contract with EPD. During the aftercare period, continuous environmental monitoring on leachate, landfill gas, groundwater, surface water and nuisances will be carried out. Therefore, the proposed shooting range will be designed so that the location of the shooting range facilities would not affect the existing landfill restoration measures/facilities installed onsite. In addition, according to the advice from EPD, the design loading on capping would amount to 60kN/m^2. The proposed shooting range will therefore comprise single-storey building and with footing in such a way that the loading will be within the limit of 60kN/m^2 and no piling and deep excavation is necessary. Only shallow excavation of not more than 300mm will be required for underground laying of utilities.

2.1.3 The tentative planning and implementation programme is shown below.

Table 1: Tentative Planning and Implementation Programme

Planning and Implementation Activities	Period
Application under Town Planning Ordinance	Jun 2007 – Dec 2007
Detailed Design	Aug 2007 – Jan 2008
Construction of the shooting range development	Jun 2008 – Dec 2008
Application of Occupation Permit	Jan 2009 – Feb 2009
Pre-2009 East Asian Games Operation	Mar 2009 – Nov 2009
2009 East Asian Games	Dec 2009

2.1.4 This proposed shooting range is necessary to provide facilities for shooting event of the 2009 East Asian Games in December in 2009. Pre-2009 East Asian Games operation is also considered necessary to test the performance of the venue to allow time for improvement in order to ensure smooth running of the shooting event during the Games.

3. Major Elements of the Surrounding Environment

3.1 General

3.1.1 PPVL (at about +150mPD) was used as a landfill site until 1996 and has been restored in 2006. An existing access connects PPVL to Lung Mun Road (at about +6mPD). The northern platform of the PPVL is within the Castle Peak Firing Range boundary and the southern platform is at the periphery of the Tuen Mun Outline Zoning Plan (S/TM/23). The subject site for the proposed shooting range is located at the southern platform of PPVL. The subject site and immediate surrounding area (except the area within the Castle Peak Firing Range boundary) is currently zoned “green belt”.

3.1.2 The eastern, northern and western sides of the subject site are mountain and hill areas of higher elevation. The mountain ridge on the eastern side of the subject site reaches up to +330mPD so that Tuen Mun district to the further east is totaled shielded. To the south of the subject site is the existing industrial (e.g. River Trade Terminal) and temporary recreational (River Trade Golf) uses situated along Lung Mun Road.

3.1.3 On the other hand, a planned holiday camp facilities is located at Siu Lang Shui Landfill to the southwest of the subject site. The holiday camp facilities are elevated lower than the proposed shooting range and separated by a hill up to +245mPD. In other words, it is shielded by the topography as well. Moreover, the horizontal separation distance would amount to about 1.1km.

3.1.4 The subject site is distant apart from the marine waters. The shortest distance from the marine waters (on the southeast side) amounts to about 700m. There is a stream/channel aligned on the opposite side of the existing access road to the west of the subject site, which runs from north to south. The separation distance of the stream/channel from the subject site is about 100m.

3.1.5 The nearest Sites of Special Scientific Interest (SSSIs) are located at Siu Lang Shui (a site known for overwintering butterfly) and Castle Peak (home of the Bell-flower, Platycodon grandiflora, and with interesting forested ravines occur on the east and west faces with rare shrubs like Uvaria hamiltonii) respectively at some 1.4km and 500m apart.

3.1.6 **Figure 1** showed the location of the Subject Site and the environs. Both existing and planned uses nearest to the development have been highlighted for reference.

3.2 Noise Sensitive Uses

3.2.1 According to Annex 13 of the EIAO-TM, potential noise sensitive receivers (NSRs) include residential uses, institutional uses and other uses such as hostels and country parks.

3.2.2 The nearest existing residential use is the village at Tsing Shan Tsuen San Shek Wan South which is at the western periphery of Tuen Mun district. The village is elevated at about +70 to +80 mPD and is completely shielded from the subject site by the hill of up to +330 mPD. The horizontal separation distance between the subject site and the village amounts to about 940m. The nearest institutional use is the kindergarten in Melody Garden to the further east/southeast and of lower elevation when compared with Tsing Shan Tsuen San Shek Wan South village. The horizontal distance is over 1.3km.

3.2.3 A Tung Wah Group of Hospital Youth Holiday Camp is planned at Siu Lang Shui near the restored Siu Lang Shui landfill to the southwest of the subject site and is elevated at about +50 to +70

mPD. The horizontal separation distance from the subject site amounts to nearly 1.1km. Moreover, the holiday camp is also shielded from the subject site by a hill of up to about +245mPD.

3.3 Air Sensitive Uses

3.3.1 According to the EIAO-TM, all domestic premises, hotel, hostel, hospital, clinic, nursery, temporary housing accommodation, school, educational institution, office, factory, shop, shopping centre, libraries, etc. should be considered as ASRs.

3.3.2 EPD's site office for PPVL is located just over 500m to the south of the subject site.

3.3.3 The nearest existing recreational uses (i.e. River Trade Golf) and industrial uses are located along Lung Mun Road and at over 700m to the south of the Subject Site.

3.3.4 According to the Tuen Mun outline zoning plan (S/TM/23), River Trade Golf is located within an area (of about 22 ha) along Lung Mun Road which is zoned as "OU" (crematorium, columbarium funeral services centre and open space). The shortest distance from this "OU" site to the subject site amounts to more than 200m.

3.3.5 Existing recreational uses and future crematorium uses will be regarded as air sensitive uses.

3.3.6 **Figure 6** showed the location of the identified ASRs in the vicinity of the subject site.

3.4 Potential Environmental Pollution Sources

3.4.1 The proposed development would include an office-cum-clubhouse building. The office-cum-clubhouse building will be ventilated using window type, split type air conditioning units or/and exhaust fans and provided with proper insulation such as well gasketted windows so that potential noise impact on the office use is not a concern.

3.4.2 Potential environmental pollution sources that may affect the proposed development include landfill gas emission onsite from gas vents of the restored PPVL, and PPVL flaring plant emission by using landfill gas as fuel for the operation of the leachate treatment plant at more than 500m from the subject site. The combustion process of the flaring plant does not emit pollutants exceeding the compliance limit according to the stack monitoring result (Tables in S2.8.1.6 of **Appendix D**) and would not generate significant air pollutant emissions so that no unacceptable air quality impact on nearby air sensitive uses after dispersion for a long distance (over 500m) is anticipated. The leachate treatment plant is a closed system sited over 500m from the subject site. The potential odour impact from the plant is considered insignificant. Moreover, no odour impact has been observed onsite. On the other hand, gunshots within Tsing Shan Firing Range may impose impact such as lead dust emissions.

4. Possible Impact on the Environment and Environmental Protection Measures to be Incorporated

4.1 General

4.1.1 The subject site is located at PPVL and is mainly bareground and partly covered with grass and without trees onsite. There is no habitat of high ecological value. Potential impact on the existing landscape value of the site is not identified to be a concern. There is no water body onsite or in close proximity to the subject site. The subject site is also remote from major development areas in Tuen Mun. The proposed development would only include single-storey building. The nearest high-rise residential buildings at Melody Garden and Butterfly Estate (i.e. the visual sensitive receivers, or VSRs) are situated at more than 1.2km to the east of the site and the view to the subject site will be totally shielded by the mountain ridge. Similarly, the platform that the proposed shooting range resides is elevated at about +150mPD and is therefore not visible from Lung Mun Road (another VSR) at about +6mPD. The separation distance of the subject site from developments along Lung Mun Road is more than 650m. The construction and operation of the proposed shooting range would therefore unlikely give rise to any significant visual impact on these VSRs.

4.1.2 The nearest residential/institutional uses (including existing and planned facilities) are located about 1km away from the subject site and is totally shielded by topography. The nearest existing office use is EPD's site office at 500m away. The nearest planned office uses would be that of the future crematorium whose design is not available at the present time. The nearest water body is located at about 100m away from the subject site.

4.1.3 There is no programme for implementation of the planned crematorium & columbarium along Lung Mun Road and the holiday camp at Siu Lang Shui. It is therefore unlikely these planned uses would come into operation before completion of construction of the proposed shooting range. These planned uses are considered not to be affected by the construction of the project.

4.1.4 The proposed shooting range would only involve construction of a few single-storey buildings and will be to a limited extent which would unlikely generate significant impact. The operational phase environmental impact is also limited to due the remoteness of the site. While noise is possibly generated from shooting activity, it is anticipated that there is unlikely any unacceptable noise impact due to the fact that the proposed shooting range is distant apart and shielded by topography from the noise sensitive uses.

4.1.5 Other than this, the potential landfill gas hazard should be addressed as the proposed development is sited at the restored landfill.

4.1.6 Individual environmental impacts are discussed below.

4.2 Noise Impact

Construction Phase

4.2.1 Construction noise is controlled under the Noise Control Ordinance (NCO) which prohibits the use of powered mechanical equipment (PME) during the restricted hours (7 p.m. to 7 a.m. on normal weekdays and any time on a public holiday, including Sunday) without a valid Construction Noise Permit (CNP) granted by the Authority. The criteria and procedures for issuing such a permit are

specified in Technical Memorandum on Noise From Construction Works other than Percussive Piling (TM-GW).

4.2.2 Noise impacts arising from general construction works during normal working hours (i.e. 0700 to 1900 hours on any day not being a Sunday or public holiday) at the openable windows of noise sensitive buildings are to be assessed as per the guidelines contained in Table 1B, Annex 5 of the EIAO-TM. The recommended noise standards are 75dB(A) for domestic premises, 70dB(A) for educational institutions and 65dB(A) during examinations.

4.2.3 Major noise during the construction of the project would come from use of powered mechanical equipment (PME). Regarding this project, there will be no piling and deep excavation activities. Major site formation work for this project would involve filling and compacting work only. Other superstructure construction and utilities installation works would unlikely generate excessive noise impact.

4.2.4 During construction of the project, the nearest noise sensitive uses will be Tsing Shan Tsuen San Shek Wan South village which will be totally shielded by topography and located at about 1km away from the subject site.

4.2.5 Given the remoteness of the noise sensitive uses, its being totally shielded by topography and limited uses of PME, no unacceptable construction noise impact is anticipated.

4.2.6 In all circumstances, the Contractor responsible for construction of the proposed shooting range shall observe and comply with the Noise Control Ordinance and its subsidiary regulations. The construction contractors will be required to implement best management practices to control and suppress noise generation from the subject site in order to minimize any adverse impact. All plant and equipment to be used onsite will be properly maintained in good operating condition and noisy construction activities shall be effectively sound-reduced by means of silencers, mufflers, acoustic linings or shields, acoustic sheds or screens or other means, to avoid disturbance to any nearby noise sensitive receivers. The Contractor shall devise, arrange methods of working and carry out the Works in such a manner so as to minimise noise impacts on the surrounding environment, and shall provide experienced personnel with suitable training to ensure that these methods are implemented.

Operational Phase

4.2.7 The proposed shooting range will generate noise during gunshot event. Other facilities onsite are not considered noisy. Air pistol will only generate limited noise and will only be used within the indoor firing range. The indoor firing range will be ventilated using window type, split type air conditioning units or/and exhaust fans and provided with proper insulation such as well gasketted windows. No significant noise impact due to the operation of the indoor air pistol firing range is anticipated.

4.2.8 Open firing ranges will not be used during night time. No night time noise impact is anticipated.

4.2.9 Both the holiday camp at Siu Lang Shui, Tsing Shan Tsuen San Shek Wan South village and other noise sensitive uses in Tuen Mun district are remote and of no direct line of sight from the proposed shooting range. However, due to the impulsive and intermittent nature of the noise generated, the possible effect is expected higher than other typical noise sources. The planned holiday camp facilities at Siu Lang Shui and the village at Tsing Shan Tsuen San Shek Wan South are selected for the purpose of assessment.

4.2.10 According to the EIAO-TM, the noise criteria should be (a) 5 dB(A) below the appropriate acceptable noise levels (ANL) shown in Table 3 of the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Site (TM-1), or (b) the prevailing background noise levels (For quiet areas with level 5dB(A) below the ANL). The ANL for a given NSR depends on the time period and area sensitivity rating according to the TM-1.

4.2.11 The planned holiday camp is located adjacent to Tuen Mun Area 38 area which is composed of the temporary fill bank, EcoPark and river trade terminal. The holiday camp is considered directly affected by such uses. An area sensitivity of "C" is considered appropriate. Regarding the village at Tsing Shan Tsuen San Shek Wan South, it will be directly affected by Lung Fu Road. An area sensitivity of "A" is considered appropriate. The ANLs of these two NSRs are therefore determined to be 70 dB(A) and 60 dB(A) respectively during day and evening time.

4.2.12 The background noise levels at these two locations were measured during daytime on 13/9/2007. The measurement location is shown in **Appendix A**. The background noise reading was taken when the Leq level remains steady after a duration of about 15 to 20 minutes. As observed onsite, noise environment at Siu Lang Shui Landfill was dominated by operational noise from River Trade Terminal and traffic along Lung Mun Road. On the other hand, noise at Tsing Shan Tsuen San Shek Wan South was dominated by traffic. For both measurement locations, there is no direct line of sight with the road carriageways as it is either shielded by topography or planting. According to the measurement result, the background noise level is presented and the applicable standard is deduced in **Table 2** below.

Table 2: Background Noise Measurement Result and Applicable Standard

Noise Sensitive Uses	Measured Background Noise Level	5 dB(A) below ANL	Applicable Standard
Planned holiday camp facilities at Siu Lang Shui	56.8 dB(A)	65dB(A)	56.8 dB(A)
Village at Tsing Shan Tsuen San Shek Wan South	58.6 dB(A)	55dB(A)	55 dB(A)

4.2.13 It is considered that noise will be emitted to the surroundings during gunshots at outdoor and semi-open (outdoor) shooting ranges only. For the 10m indoor air pistol shooting range, it will be completely shielded so that noise after escaping from the enclosed room will unlikely be significant. Moreover, the indoor shooting range will cater for air pistol only and is less noisy when compared with other weapons. The noise impact due to the indoor shooting range is therefore considered insignificant and would not be accounted in this study. Noise from the other two open shooting ranges will be accounted in this assessment.

4.2.14 Noise tests were conducted on 1/6/2007 and 4/6/2007 at Hong Kong Gun Club and Hong Kong Rifle Association to measure noise levels generated by gunshots. Different types of weapons including air pistol, pistol, rifle and shotgun were employed in the noise test. For each weapon, the noise level was measured at 5 different directions (in front and at 4 other locations surrounding the gunshot location) and the highest noise level was adopted to deduce the noise impact.

4.2.15 The measurement result for gunshot noise is summarized in the following table. Detailed result of noise measurement is shown in **Appendix B**.

Table 3: Summary of Noise Measurement Result in Noise Test

Weapon	Maximum Sound Exposure Level per Shot	Distance of Measurement	Applicable Shooting Range
Air pistol	91.7 dB(A)	2m	Indoor 10m shooting range
.22 rifle	**105.0 dB(A)**	2m	50m shooting range
9mm pistol	113.7 dB(A)	2m	25m shooting range
.45 pistol	**114.4 dB(A)**	2m	25m shooting range
.22 pistol	105.4 dB(A)	2m	25m shooting range
.32 pistol	106.3 dB(A)	2m	25m shooting range
.38 revolver	110.5 dB(A)	2m	25m shooting range

*bold values are maximum SEL adopted for noise assessment for individual shooting range

4.2.16 As advised by HKSA, the worst-case scenario from noise perspective was formulated as with simultaneous operation of all 120 lanes in the 50m and 25m shooting range. For both the 50m and 25m shooting ranges, the maximum shooting frequency would amount to about 5 shots in 5-minutes for each lane. Within a time period of 30 minutes, there can be a maximum of 1,800 shots from both the 50m shooting range and 25m shooting range.

4.2.17 The noise source is assumed as point source for calculation of distance attenuation. For impulsiveness, a correction of +3 dB is assumed. As of substantial shielding by topography, a correction of -15 dB is applied. To account for façade reflection, a correction of +3 dB is assumed. The noise levels at the NSRs of the planned Siu Lang Shui holiday camp and Tsing Shan Tsuen San Shek Wan South Village are predicted as follows:

Table 4: Calculation of Noise Impact due to Gunshots

Siu Lang Shui Holiday Camp	25m shooting range	50m shooting range
Reference SEL for 1 shot	114.4 dB(A)	105.0 dB(A)
Reference distance	2m	2m
Number of shots in 30 min	1800	1800
Distance from NSR	1100m	1100m
Impulsiveness corr	+3dB(A)	+3dB(A)
Barrier corr	-15dB(A)	-15dB(A)
Façade corr	+3 dB(A)	+3 dB(A)
SEL in 30 min at reference distance	147.0 dB(A)	137.6 dB(A)
SEL in 30 min at NSR without correction	92.1 dB(A)	82.7 dB(A)
Leq in 30 min at NSR without correction	59.6 dB(A)	50.2 dB(A)
Leq in 30 min after impulsiveness, barrier and façade corr	50.6 dB(A)	41.2 dB(A)
Overall Leq in 30 min	**51.1 dB(A)**	
Applicable Standard	**56.8 dB(A)**	
Compliance with the Standard?	**Yes**	

Tsing Shan Tsuen San Shek Wan South Village	25m shooting range	50m shooting range
Reference SEL for 1 shot	114.4 dB(A)	105.0 dB(A)
Reference distance	2m	2m
Number of shots in 30 min	1800	1800
Distance from NSR	940m	940m
Impulsiveness corr	+3dB(A)	+3dB(A)
Barrier corr	-15dB(A)	-15dB(A)
Façade corr	+3 dB(A)	+3 dB(A)
SEL in 30 min at reference distance	147.0 dB(A)	137.6 dB(A)
SEL in 30 min at NSR without correction	93.5 dB(A)	84.1 dB(A)
Leq in 30 min at NSR without correction	61.0 dB(A)	51.6 dB(A)
Leq in 30 min after impulsiveness, barrier and façade corr	52.0 dB(A)	42.6 dB(A)
Overall Leq in 30 min	**52.4 dB(A)**	
Applicable Standard	**55 dB(A)**	
Compliance with the Standard?	**Yes**	

4.2.18 According to the result, the predicted noise level under the worst case scenario is within the acceptable criterion owing to the remoteness of the subject site and shielding by the topography.

4.2.19 Nevertheless, the open shooting ranges will be erected with solid fence wall. The fence wall will be 3.5m high including the 1.5m raised platform of the shooting shed. **Figure 5** showed the section of the open firing range. Fence wall in terms of timber baffles will be erected on 3 sides of the open firing ranges. Considering the fact that all identified NSRs are elevated lower than the proposed shooting range, these proposed measures will help to assure that there will be no direct line of sight between the shooting activities and the NSRs, and/or increase the substance of shielding in order to mitigate the noise impact.

4.2.20 Every shooting range must have its range order prepared and approved by the Hong Kong Police before operation. A shooting range order will be prepared to contain information such as the opening hours of the shooting range, weapons allowed, etc. based on which the noise impact is evaluated in this project profile. The shooting range order will be strictly followed for the operation of the proposed shooting range so that no violation leading to increase noise impact is expected. **Appendix C** showed a shooting range order proposed for the development which may be refined and subject to approval by relevant authority.

4.3 Air Quality Impact

4.3.1 The principal legislation against air pollution in Hong Kong is the Air Pollution Control Ordinance (APCO) (Cap. 311). Air Quality Objectives (AQOs), which specify the statutory concentration limits for various criteria pollutants and the maximum numbers of times allowed to

exceed over a specified period of time are set for the whole territory. These AQOs are also referred to in the EIAO-TM.

4.3.2 In addition to the AQOs, Annex 4 in the EIAO-TM issued under the EIA Ordinance sets an hourly TSP limit of 500μg/m^3 for construction dust impact assessment.

4.3.3 The proposed shooting range itself with office building will be an air sensitive use during its operation. Conversely, it may impose air quality impact on the nearby air sensitive uses during construction and operation of the project.

Background Air Quality

4.3.4 The subject site is located at the Pillar Point Valley Landfill within the waste boundary and outside the Tsing Shan Firing Range in Tuen Mun. According to "Air quality in Hong Kong" published by EPD, EPD's nearest air quality monitoring station is located in Yuen Long. In addition, CLP's air quality monitoring station at Butterfly Estate and Lung Kwu Tan is nearer to the subject site. The background air quality levels for individual pollutants is derived based on the latest 5-year annual average pollutant levels and shown below. According to the background air quality level, there is exceedance of the AQO for TSP and RSP.

Table 5: Background Air Quality

Air Quality Monitoring Station	SO_2	TSP	RSP	NO_2
EPD's station in Yuen Long	24μg/m^3	100μg/m^3	62μg/m^3	60μg/m^3
CLP's station at Butterfly Estate	17μg/m^3	-	-	43μg/m^3
CLP's station in Lung Kwu Tan	12μg/m^3	-	-	28μg/m^3
AQO Standard (1-yr average)	80μg/m^3	80μg/m^3	55μg/m^3	80μg/m^3

Construction Phase

4.3.5 The project will be designed in such a way to adapt to the existing topography where possible. No extensive site formation work is expected. During the construction of the project, there will be no deep excavation. Dusty activities may include loading/unloading, shallow excavation and filling during site formation, but are expected to be minimal due to limited extent of construction. The nearest air sensitive uses will be the EPD's site office and office of the recreational use along Lung Mun Road to the south of the subject site. The separation distance is more than 500m. No unacceptable air quality impact due to the project is therefore anticipated.

4.3.6 In all circumstances, the Contractor shall observe and comply with the Air Pollution Control Ordinance and its subsidiary regulations, particularly the Air Pollution Control (Open Burning) Regulation and Air Pollution Control (Construction Dust) Regulation and Air Pollution Control (Smoke) Regulation. Best management practice will be followed by the Contractor at all times to prevent dust nuisance and smoke as a result of the construction activities. The Contractor shall ensure that there will be adequate water supply/storage for dust suppression where necessary. The Contractor shall devise, arrange methods of working and carrying out the works in such a manner so as to minimise dust impacts on the surrounding environment, and shall provide experienced personnel with suitable training to ensure that these methods are implemented.

Operational Phase - Possible Impact on the Proposed Shooting Range

4.3.7 Potential emission source within 500m from the project site boundary includes LFG emission from passive gas vent on the landfill site. There is no generator used onsite and no emission due to fuel burning is anticipated. Other emission sources such as the flaring system of the leachate treatment facility is located more than 500m outside the project site.

Appraisal of impact due to emissions from passive gas vent

4.3.8 There will be 2 passive gas vents within and along the northeastern boundary of the subject site and two other gas vents outside the subject site near to the southern tip area while the proposed air sensitive uses are located near the southwest boundary so that the separation from gas vents have been maximised. The minimum separation distances measured from the office-cum-clubhouse building and lavatory/beverage house to the nearest gas vents are about 115m and 90m respectively, The gas vent serves to avoid the accumulation of landfill gas (LFG) so that LFG is expected to be released to the atmosphere from the passive gas vents. Methane, oxygen and carbon dioxide are the main constituents and are regularly monitored by the aftercare contractor. Tables in S2.8.1.4 of **Appendix D** showed the passive gas vent monitoring records. There is no other aerial emission envisaged other than methane and carbon dioxide that are considered to be significant. On the other hand, the aftercare contractor of PPVL conducts regular landfill gas monitoring and air monitoring which include: survey of surface gas emissions, drillholes & piezometer monitoring, landfill gas monitoring of on-site buildings, survey of off-site building, passive vents monitoring, stack emission monitoring, gas extraction wells monitoring, dust monitoring, ambient VOC emission monitoring, odour monitoring and meteorological monitoring. PPVL's site VOC monitoring data taken by the aftercare contractor (Tables in S2.8.5.2 of **Appendix D**) has indicated that the ambient VOC level is generally well below the compliance limit based on more recent measurement result (from Year 2007 onwards). No significant VOC emission impact is therefore anticipated. According to PPVL's odour monitioring data taken by the aftercare contractor (Tables in S2.8.5.3 of **Appendix D**), no odour can be detected. Therefore, no significant odour impact is anticipated.

4.3.9 Methane itself is not toxic. Yet, it is flammable so that caution should be made not to allow the accumulation of methane to the limit above which it can be ignited and exploded. Carbon dioxide accumulation, on the other hand, would result in a risk of asphyxiation.

4.3.10 Further, the restoration work for Pillar Point Valley Landfill was completed in 2006. The aftercare contractor will be responsible for maintenance and monitoring of the facilities for 30 years under the Contract with EPD to ensure that there would be no excessive emission of landfill gas to the atmosphere. No unacceptable impact on the future users of the facility is anticipated.

Operational Phase - Possible Impact on Offsite Air Sensitive Uses

4.3.11 There is no existing ASR identified within 500m from the proposed shooting range. For the planned uses, the crematorium/columbarium is partially within 500m from the proposed shooting range to the south and along Lung Mun Road. While there is no detailed information for this planned use, it is assumed that office will be present and is regarded as an ASR which may be within 500m from the proposed shooting range.

4.3.12 There will be electricity supply for the proposed shooting range and the proposed development would not rely on diesel powered generator to provide electricity so that pollution due to fuel burning is not considered an issue.

4.3.13 The use of air pistol will be CO2 powered. No criteria pollutants will be released during use of air pistol. Therefore, the ventilation exhaust of the indoor shooting range would not emit any criteria pollutants.

4.3.14 On the other hand, there is limited emission from normal gun shots. Firstly, lead shots contain primarily lead of about 97%. Lead dust (including lead metal, lead ion and oxidized lead compound) as a result of breakdown of lead bullet is the major source of air pollution. Secondly, gunshot would also involve burning of primer mixtures. Primer mixture does include diazodinitrophenol, potassium salts, inert sensitizer (ceramic powder), but not contain lead compound (i.e. lead-free) so that no lead fume emission during burning of primer mixture is expected. However, there would be some fume generated when hot gases act on the bullet passing through the barrel to produce lead fumes. Lastly, the bullet itself may be broken down to smaller particulates after hitting on the target so as to generate lead dust again.

4.3.15 It is understood that most of airborne lead emitted during gunshot does come from the bullet being ejected. Airborne lead is in the form of lead dust or lead fume. Drag force during gun shot is impulsive and not considered an important mechanism that would bring lead dust to remote location so that most lead emission is considered rather localised. Moreover, the proposed shooting range is designed so that all gun shots will be pointing towards the hill slope on the northeast side whereas the nearest ASR (the planned crematorium/columbarium) is situated to the south. The drag force will in fact drive lead dust further from the ASRs.

4.3.16 Lead-free primer mixture is effective in avoiding lead fume emission and will be adopted for the firearm used within the proposed shooting range so that lead fume emission is unlikely a concern.

4.3.17 Lastly, in order to minimize the potential to generate fine particulate, backstop of soft materials will be erected behind the target plate to collect the bullets so that the bullet would remain intact, thus eliminating lead dust when hitting the target [1]. Referring to **Figure 5**, timber baffles with sand bag will be used as the backstop. Fence wall of 3.5m aboveground will be provided to further obstruct and depress possible dispersion of the heavier lead dust within the shooting range area.

4.3.18 The centre of Tsing Shan Firing Range is at about 3.3km apart from the subject site. In order to avoid disturbances to the public, it is reasonable to assume that the firing practice within Tsing Shan Firing Range will be carried out at an area distant apart from the Firing Range boundary and probably near to the centre of the Firing Range. Moreover, there have been no firing activities within the viewable distance of some 500m to 700m observed from the subject site before. As all nearest air sensitive uses are sited to the south of the subject site, they will be further away from Tsing Shan Firing Range and the likely firing practice location. Considering the remoteness of the air sensitive uses from the subject site and limited emission from the proposed development, and further away from Tsing Shan Firing Range's likely firing location, the potential air quality impact due to the proposed shooting range as well as cumulative impact due to concurrent operation in Tsing Shan Firing Range on the air sensitive uses is considered insignificant with mitigations in place.

4.4 Water Quality Impact

4.4.1 The Water Pollution Control Ordinance (WPCO) (Cap. 358) enacted in 1980 is the principal legislation controlling water quality in Hong Kong. Under the WPCO, Hong Kong waters are classified into 10 Water Control Zones (WCZs). Statutory Water Quality Objectives (WQOs) are specified for

[1] USEPA, June 2005, Best Management Practices for Lead at Outdoor Shooting Ranges

each WCZs. The WQOs for any particular waters, as defined in the WPCO, shall be the quality, which should be achieved and maintained in order to promote conservation and best use of those waters in the public interest.

4.4.2 The Technical Memorandum on "Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters" issued under Section 21 of the WPCO defines acceptable discharge limits of effluent to different types of receiving waters. Under the Ordinance, any discharge into a WCZ requires licensing and must comply with the terms and conditions specified in the licence, except for domestic sewage discharged into public foul sewers, and unpolluted water into stormwater drains and river courses.

Construction Phase

4.4.3 Water quality impacts may arise due to site effluent including site runoff and potential washouts, fuel contaminated fluids and improper site housekeeping, especially during the rainy season.

4.4.4 Runoff and any discharge will be collected by either existing drainage system or temporary drainage system where necessary. Facilities such as sand traps and oil interceptors will be provided.

4.4.5 There is no aquatic system within or in close proximity to the subject site. There is a separation distance of 100m from the existing stream/channel on the western side of the subject site. Marine waters are located far away with separation of over 700m. There is no direct impact of water quality to the identified aquatic system expected due to the proposed development.

4.4.6 In all circumstances, the Contractor will be required to note and comply with the Water Pollution Control Ordinance and its subsidiary regulations. The Contractor shall carry out the Works in such a manner as to minimise adverse impacts on the water quality during the execution of the Works and rearrange the working method to minimise water pollution within and outside the site area. The Contractor shall follow the practices, and be responsible for the design, construction, operation and maintenance of all the mitigation measures as specified in the Professional Persons Environmental Consultative Committee Practice Note (ProPECC PN) 1/94 "Construction Site Drainage" issued by the Director of Environmental Protection.

Operational Phase

4.4.7 Holding tank (aboveground) and chemical toilet facilities will be provided. All wastes will be stored using the holding tank and disposed of by waste disposal agents then. Surface channel will be provided to collect stormwater. The requirement under the Water Pollution Control Ordinance is observed. No discharge of wastewater will be permitted. Therefore, there is no unacceptable water quality impact envisaged.

4.4.8 Shooting generally would not attract much audience as other sport competitions do. Peak flow is only expected for larger scale events such as East Asian Games. Based on estimation, a maximum of about 500 persons including visitors and staffs are assumed. According to the design flow rate of 23L per head per day, there will be a maximum of about 11.5m^3 of wastewater generated. The holding tank facilities will be designed to have a capacity of about 23m^3, which is about two times of the maximum daily discharge. Arrangement will be made so that the wastewater will be disposed of daily during peak utilization period. No unacceptable sewerage impact is envisaged.

4.5 Ecological Impact

4.5.1 The subject site is within the waste boundary of the PPVL which was restored in 2006. The area comprises mainly disturbed land and a small portion of grassland. There is no invaluable species and important habitat of high ecological importance identified within the subject site. The proposed development would not result in any significant direct ecological impact.

4.5.2 The SSSIs identified in Tuen Mun district (i.e. Castle Peak SSSI and Siu Lang Shui SSSI) are remote from the subject site (with separation distance of respectively 500m and 1.4km). For the nearest SSSI at Castle Peak, it is mainly with respect to flora species. On the other hand, the SSSI at Siu Lang Shui is shielded from the proposed shooting range by topography. Given the long separation distance from these two SSSIs and natural shielding protecting Siu Lang Shui SSSI, the construction of the proposed shooting range would unlikely result in any significant offsite impact. In addition, during the operational phase of the project, shooting activities will either be carried out within the indoor shooting range or at the outdoor shooting range with fence wall erected on three sides for shielding purpose. Given long separation and shielding by the fence wall in addition to topography shielding, the potential disturbance to offsite habitat of high ecological value is considered insignificant.

4.6 Waste Management Implication

4.6.1 The principle legislation governing waste management in Hong Kong is the Waste Disposal Ordinance (Cap. 354) (WDO), and its subsidiary regulations. The Ordinance, enacted in 1980, generally encompasses all stages of waste management, from place of arising to final disposal point of waste. The Waste Disposal (Chemical Waste) (General) Regulation, enacted under the WDO in 1992, provides controls on all aspects of chemical waste disposal, including storage, collection, transport, treatment and final disposal.

4.6.2 In addition to the WDO and its subsidiary regulation, the following legislation have some bearing on the handling, treatment and disposal of wastes in Hong Kong, viz.,:

- Dumping at Sea Ordinance (1995);
- Crown Land Ordinance (Cap. 28);
- Public Health and Municipal Services Ordinance (Cap. 132) Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-laws; and
- Dangerous Goods Ordinance.

<u>Construction Phase</u>

4.6.3 The construction activities are considered minimal due to the limited extent of the proposed development. The formation of the site would neither require substantial filling nor excavation. Therefore, there will be negligible construction and demolition materials expected. Fill materials possibly generated due to shallow excavation will be used to fill up other area onsite. Therefore, no net fill materials will be generated. No significant truck traffic and related problem will arise from the construction of the project.

4.6.4 On the other hand, other construction & demolition waste, and chemical waste quantity is expected to be limited. General refuse quantity is expected to be insignificant.

4.6.5 In all circumstances, the contractor is required to observe and comply with the Waste Disposal Ordinance and its subsidiary regulations. Regarding the handling of chemical waste, the contractor shall apply for registration as chemical waste producer under the Waste Disposal (Chemical Waste) (General) Regulation when chemical waste is produced. All chemical waste shall be properly stored, labelled, packaged and collected in accordance with the Regulation.

4.6.6 The contractor shall minimise the generation of waste from his work. Avoidance and minimisation of waste generation can be achieved through changing or improving design and practices, careful planning and good site management. The contractor shall ensure that different types of wastes are segregated on-site and stored in different containers, skips or stockpiles to facilitate reuse/recycling of waste and, as the last resort, disposal at different outlets as appropriate. The reuse and recycling of waste shall be practised as far as possible. The recycled materials shall include paper/cardboard, timber and metal etc. The C&D waste which comprises metal, timber, paper, glass, junk and general garbage shall be reused or recycled and, as the last resort, disposal of at landfills. The Contractor shall record the amount of wastes generated, recycled and disposed of (including the disposal sites). The Contractor shall use a trip ticket system for the disposal of C&D materials, if any, to any designated public filling facility and/or landfill. Training shall be provided for workers about the concepts of site cleanliness and appropriate waste management procedure, including waste reduction, reuse and recycling.

Operational Phase

4.6.7 According to the nature of the proposed development, cartridge casings and other debris will be generated during its operation. All cartridge casings and other debris will be collected from the shooting range daily by the operator's staff.

4.6.8 Two holding tanks (aboveground and without soakaway system) and chemical toilet facilities will be provided respectively at the club house and lavatory/beverage house. **Figure 4** indicated the location of the holding tanks. All wastes retained in the holding tank will be disposed of by waste disposal agents then.

4.6.9 The project is expected to generate limited municipal wastes similar to other commercial and tourism facilities during its operational phase. The associated environmental impacts should not be significant. Nevertheless, requirements on proper waste management are to be identified for future implementation.

4.7 Landfill Gas Hazard Review

4.7.1 The proposed shooting range will be built on the restored PPVL. There will be direct interfacing with the maintenance operation and facilities of PPVL.

4.7.2 The potential landfill gas migration impact has been assessed in this context. On the other hand, there will be no piling and deep excavation for the proposed shooting range development during construction. All facilities will be aboveground while some utilities may be laid in shallow underground without affecting the existing landfill restoration facilities. Only shallow excavation of not more than 300mm will be required for underground laying of utilities. There will be no chance for direct contact with leachate during both construction and operational phase of the project. The potential leachate migration impact is considered insignificant.

4.7.3 Environmental Protection Department (EPD) has issued two guidance notes regarding landfill gas hazard assessment including ProPECC PN 3/96 – Landfill Gas Hazard Assessment for Development Adjacent to Landfill; and EPD/TR8/97 – Landfill Gas Hazard Assessment Guidance Note. The government has adopted the general guideline of a consultation zone of 250m from the perimeter of a landfill as recommended by the UK DoE in Waste Management Paper No. 27. As the Subject Site is right on the PPVL and is definitely within this consultation zone, the guideline should be followed to evaluate possible hazards due to the migration of LFG. According to the guidance note, the framework of a source-pathway-target analysis is devised for qualitative risk assessment and is thus followed in this assessment.

Proposed Shooting Range and Activities

4.7.4 The proposed shooting range will consist of two indoor air pistol shooting ranges, one outdoor 25m pistol shooting range and one outdoor 50m rifle shooting range. Normal shooting training and shooting games event will take place in the proposed shooting range and will be limited to day and evening time only. All visitors are required to follow the shooting range order and only permitted weapons can be used. Outdoor shooting (standing, kneeling, proneness) will be carried out on the raised floor platform and there will be no direct contact with ground.

4.7.5 The indoor shooting range will involve air pistol shooting only so that the possibility of igniting accumulated landfill gas due to shooting activities can be eliminated. All outdoor shooting ranges will be fenced on three sides (except the rear side of the shooting place). All existing landfill facilities (e.g. gas well, extraction well, vent pipe) will not be affected. There will be no gas well underneath the proposed building/structure. There will only be 3 gas wells within the open ground area of the two outdoor shooting ranges. These gas wells are normally covered and does not include any aboveground structure. The cover of these gas wells within the open shooting range will be protected by providing extra cover by using combination of rubber tyres and sand bags that would not result in sparkling if hit by bullet.

Background and Nature of Landfill Gas

4.7.6 LFG is produced continuously from anaerobic degradation of putrescible organic matter in the buried waste. It was found to consist of 50-60% methane, 30-40% of carbon dioxide and trace amount of volatile organic compounds. The proportion of methane and carbon dioxide mixtures recorded are typical of a methanogenic landfill. The actual rates of LFG generation will vary depending on a range of environmental parameters viz. moisture, temperature and atmospheric pressure. Following peak LFG generation rates, a rapid decline in generation is envisaged to be followed by an extended period of lower generation rates over time.

4.7.7 The LFG mixture has a density similar to that of air, although it varies according to the exact composition. Upward movement of LFG is usually a result of excess pressure over the ambient rather than buoyancy. Also, bulk gas movements may be caused by changes in atmospheric pressure or by the pumping effect of a rising water table, whereas sub-surface lateral diffusion through semi-porous strata, cracks and faults may be predominately due to concentration gradients. Every effort has to be made either to stop the migration or to have it vented to avoid accumulation in undesirable locations of the development. LFG has possible hazards in the following aspects:

- methane forms explosive mixtures in air at concentrations in the approximate range of 5 -15% by volume. If allowed to accumulate in voids of buildings, ignition of the gas can lead to an explosion capable of causing significant structural damage.

- carbon dioxide is an asphyxiant. The long-term occupational exposure limit (OEL), specified in the HSE Guidance Note EH 40 for carbon dioxide is 0.5% by volume and the short-term OEL is 1.5% by volume. Therefore, accumulations of landfill gas sufficient to exceed lower explosive limit (LEL, 5% v/v) for methane could also pose a severe asphyxiation hazard to humans or animals.

Source and Classification

4.7.8 PPVL commenced its operation to receive waste from 1983 and closed in 1996. The Landfill measures about 38 ha and received waste totaled about 11 million m^3. The maximum waste depth amounts to 69m. The types of waste received include construction, domestic, commercial, industrial and special waste.

4.7.9 The landfill restoration work commence in 2004 and was completed in 2006. Platform capping system, slope capping system, leachate treatment plant and landfill gas collection system have been installed. The aftercare contractor is responsible for operation and maintenance of the restoration facilities for 30 years under the Contract with EPD. During the aftercare period, continuous environmental monitoring on leachate, landfill gas, groundwater, surface water and nuisances will be carried out. The platform that the proposed shooting range will reside on is within the waste boundary of the PPVL. The platform is mainly bareground and partly covered with grass.

Recent Monitoring Results

4.7.10 LFG monitoring result conducted by aftercare contractor at selected drillholes and LFG surface emission result from July 2006 (after restoration) to Apr 2007 have been provided by EPD. Tables in S2.8.1.2 of **Appendix D** showed the location of the drillholes/surface monitoring location and monitoring results. According to the monitoring result, it is noted that the monitored methane concentration at selected drillholes ranges from 0.0 to 0.1%. On the other hand, the monitored carbon dioxide concentration has a higher degree of variation and ranges from 0.1 to 13.1%. The monitored methane concentration is negligible in most of the time while the carbon dioxide concentration is still high which indicates a risk of asphyxiation. On the other hand, the surface LFG monitoring result (Tables in S2.8.1.1 of **Appendix D**) indicated that the highest possible methane concentration amounts to about 30ppm or 0.003% and is well below the 0.5%, i.e. 10%LEL level. The monitored carbon dioxide concentration is negligible. The result supported that LPG migration risk in open area or area with sufficient ventilation would not be a concern.

Classification

4.7.11 Despite that the monitoring result indicates that there is negligible methane detected in most of the time, it is considered that the PPVL (the source) should be classified as Medium Source concerning landfill gas migration risk given that active gas collection system is in operation at present, carbon dioxide levels are significant at some monitoring locations which suggest that there is a potential for LFG migration, and that the landfill has been restored in 2006 only so that there is not adequate data to justify that the risk of LFG migration is very low.

Pathway and Classification

Construction Phase Pathway and Classification

4.7.12 The main pathway for potential gas migration to the proposed shooting range development during construction phase is intervening soil. During restoration, a capping system was installed for this landfill but landfill gas migration is still possible if the capping system did not maintain properly.

The landfill gas can escape directly to the atmosphere through the soil layer. However, active gas collection system was installed so that the likeliness of gas migration has been alleviated. On the other hand, Risk may exist as pipeline and the landfill gas management system may have leakage or breakage if the maintenance is not provided properly.

4.7.13 As discussed earlier, there will be no deep excavation in this project in order not to damage the capping system and pipelines. On the other hand, additional soil will be used to fill up some of the areas. The capping system and the pipelines will not be disturbed and remain intact.

4.7.14 Regarding emission from passive vent installed onsite, LFG from the vent will be released to the atmosphere without any chance to accumulate. However, construction work involving naked flame close to the passive vent may still have a chance to result in explosion. Nevertheless, with good practice to avoid having any naked flame operation close to the passive vent, no significant risk impact is anticipated.

4.7.15 Given the short physical distance between the proposed recreational facilities and the waste underneath it, the pathway is considered as Very Short/Direct in accordance with Section 3.14 of the Landfill Gas Hazard Assessment Guidance Note.

Operational Phase Pathway and Classification

4.7.16 Similar to the construction phase, intervening soil is the main pathway. With respect to emissions from passive vent, the potential risk can be alleviated by prohibition of smoking and any naked flame and installation of facilities with sufficient separation from the passive vent.

4.7.17 During Operation Phase, another pathway for potential gas migration to the proposed development would be the utilities such as electrical cable, potable water supply, etc.

4.7.18 As the pathway of both intervening soil and underground utilities is of very short physical separation, the pathway for the operational phase is considered as Very Short/Direct in accordance with Section 3.14 of the Landfill Gas Hazard Assessment Guidance Note.

Target and Classification

Construction Phase Target and Classification

4.7.19 Deep excavation would not be carried out for the construction of the project to avoid damage to the existing restoration facilities underground. Only shallow excavation of note more than 300mm will be required for underground laying of utilities. The location of the proposed development has been determined with due consideration of the existing landfill gas restoration facilities so as to avoid any conflict. Moreover, there will be no piling activities. However, some shallow excavation activities for laying of utilities may be possible.

4.7.20 Sensitive targets during construction are those activities with naked flame and facilities with potential ignition source, and places with lack of natural ventilation and thus potential risk of asphyxiation. It is anticipated that all activities with naked flame and facilities with potential ignition source will be carried out and employed in open area where there is no risk of LFG accumulation. For confined area with lack of natural ventilation, it is identified that such area may be created under excavation work during site formation and under utilities installation work (trenching). The construction phase target sensitivity is considered Medium in accordance with Section 3.18 of the Landfill Gas Hazard Assessment Guidance Note.

Operational Phase Target and Classification

4.7.21 There will be no underground buildings for the proposed shooting range development. The proposed development consists of several enclosed building blocks including a clubhouse building, indoor air pistol shooting ranges totaled 60 lanes, and a lavatory/beverage house. Other developments include two open shooting ranges with canopy erected for the shooters only. No asphyxiation risk is anticipated for outdoor activities. Smoking and other naked flame will be prohibited within the proposed development. Moreover, soft backstop will be provided so that potential source of ignition is expected at the firing area only. The activities outdoors that may have the possibility of ignition is during gunshot. Yet, the outdoor area is well ventilated. The surface LFG monitoring result indicated that the monitored methane concentration (at locations near to the waste boundary) amounts to not more than 0.003% and is well below 0.5%, i.e. 10% LEL level. Risk of ignition is considered low. While gas from passive vent may be the only source with concentration reaching LEL, provided that the firing location is not close to the source of emission (e.g. passive vent), it is anticipated that the LFG concentration after dispersion to the firing location will be diluted to a level well below the ignition concentration. For the proposed shooting range, the separation distance between the firing location and the nearest passive gas vent amounts to more than 50m. Therefore, risk of having high methane concentration reaching LEL at the firing location is insignificant. Moreover, backstop using soft materials will be employed so that sparkling when hitting the backstop can be avoided. Fence wall will be erected on three sides of the open shooting ranges so that the passive gas vents erected outside the shooting range will be adequately shielded. Bullets cannot hit the passive gas vents by accidents

4.7.22 Sensitive targets are confined space where natural ventilation is less effective and with walls and floors in contact with the soil.

4.7.23 According to Section 3.18 of the Landfill Gas Hazard Assessment Guidance Note, the operational phase target sensitivity for the enclosed buildings is considered High for it does not only allow access by trained staff but also the participants of the shooting games and visitors (although access is generally restricted to, say, members only). Ammunition store inside the clubhouse will be restricted to trained staff only. However, as ammunitions are present, the consequence of landfill gas accumulation and ignition will be more significant. The target sensitivity is therefore considered High based on a more conservative approach. Other uses such as pumphouse, transformer, etc. situated offsite will be restricted to authorized, well trained staff and the target sensitivity is considered Medium.

Source-Pathway-Target Analysis

4.7.24 The risk classification, as recommended in the Landfill Gas Hazard Assessment Guidance Note, for a Medium source, Short/Direct pathway, and Medium/High sensitive target will result in a Medium/High risk category as shown in the table below.

Table 6: Source- pathway- target Analysis

Source	Pathway	Target	Assessment of Risk
S1. PPVL The landfill was closed in 1996 and restoration commenced in 2004 and completed in 2006 with about 11Mm^3 of waste deposited. LFG monitoring results for July 2006 to Apr 2007 indicated low possibility of landfill gas migration (with negligible methane level in most of the time). Due to the recent restoration of the landfill site, there is limited data to demonstrate the efficacy of the mitigation. Moreover, some active gas control is relied on. **(Medium source)**	**P1. Intervening Soil** The development is sited just above the landfill. **P2. Utilities** Utilities entering rooms from underground through floor slab **(Very short/ direct pathway)**	**C1. Works in confined space or underground within semi-confined workspace including excavation and utilities installation. Welding, flame-cutting & hot works in open area (Medium sensitive target)** **T1. Clubhouse, indoor shooting range and lavatory/beverage house (with enclosed rooms) with floor in contact with ground and allow public access** **T2. Ammunition store inside the clubhouse with restricted access (High sensitive target)** **T3. Other enclosed areas such as pumphouse & transformer room with restricted access (Medium sensitive target)**	**Medium** **High** **High** **Medium**

Proposed LFG Migration Mitigation Measures

4.7.25 The site is classified with Risk Category B (High Risk) or C (Medium Risk). For Category B, significant engineering measures will be required to protect the proposed development. For Category C, engineering measures will be required to protect the proposed development whereas some precautionary measures will be required to ensure that the planned development is safe. General protection measures should include use of active control of gas, including barriers and detection systems for Risk Category B, and 'semi active' or enhanced passive gas controls, and detection systems in some situations for Risk Category C.

4.7.26 LFG protection measures are recommended for implementation during construction, as well as operation stages of the development.

Construction Phase Measures

4.7.27 During the construction phase, hazards may arise which are related either to the flammability of landfill gas or its potentially asphyxiating properties. It is advisable to include appropriate specification clauses for incorporation into contract documents. In general, the contractor should be aware of, and should inform construction contractors the followings:

- Methane and carbon dioxide are always likely to be present in the soil voids;
- Physical and chemical nature of landfill gas;
- Methodologies for landfill gas detection;
- Fire and explosion hazards associated with landfill gas;
- Toxicity effects and health hazards associated with landfill gas; and
- Potential health effects from direct contact with leachate/groundwater contaminated by leachate.

4.7.28 Precautions should be clearly laid down and rigidly adhered to with respect to trenching and excavation; and creation of confined spaces at, near to or below ground level such that potential hazard on workers from landfill gas/ leachate migration are minimised.

4.7.29 In addition to normal site safety procedures, gas detection equipment and appropriate breathing apparatus should be available and used where necessary when entering confined spaces without proper ventilation. A properly-trained dedicated person (e.g. Safety Officer) should be present on site throughout the construction stage.

4.7.30 All personnel who work on site and all visitors to the site should be made aware of the possibility of ignition of gas in the vicinity of excavations and possibility of asphyxiation in confined area (e.g. deep trench or underground area with only small opening entrance) due to landfill gas migration. Safety notices should be posted warning of the potential hazards.

4.7.31 Those staff who work in, or have responsibility for 'at risk' areas, including all excavation workers, supervisors and engineers working within the Consultation Zone, should receive appropriate training organised by the contractor or other appropriate parties on working in areas susceptible to landfill gas, fire or explosion hazards.

4.7.32 An excavation procedure or code of practice to minimise risks including landfill gas related risk should be devised and carried out by the contractor.

4.7.33 Safe practice should be followed by workers while working in the construction site.

4.7.34 Smoking, naked flames and all other sources of ignition should be prohibited within semi-confined and confined area where possible, and areas in close proximity to the passive vents. 'No smoking' and 'No naked flame' notices should be posted prominently on the construction site and, if necessary, special areas designated for smoking.

4.7.35 Any electrical equipment, such as motors and extension cords, should be intrinsically safe. Construction plant should be fitted with vertical exhaust of sufficient height and with spark arrestors where necessary.

4.7.36 During piping assembly or conduiting construction, all valves/seals should be closed immediately after installation where possible. As construction progresses, all valves/seals should be closed as installed to prevent the migration of gases through the pipeline/conduit. All piping/conduiting should be capped at the end of each working day.

4.7.37 Mobile offices, equipment stores, mess rooms etc. should be located on an area which has been proven to be gas free (by survey with portable gas detectors) and ongoing monitoring should be carried out to ensure that these areas remain gas free. Alternatively, such buildings should be raised clear of the ground with a minimum clear separation distance of 500mm..

4.7.38 During construction, adequate fire extinguishing equipment, fire-resistant clothing and breathing apparatus (BA) sets should be made available on site. The operator should formulate a health and safety policy, standards and instructions for site personnel to follow.

4.7.39 For drilling operations, “Special Advice Relating to the Drilling of Boreholes” in Landfill Gas Hazard Assessment Guidance Note should be referenced to ensure that such operations are properly supervised, and provided with safety equipment and clothing and well-defined working and safety procedures.

4.7.40 Welding, flame-cutting or other hot works, where necessary, should be confined to open areas at least 15m from any trench or excavation if possible. They may only be carried out in trenches or confined spaces when controlled by a 'permit to work' procedure, properly authorized by the Safety Officer or other appropriately qualified person. The 'permit to work' procedure should set down the requirements for continuous monitoring for methane, carbon dioxide and oxygen throughout the period during which the hot works are in progress. The procedure should also require the presence of an appropriately qualified person in attendance outside the 'confined area', who shall be responsible for reviewing the gas measurements, and who shall have executive responsibility to suspend the work in the event of unacceptable or hazardous conditions. Only workers who are appropriately trained and fully aware of the potentially hazardous conditions should be permitted to carry out hot works in confined areas.

4.7.41 For other work in confined space, if any, controlled by the Factories and Industrial Undertakings (Confined Spaces) Regulations of the Factories and Industrial Undertakings Ordinance, the Safety Guide to Working in Confined Spaces should be followed to ensure compliance with the regulations mentioned above. Key issues with regards to confined spaces which are at risk of landfill gas build-up are listed out below:

- The entry or access point should be clearly marked with a warning notice (in English and Chinese) which states that there is the possibility of flammable and asphyxiating gases accumulating within.
- The warning notice should also give the telephone number of an appropriate competent person who can advise on the safety precautions to be followed before entry and during occupation of the confined space.
- Personnel should be made aware of the dangers of entering confined spaces potentially containing hazardous gases and, where appropriate, should be trained in the use of gas detection equipment.
- Prior to entry, the atmosphere within the chamber should be checked for oxygen, methane and carbon dioxide concentrations. The chamber may then only be entered if oxygen is greater than 18% by volume, methane is less than 10% of the Lower Explosive Limit (LEL), which is equivalent to 0.5% by volume (approximately), and carbon dioxide is less than 0.5% by volume.
- If either carbon dioxide or methane are higher, or oxygen lower, than the values given above, then entry to the chamber should be prohibited and expert advice sought.
- Even if conditions are safe for entry, no worker should be permitted to enter the chamber without having another worker present at the surface. The worker who enters the chamber should wear an appropriate safety/recovery harness and, preferably, should carry a portable methane, carbon dioxide and oxygen meter.
- In general, when work is being undertaken in confined spaces sufficient approved resuscitation equipment, breathing apparatus and safety torches should be available. Persons involved in or supervising such work should be trained and practised in the use of such equipment. A permit-to-work system for entry into confined spaces should be developed by an appropriately qualified person and consistently employed.

LFG Monitoring during the Construction Stage

4.7.42 The objective of gas monitoring during the construction phase of the subject development is to ensure that landfill gas does not accumulate in the work areas (those with relatively poor ventilation, e.g. pits, trenches, caissons and voids) likely to pose a risk of explosion or hazards to the workers.

4.7.43 It has to ensure that any levels of LFG can be readily detected and that timely remedial measures and actions can be taken to bring the LFG level down to a safe level so that works can be resumed.

4.7.44 The level of LFG shall be checked daily before work at the existing monitoring well along the site boundary adjacent to the landfill with portable measuring instrument which is intrinsically safe and capable of measuring the following gases in the range indicated : -

- methane 0-100 % LEL and 0-100 % v/v
- carbon dioxide 0-100 % and
- oxygen 0-21 %

4.7.45 An action plan is given below for inclusion in the works contract.

Table 7: Action Plan - LFG Monitoring during the Construction Stage

Parameter	Measurement	Action
O_2	< 19 % < 18 %	Ventilate trench/void to restore O_2 level to > 19% Stop works. Evacuate personnel/ prohibit entry increase ventilation to restore O_2 to > 19%
CH_4	> 10 % LEL > 20 % LEL	Post 'No Smoking' signs prohibit hot works ventilate to restore CH_4 to < 10% LEL Stop works evacuate personnel/ prohibit entry increase ventilation to restore CH_4 to < 10% LEL
CO_2	> 0.5 % > 1.5 %	ventilate to restore CO_2 to < 0.5% Stop works evacuate personnel/ prohibit entry increase ventilation to restore CO_2 to < 0.5%

4.7.46 Monitoring is to be carried out in excavations and any other confined and semi-confined spaces that may have been created where necessary. All measurements in excavations, if necessary, should be made with the monitoring tube located not more than 10mm from the exposed ground surface. Prior to hot works and any works involving naked flame in the confined or semi-confined area, if any, monitoring should be carried out.

4.7.47 The implementation of the precautionary measures listed above shall be the responsibility of the dedicated and qualified person. The dedicated person shall carry out monitoring works and decide which locations shall be monitored and the actual monitoring frequencies. As a minimum, a measurement shall be taken before workers enter a confined space, or places with poor ventilation.

Operational Phase Measures

4.7.48 The proposed LFG mitigation measures during the construction of the project will be followed by the operator of the shooting range when the maintenance work during the operation phase is carried out.

4.7.49 According to the advice from EPD, the design loading on capping would amount to 60kN/m^2. As the proposed shooting range facilities will be located on top of the waste and capping, such requirement will be observed in design of the facilities. In order not to affect the capping system, there will be no piling for foundation construction. No basement will be constructed and all buildings will have foot rest on ground. All buildings will have single storey only and the loading will be minimized wherever possible and the loading requirement will be met in all circumstances to avoid any damage to the capping layer and other sub-soil piping facilities. The disposition of the facilities will be designed in such a way that the existing landfill site facilities will not be affected. In other words, no demolition, diversion and reprovision of the existing facilities is required. All monitoring and extraction wells located within the 25m/50m shooting range will have additional protection provided (e.g. by using combination of rubber tyres and sand bags to on top of the existing well cover so that it would not result in sparkling if hit by bullet) to avoid damage due to shooting activities.

4.7.50 Moreover, no naked flame and smoking can be allowed onsite. In particular, “No smoking” sign and other signage should be provided close to passive vent.

4.7.51 Other than the protection measures to be implemented for the existing restoration facilities, measures are to be incorporated into the design to protect the future occupants and discussed below.

4.7.52 A raised floor design will be adopted for the office-cum-clubhouse, indoor shooting range and other enclosed room, if any, with vertical clearance between the floor slab and the ground not less than 500mm.

Passive Control

4.7.53 The enclosed buildings of the proposed shooting range development including the indoor shooting range, office-cum-clubhouse building, lavatory/beverage house at PPVL, and water pump and transformer house situated offsite with High/Medium risk level will adopt a raised floor design. **Figure 7** highlights the enclosed buildings within PPVL which adopt raised floor design. The floor slab will not be of direct contact with the soil and will maintain a vertical clearance between the floor slab and the ground of not less than 500mm. Voids are created between the floor slab and the ground where air can move in/out of the void area in an unobstructed manner. The voids are designed to be well ventilated by natural air movements such that any emission of gas from the ground are mixed and diluted by air. Given the special building design measures, the buildings with enclosed rooms are considered less prone to gas ingress. In addition, to provide enhanced passive gas mitigation, 1mm HDPE geo-membrane or equivalent materials (with hydraulic conductivity of less than 10^{-12}m/s) will be lined on the floor slab of these enclosed building to minimize possibility of landfill gas (LFG) migration into enclosed rooms. **Figure 7** indicates the enclosed building areas where geo-membrane is applied. Furthermore, the annulus around any service entry points into the buildings will effectively be blocked

by means of sealant, collars or puddle flanges as appropriate to prevent the ingress of gas into a building via service entry points. With collar seal applied, HDPE collar will be fitted around the HDPE pipe (sealed with the pipe entering the building) and welded to the membrane line on floor slab. Water seal will be provided in water pipes and sewers, if any, to prevent ingress of landfill gas (by retaining water within the section of the "U" tube to block passage of air). **Figure 8** showed the typical details of sealing using collar seal, and water seal. Lastly, to avoid migration of LFG outside the site, all utilities connecting to offsite area is proposed to be laid aboveground instead of buried underground, subject to the final design of the utilities service entries to the site. For example, water pump and electricity line will be laid on the slope and connected to the water pump and transformer house offsite.

Active Control

4.7.54 For development with High risk level (i.e. enclosed buildings including indoor shooting ranges, clubhouse and lavatory/beverage house), mechanical ventilation of 5 air change per hour will be provided so as to avoid accumulation of LFG even when it penetrates into the enclosed room.

Detection System and LFG Monitoring

4.7.55 Detection system will be installed at clubhouse, 2 indoor shooting ranges and lavatory/beverage house (with "High" LFG risks). Both methane and carbon dioxide will be monitored. Oxygen is not monitored for the fact that landfill gas of low oxygen content is usually characterized by its high carbon dioxide level so that the carbon dioxide detector can serve the purpose. The tentative locations of the LFG detectors are indicated in **Figure 9**.

4.7.56 An action plan is given here to specify the actions to be taken at different levels of gas detected at the monitoring points. Further investigation should be carried out by the project proponent and if necessary, an environmental consultant in this specific field. Expert advice should be sought where necessary. The project proponent will maintain good communication with the landfill restoration and aftercare contractor with respect to landfill gas management at the restored landfill.

Table 8: Action Plan - LFG Monitoring during the Operational Phase

Parameter conc. % v/v	Actions
All detectable level for CH_4	Record, carry out additional monitoring and investigations. Consult professionals if necessary.
0.5 % v/v (10% LEL) CH_4 or 0.5% CO_2 whichever is exceeded	Trigger level, Report to EPD/Landfill Restoration and Aftercare contractor, increase ventilation and monitor LFG concentration, and carry out further investigation
1 % v/v (20% LEL) CH_4 or 1.5% CO_2 whichever is exceeded	Action level, To evacuate personnel/prohibit entry at the sensitive target of the premises, increase ventilation. Report to EPD who will liase with the landfill contractor/ operator to remedy the migration problem, if any;

4.7.57 A contingency plan/evacuation procedure to deal with LFG incidents should be developed by the future operator.

4.7.58 Despite that detection system is proposed to be installed at sensitive target area, it is prudent to conduct a monitoring exercise by competent person prior to the operation of the proposed development. The objectives of monitoring during the operational phase of the proposed development are to: -

- Avoid accumulation of LFG in sensitive targets of the development that is likely to pose a risk of fire, explosion or asphyxiation;
- To obtain early warning of potential problematic areas and permit timely remedial actions taken by the estate manager or the operator of the PPVL;
- To provide reassurance to the residents and the local communities.
- Determinants should include carbon dioxide, oxygen and methane.

4.7.59 Monitoring is proposed to be undertaken within the sensitive target of the proposed development identified in this assessment. That is, monitoring will be conducted in the clubhouse, indoor air pistol shooting ranges and lavatory/beverage house.

Others

4.7.60 The operator of the proposed shooting range will closely liase with EPD and the aftercare contractor to ensure that the construction and operation of the proposed shooting range would not result in adverse impact on the existing landfill facilities. The operator of the proposed shooting range has the responsibility to ensure the safety of EPD and the aftercare contractor staff who will have the right to access the site to carry out their aftercare duties.

5. Project Summary

5.1 Comment on the Possible Severity, Distribution and Duration of Environmental Effects

5.1.1 The environmental impacts under the ambit of the EIA Ordinance have been evaluated from the perspective of the Project's long-term operations as well as the associated temporary construction works. The assessment results indicate no unacceptable impacts that could be imposed upon the proposed development and identified sensitive uses in its neighbourhood both in the construction and operational phases.

5.1.2 Impacts during the construction phase of the Project are temporary in nature but could readily be alleviated to acceptable levels by certain mitigation measures outlined in this Project Profile.

5.1.3 No significant environmental impact on the identified sensitive uses in the surroundings will be expected during the operational phase of the Project. On the other hand, the potential environmental impact on the proposed development is considered acceptable.

5.2 Environmental Protection Measures Provided

5.2.1 An implementation schedule of environmental mitigation measures is shown in **Appendix E**. The key environmental protection measures are summarized below.

Construction

5.2.2 General construction phase environmental mitigation measures are suggested to be implemented by the contractor. The contractor should fully observe all relevant ordinance and regulations, technical memoranda and practice notes, and carry out the works in a manner to comply with all relevant criteria.

Operation

5.2.3 For the operation of the project, the indoor firing range will be ventilated using window type, split type air conditioning units or/and exhaust fans and provided with proper insulation such as well gasketted windows so that noise impact during indoor shooting will be shielded.

5.2.4 The open shooting ranges will be erected with solid fence wall in terms of timber baffles. The fence wall will be 3.5m high of density not less than 20kg/m^2 including the 1.5m raised platform of the shooting shed. The proposed measures will provide additional shielding to attenuate potential noise impact on the NSRs, and will further obstruct and depress possible dispersion of the heavier lead dust within the shooting range area. Fence wall will also function to shield the passive gas vents erected outside the shooting range so that bullets cannot hit the passive gas vents by accidents. It will also help avoid disturbance to offsite SSSIs.

5.2.5 Lead-free primer will be adopted for the firearm permitted in the proposed shooting range so that lead fume emission impact will not be a concern.

5.2.6 Backstop of soft materials (timber baffles with sand bag) will be erected behind the target plate to collect the bullets so that the bullet would remain intact. Lead emission when broken into pieces will therefore be avoided. On the other hand, no sparkling will be resulted when hitting the

backstop. The risk of explosion if methane concentration reaches the LEL near backstop will be avoided.

5.2.7 All wastes will be stored using the holding tank and disposed of by waste disposal agents then to avoid causing pollution by discharging to nearby water body. The requirement under the Water Pollution Control Ordinance is observed. No discharge of wastewater will be permitted.

5.2.8 All cartridge casings and other debris will be collected from the shooting range daily to avoid possible contamination.

5.2.9 No naked flame and smoking can be allowed onsite. In particular, “No smoking” sign and other signage should be provided close to passive vent to avoid ignition of landfill gas.

5.2.10 A raised floor design with vertical clearance between the floor slab and the ground not less than 500mm will be adopted for the office-cum-clubhouse, indoor shooting range and other enclosed room as well as water pump and transformer houses offsite to avoid landfill gas entry into the building.

5.2.11 To provide enhanced passive gas mitigation, 1mm HDPE geo-membrane or equivalent materials (with hydraulic conductivity of less than 10^{-12}m/s) will be lined on the floor slab of these enclosed building to minimize possibility of landfill gas (LFG) migration into enclosed rooms. The annulus around any service entry points into the buildings will effectively be blocked by means of sealant, collars or puddle flanges as appropriate to prevent the ingress of gas into a building via service entry points. With collar seal applied, HDPE collar will be fitted around the HDPE pipe (sealed with the pipe entering the building) and welded to the membrane line on floor slab. Water seal will be provided in water pipes and sewers, if any, to prevent ingress of landfill gas (by retaining water within the section of the “U” tube to block passage of air). Utilities will be laid aboveground to avoid migration of landfill gas along utilities. No manhole will be provided. For enclosed buildings including indoor shooting ranges, clubhouse and lavatory/beverage house, mechanical ventilation using window type, split type air conditioning units or/and exhaust fans and with at least 5 air change per hour will be provided so as to avoid accumulation of LFG even it can penetrate into the enclosed room. Detection system will be installed at clubhouse, indoor shooting ranges and lavatory/beverage house.

FIGURES

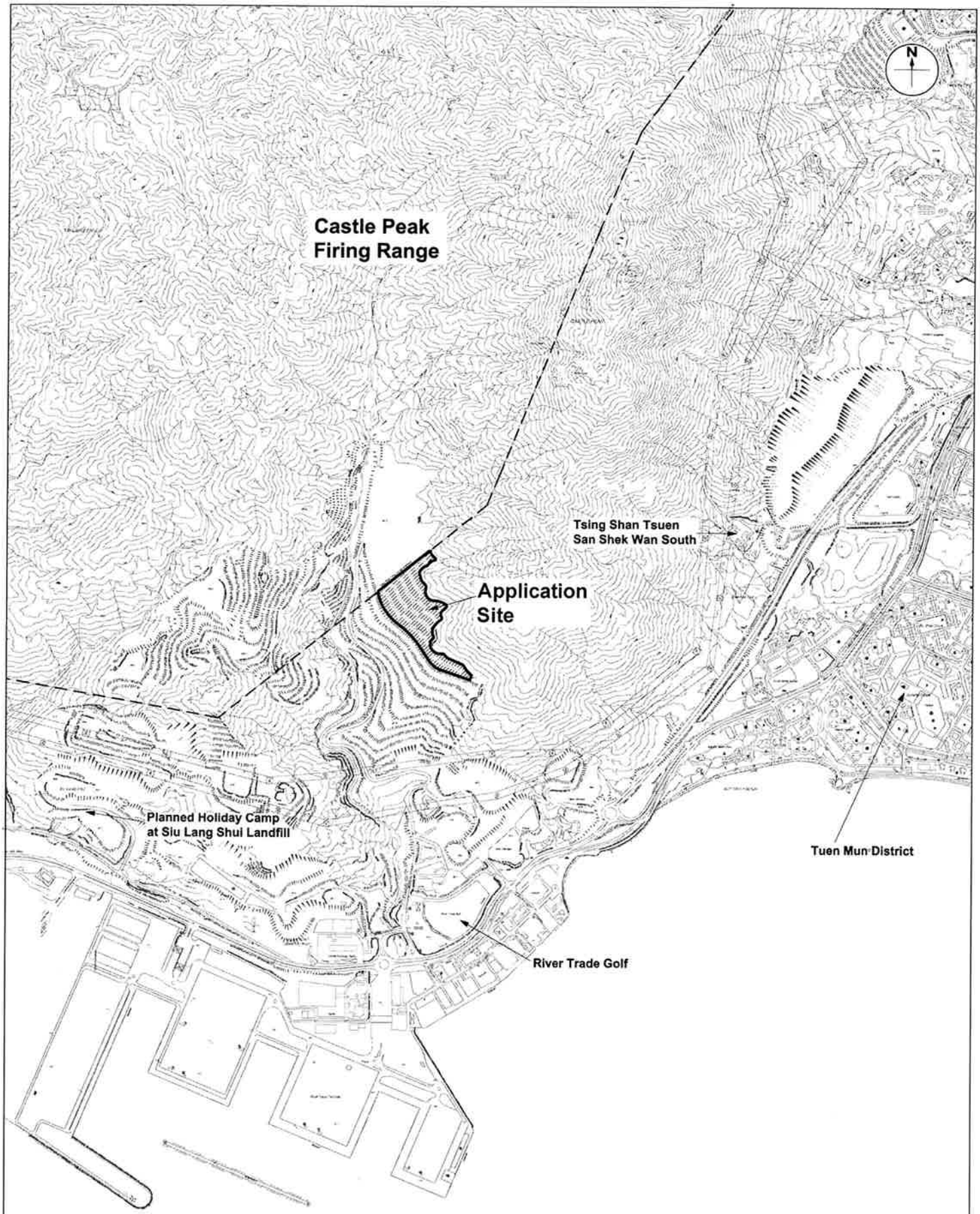


Figure: 1	ENVIRON
Title: Location of the Proposed Shooting Range and its Environs	Drawn by: SL
	Checked by: CC
Project: Project Profile for Proposed Shooting Range at Pillar Point Valley Landfill	Rev.: 0
	Date: Jan 2008

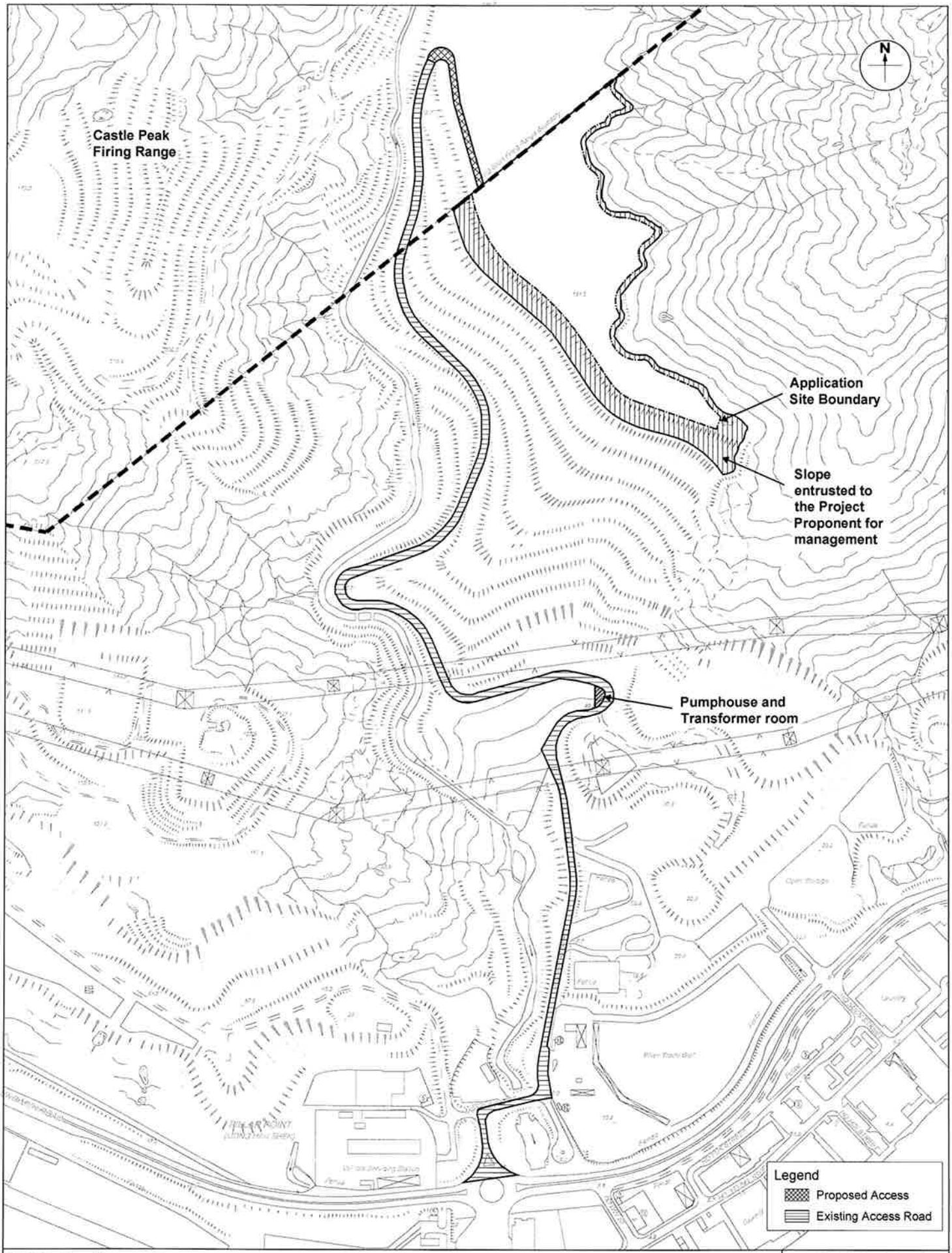


Figure: 2	ENVIRON
Title: Location of the Access Road	Drawn by: SL
	Checked by: CC
Project: Project Profile for Proposed Shooting Range at Pillar Point Valley Landfill	Rev.: 0
	Date: Mar 2008

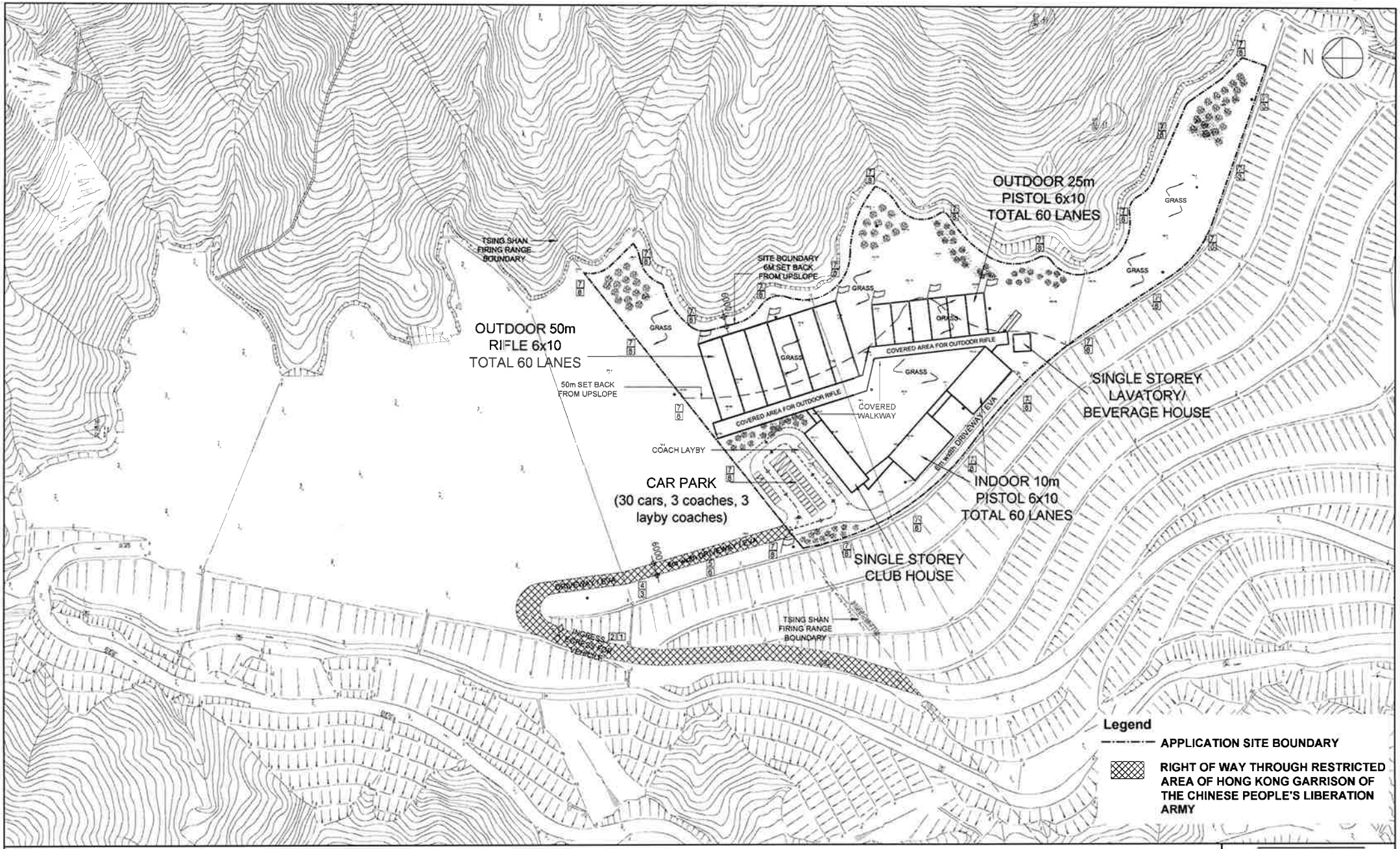


Figure: 3

Title: Layout of Proposed Shooting Range

Project: Project Profile for Proposed Shooting Range at Pillar Point Valley Landfill

ENVIRON

Drawn by:	SL
Checked by:	CC
Rev.:	1
Date:	Feb 2008

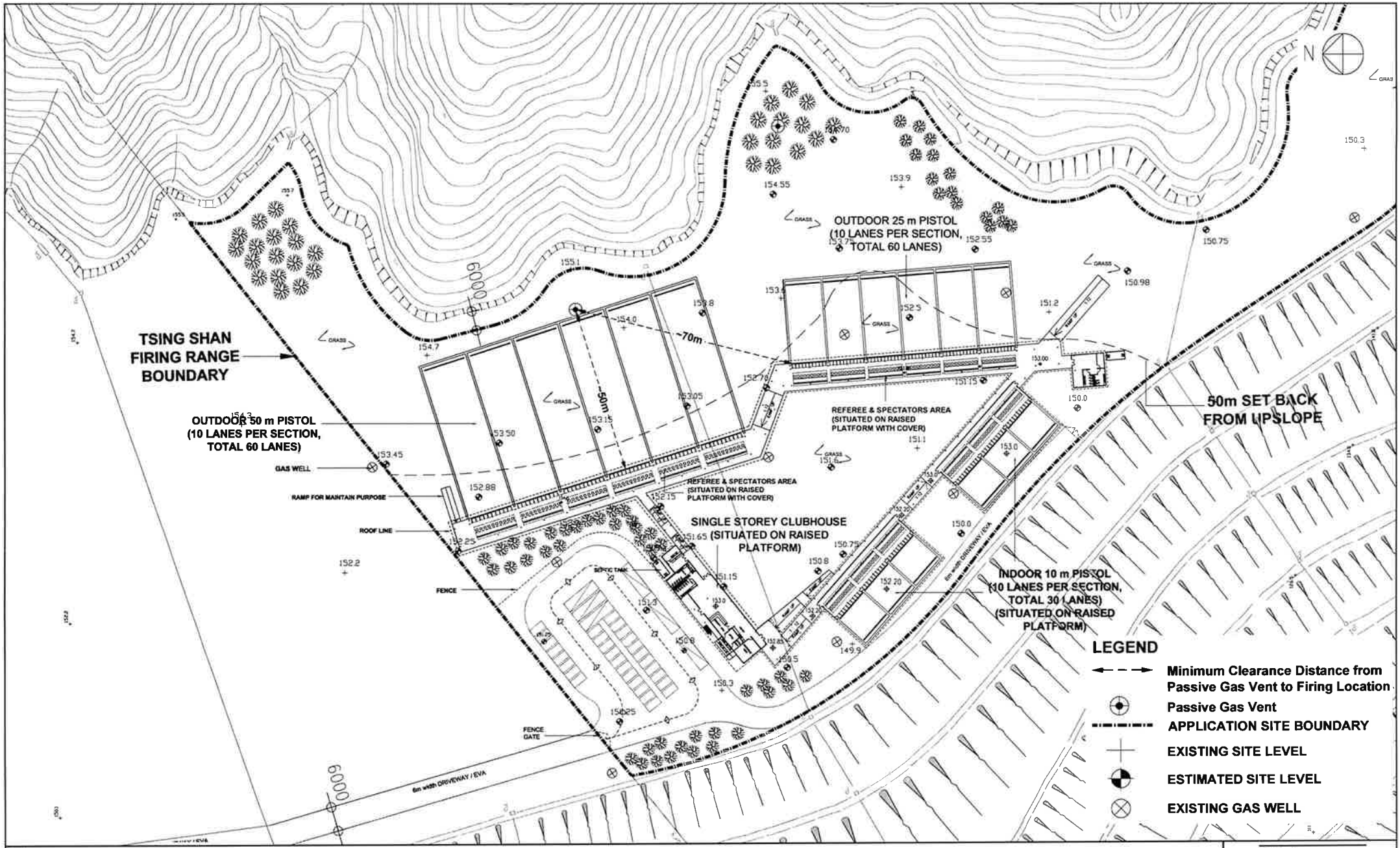
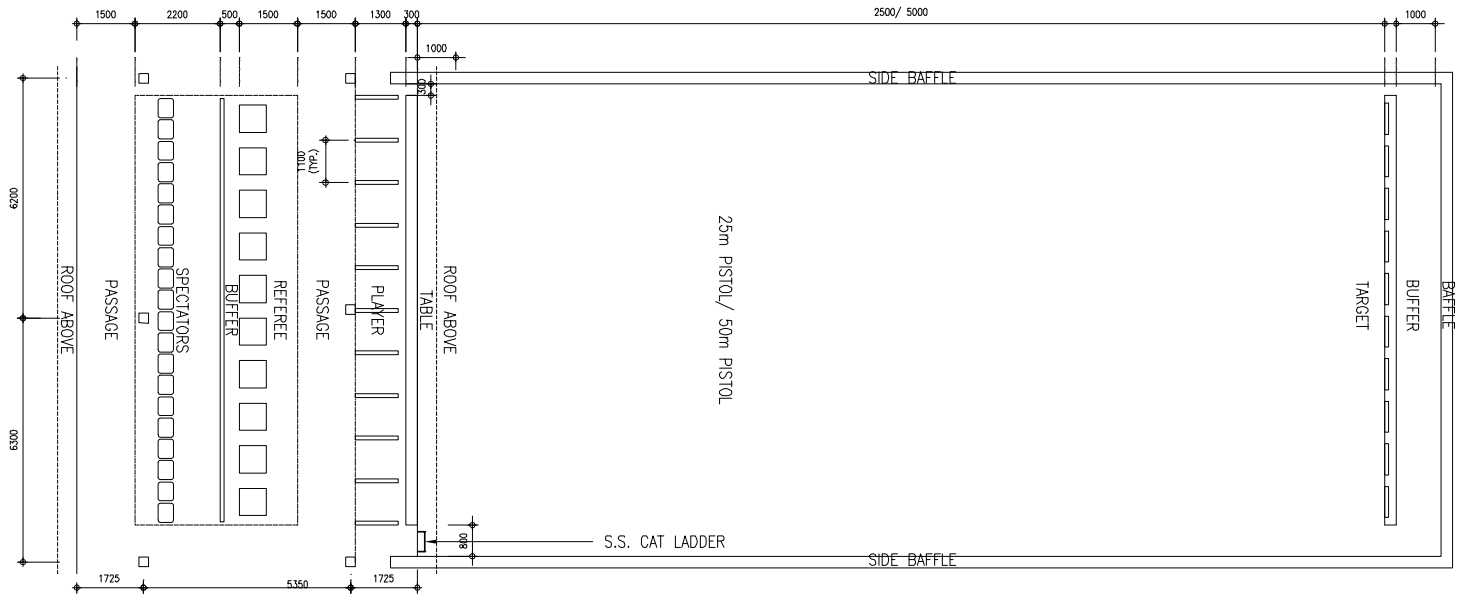
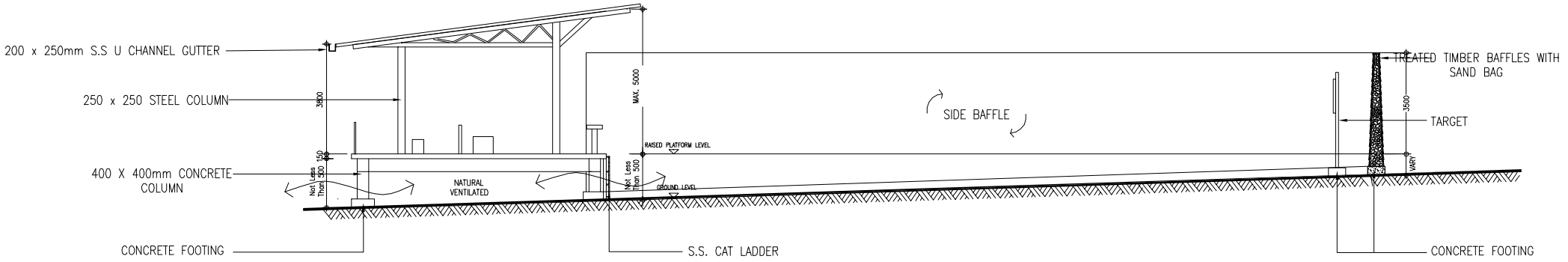


Figure: 4	ENVIRON
Title: Ground Level Plan of Proposed Shooting Range	Drawn by: SL
	Checked by: CC
Project: Project Profile for Proposed Shooting Range at Pillar Point Valley Landfill	Rev.: 1
	Date: Feb 2008



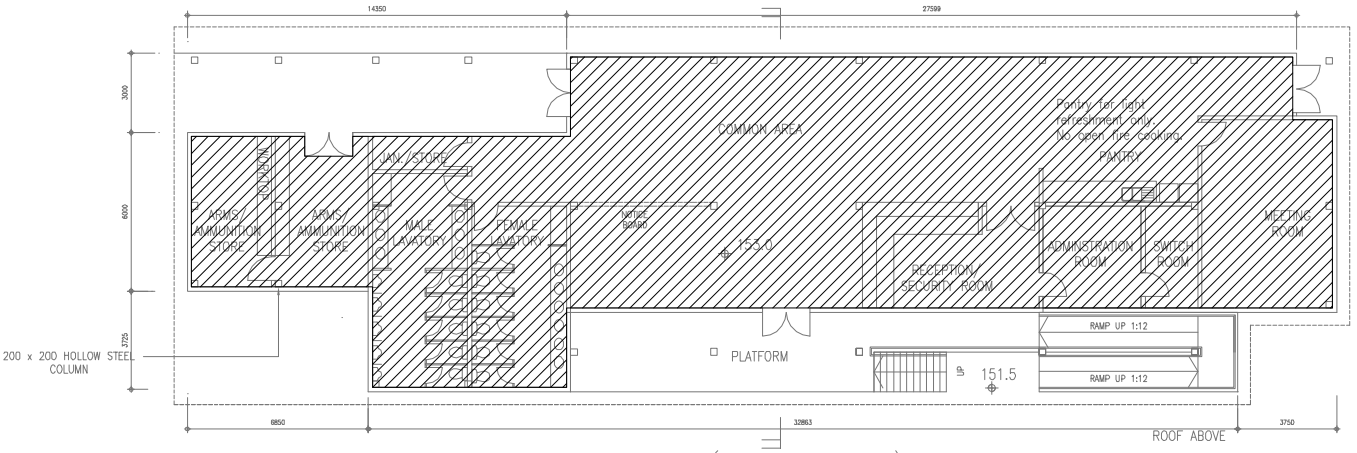
TYPICAL PLAN OF ONE SECTION (10 LANES) OF OUTDOOR 25m PISTOL / 50m RIFLE SHOOTING RANGE



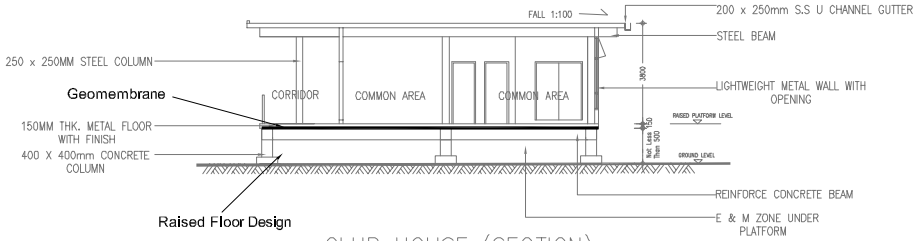
TYPICAL SECTION OF OUTDOOR 25m PISTOL / 50m RIFLE SHOOTING RANGE

Figure: 5	ENVIRON
Title: Typical Plan & Section of Outdoor 25m Pistol/50m Rifle Shooting Ranges	Drawn by: SL
	Checked by: CC
Project: Project Profile for Proposed Shooting Range at Pillar Point Valley Landfill	Rev.: 0
	Date: Mar 2008

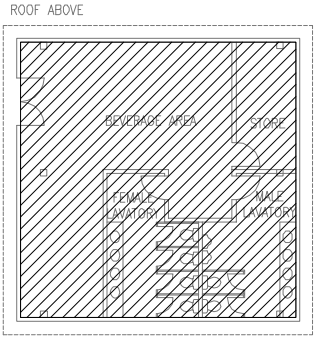
Figure: 6	ENVIRON
Title: Location of the Air Sensitive Receivers	Drawn by: SL
	Checked by: CC
Project: Project Profile for Proposed Shooting Range at Pillar Point Valley Landfill	Rev.: 1
	Date: Feb 2008



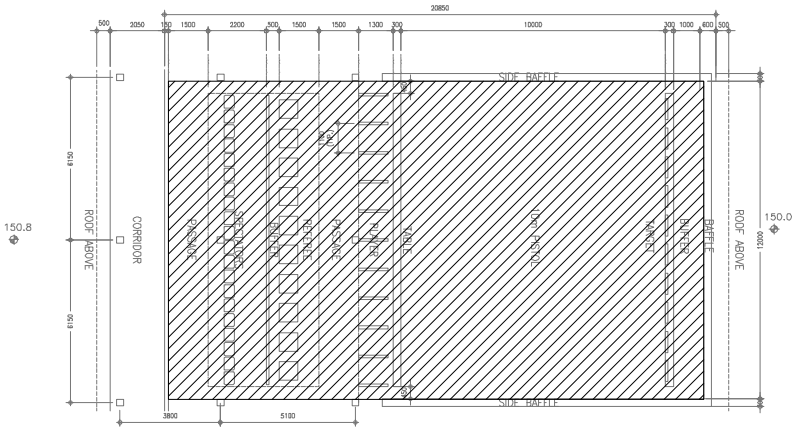
CLUB HOUSE (SINGLE STOREY)



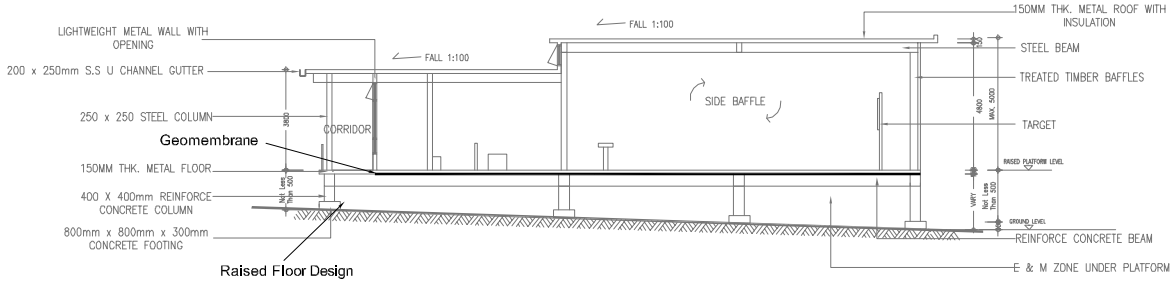
CLUB HOUSE (SECTION)



LAVATORY PLAN



TYPICAL PLAN OF ONE SECTION (10 LANES) OF INDOOR 10m PISTOL SHOOTING RANGE



TYPICAL SECTION OF INDOOR 10m PISTOL SHOOTING RANGE

Legend

Area lined using Geomembrane

Figure: 7	ENVIRON
Title: Enclosed Buildings with Raised Floor Design and Geomembrane Applied	Drawn by: SL
	Checked by: CC
Project: Project Profile for Proposed Shooting Range at Pillar Point Valley Landfill	Rev.: 0
	Date: Mar 2008

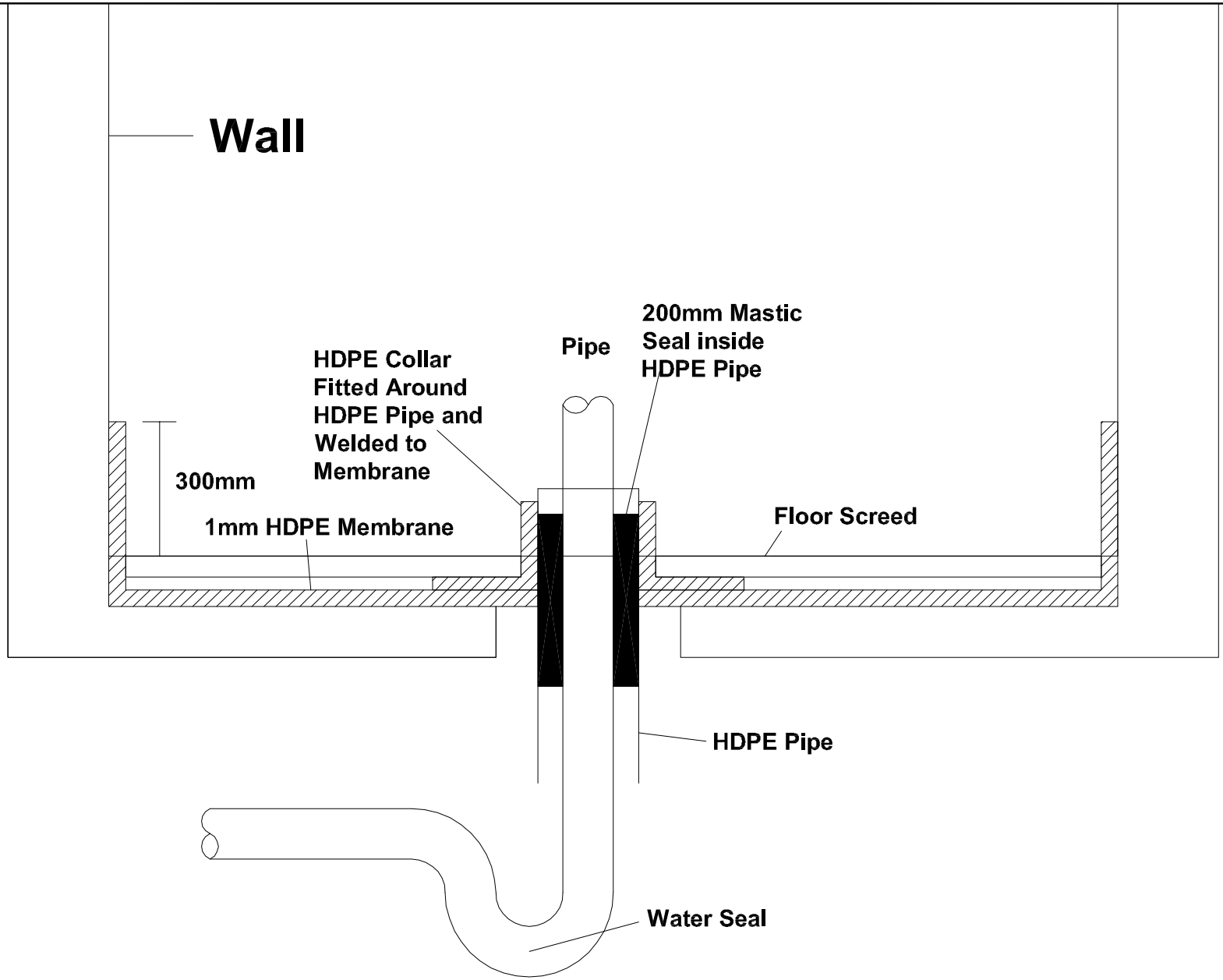


Figure: 8	ENVIRON
Title: Typical Details of Collar Seal & Water Seal	Drawn by: SL
	Checked by: CC
Project: Project Profile for Proposed Shooting Range at Pillar Point Valley Landfill	Rev.: 0
	Date: Mar 2008

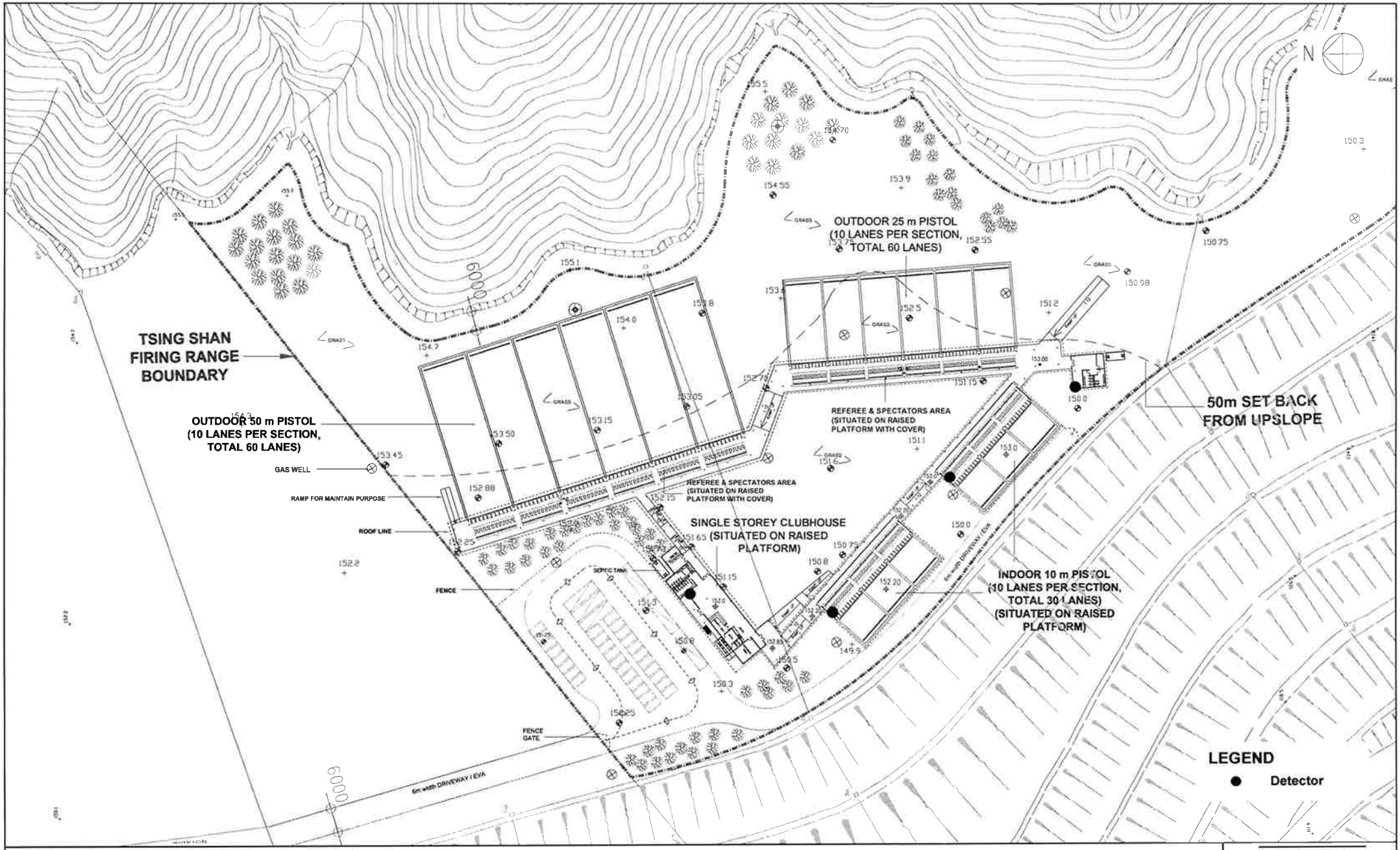


Figure: 9	ENVIRON
Title: Tentative Location for Installation of Detectors	Drawn by: SL
	Checked by: CC
Project: Project Profile for Proposed Shooting Range at Pillar Point Valley Landfill	Rev.: 0
	Date: Feb 2008

APPENDIX A:
LOCATION FOR BACKGROUND NOISE MEASUREMENT

Background Noise Measurement Location

Tsing Shan Tsuen San Shek Wan Village

Siu Lang Shui Landfill

APPENDIX B:
DETAILS OF NOISE TEST RESULTS

Noise Measurement Record

Project: Proposed Shooting Range at Pillar Point
Date: 1-Jun-07
Time: 12:00-15:30
Venue: Shooting Range at HK Gun Club, Tai Mo Shan
Subect: Pistol, Shotgun, Revolver

Record ID	Description	Parameter	Noise Level
1	Background noise at trap & skeet with aircraft and road traffic noise	Leq	56.0 dB(A)
2	12 gauge shotgun at trap & skeet, measurement distance=4m, at 12:00 direction	SEL	92.7 dB(A)
3	12 gauge shotgun at trap & skeet, measurement distance=4m, at 1:30 direction	SEL	98.3 dB(A)
4	12 gauge shotgun at trap & skeet, measurement distance=4m, at 10:30 direction	SEL	100.8 dB(A)
5	12 gauge shotgun at trap & skeet, measurement distance=4m, at 7:30 direction	SEL	99.3 dB(A)
6	12 gauge shotgun at trap & skeet, measurement distance=4m, at 4:30 direction	SEL	100.2 dB(A)
7	Background noise at 25m shooting range	Leq	64.5 dB(A)
8	.22 pistol at 25m shooting range, measurement distance=2m, at 12:00 direction	SEL	96.8 dB(A)
9	.22 pistol at 25m shooting range, measurement distance=2m, at 1:30 direction	SEL	105.0 dB(A)
10	.22 pistol at 25m shooting range, measurement distance=2m, at 10:30 direction	SEL	105.4 dB(A)
11	.22 pistol at 25m shooting range, measurement distance=2m, at 7:30 direction	SEL	104.4 dB(A)
12	.22 pistol at 25m shooting range, measurement distance=2m, at 4:30 direction	SEL	104.9 dB(A)
13	.32 pistol at 25m shooting range, measurement distance=2m, at 12:00 direction	SEL	99.7 dB(A)
14	.32 pistol at 25m shooting range, measurement distance=2m, at 1:30 direction	SEL	106.2 dB(A)
15	.32 pistol at 25m shooting range, measurement distance=2m, at 10:30 direction	SEL	105.6 dB(A)
16	.32 pistol at 25m shooting range, measurement distance=2m, at 7:30 direction	SEL	106.1 dB(A)
17	.32 pistol at 25m shooting range, measurement distance=2m, at 4:30 direction	SEL	106.3 dB(A)
18	.38 revolver at 25m shooting range, measurement distance=2m, at 12:00 direction	SEL	100.1 dB(A)
19	.38 revolver at 25m shooting range, measurement distance=2m, at 1:30 direction	SEL	105.9 dB(A)
20	.38 revolver at 25m shooting range, measurement distance=2m, at 10:30 direction	SEL	105.5 dB(A)
21	.38 revolver at 25m shooting range, measurement distance=2m, at 7:30 direction	SEL	109.6 dB(A)
22	.38 revolver at 25m shooting range, measurement distance=2m, at 4:30 direction	SEL	110.5 dB(A)

Remark: 12:00 direction - in front of the shooter
1:30 direction - front right hand side of the shooter
4:30 direction - rear right hand side of the shooter
7:30 direction - rear left hand side of the shooter
10:30 direction - front left hand side of the shooter

Noise Measurement Record

Project: Proposed Shooting Range at Pillar Point
Date: 4-Jun-07
Time: 11:30-12:30
Venue: Shooting Range at HK Rifle Association, Kau Wa Keng
Subect: Air Pistol, Pistol, Rifle

Record ID	Description	Parameter	Noise Level
1	Background noise at 25m shooting range	Leq	53.2 dB(A)
2	.22 rifle at 25m shooting range, measurement distance=2m, at 12:00 direction	SEL	103.7 dB(A)
3	.22 rifle at 25m shooting range, measurement distance=2m, at 1:30 direction	SEL	105.0 dB(A)
4	.22 rifle at 25m shooting range, measurement distance=2m, at 10:30 direction	SEL	103.6 dB(A)
5	.22 rifle at 25m shooting range, measurement distance=2m, at 7:30 direction	SEL	100.3 dB(A)
6	.22 rifle at 25m shooting range, measurement distance=2m, at 4:30 direction	SEL	103.1 dB(A)
7	9mm pistol at 25m shooting range, measurement distance=2m, at 12:00 direction	SEL	104.2 dB(A)
8	9mm pistol at 25m shooting range, measurement distance=2m, at 1:30 direction	SEL	105.4 dB(A)
9	9mm pistol at 25m shooting range, measurement distance=2m, at 10:30 direction	SEL	105.1 dB(A)
10	9mm pistol at 25m shooting range, measurement distance=2m, at 7:30 direction	SEL	113.6 dB(A)
11	9mm pistol at 25m shooting range, measurement distance=2m, at 4:30 direction	SEL	113.7 dB(A)
12	.45 pistol at 25m shooting range, measurement distance=2m, at 12:00 direction	SEL	107.3 dB(A)
13	.45 pistol at 25m shooting range, measurement distance=2m, at 1:30 direction	SEL	106.8 dB(A)
14	.45 pistol at 25m shooting range, measurement distance=2m, at 10:30 direction	SEL	106.5 dB(A)
15	.45 pistol at 25m shooting range, measurement distance=2m, at 7:30 direction	SEL	114.4 dB(A)
16	.45 pistol at 25m shooting range, measurement distance=2m, at 4:30 direction	SEL	114.4 dB(A)
17	Background noise at 10m indoor shooting range	Leq	63.1 dB(A)
18	.177 air pistol at 10m shooting range, measurement distance=2m, at 12:00 direction	SEL	91.7 dB(A)
19	.177 air pistol at 10m shooting range, measurement distance=2m, at 1:30 direction	SEL	90.2 dB(A)
20	.177 air pistol at 10m shooting range, measurement distance=2m, at 10:30 direction	SEL	87.7 dB(A)
21	.177 air pistol at 10m shooting range, measurement distance=2m, at 7:30 direction	SEL	82.7 dB(A)
22	.177 air pistol at 10m shooting range, measurement distance=2m, at 4:30 direction	SEL	84.9 dB(A)

Remark: 12:00 direction - in front of the shooter
1:30 direction - front right hand side of the shooter
4:30 direction - rear right hand side of the shooter
7:30 direction - rear left hand side of the shooter
10:30 direction - front left hand side of the shooter

Photos taken during measurement exercise

Hong Kong Gun Club at Tai Mo Shan

Trap and skeet at HK Gun Club

12 gauge shotgun

Bullet for 12 gauge shotgun

25m shooting range with canopy

25m shooting range

Noise measurement during shooting

.22 pistol

.32 pistol

.38 revolver

HK Rifle Association at Kau Wah Keng

25m shooting range with canopy

Noise measurement during shooting

.45 pistol

9mm pistol

.22 rifle

10m indoor shooting range

Noise measurement during shooting

.177 air pistol

Bullet for .177 air pistol

APPENDIX C:
PROPOSED SHOOTING RANGE ORDER

Proposed Shooting Range at Pillar Point for
Hong Kong Shooting Association

Standard Operating Procedures and Range Order

1.0 Name and Location of the Range

The name of the range is "Hong Kong Shooting Association Shooting Range", hereinafter called "the range".

It is located at the present landfill site at Pillar Point, Tuen Mun.

2.0 Name and Unit of Officer or Person Responsible for the Range

The person-in-charge of the range shall be the Chairman of the Hong Kong Shooting Association or a full time ranger officer (hereinafter refer to as the Chief Range Officer) appointed by the Chairman of the Hong Kong Shooting Association.

The Chief Range Officer shall be an Approved Ranger Officer (RO) and an Authorized Arms Instructor (AI) of the Hong Kong Police Force and certified by the Arms Licensing Office.

The Chief Range Office may deputize any persons, Duty Range Officers or Authorized Instructors, he deems fit to operate the range within their capacity. However, such persons must possess qualifications recognized by the Hong Kong Shooting Association.

3.0 Other Related Bye-Law

The range shall only be operated and used in accordance with the Shooting Bye-law of all I.S.S.F. Disciplines.

4.0 Description of the Range

**Notes -* *A Range Order would only apply for a shooting range of a specific firing distance. A separate Range Order should be prepared for the proposed 10m indoor range, 25m outdoor range and 50m outdoor range.*

The descriptions provided under item 4.1 should be read in relation to the specific firing distance.

4.1 The firing distance (the area of firing emplacements from which firing may take place)

* The 10m indoor range is set up for I.S.S.F competition shooting in accordance with I.S.S.F. Technical Rules. Only static firing positions are allowed from the basic firing lines with approved "back stops".

* The 25m range is set up for I.S.S.F. competition shooting in accordance with I.S.S.F. Technical Rules with approved "Back Stops".

* The 50m range is set up for I.S.S.F. competition shooting in accordance with I.S.S.F. Technical Rules with approved "Back Stops".

4.0 Description of the Range (cont'd)

4.2 Only the type of firearms allowed for the specific firing distance should be used.

4.3 The layout of the range is attached and displayed together with the Range Order.

4.4 Permanent warning signs are erected along the access road at 200m, 100m and 50m away from the Main Entrance Gate, and, at the front of the Main Entrance Gate.

The warning signs are of size 1200mm x 600mm in red coloured background and white wording in English and Chinese with wording:

WARNING : FIRING RANGE 200 METRES AHEAD. LIVE FIRE PRACTICE IN PROGRESS WHEN RED FLAG IS HOISTED.

警告 : 前行 200 米有實彈射擊場 當紅旗升起時實彈射擊正在行中

WARNING : FIRING RANGE 100 METRES AHEAD. LIVE FIRE PRACTICE IN PROGRESS WHEN RED FLAG IS HOISTED.

警告 : 前行 100 米有實彈射擊場 當紅旗升起時實彈射擊正在行中

WARNING : FIRING RANGE 50 METRES AHEAD. LIVE FIRE PRACTICE IN PROGRESS WHEN RED FLAG IS HOISTED.

警告 : 前行 50 米有實彈射擊場 當紅旗升起時實彈射擊正在行中

WARNING : FIRING RANGE. LIVE FIRE PRACTICE IN PROGRESS WHEN RED FLAG IS HOISTED.

警告 : 實彈射擊場 當紅旗升起時實彈射擊正在行中

4.5 Permanent warning signs same as the ones at the front of the Main Entrance Gate are erected on the boundary fence at approximately 50m intervals.

4.6 A red warning flag measuring 900mm x 600mm to be posted on a 7m high flag pole at the right side of the Main Entrance Gate. This flag shall be raised during all live fire practice and will be lowered and retrieved for safe keeping whenever live fire practice ceased.

4.7 Six red butt stop flags each measuring 900mm x 600mm to be posted on at a 7m high flag pole located at the flanks and/ or behind the bullet catchers.

4.8 The location of the 10m, 25m and 50m firing ranges, warning signs and flags are illustrated on the key plan attached as Annex "A".

5.0 Range Staff

** Notes-* *A Range Office(RO) and Arms Instructor(AI) must be qualified by the Hong Kong Police Force based on a recommendation by Chairman of the Hong Kong Shooting Association. Upon such approval/ authorization, the RO and AI candidates must attend a class given by the Chief Range Officer (CRO) on the operation and administration of the range.*

5.1 Chief Range Officer (CRO)

(a) Maintain and manage the range.
(b) Ensure the Duty Range Officers (DRO) receives written schedules including matches, recreational firing and any special instructions.
(c) Report for duty at least one hour prior to the first scheduled live fire for the day.
(d) Ensure all DRO check in and receive briefing prior to the scheduled live fire.
(e) Ensure all DRO wear the proper attire and identification.
(f) Ensure proper setting up of all equipment, targets, warning flags, etc. and provision of first-aid kit.
(g) Ensure all DRO understand and execute live fire procedures.
(h) Inspect the range with all the DRO prior to the scheduled live fire.
(j) Inspect the range with all the DRP after the scheduled live fire.
(k) Conduct RO training as required.

5.2 Duty Range Officer (DRO)

(a) Check in with the CRO half an hour prior to the first scheduled live fire.
(b) Present relevant and valid RO or AI identification for verification of authenticity.
(c) Obtain and execute briefing and all instructions given by the CRO.
(d) Provide briefing to the shooters assigned to observe.
(e) Maintain the highest standard of safety precaution in accordance with the Standard Operation Procedures and Range Orders.

5.3 Range Staff/ Security Personnel

(a) Assist the CRO and DRO in administration and management of the range.
(b) Control access and security. Check in of all shooters and/ or visitors.
(c) Setting up of warning flags and signs.
(d) Ensure no trespassers enter the boundary of the range.
(e) Maintain the highest standard of safety precaution in accordance with the Standard Operation Procedures and Range Orders.

5.4 All shooters are encouraged to book their firing time in advance. The range should only be opened for live fire with the minimum staffing of one RO. The number of RO or DRO may vary depending on the booking and the anticipated number of shooters. The attendance shall be determined by the CRO.

6.0 Use of the Range (cont'd)

6.1 The range is opened from 0700 hours to 2230 hours daily.

The range shall be closed upon hoisting of Typhoon Signal no.3 or higher.

The range or portions of the range may also be closed in case of accidents or other emergency incidents at the discretion of the Hong Kong Shooting Association.

6.2 Users

(a) Members of the Hong Kong Shooting Association
(b) Guest of members approved by the Hong Kong Shooting Association who have attended the prescribed course or are under the supervision of AI, or in possession of the relevant and valid arms license, are eligible to be engaged with shooting activities.
(c) Guest shooters attending competitions who are in possession of the relevant and valid armed license and personal firearms.
(d) Children of age 15 and under are prohibited from entering the range.

6.3 Only competitions organized and/ or approved by the Hong Kong Shooting Association can be held on the range.

The schedule, operation, staffing, safety precautionary measures shall be determined or subject to the approval of the Hong Kong Shooting Association.

6.4 Targets

Only the I.S.S.F competition paper targets are permitted.

7.0 Arms and Ammunition

7.1 Only arms and ammunitions permitted under the I.S.S.F. rules and regulations are allowed.

7.2 All firearms should be licensed.

7.3 The following ammunitions are not allowed:

- Jacket ammunitions
- Armour piercing ammnitions
- Tracer ammunitions
- Any ammunition with energy exceeding the range capacity

7.0 Arms and Ammunition (cont'd)

7.4 Restrictions specifically for each firing distance

(a)	10m indoor range	- only 177 cal. Pellet air gun is allowed.
(b)	25m and 50m outdoor range	- hand guns and ammunitions up to .45 or 9mm caliber with a muzzle velocity of not more than 1,400 ft. per sec. - rifles up to 0.22 or full bore rifle up to 7.62mm

8.0 Security and Safety

8.1 The boundary of the range including the car/ coach drop-off and parking area is fully fenced with only one entrance point through the Main Entrance gate.

Access for emergency vehicles is provided.

8.2 Control of Entry

(a) The range shall only be opened to users as delineated in item 6.2 above.
(b) All users are required to report and register at the Reception Table inside the Club House as the control entrance of the range.
(c) All users will be issued a "user" tag at the Reception Table that should be worn and displayed after entry into the range.
(d) All users are restricted to carry out firing activity at the designated shooting bay.

8.3 Safety Rules - Gun Handling

(a) Treat every firearm as is it is loaded.
(b) Never point at anything that you don't want to destroy.
(c) Keep your finger off the trigger unless you are ready to fire.
(d) Be sure of your target.

9.0 Display of Range Orders

9.1 The Range Order in both English and Chinese shall be posted permanently and at location prominent to view by the users at all firing ranges.

9.2 The safety rules, emergency procedures, and other operation regulations shall also be posted at the Main Entrance of the range and at the Reception Table inside the Club House.

9.3 For international competitions, English will be the only language for official communication.

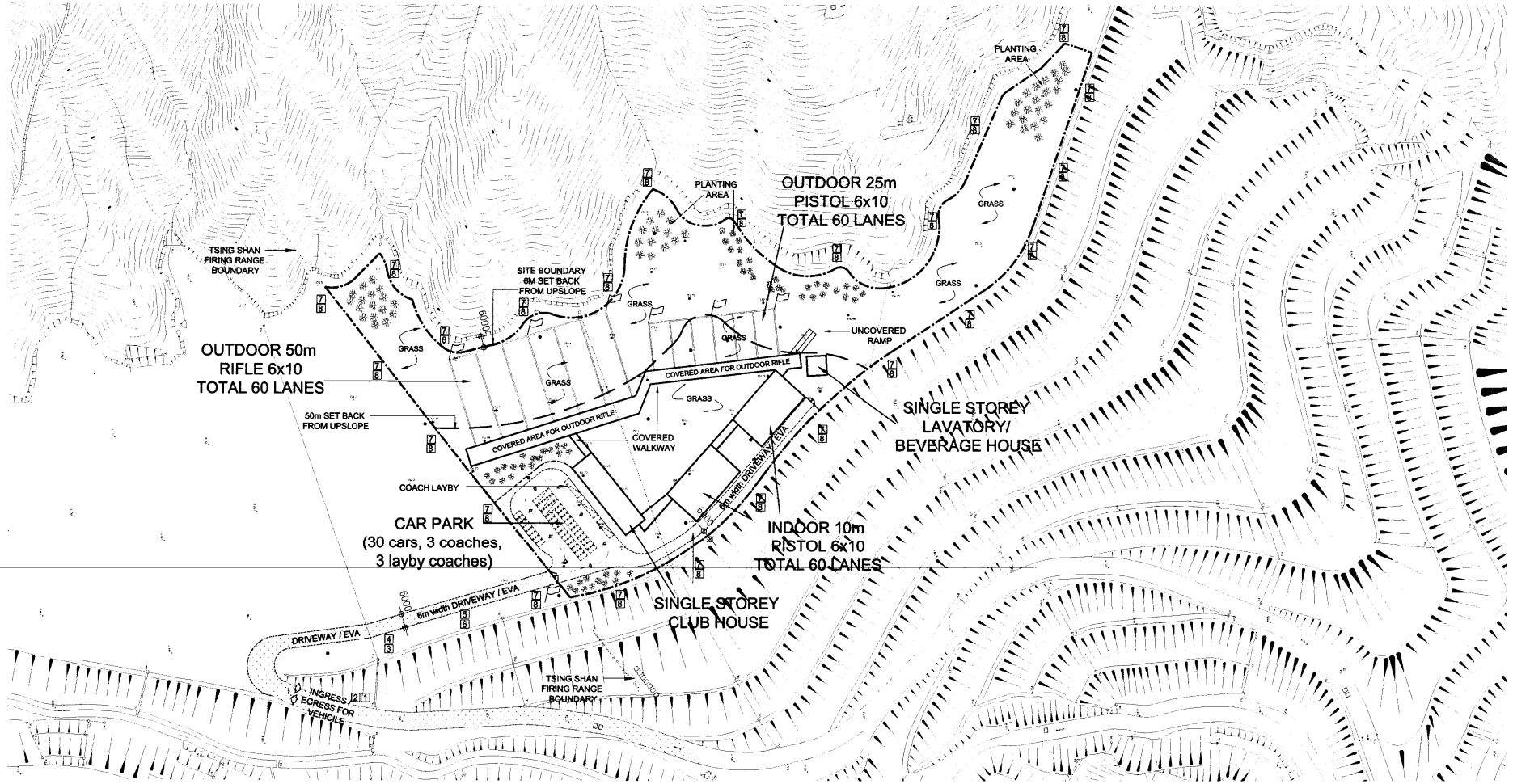
10.0 Emergency Procedure

10.1 Misfire or Accidental Discharge that causes Body Injury

(a) The Range Officer should instruct all shooters, at the range where the accident happened to unload their firearms and to clear the range.
(b) The injured person shall be treated with first-aid.
(c) Call the Police who will direct ambulance at scene.
(d) If the injured person is shot by his own firearms, remove the firearms and keep in unloaded conditions for police inspection upon arrival.
(e) The range where the accident happened will not be open until the injured person is removed and sent to hospital, and, obtains a clear instruction from the Police that the range is not required to be closed for investigation.
(f) The Range Officer should submit an accident report at his best knowledge to the arms licensee and the council of the Hong Kong Shooting Association.

10.2 Misfire or Accidental Discharge that causes Material Damage

(a) The Range Officer should stop the subject range activities and clear all shooters, if any, away from the range where the accident happened.
(b) The Range Officer should report if the damage is done by firing in a safe manner to the arms licensee and the council of the Hong Kong Shooting Association for final assessment.
(c) If the firing that causes the damage is not safe or breaches the range order, the arms licensee will write to the Police for investigation should the alleged offence, if any be substantiated.



LEGEND :

APPLICATION SITE BOUNDARY

RIGHT OF WAY THROUGH RESTRICTED AREA OF HONG KONG GARRISON OF THE CHINESE PEOPLE'S LIBERATION ARMY

900mm X 600mm TO BE POSTED ON 7m HIGH FLAG POLE

WARNING SIGNS SCALE 1: 25 :

1
WARNING :
FIRING RANGE 200 METRES AHEAD.
LIVE FIRE PRACTICE IN PROGRESS
WHEN RED FLAT IS HOISTED.

2
警告 :
前行200M米實彈射擊場
當紅旗升起時實彈射擊正在進行中

3
WARNING :
FIRING RANGE 100 METRES AHEAD.
LIVE FIRE PRACTICE IN PROGRESS
WHEN RED FLAT IS HOISTED.

4
警告 :
前行100M米實彈射擊場
當紅旗升起時實彈射擊正在進行中

5
WARNING :
FIRING RANGE 50 METRES AHEAD.
LIVE FIRE PRACTICE IN PROGRESS
WHEN RED FLAT IS HOISTED.

6
警告 :
前行50M米實彈射擊場
當紅旗升起時實彈射擊正在進行中

7
WARNING :
FIRING RANGE.
LIVE FIRE PRACTICE IN PROGRESS
WHEN RED FLAT IS HOISTED.

8
警告 :
實彈射擊場
當紅旗升起時實彈射擊正在進行中

N

PROJECT NO. 07001

PROJECT

PROPOSED SHOOTING RANGE AT PPVL, PILLAR POINT, TUEN MUN FOR HONG KONG SHOOTING ASSOCIATION

REVISIONS

No.	Description	Date

NOTES

Drawing to be displayed together with Range Order

DRAWING TITLE

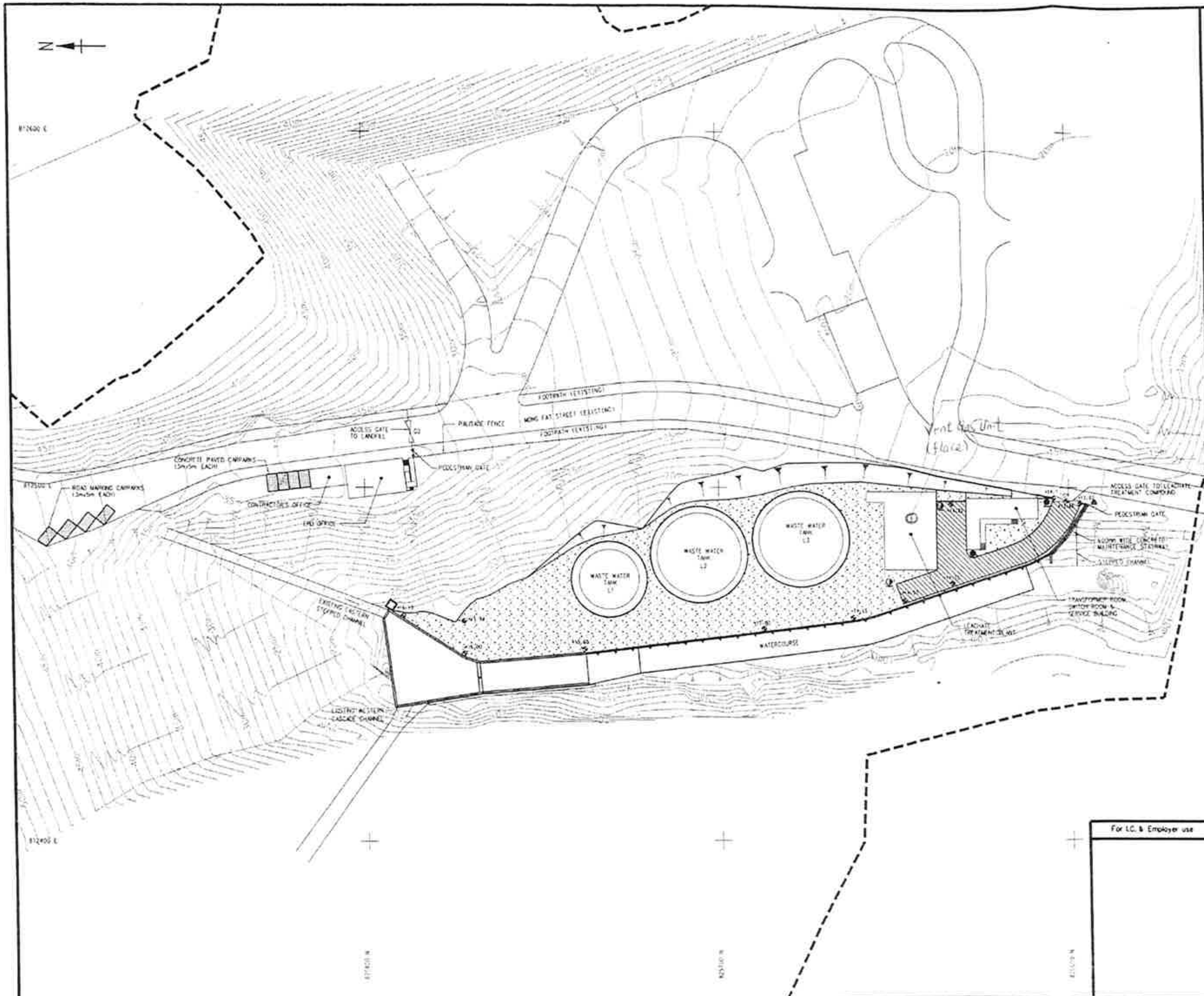
LAYOUT PLAN

DRAWING NO.	SCALE	DATE
Annex A	1:2500 (A3)	16 Nov 07

ORIGINATOR

STUDIO ONE DESIGN LIMITED
弐一建築設計事務所有限公司

APPENDIX D:
STACK, VOC, ODOUR, DRILLHOLES & PIEZOMETER, GAS VENT & SURFACE MONITORING RESULTS BY AFTERCARE CONTRACTOR



NOTES

1. ALL GRIDS ARE HONG KONG GRID 1980
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM (mPD)
3. SECTION OF EXISTING FOOTPATH IMMEDIATELY OUTSIDE ACCESS GATE G1 TO BE MODIFIED TO PROVIDE A TRANSITION INTO THE ACCESS ROAD LEADING TO THE TREATMENT COMPOUND
4. SETTING OUT OF THE FORMATION PLATFORM AND THE ACCESS ROAD REFERS TO DRAWING PPV/FOR/DRW/001/A

LEGEND

- LANDFILL SITE BOUNDARY
- RETAINING WALL
- 100 THICK CONCRETE SURFACE WITH A LAYER OF 8282 MESH REINFORCEMENT AT CENTRE
- ACCESS ROAD (EMERGENCY VEHICULAR ACCESS)
- NEW CUT SLOPE
- PALISADE FENCE
- FINISHED GROUND LEVEL
- ACCESS GATE G1 TO LEACHATE TREATMENT COMPOUND
- ACCESS GATE G2 TO LANDFILL
- PEDESTRIAN GATE
- CONCRETE MAINTENANCE STAIRWAY
- EVA SIGN TYPE 1 - LAYOUT SIGN
- EVA SIGN TYPE 2 - NO PARKING
- EVA SIGN TYPE 3 - KEEP CLEAR EVA DRIVEWAY

Rev.	Date	Description	Initial
A	8/05	MINOR CHANGES	

	Designed	Drawn	Checked
Initial			
Date			

Approved

CAD ref.

Contract no. EP/SP/45/03

Contract
PILLAR POINT VALLEY LANDFILL RESTORATION

Drawing title
GENERAL INFRASTRUCTURE LAYOUT

Drawing no. PPV/INF/DRW/010/A

Scale 1:500 (A1) 1:1000 (A3)

BLACK & VEATCH HONG KONG LIMITED
博威工程顧問有限公司

Construction Contractor
KIN SHING CONSTRUCTION CO. LTD
建成建築有限公司

Environmental Consultants
BMT Asia Pacific Limited

Independent Consultants
Scott Wilson Ltd
偉信顧問集團有限公司

Swire SITA Waste Services Ltd

For I.C. & Employer use

ppv-inf-drw-010a.dgn Aug. 16, 2006 13:29:43

Stacking Emission Monitoring

Section 2.8.1.6

Name of laboratory: Lam Laboratories Ltd.

Sample location		VGU	Compliance Limit
Date of sampling		05/01/2007	
Sampling time		11:00	
Chemical analysis of gas sample (mg/m3)	Hydrogen sulphide	<1.0	5 mg/m^3
	Chlorine and its compounds (expressed as HCl)	<10	50 mg/m^3
	Hydrogen fluoride, fluorine and its compounds (expressed as HF)	<2	2 mg/m^3 for HF, 10 mg/m^3 for F & its cpds.
	Bromides (expressed as HBr)	<5.0	5 mg/m^3
	Sulphur dioxide	2.4	250 mg/m^3
	Nitrogen oxides (expressed as NO_2)	<1.0	400 mg/m^3
	Non-methane hydrocarbons (expressed as CH4)	<1.0	20 mg/m^3
	Carbon monoxide	<100	100 mg/m^3
Particulates (mg/m3)		2.5	50 mg/m^3
Smoke (Ringelmann Chart)		<1	Less than Ringelmann Shade 1

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Stacking Emission Monitoring

Section 2.8.1.5

Name of laboratory: Lam Laboratories Ltd

Sample location		VGU	Compliance Limit
Date of sampling		08/02/2007	
Sampling time		11:00	
Chemical analysis of gas sample (mg/m3)	Hydrogen sulphide	<1.0	5 mg/m^3
	Chlorine and its compounds (expressed as HCl)	<10	50 mg/m^3
	Hydrogen fluoride, fluorine and its compounds (expressed as HF)	<2	2 mg/m^3 for HF, 10 mg/m^3 for F & its cpds.
	Bromides (expressed as HBr)	<5.0	5 mg/m^3
	Sulphur dioxide	<1.0	250 mg/m^3
	Nitrogen oxides (expressed as NO_2)	<1.0	400 mg/m^3
	Non-methane hydrocarbons (expressed as CH4)	<1.0	20 mg/m^3
	Carbon monoxide	<100	100 mg/m^3
Particulates (mg/m3)		<2.5	50 mg/m^3
Smoke (Ringelmann Chart)		<1	Less than Ringelmann Shade 1

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Stacking Emission Monitoring

Section 2.8.1.5

Name of laboratory: Lam Laboratories Ltd.

Sample location		VGU	Compliance Limit
Date of sampling		15/03/2007	
Sampling time		11:00	
Chemical analysis of gas sample (mg/m3)	Hydrogen sulphide	<1.0	5 mg/m^3
	Chlorine and its compounds (expressed as HCl)	<2.0	50 mg/m^3
	Hydrogen fluoride	<2.0	2 mg/m^3
	Fluorine and its compounds (expressed as HF)	<2.0	10 mg/m^3
	Bromides (expressed as HBr)	<2.0	5 mg/m^3
	Sulphur dioxide	<1.0	250 mg/m^3
	Nitrogen oxides (expressed as NO_x)	<1.0	400 mg/m^3
	Non-methane hydrocarbons (expressed as CH_4)	<1.0	20 mg/m^3
	Carbon monoxide	<10	100 mg/m^3
Particulates (mg/m3)		<2.5	50 mg/m^3
Smoke (Ringelmann Chart)		<1	Less than Ringelmann Shade 1

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

Stacking Emission Monitoring

Section 2.8.1.6

Name of laboratory: Lam Laboratories Ltd.

Sample location		VGU	Compliance Limit
Date of sampling		12/04/2007	
Sampling time		11:00	
Chemical analysis of gas sample (mg/m3)	Hydrogen sulphide	<1.0	5 mg/m^3
	Chlorine and its compounds (expressed as HCl)	<2.0	50 mg/m^3
	Hydrogen fluoride	<2.0	2 mg/m^3
	Fluorine and its compounds (expressed as HF)	<2.0	10 mg/m^3
	Bromides (expressed as HBr)	<2.0	5 mg/m^3
	Sulphur dioxide	<1.0	250 mg/m^3
	Nitrogen oxides (expressed as NO_x)	<1.0	400 mg/m^3
	Non-methane hydrocarbons (expressed as CH_4)	<1.0	20 mg/m^3
	Carbon monoxide	<10	100 mg/m^3
Particulates (mg/m3)		<2.5	50 mg/m^3
Smoke (Ringelmann Chart)		<1	Less than Ringelmann Shade 1

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Stacking Emission Monitoring

Section 2.8.1.5

Name of laboratory: Lam Laboratories Ltd.

Sample location		VGU	Compliance Limit
Date of sampling		08/05/2007	
Sampling time		11:00	
Chemical analysis of gas sample (mg/m3)	Hydrogen sulphide	<1.0	5 mg/m^3
	Chlorine and its compounds (expressed as HCl)	<2.0	50 mg/m^3
	Hydrogen fluoride	<2.0	2 mg/m^3
	Fluorine and its compounds (expressed as HF)	<2.0	10 mg/m^3
	Bromides (expressed as HBr)	<2.0	5 mg/m^3
	Sulphur dioxide	<1.0	250 mg/m^3
	Nitrogen oxides (expressed as NO_x)	<1.0	400 mg/m^3
	Non-methane hydrocarbons (expressed as CH4)	<1.0	20 mg/m^3
	Carbon monoxide	<10	100 mg/m^3
Particulates (mg/m3)		<2.5	50 mg/m^3
Smoke (Ringelmann Chart)		<1	Less than Ringelmann Shade 1

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

Stacking Emission Monitoring

Section 2.8.1.5

Name of laboratory: Lam Laboratories Ltd.

Sample location		VGU	Compliance Limit
Date of sampling		05/06/2007	
Sampling time		11:00	
Chemical analysis of gas sample (mg/m3)	Hydrogen sulphide	<1.0	5 mg/m^3
	Chlorine and its compounds (expressed as HCl)	<2.0	50 mg/m^3
	Hydrogen fluoride	<2.0	2 mg/m^3
	Fluorine and its compounds (expressed as HF)	<2.0	10 mg/m^3
	Bromides (expressed as HBr)	<2.0	5 mg/m^3
	Sulphur dioxide	<1.0	250 mg/m^3
	Nitrogen oxides (expressed as NO_x)	2.3	400 mg/m^3
	Non-methane hydrocarbons (expressed as CH4)	2.6	20 mg/m^3
	Carbon monoxide	<10	100 mg/m^3
Particulates (mg/m3)		<2.5	50 mg/m^3
Smoke (Ringelmann Chart)		<1	Less than Ringelmann Shade 1

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Stacking Emission Monitoring

Section 2.8.1.6

Name of laboratory: Lam Laboratories Ltd.

Sample location		VGU	Compliance Limit
Date of sampling		10/07/2007	
Sampling time		11:00	
Chemical analysis of gas sample (mg/m3)	Hydrogen sulphide	<1.0	5 mg/m^3
	Chlorine and its compounds (expressed as HCl)	<2.0	50 mg/m^3
	Hydrogen fluoride	<2.0	2 mg/m^3
	Fluorine and its compounds (expressed as HF)	<2.0	10 mg/m^3
	Bromides (expressed as HBr)	<2.0	5 mg/m^3
	Sulphur dioxide	<1.0	250 mg/m^3
	Nitrogen oxides (expressed as NO_x)	1.4	400 mg/m^3
	Non-methane hydrocarbons (expressed as CH4)	4.0	20 mg/m^3
	Carbon monoxide	<10	100 mg/m^3
Particulates (mg/m3)		<2.5	50 mg/m^3
Smoke (Ringelmann Chart)		<1	Less than Ringelmann Shade 1

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Stacking Emission Monitoring

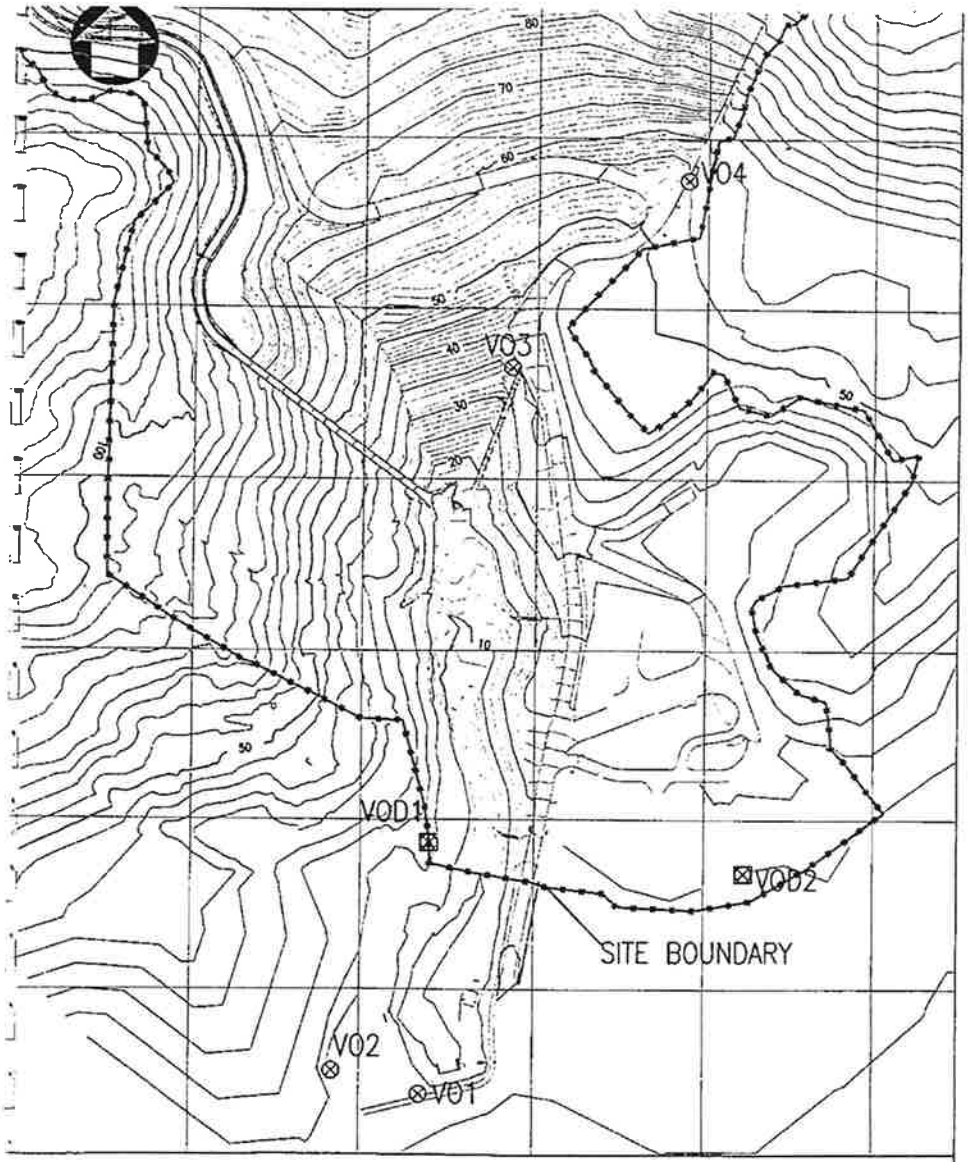
Section 2.8.1.6

Name of laboratory: Lam Laboratories Ltd.

Sample location		VGU	Compliance Limit
Date of sampling		09/10/2007	
Sampling time		11:00	
Chemical analysis of gas sample (mg/m3)	Hydrogen sulphide	<1.0	5 mg/m^3
	Chlorine and its compounds (expressed as HCl)	<2.0	50 mg/m^3
	Hydrogen fluoride	<2.0	2 mg/m^3
	Fluorine and its compounds (expressed as HF)	<2.0	10 mg/m^3
	Bromides (expressed as HBr)	<2.0	5 mg/m^3
	Sulphur dioxide	<1.0	250 mg/m^3
	Nitrogen oxides (expressed as NO_x)	1.3	400 mg/m^3
	Non-methane hydrocarbons (expressed as CH4)	6.2	20 mg/m^3
	Carbon monoxide	<10	100 mg/m^3
Particulates (mg/m3)		<2.5	50 mg/m^3
Smoke (Ringelmann Chart)		<1	Less than Ringelmann Shade 1

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager



PILLAR POINT VALLEY LANDFILL RESTORATION
CONTRACT NO. EP/SP/45/03

Swire SITA Waste Services Ltd

ENVIRONMENTAL MONITORING FOR AFTERCARE

AIR (VOC, ODOUR, AND DUST)

VOC MONITORING - LABORATORY MEASUREMENT

Name of laboratory: MateriaLab

Sample location	VO1	VO2	VO3	VO4	VOD1	VOD2	Compliance Limit
Date of sampling	26/7/2006	26/7/2006	26/7/2006	26/7/2006	26/7/2006	26/7/2006	
Sampling time	16:07	15:59	15:04	15:20	16:27	15:36	
Trichloroethylene, ppb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	50,000
Vinyl chloride, ppb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	4.4
Methylene chloride, ppb	2.07	<0.2	0.51	<0.2	2.93	1.06	50,000
Chloroform, ppb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	10,000
1,2-dichlorethane, ppb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	10,000
1,1,1-trichloroethane, ppb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	350,000
Carbon tetrachloride, ppb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	5,000
Tetrachloroethylene, ppb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	25,000
1,2-dibromethane, ppb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	508
Benzene, ppb	0.52	0.49	2.06	<0.2	2.66	0.64	9
Methane, ppb	1.63	1.65	2.63	1.73	1.81	1.62	-

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

VOC MONITORING - LABORATORY MEASUREMENT

Section 2.8.5.2b

Name of laboratory: MateriaLab

Sample location	VO1	VO2	VO3	VO4	VOD1	VOD2	Compliance Limit
Date of sampling	20/10/2006	20/10/2006	20/10/2006	20/10/2006	20/10/2006	20/10/2006	
Sampling time	10:32	10:13	11:00	11:23	9:43	11:35	
Trichloroethylene, ppb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	50,000
Vinyl chloride, ppb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	4.4
Methylene chloride, ppb	7.02	11.7	10.9	24.0	130	46.1	50,000
Chloroform, ppb	<0.2	<0.2	0.23	0.20	0.71	<0.2	10,000
1,2-dichlorethane, ppb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	10,000
1,1,1-trichloroethane, ppb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	350,000
Carbon tetrachloride, ppb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	5,000
Tetrachloroethylene, ppb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	25,000
1,2-dibromethane, ppb	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	508
Benzene, ppb	1.04	8.01	0.93	0.96	37.0	8.86	9
Methane, ppb	1.97	1.91	7.42	4.48	2.00	2.40	-

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

VOC MONITORING - LABORATORY MEASUREMENT

Name of laboratory: Lam Laboratories Ltd.

Sample location	VO1	VO2	VO3	VO4	VOD1	VOD2	Compliance Limit
Date of sampling	9/1/2007	9/1/2007	9/1/2007	9/1/2007	9/1/2007	9/1/2007	
Sampling time	12:16	12:25	11:36	11:40	12:05	11:55	
Trichloroethylene, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	50,000
Vinyl chloride, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.4
Methylene chloride, ppb	2.2	1.8	<1.0	3.2	1.1	1.2	50,000
Chloroform, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10,000
1,2-dichlorethane, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10,000
1,1,1-trichloroethane, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	350,000
Carbon tetrachloride, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5,000
Tetrachloroethylene, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	25,000
1,2-dibromethane, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	508
Benzene, ppb	1.4	1.5	<1.0	<1.0	<1.0	1.2	9
Methane, ppm	14	17	220	81	18	28	-

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

OC-EMC-019 Rev0 01/09/2006

Swire SITA Waste Services Limited

VOC MONITORING - LABORATORY MEASUREMENT

Name of laboratory: Lam Laboratories Ltd.

Sample location	VO1	VO2	VO3	VO4	VOD1	VOD2	Compliance Limit
Date of sampling	12/4/2007	12/4/2007	12/4/2007	12/4/2007	12/4/2007	12/4/2007	
Sampling time	14:44	14:46	14:19	14:13	14:32	14:23	
Trichloroethylene, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	50,000
Vinyl chloride, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.4
Methylene chloride, ppb	<1.0	<1.0	2.7	<1.0	<1.0	<1.0	50,000
Chloroform, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10,000
1,2-dichlorethane, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10,000
1,1,1-trichloroethane, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	350,000
Carbon tetrachloride, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5,000
Tetrachloroethylene, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	25,000
1,2-dibromethane, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	508
Benzene, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	9
Methane, ppm	200	13	30	88	30	90	-

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

VOC MONITORING - LABORATORY MEASUREMENT

Section 2.8.5.2b

Name of laboratory: Lam Laboratories Ltd.

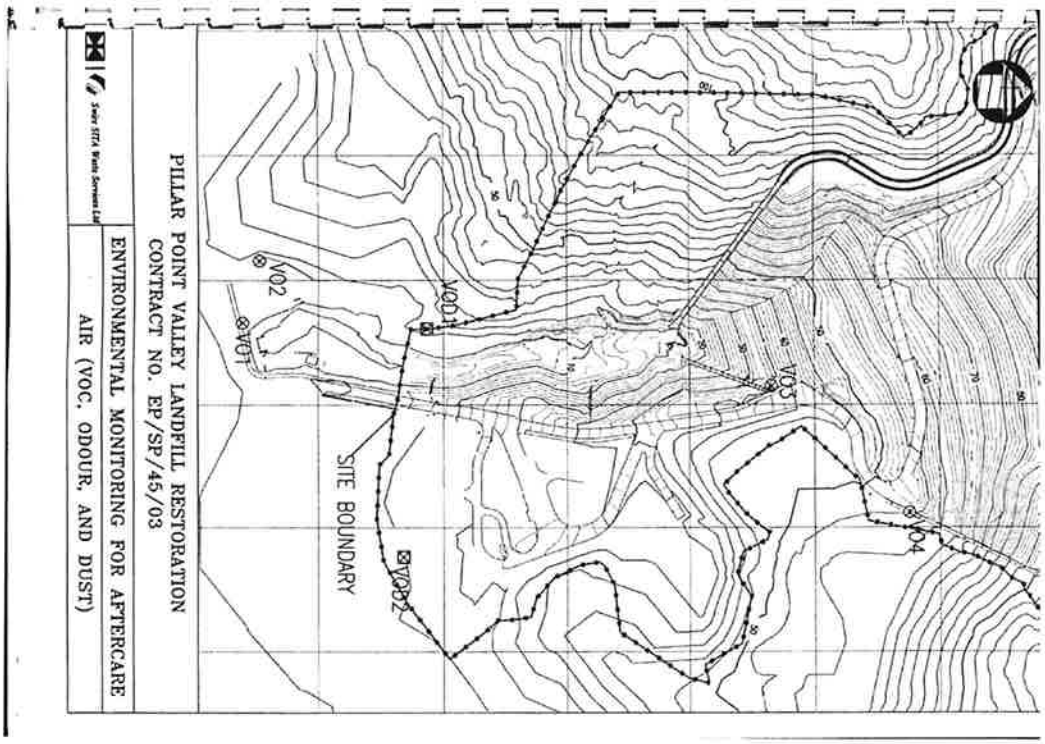
Sample location	VO1	VO2	VO3	VO4	VOD1	VOD2	Compliance Limit
Date of sampling	10/7/2007	10/7/2007	10/7/2007	10/7/2007	10/7/2007	10/7/2007	
Sampling time	14:53	14:46	14:16	14:11	14:37	14:27	
Trichloroethylene, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	50,000
Vinyl chloride, ppb	<1.0	<1.0	2.0	2.1	1.0	1.3	4.4
Methylene chloride, ppb	2.9	7.7	4.0	11	1.6	15	50,000
Chloroform, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10,000
1,2-dichlorethane, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10,000
1,1,1-trichloroethane, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	350,000
Carbon tetrachloride, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5,000
Tetrachloroethylene, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	25,000
1,2-dibromethane, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	508
Benzene, ppb	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	9
Methane, ppm	3.3	2.0	2.3	3.0	3.1	3.8	-

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

OC-EMC-019 Rev0 01/09/2006

Swire SITA Waste Services Limited



ODOUR MONITORING

Section 2.8.5.3 - Odour monitoring

Date of monitoring: 26/7/2006

Name of laboratory: MateriaLab

Weather: Cloudy

Sample location	Sampling time	Temperature (℃)	Wind direction	Wind speed (m/s)	Odour Unit		
					C. F. Leung (FTS)	W. M. Fuk (FTS)	Overall Result
VO1	16:10	29.0	N	1-2	None	None	None
VO2	16:02	31.0	Nil	<1	None	None	None
VO3	16:47	27.5	Nil	<1	None	None	None
VO4	16:57	27.0	Nil	<1	None	None	None
VOD1	16:30	28.0	Nil	<1	None	None	None
VOD2	16:40	28.5	Nil	<1	None	None	None

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

ODOUR MONITORING

Section 2.8.5.3

Date of monitoring: 25/10/2006

Name of laboratory: MateriaLab

Weather: Hazy

Sample location	Sampling time	Temperature (℃)	Wind direction	Wind speed (m/s)	Odour*		
					C. F. Leung (FTS)	W. M. Fuk (FTS)	Overall Result
VO1	15:52	29.0	SE	1	None	None	None
VO2	15:48	29.0	S	1-2	None	None	None
VO3	16:02	28.0	Nil	<1	None	None	None
VO4	15:58	29.0	Nil	<1	None	None	None
VOD1	15:20	27.5	S	<1	None	None	None
VOD2	16:10	28.5	Nil	<1	None	None	None

Remarks: *Odours are characterised as follows:

None: No odour perceived or an odour so weak that it cannot be readily characterised or described. Equivalent to 0 o.u.

Slight: Detectable odour (slight). Equivalent to 1 o.u.

Noticeable: Detectable odour (moderate). Equivalent to 2 o.u.

Strong: Detectable odour (strong). Equivalent to 3 o.u.

Extreme: Severe odour. Equivqlent to 4 o.u.

Compliance Limit of odour monitoring is 2 odour unit.

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

ODOUR MONITORING

Date of monitoring: 5/1/2007

Name of laboratory: Wellab

Weather: Sunny

Sample location	Sampling time	Temperature (℃)	Wind direction	Wind speed (m/s)	Odour*		
					Tsang Tsz Keung Wellab	Ng Hoi Hong Wellab	Overall Result
VO1	15:45	22.0	E	<1	None	None	None
VO2	15:41	23.0	SE	<1	None	None	None
VO3	15:15	24.0	N	<1	None	None	None
VO4	15:10	21.0	E	<1	None	None	None
VOD1	15:30	22.0	E	<1	None	None	None
VOD2	15:23	23.0	SE	1-2	None	None	None

Remarks: *Odours are characterised as follows:

None: No odour perceived or an odour so weak that it cannot be readily characterised or described. Equivalent to 0 o.u.

Slight: Detectable odour (slight). Equivalent to 1 o.u.

Noticeable: Detectable odour (moderate). Equivalent to 2 o.u.

Strong: Detectable odour (strong). Equivalent to 3 o.u.

Extreme: Severe odour. Equivqlent to 4 o.u.

Compliance Limit of odour monitoring is 2 odour unit.

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

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Swire SITA Waste Services Limited

ODOUR MONITORING

Date of monitoring: 4/4/2007

Name of laboratory: Wellab

Weather: Sunny

Sample location	Sampling time	Temperature (℃)	Wind direction	Wind speed (m/s)	Odour*		
					Tsang Tsz Keung Wellab	Tao Ching Hang Wellab	Overall Result
VO1	16:16	14.8	N	1.3	None	None	None
VO2	16:13	15.0	NE	0.4	None	None	None
VO3	15:43	14.2	NE	0.4	None	None	None
VO4	15:40	15.6	W	0.4	None	None	None
VOD1	16:03	14.8	N	0.9	None	None	None
VOD2	15:52	14.9	NW	0.4	None	None	None

Remarks: *Odours are characterised as follows:

None: No odour perceived or an odour so weak that it cannot be readily characterised or described. Equivalent to 0 o.u.

Slight: Detectable odour (slight). Equivalent to 1 o.u.

Noticeable: Detectable odour (moderate). Equivalent to 2 o.u.

Strong: Detectable odour (strong). Equivalent to 3 o.u.

Extreme: Severe odour. Equivqlent to 4 o.u.

Compliance Limit of odour monitoring is 2 odour unit.

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

ODOUR MONITORING

Section 2.8.5.3

Date of monitoring: 4/7/2007

Name of laboratory: Wellab

Weather: Sunny

Sample location	Sampling time	Temperature (℃)	Wind direction	Wind speed (m/s)	Odour*		
					Tsang Tsz Keung Wellab	Tao Ching Hang Wellab	Overall Result
VO1	16:20	33.3	N	0.4	None	None	None
VO2	16:16	33.5	N	1.3	None	None	None
VO3	16:00	33.6	Nil	Nil	None	None	None
VO4	16:06	33.4	Nil	Nil	None	None	None
VOD1	16:30	33.3	Nil	Nil	None	None	None
VOD2	16:10	33.5	SW	0.4	None	None	None

Remarks: *Odours are characterised as follows:

None: No odour perceived or an odour so weak that it cannot be readily characterised or described. Equivalent to 0 o.u.

Slight: Detectable odour (slight). Equivalent to 1 o.u.

Noticeable Detectable odour (moderate). Equivalent to 2 o.u.

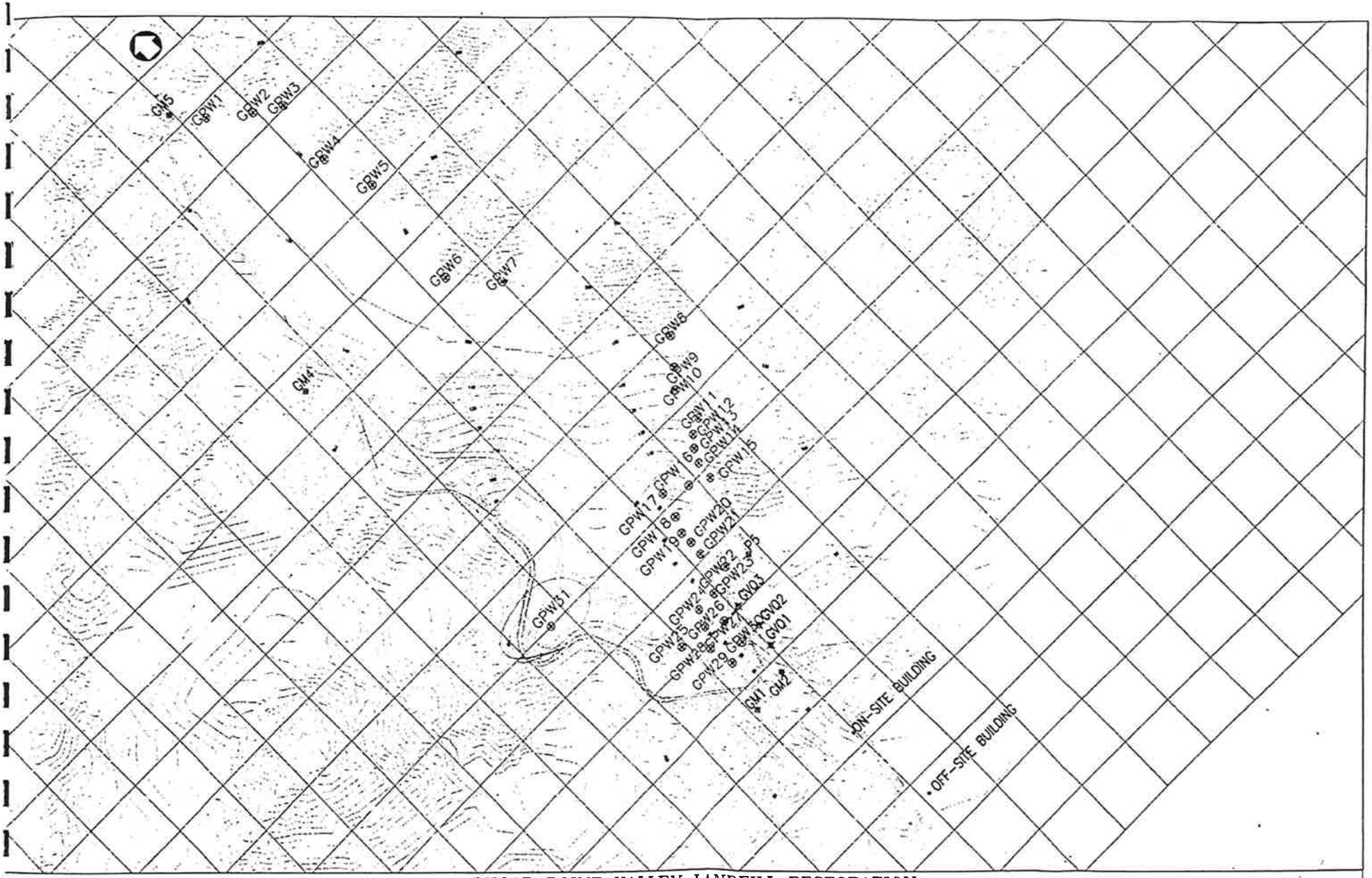
Strong: Detectable odour (strong). Equivalent to 3 o.u.

Extreme: Severe odour. Equivqlent to 4 o.u.

Compliance Limit of odour monitoring is 2 odour unit.

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager



PILLAR POINT VALLEY LANDFILL RESTORATION
CONTRACT NO. EP/SP/45/03

ENVIRONMENTAL MONITORING FOR AFTERCARE

Swire SITA Waste Services Ltd

LANDFILL GAS

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Section 2.8.1.2 - Drillholes and Piezometer Monitoring

Sampling equipment	Dates calibrated
GEM2000	14/7/2006, 24/7/2006

Sampling date	Weather conditions	Sample location	Sampling time	Atmospheric pressure (mBar)	Atmospheric temperature (°C)	On-site piezometer and monitoring holes: Gas pressure (mBar)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Gas temperature (°C)	Remarks
14/07/2006	Sunny	GM1	08:45	989	32.7	0.0	0.0	11.7	6.0	32.9	
		GM4	10:00	975	33.5	1.3	0.0	4.4	15.8	34.6	
		GM5	10:25	976	33.9	0.0	0.0	5.8	13.8	34.0	
		P5	11:00	988	32.1	0.0	0.0	0.4	21.0	32.8	
		GM2	11:07	988	32.2	0.0	0.0	8.7	12.6	30.9	
		GVQ3	11:15	989	33.6	0.0	0.0	1.2	20.3	33.5	
		GVQ2	11:20	989	33.9	0.0	0.0	8.3	8.7	32.9	
		GVQ1	11:25	989	33.3	0.0	0.0	2.5	16.7	34.6	
24/07/2006	Sunny	P5	14:00	980	33.9	-0.2	0.0	0.2	20.5	34.2	Sample of piezometer

Prepared by:: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Section 2.8.1.2 - Drillholes and Piezometer Monitoring

Sampling equipment	Dates calibrated
GEM2000	28/08/2006

Sampling date	Weather conditions	Sample location	Sampling time	Atmospheric pressure (mBar)	Atmospheric temperature (°C)	Gas pressure (mBar)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Gas temperature (°C)	Remarks
28/08/2006	Sunny	GM1	09:34	1002	34.1	0.0	0.0	5.2	3.0	33.3	
		GM4	10:36	987	35.9	-0.1	0.0	5.7	13.8	35.7	
		GM5	10:50	988	32.9	-0.1	0.0	7.1	11.0	32.8	
		P5	11:14	999	32.2	-0.1	0.0	0.8	19.9	31.8	
		GVQ3	11:19	999	32.5	-0.1	0.0	2.0	18.3	32.3	
		GVQ2	11:22	999	32.5	-24.5	0.0	1.0	19.6	32.0	
		GM2	14:07	1001	33.1	-0.1	0.0	9.6	9.5	33.2	
		GVQ1	14:12	1001	34.1	-0.4	0.0	10.0	8.1	34.0	Sampling of drillhole

Remarks:

	Compliance Limit
Methane	1% by volume
Carbon dioxide	1.5% by volume above the natural background level

Prepared by: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Section 2.8.1.2 - Drillholes and Piezometer Monitoring

Sampling equipment	Dates calibrated
GEM2000	22/09/2006

Sampling date	Weather conditions	Sample location	Sampling time	Atmospheric pressure (mBar)	Atmospheric temperature (°C)	Gas pressure (mBar)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Gas temperature (°C)	Remarks
22/09/2006	Sunny	GM1	11:50	1005	31.6	0.0	0.0	9.3	3.9	31.2	
		GM2	13:15	1004	32.8	-0.1	0.0	10.3	8.7	29.7	
		GVQ1	13:30	1004	32.8	0.0	0.0	10.2	8.3	33.8	
		GVQ2	13:45	1004	32.9	-43.1	0.0	2.8	11.7	33.8	
		GVQ3	13:55	1001	31.4	-0.2	0.1	1.8	18.6	31.0	
		GM4	14:35	987	32.7	-0.4	0.0	4.9	14.6	32.3	
		GM5	14:45	987	30.9	-0.1	0.0	6.6	12.0	32.0	
		P5	15:40	999	30.8	-0.2	0.0	0.3	20.3	31.2	Sample of piezometer

Remarks:

	Compliance Limit
Methane	1% by volume
Carbon dioxide	1.5% by volume above the natural background level

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Section 2.8.1.2 - Drillholes and Piezometer Monitoring

Sampling equipment	Dates calibrated
GEM2000	20/10/2006

Sampling date	Weather conditions	Sample location	Sampling time	Atmospheric pressure (mBar)	Atmospheric temperature (°C)	Gas pressure (mBar)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Gas temperature (°C)	Remarks
20/10/2006	Cloudy	GM2	10:47	1012	29.5	0.1	0.0	10.6	9.0	30.0	
		GVQ1	10:52	1012	29.3	0.0	0.0	10.3	9.4	32.0	
		GVQ2	11:04	1012	29.9	0.0	0.0	6.7	14.5	30.0	
		GVQ3	11:07	1012	29.7	0.0	0.0	1.6	19.1	29.8	
		P5	11:19	1009	28.8	-0.1	0.0	0.9	19.7	28.2	
		GM4	14:11	994	30.2	0.1	0.0	4.5	16.6	31.7	
		GM5	14:20	996	30.5	0.0	0.0	7.6	11.8	32.3	Bulk gas sample was taken
		GM1	15:40	1009	29.2	0.0	0.0	10.8	8.9	29.5	

Remarks:

	Compliance Limit
Methane	1% by volume
Carbon dioxide	1.5% by volume above the natural background level

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Section 2.8.1.2 - Drillholes and Piezometer Monitoring

Sampling equipment	Dates calibrated
GEM2000	13/11/2006

Sampling date	Weather conditions	Sample location	Sampling time	Atmospheric pressure (mBar)	Atmospheric temperature (°C)	Gas pressure (mBar)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Gas temperature (°C)	Remarks
14/11/2006	Hazy	GM1	11:45	101	28.6	0.1	0.0	10.1	10.6	28.3	Sampling of drillhole
		GM2	14:20	1008	28.0	0.1	0.0	10.1	11.0	27.6	
		GVQ1	14:26	1008	30.1	0.0	0.0	10.0	10.0	30.0	
		GVQ2	14:43	1008	30.8	0.0	0.0	3.9	17.1	30.9	
		GVQ3	14:48	1008	29.6	0.0	0.0	1.1	18.9	29.7	
		P5	14:58	1007	29.6	0.0	0.0	0.7	19.1	29.3	
		GM4	15:18	1007	29.4	0.0	0.1	3.9	16.9	28.6	
		GM5	15:30	1007	29.2	-0.1	0.0	5.5	14.2	28.4	

Remarks:

	Compliance Limit
Methane	1% by volume
Carbon dioxide	1.5% by volume above the natural background level

Prepared by: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Section 2.8.1.2 - Drillholes and Piezometer Monitoring

Sampling equipment	Dates calibrated
GEM2000	18/12/2006

Sampling date	Weather conditions	Sample location	Sampling time	Atmospheric pressure (mBar)	Atmospheric temperature (°C)	Gas pressure (mBar)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Gas temperature (°C)	Remarks
18/12/2006	Sunny	GM5	10:09	1006	16.4	0.0	0.0	8.1	12.7	19.5	
		GM4	10:21	1006	16.5	0.0	0.0	5.4	16.3	16.1	
		GM2	14:07	1018	10.3	-0.7	0.1	9.7	12.0	20.9	Sampling of drillhole
		GVQ1	14:23	1018	19.2	0.0	0.0	8.8	12.6	25.5	
		GVQ2	14:28	1018	19.4	0.1	0.0	13.1	7.8	25.0	
		GVQ3	14:32	1018	19.1	0.0	0.0	0.8	18.9	22.4	
		P5	14:39	1018	18.9	0.0	0.0	2.6	17.9	20.1	
		GM1	14:54	1017	19.7	0.1	0.0	10.7	10.0	20.0	

Remarks:

	Compliance Limit
Methane	1% by volume
Carbon dioxide	1.5% by volume above the natural background level

Prepared by: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Section 2.8.1.2 - Drillholes and Piezometer Monitoring

Sampling equipment	Dates calibrated
GEM2000	04/01/2007

Sampling date	Weather conditions	Sample location	Sampling time	Atmospheric pressure (mBar)	Atmospheric temperature (°C)	Gas pressure (mBar)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Gas temperature (°C)	Remarks
04/01/2007	Cloudy	GM1	09:00	1013	15.7	0.0	0.0	10.3	11.2	16.5	
		GM5	09:25	999	15.9	0.1	0.0	7.4	13.7	15.9	
		GM4	09:35	999	15.4	0.0	0.0	5.0	16.4	15.2	
		P5	09:46	999	15.4	0.0	0.0	1.7	19.1	15.5	
		GVQ3	09:50	999	16.0	0.0	0.0	0.5	20.1	16.0	
		GVQ2	09:55	999	16.0	0.0	0.0	6.6	16.1	16.3	
		GVQ1	10:00	999	16.1	0.0	0.0	6.9	13.9	16.6	
05/01/2007	Sunny	GM2	11:53	1014	17.4	0.6	0.0	6.7	13.2	18.1	Sampling of drillhole

Remarks:

	Compliance Limit
Methane	1% by volume
Carbon dioxide	1.5% by volume above the natural background level

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Section 2.8.1.2 - Drillholes and Piezometer Monitoring

Sampling equipment	Dates calibrated
GEM2000	08/02/2007

Sampling date	Weather conditions	Sample location	Sampling time	Atmospheric pressure (mBar)	Atmospheric temperature (°C)	Gas pressure (mBar)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Gas temperature (°C)	Remarks
08/02/2007	Sunny	GM1	11:55	1015	27.5	0.0	0.0	0.1	22.4	27.1	Sampling of drillhole
09/02/2007	Sunny	GM4	15:05	992	29.4	0.0	0.0	4.2	17.0	27.5	
		GM5	15:20	992	29.5	0.0	0.0	5.1	14.9	27.6	
		P5	15:45	992	29.0	0.0	0.1	0.5	19.9	29.7	
		GVQ3	15:50	992	28.9	0.0	0.0	0.2	19.7	31.7	
		GVQ2	15:54	992	28.9	0.0	0.0	4.4	16.7	31.8	
		GVQ1	15:57	992	29.0	0.0	0.0	5.0	14.5	30.9	
		GM2	16:02	992	29.0	0.0	0.0	7.6	13.6	29.4	

Remarks:

	Compliance Limit
Methane	1% by volume
Carbon dioxide	1.5% by volume above the natural background level

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Section 2.8.1.2 - Drillholes and Piezometer Monitoring

Sampling equipment	Dates calibrated
GEM2000	15/03/2007

Sampling date	Weather conditions	Sample location	Sampling time	Atmospheric pressure (mBar)	Atmospheric temperature (°C)	Gas pressure (mBar)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Gas temperature (°C)	Remarks
15/03/2007	Hazy	GM1	08:43	1005	22.9	0.0	0.0	8.2	12.8	23.6	
		GM2	08:57	1006	22.9	-0.1	0.0	7.4	14.4	25.3	
		GVQ1	09:09	1006	23.0	0.0	0.0	5.5	14.3	24.4	
		GVQ2	09:13	1006	23.2	0.0	0.0	4.0	16.5	24.0	
		GVQ3	09:16	1006	23.1	0.0	0.0	0.5	19.2	23.8	
		GM4	09:28	1006	23.3	0.0	0.1	3.7	17.2	23.5	
		GM5	09:39	1006	23.2	0.0	0.0	6.8	14.2	23.5	
		P5	11:27	1003	23.3	0.1	0.1	0.8	19.4	25.7	Sampling of drillhole

Remarks:

	Compliance Limit
Methane	1% by volume
Carbon dioxide	1.5% by volume above the natural background level

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Section 2.8.1.2 - Drillholes and Piezometer Monitoring

Sampling equipment	Dates calibrated
GEM2000	11/04/2007

Sampling date	Weather conditions	Sample location	Sampling time	Atmospheric pressure (mBar)	Atmospheric temperature (°C)	Gas pressure (mBar)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Gas temperature (°C)	Remarks
11/04/2007	Sunny	GVQ1	10:23	1012	22.1	0.0	0.0	7.0	13.6	22.7	
		GVQ2	10:32	1012	22.1	0.0	0.0	5.4	15.3	24.1	
12/04/2007	Sunny	GM1	09:04	1012	25.3	0.0	0.1	7.6	14.0	27.9	
		GM2	09:39	1010	25.3	0.0	0.1	6.9	14.6	26.1	
		P5	09:46	1010	25.3	0.1	0.0	1.4	18.2	23.0	
		GM4	10:03	1010	25.3	0.0	0.0	3.5	17.1	28.8	
		GM5	10:19	1010	25.5	0.0	0.0	6.4	14.3	26.0	
		GVQ3	11:52	1003	25.5	0.0	0.0	0.5	19.0	27.5	Sampling of drillhole

Remarks:

	Compliance Limit
Methane	1% by volume
Carbon dioxide	1.5% by volume above the natural background level

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Section 2.8.1.4 - Passive Vent Monitoring

Sampling equipment used	Dates calibrated
GEM2000	9/5/2007
ADM-860C	11/4/2006

					Passive vent monitoring							
Sampling date	Weather condition	Sample location	Sampling time	Atmospheric pressure (mBar)	Flow meter reading (m/s)	Flow rate (L/min)	Gas pressure (mBar)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Gas temperature (°C)	Remarks
9/5/2007	Sunny	GPW1	8:44	991	0.00	0.0	0.0	0.0	8.1	10.4	25.9	
		GPW2	8:50	991	-0.20	-94.2	0.0	15.6	11.2	10.5	29.7	
		GPW3	8:56	991	0.89	419.4	-0.1	37.5	24.8	0.1	32.3	
		GPW4	8:59	991	0.00	0.0	0.0	41.7	18.4	2.4	32.2	
		GPW5	9:02	991	-0.23	-108.4	0.0	46.4	26.5	0.0	31.3	
		GPW6	9:07	991	0.96	452.4	0.0	48.0	29.3	0.0	22.7	
		GPW7	9:12	991	0.21	99.0	0.0	45.5	27.2	0.0	31.1	
		GPW8	9:18	991	1.36	640.9	0.1	36.6	28.8	0.0	29.3	
		GPW9	9:23	991	0.15	70.7	0.0	40.6	27.8	0.1	28.1	
		GPW10	9:26	991	0.41	193.2	0.0	29.8	22.4	0.8	29.5	
		GPW11	9:29	991	0.00	0.0	0.0	0.1	5.3	13.4	29.7	
		GPW12	9:32	991	0.00	0.0	0.0	2.2	6.0	14.4	29.1	
		GPW13	9:35	991	0.14	66.0	0.0	32.5	23.5	1.2	27.3	
		GPW14	9:39	991	0.00	0.0	0.0	0.0	0.5	19.7	27.2	
		GPW15	9:46	991	0.00	0.0	0.0	0.0	2.8	17.3	30.0	
		GPW16	9:50	991	-0.30	-141.4	0.0	3.2	19.2	0.6	29.4	
		GPW17	9:54	991	0.00	0.0	0.0	0.0	0.2	20.2	29.9	
		GPW18	9:56	991	-0.25	-117.8	0.0	11.7	19.0	3.4	30.0	
		GPW19	10:00	991	-0.15	-70.7	0.0	0.0	2.2	18.7	30.2	
		GPW20	10:04	991	0.23	108.4	0.0	18.4	14.0	10.0	28.9	
		GPW21	10:07	991	0.00	0.0	0.0	0.0	1.3	18.5	27.7	
		GPW22	10:10	991	-0.22	-103.7	0.0	3.4	17.1	29.9	29.9	
		GPW23	10:15	991	0.28	131.9	0.0	0.0	1.3	19.3	29.7	
		GPW24	10:18	991	-0.39	-183.8	0.0	0.0	0.5	20.1	29.8	
		GPW25	10:24	991	0.00	0.0	0.0	0.0	4.3	15.9	31.3	
		GPW26	10:26	991	0.14	66.0	0.0	0.0	0.0	20.7	30.9	
		GPW27	10:30	991	0.29	136.7	0.0	25.2	21.2	5.8	30.5	
		GPW28	10:33	991	0.41	193.2	0.0	0.0	1.0	19.4	30.1	
		GPW29	10:40	991	-0.26	-122.5	0.0	0.0	3.3	17.2	29.3	
		GPW30	10:37	991	-0.13	-61.3	0.0	0.0	3.3	16.9	30.2	
		GPW31	10:50	991	2.18	1027.3	-1.0	38.0	29.9	1.6	35.4	

Remarks: LTP blower was turned off on 9/5/2007 morning

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Section 2.8.1.4 - Passive Vent Monitoring

Sampling equipment used	Dates calibrated
GEM2000	25/6/2007
ADM-860C	11/4/2006

					Passive vent monitoring							
Sampling date	Weather condition	Sample location	Sampling time	Atmospheric pressure (mBar)	Flow meter reading (m/s)	Flow rate (L/min)	Gas pressure (mBar)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Gas temperature (°C)	Remarks
25/6/2007	Sunny	GPW1	9:07	986	-0.13	-61.3	0.0	0.1	0.0	20.0	29.9	
		GPW2	9:10	986	-0.29	-136.7	0.0	0.0	0.0	20.0	31.2	
		GPW3	9:14	986	-0.31	-146.1	0.0	0.0	0.0	19.9	32.7	
		GPW4	9:25	986	0.19	89.5	0.0	0.0	0.0	19.9	35.1	
		GPW5	9:29	986	0.21	99.0	0.0	0.0	0.0	19.8	33.5	
		GPW6	9:35	986	-0.50	-235.6	0.0	0.0	0.0	19.9	33.7	
		GPW7	9:38	986	-0.32	-150.8	-0.1	0.0	0.0	19.9	34.7	
		GPW8	9:47	986	0.00	0.0	0.0	0.0	0.0	19.9	33.0	
		GPW9	9:51	986	-0.27	-127.2	0.0	0.0	0.0	19.9	33.8	
		GPW10	9:53	986	0.00	0.0	0.0	0.0	0.7	18.9	35.0	
		GPW11	9:56	986	-0.19	-89.5	0.0	2.9	9.3	10.2	35.6	
		GPW12	9:59	986	-0.15	-70.7	0.0	0.1	4.8	14.4	34.9	
		GPW13	10:03	986	-0.30	-141.4	-0.1	19.0	17.3	3.1	35.2	
		GPW14	10:06	986	0.19	89.5	0.0	0.0	0.1	18.9	34.3	
		GPW15	10:14	986	0.24	113.1	0.0	0.0	0.1	19.5	33.8	
		GPW16	10:18	986	0.29	136.7	0.0	0.0	0.0	19.8	32.0	
		GPW17	10:21	986	0.00	0.0	0.0	0.0	0.1	19.8	30.9	
		GPW18	10:24	986	0.00	0.0	0.0	0.0	0.2	19.6	32.6	
		GPW19	10:26	986	-0.16	-75.4	0.0	0.0	0.4	19.3	34.7	
		GPW20	10:28	986	-0.20	-94.2	-0.1	14.7	17.8	1.9	34.3	
		GPW21	10:31	986	-0.16	-75.4	0.0	0.0	1.5	17.3	33.4	
		GPW22	10:35	986	-0.19	-89.5	0.0	0.0	0.1	19.5	33.0	
		GPW23	15:51	995	0.18	84.8	0.0	12.6	19.3	6.3	32.5	
		GPW24	10:38	986	0.32	150.8	0.0	0.0	3.9	14.4	33.2	
		GPW25	10:41	986	0.00	0.0	0.0	0.1	0.8	18.4	34.5	
		GPW26	15:48	995	0.31	146.1	0.0	2.8	10.8	6.8	32.9	
		GPW27	15:41	995	0.00	0.0	-0.7	0.1	0.2	19.5	33.0	
		GPW28	15:44	995	0.17	80.1	0.0	0.0	4.9	14.6	33.9	
		GPW29	15:33	995	0.22	103.7	0.0	0.0	2.8	16.3	32.3	
		GPW30	15:38	995	0.00	0.0	0.0	0.0	5.1	14.5	33.0	
		GPW31	11:38	991	-0.39	-183.8	0.1	58.2	35.7	0.6	32.1	

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Sita SITA Waste Services Limited
QC-EMC-012 Rev0 01/09/2006

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Section 2.8.1.5 - Passive Vent Monitoring

Sampling equipment used	Dates calibrated
GEM2000	9/7/2007
ADM-860C	11/4/2006

					Passive vent monitoring							
Sampling date	Weather condition	Sample location	Sampling time	Atmospheric pressure (mBar)	Flow meter reading (m/s)	Flow rate (L/min)	Gas pressure (mBar)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Gas temperature (°C)	Remarks
9/7/2007	Sunny	GPW1	11:10	981	-0.13	-61.3	0.0	0.0	0.4	19.3	34.5	
		GPW2	11:15	981	-0.14	-66.0	0.0	0.0	0.0	20.0	33.4	
		GPW3	11:19	981	-0.28	-131.9	0.0	0.0	0.8	18.8	35.5	
		GPW4	11:26	981	-0.17	-80.1	0.0	0.0	0.1	19.9	33.1	
		GPW5	11:32	981	-0.28	-131.9	0.0	0.0	0.5	19.1	28.5	
		GPW6	11:38	981	-0.36	-179.1	0.0	0.0	0.4	19.5	27.2	
		GPW7	11:45	981	-0.35	-164.9	0.0	0.0	0.1	20.1	27.9	
		GPW8	11:50	981	-0.64	-301.6	0.0	0.0	0.0	20.3	32.3	
		GPW9	13:50	982	-0.20	-94.2	0.0	8.8	17.6	0.7	35.0	
		GPW10	13:55	982	0.23	108.4	0.0	0.0	0.0	19.0	37.2	
		GPW11	13:58	982	0.13	61.3	0.0	3.8	13.7	6.2	37.1	
		GPW12	14:02	982	0.29	136.7	0.0	6.0	13.0	5.5	35.2	
		GPW13	14:03	982	0.00	0.0	0.1	0.0	0.1	18.8	35.4	
		GPW14	14:07	982	-0.17	-80.1	0.0	0.0	7.2	7.8	35.8	
		GPW15	14:15	982	-0.29	-136.7	0.0	0.0	0.3	19.1	36.7	
		GPW16	14:19	982	-0.21	-99.0	0.0	0.0	0.6	17.9	35.9	
		GPW17	14:23	982	0.20	94.2	0.0	0.0	2.9	16.2	35.3	
		GPW18	14:26	982	-0.30	-141.4	0.0	0.0	5.5	12.9	35.5	
		GPW19	14:30	982	0.33	155.5	0.0	0.5	11.6	2.7	34.7	
		GPW20	14:33	982	-0.31	-146.1	0.0	15.2	15.4	0.3	36.1	
		GPW21	14:35	982	0.00	0.0	0.0	0.1	1.3	16.3	36.4	
		GPW22	14:40	982	-0.16	-75.4	0.0	8.8	11.8	2.4	34.6	
		GPW23	14:44	982	0.00	0.0	0.0	0.0	6.5	9.0	34.7	
		GPW24	14:49	982	0.20	94.2	0.0	2.4	17.5	0.5	33.0	
		GPW25	14:53	982	0.16	75.4	0.0	8.3	14.5	7.0	32.6	
		GPW26	14:56	982	-0.29	-136.7	0.1	1.1	7.8	6.2	32.1	
		GPW27	14:59	982	0.19	89.5	2.7	0.0	0.0	14.0	32.8	
		GPW28	15:03	982	-0.22	-103.7	0.0	0.0	5.0	9.6	33.2	
		GPW29	15:08	982	-0.21	-99.0	0.0	0.0	6.4	7.5	33.1	
		GPW30	15:12	982	-0.19	-89.5	0.0	0.0	6.4	6.9	32.7	
10/7/2007	Sunny	GPW31	14:00	984	-0.18	-84.8	0.1	56.2	22.7	0.9	35.3	Sampling of passive vent

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Contract No EDSP/45/03
Pillar Point Valley Landfill Restoration

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Section 2.8.1.4 - Passive Vent Monitoring

Sampling equipment used	Dates calibrated
GEM2000	22/8/2007
ADM-860C	11/4/2006

					Passive vent monitoring							
Sampling date	Weather condition	Sample location	Sampling time	Atmospheric pressure (mBar)	Flow meter reading (m/s)	Flow rate (L/min)	Gas pressure (mBar)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Gas temperature (°C)	Remarks
22/8/2007	Cloudy	GPW1	8:25	985	0.36	169.6	0.0	0.0	0.0	20.2	25.2	
		GPW2	8:30	985	0.57	268.6	0.0	0.0	0.0	20.2	24.7	
		GPW3	8:35	985	-0.97	-457.1	0.0	0.0	0.0	20.3	23.6	
		GPW4	8:38	985	-2.04	-961.3	0.0	0.0	0.0	20.3	24.8	
		GPW5	8:41	985	0.94	443.0	0.0	0.0	0.0	20.3	24.1	
		GPW6	8:45	985	-1.00	-471.2	0.0	0.0	0.0	20.3	23.0	
		GPW7	8:59	985	0.88	414.7	0.0	0.0	0.0	20.4	22.2	
23/8/2007	Hazy	GPW8	8:25	986	-2.06	-970.8	0.0	0.0	0.0	20.0	28.1	
		GPW9	8:28	986	0.67	315.7	0.0	0.0	0.0	20.0	29.3	
		GPW10	8:30	986	0.14	66.0	0.0	0.0	0.0	20.0	29.5	
		GPW11	8:33	986	0.29	136.7	0.0	0.0	0.0	20.0	29.4	
		GPW12	8:35	986	0.47	221.5	0.0	0.0	1.4	18.5	29.1	
		GPW13	8:38	986	0.92	433.5	0.0	0.0	0.0	19.9	29.1	
		GPW14	8:42	986	-0.34	-160.2	0.0	0.0	0.0	19.9	29.3	
		GPW15	8:53	986	0.79	372.3	0.0	0.0	0.0	19.8	29.1	
		GPW16	8:49	986	-1.31	-617.3	0.0	0.0	0.0	20.0	29.0	
		GPW17	8:55	986	0.36	169.6	0.0	0.0	0.0	20.0	29.3	
		GPW18	8:59	986	-0.14	-66.0	0.0	0.0	0.0	20.0	29.6	
		GPW19	9:04	986	-0.34	-160.2	0.0	0.0	0.0	20.1	30.0	
		GPW20	9:06	986	-0.23	-108.4	0.0	0.0	0.0	20.1	29.8	
		GPW21	9:09	986	0.00	0.0	0.0	0.0	1.7	17.7	29.5	
		GPW22	9:11	986	0.75	353.4	0.0	0.0	0.0	19.9	29.7	
		GPW23	9:22	986	0.14	66.0	0.1	2.4	8.5	16.5	29.3	
		GPW24	9:13	986	1.01	476.0	0.0	0.0	2.0	16.0	30.5	
		GPW25	9:19	986	0.92	433.5	0.0	0.0	0.1	19.8	29.9	
		GPW26	9:25	986	0.55	259.2	0.0	0.0	7.3	4.7	29.5	
		GPW27	9:28	986	-0.25	-117.8	-0.1	0.0	0.0	20.0	29.5	
		GPW28	9:32	986	0.29	136.7	0.0	0.0	3.3	15.0	29.7	
		GPW29	9:38	986	-0.51	-240.3	0.0	0.0	1.9	17.1	29.8	
		GPW30	9:35	986	-0.41	-193.2	0.0	0.0	0.3	19.3	30.0	
		GPW31	10:08	992	3.49	424.4	0.0	54.1	33.4	0.6	35.4	

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Swire SITA Waste Services Limited
DC-EMC-012 Rev0 01/09/2006

LANDFILL GAS MONITORING - FIELD MEASUREMENT

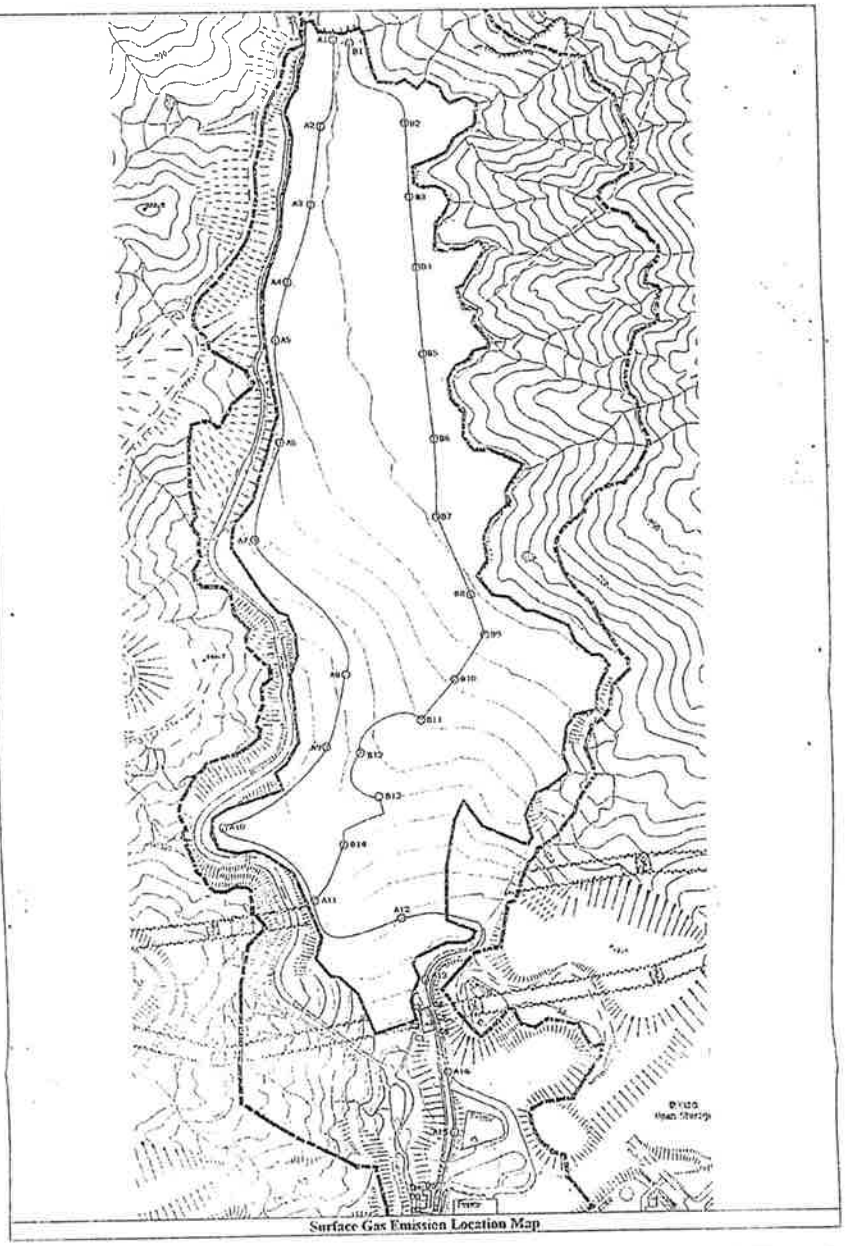
Section 2.8.1.4 - Passive Vent Monitoring

Sampling equipment used	Dates calibrated
GEM2000	5/9/2007
ADM-860C	11/4/2006

					Passive vent monitoring							
Sampling date	Weather condition	Sample location	Sampling time	Atmospheric pressure (mBar)	Flow meter reading (m/s)	Flow rate (L/min)	Gas pressure (mBar)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Gas temperature (°C)	Remarks
5/9/2007	Cloudy	GPW1	8:30	992	-0.38	-179.1	0.0	0.0	0.0	20.4	23.0	
		GPW2	8:35	992	-0.25	-117.8	0.0	0.0	0.0	20.3	23.6	
		GPW3	8:38	992	-0.18	-84.8	0.0	0.0	0.0	20.3	24.7	
		GPW4	8:45	992	0.22	103.7	0.0	0.0	0.0	20.3	24.3	
		GPW5	8:49	992	-0.22	-103.7	0.0	0.0	0.0	20.4	24.3	
		GPW6	8:53	992	-0.95	-447.7	0.0	0.0	0.0	20.5	23.2	
		GPW7	8:56	992	-0.12	-56.5	0.0	0.0	0.0	20.4	23.3	
		GPW8	9:03	992	-1.69	-796.4	0.0	0.0	0.0	20.5	23.5	
		GPW9	9:06	992	0.00	0.0	0.0	0.0	0.0	20.5	25.5	
		GPW10	9:08	992	0.16	75.4	0.0	0.0	0.0	20.5	25.9	
		GPW11	9:11	992	0.00	0.0	0.0	0.0	0.0	20.4	26.1	
		GPW12	9:14	992	-0.18	-84.8	0.0	0.0	0.0	20.4	26.1	
		GPW13	9:16	992	0.00	0.0	0.0	0.0	0.0	20.6	25.5	
		GPW14	9:24	992	-0.23	-108.4	0.0	0.0	0.0	20.6	25.5	
		GPW15	9:32	992	0.35	164.9	0.0	0.0	1.3	19.7	25.4	
		GPW16	9:34	992	0.00	0.0	0.0	0.0	0.1	20.3	25.4	
		GPW17	9:38	992	0.00	0.0	0.0	0.0	0.0	20.4	25.9	
		GPW18	9:40	992	0.15	70.7	0.0	0.0	0.0	20.6	25.8	
		GPW19	9:44	992	0.24	113.1	0.0	0.0	0.0	20.0	26.1	
		GPW20	9:46	992	0.32	150.8	0.0	0.0	0.0	20.6	26.0	
		GPW21	9:49	992	0.00	0.0	0.0	0.0	1.6	18.8	25.7	
		GPW22	9:52	992	0.00	0.0	0.0	0.0	0.0	20.3	26.4	
		GPW23	10:03	992	0.00	0.0	0.0	0.9	14.8	7.8	26.9	
		GPW24	9:56	992	0.35	164.9	0.0	0.0	1.6	18.5	27.2	
		GPW25	9:59	992	-0.20	-94.2	0.0	0.0	8.5	8.7	27.2	
		GPW26	10:06	992	-0.20	-94.2	0.0	1.7	6.8	10.4	27.1	
		GPW27	10:08	992	-0.69	-325.2	0.0	0.0	0.0	20.3	26.8	
		GPW28	10:10	992	0.28	131.9	0.0	0.0	2.3	17.8	27.0	
		GPW29	10:16	992	0.00	0.0	0.0	0.0	0.8	19.4	26.9	
		GPW30	10:14	992	-0.20	-94.2	0.0	0.0	0.2	20.1	27.1	
		GPW31	10:34	998	1.28	155.7	0.0	50.0	31.0	1.0	31.9	

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager



Surface Gas Emission Location Map

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1 - Surface Gas Monitoring

Weather conditions: Sunny

Ambient air temp. (°C): 30.5°C

Sampling equipment	Dates calibrated
GEM2000	22/7/2006
ppm gas surveyor	7/4/2006

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
A1	9.05	983	0	0.0	20.1	
A2	9.10	987	0	0.0	20.5	
A3	9.15	987	0	0.0	20.4	
A4	9.20	987	0	0.0	20.4	
A5	9.25	987	0	0.0	20.2	
A6	9.30	987	0	0.0	20.1	
A7	9.35	987	0	0.0	20.0	
A8	9.43	987	0	0.0	20.0	
A9	9.49	987	5	0.0	20.0	
A10	9.58	987	0	0.0	20.0	
A11	10.07	987	0	0.0	20.0	
A12	10.15	999	15	0.0	20.1	
A13	10.20	999	0	0.0	20.0	
C1	10.25	999	0	0.0	20.2	
C2	10.27	999	0	0.0	20.2	
C3	10.30	999	5	0.0	20.2	
C4	10.32	999	0	0.0	20.2	
C5	10.35	999	0	0.0	20.2	
C6	10.38	999	0	0.0	20.1	
A14	10.45	999	0	0.0	20.0	
A15	10.50	999	0	0.0	20.0	
D1	10.52	999	0	0.0	20.0	
D2	10.55	999	0	0.0	20.0	
D3	10.57	999	0	0.0	20.0	
D4	10.59	999	0	0.0	20.0	
D5	11.02	999	5	0.0	20.0	
A16	11.07	999	0	0.0	20.2	
A17	11.10	999	0	0.0	20.1	
A18	11.13	999	0	0.0	20.1	
A19	11.17	999	0	0.0	20.2	
A20	11.22	999	0	0.0	20.1	
A21	11.25	999	0	0.0	20.1	
A22	11.28	999	0	0.0	20.0	
B1	13.30	983	15	0.0	20.1	
B2	13.35	983	25	0.0	19.9	
B3	13.40	983	25	0.0	20.0	
B4	13.45	983	30	0.0	20.0	
B5	13.50	983	25	0.0	20.0	
B6	13.55	983	25	0.0	20.0	
B7	13.59	983	25	0.0	20.0	
B8	14.05	983	25	0.0	20.0	
B9	14.10	983	25	0.0	19.9	
B10	14.15	983	25	0.0	20.0	
B11	14.20	983	25	0.0	20.0	
B12	14.25	983	25	0.0	19.9	
B13	14.30	983	25	0.0	19.9	
B14	14.35	983	30	0.0	20.0	

Date of measurement: 22/7/2006

Prepared by:: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1 - Surface Gas Monitoring

Weather conditions: Sunny

Ambient air temp. (°C): 32.7°C

Sampling equipment	Dates calibrated
GEM2000	7/8/2006
ppm gas surveyor	7/4/2006

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
A1	14:00	984	0	0	19.7	
A2	14:05	984	0	0	20.6	
A3	14:08	984	0	0	20.6	
A4	14:13	984	0	0	20.6	
A5	14:15	984	0	0	20.6	
A6	14:20	984	0	0	20.6	
A7	14:24	984	0	0	20.6	
A8	14:29	984	0	0	20.6	
A9	14:35	984	0	0	20.6	
A10	14:42	984	0	0	20.6	
A11	14:48	984	0	0	20.6	
A12	14:53	984	0	0	20.6	
A13	15:00	984	0	0	20.7	
C1	15:03	984	0	0	20.6	
C2	15:05	996	0	0	20.6	
C3	15:08	996	0	0	20.6	
C4	15:11	996	0	0	20.6	
C5	15:15	996	0	0	20.5	
C6	15:19	996	0	0	20.6	
A14	15:25	996	0	0	20.5	
A15	15:27	996	0	0	20.6	
D1	15:30	996	0	0	20.6	
D2	15:32	996	0	0	20.6	
D3	15:35	996	0	0	20.6	
D4	15:37	996	0	0	20.6	
D5	15:39	996	0	0	20.7	
A16	15:43	996	0	0	20.6	
A17	15:45	996	0	0	20.7	
A18	15:48	996	0	0	20.7	
A19	16:02	996	0	0	20.7	
A20	16:05	996	0	0	20.7	
A21	16:09	996	0	0	20.6	
A22	16:13	996	0	0	20.6	
B1	16:20	983	0	0	20.4	
B2	16:23	983	0	0	20.5	
B3	16:26	983	0	0	20.5	
B4	16:30	983	0	0	20.6	
B5	16:33	983	0	0	20.6	
B6	16:35	983	0	0	20.6	
B7	16:38	983	0	0	20.5	
B8	16:41	983	0	0	20.5	
B9	16:43	983	0	0	20.5	
B10	16:45	983	0	0	20.5	
B11	16:48	983	0	0	20.5	
B12	16:50	983	0	0	20.6	
B13	16:53	983	0	0	20.4	
B14	16:58	983	0	0	20.6	

Remarks Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 7/8/2006

Prepared by: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1 - Surface Gas Monitoring

Weather conditions: Sunny

Ambient air temp. (°C): 26.5°C

Sampling equipment	Dates calibrated
GEM2000	26/9/2006
ppm gas surveyor	7/4/2006

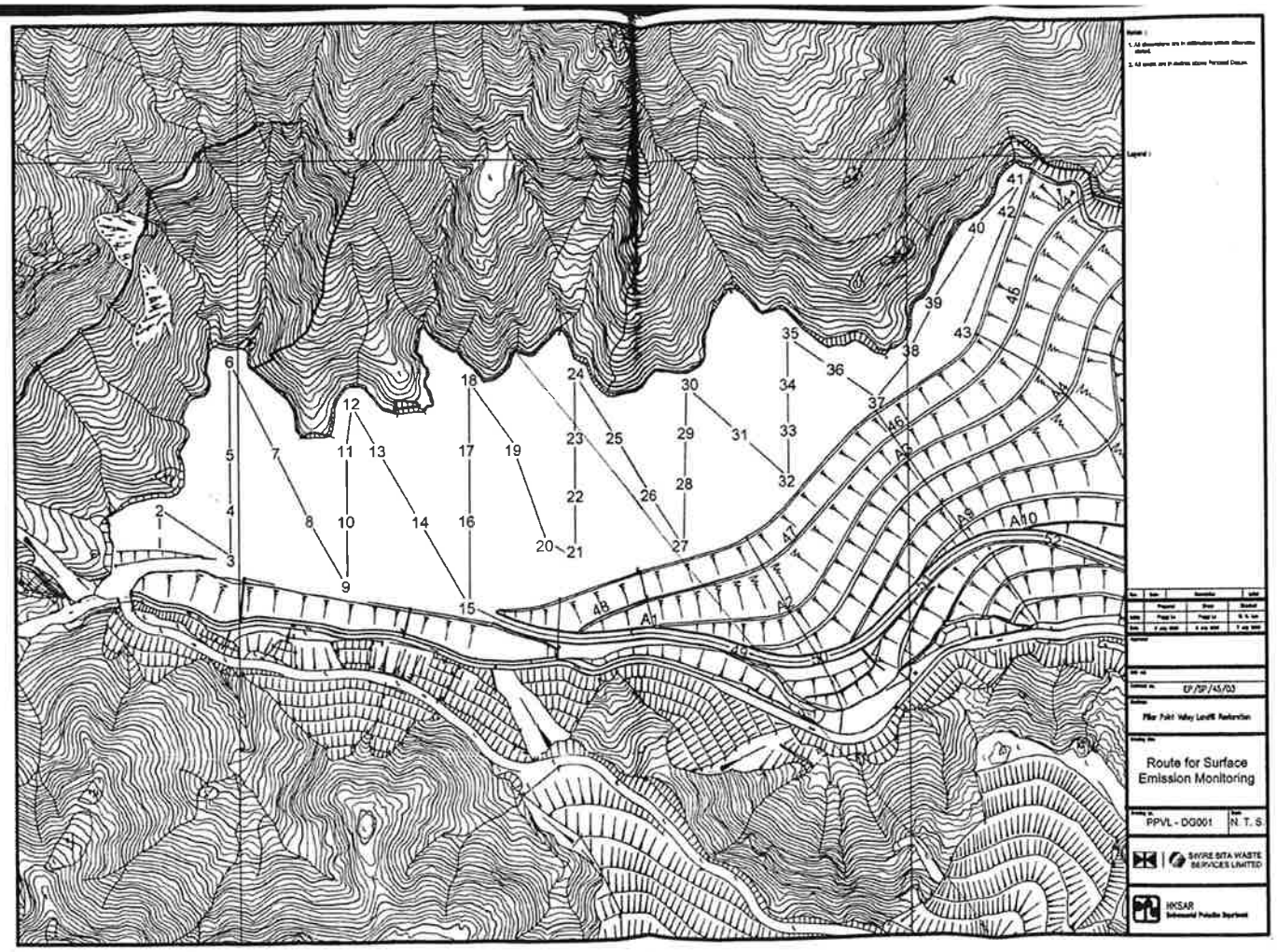
Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
A1	9:32	991	5	0.0	21.0	
A2	9:37	991	0	0.0	21.1	
A3	9:40	991	0	0.0	21.1	
A4	9:43	991	0	0.0	21.0	
A5	9:45	991	0	0.0	21.0	
A6	9:47	991	0	0.0	21.0	
A7	9:50	991	0	0.0	20.9	
A8	9:55	991	0	0.0	20.8	
A9	9:57	991	0	0.0	20.8	
A10	10:00	991	0	0.0	20.8	
A11	10:04	991	0	0.0	20.7	
A12	10:07	991	0	0.0	20.8	
A13	10:12	991	0	0.0	20.9	
C1	10:18	991	0	0.0	20.9	
C2	10:19	991	0	0.0	21.0	
C3	10:19	991	0	0.0	21.0	
C4	10:20	991	0	0.0	21.0	
C5	10:21	991	0	0.0	21.0	
C6	10:21	991	0	0.0	21.1	
A14	10:22	991	0	0.0	21.1	
A15	10:24	991	0	0.0	21.0	
D1	10:26	991	0	0.0	21.1	
D2	10:26	991	0	0.0	21.1	
D3	10:27	991	0	0.0	21.2	
D4	10:27	991	0	0.0	21.1	
D5	10:28	991	0	0.0	21.1	
A16	10:30	991	0	0.0	21.2	
A17	10:30	991	0	0.0	21.2	
A18	10:31	991	0	0.0	21.2	
A19	10:32	991	0	0.0	21.2	
A20	10:33	991	0	0.0	21.2	
A21	10:33	991	0	0.0	21.2	
A22	10:34	991	0	0.0	21.2	
B1	10:45	989	0	0.0	20.7	
B2	10:48	989	0	0.0	20.8	
B3	11:04	989	0	0.0	21.1	
B4	11:06	989	0	0.0	21.1	
B5	11:09	989	0	0.0	21.1	
B6	11:12	989	0	0.0	21.1	
B7	11:15	989	0	0.0	21.1	
B8	11:18	989	0	0.0	21.1	
B9	11:19	989	0	0.0	21.1	
B10	11:21	989	0	0.0	21.2	
B11	11:23	989	0	0.0	21.2	
B12	11:26	989	0	0.0	21.1	
B13	11:28	989	0	0.0	21.1	
B14	11:30	989	0	0.0	21.1	

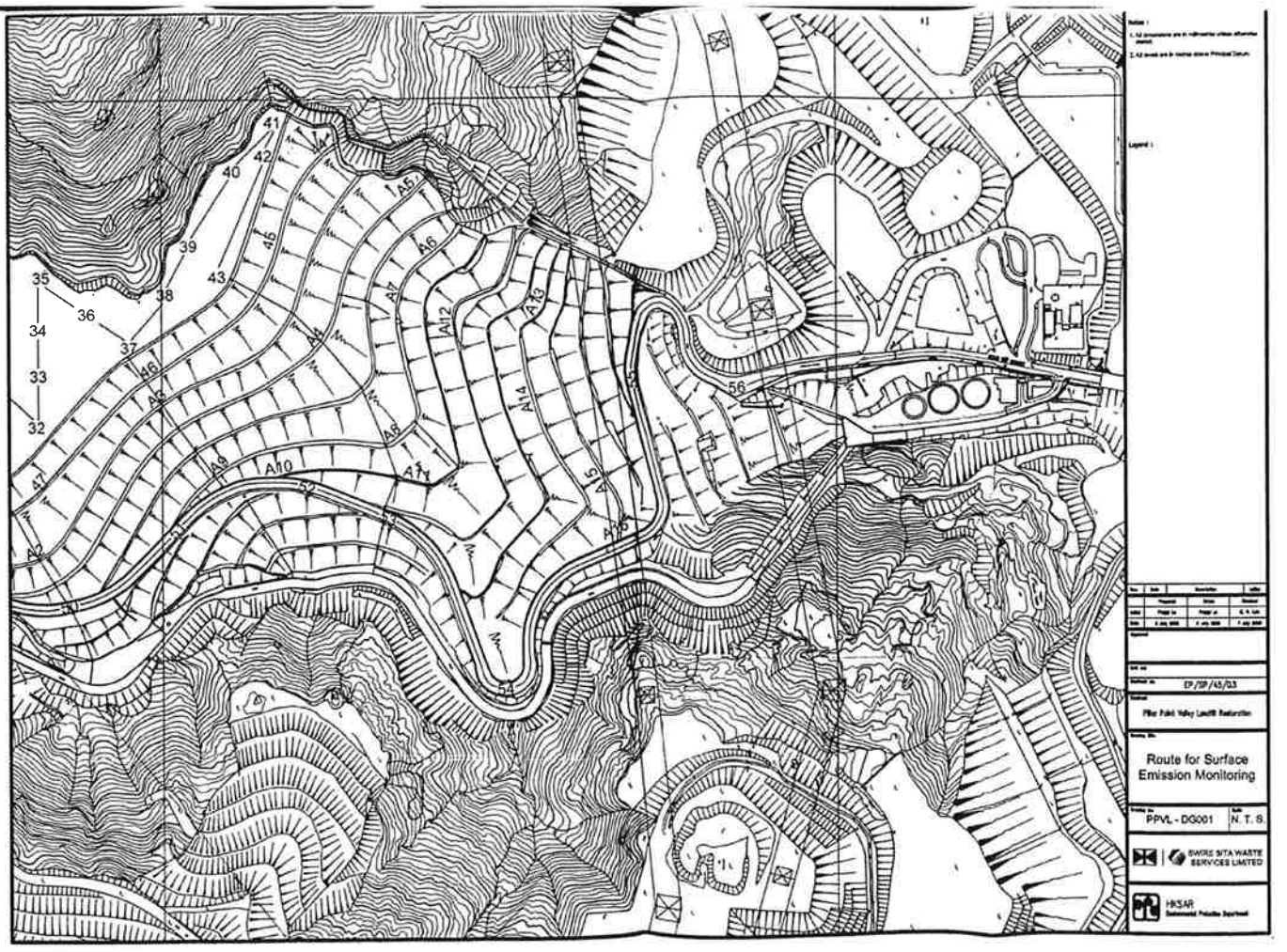
Remarks Compliance limit of methane is 10,000 ppm (1% by volume)

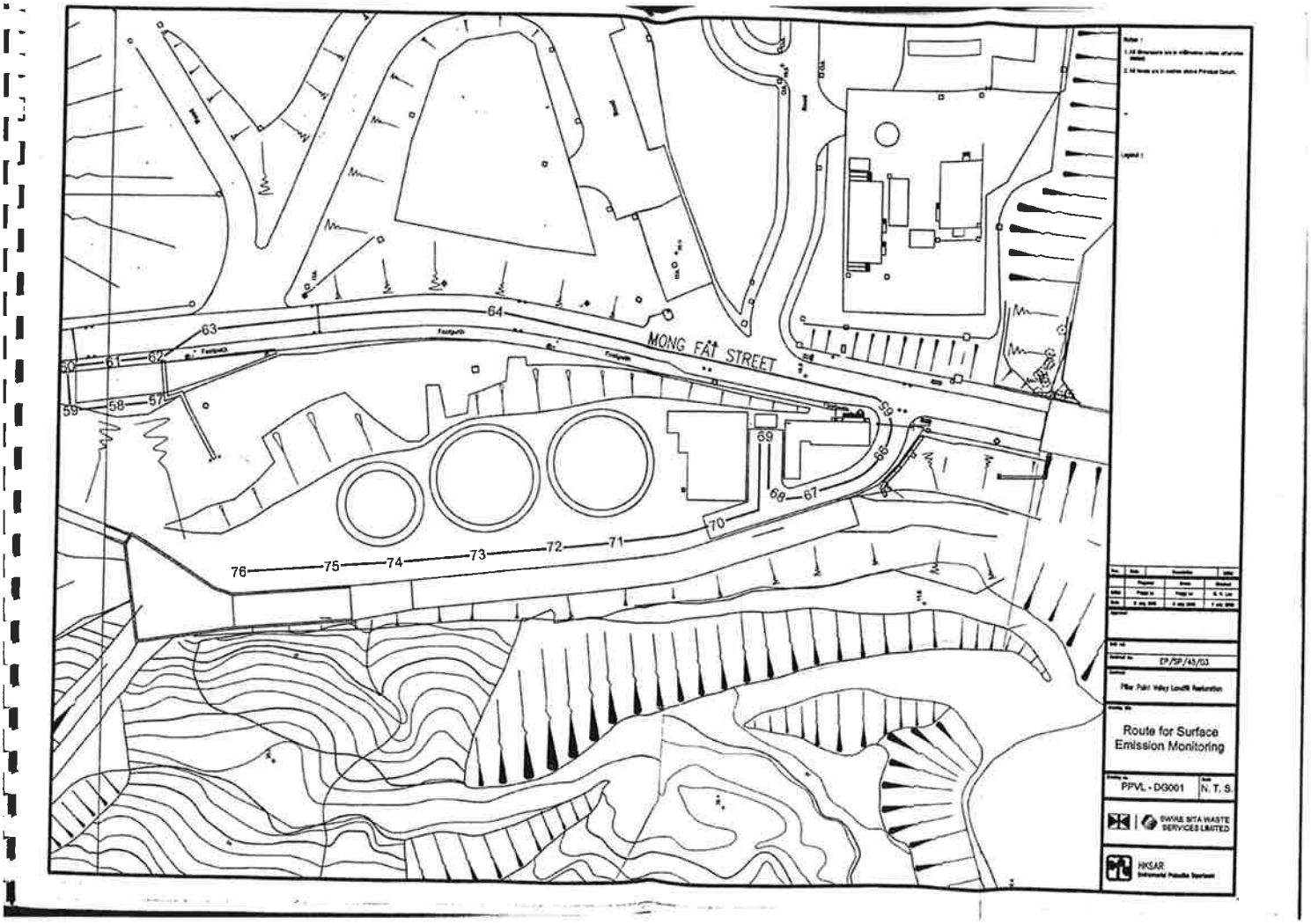
Date of measurement: 26/9/2006

Prepared by: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager


Notes :
1. All dimensions are in millimetres unless otherwise stated.
2. All levels are in metres above Principal Datum.
Legend :
EP/SP/45/03
Pillar Point Valley Landfill Restoration
Route for Surface Emission Monitoring
PPVL - DG001
N. T. S.
SWIRE SITA WASTE SERVICES LIMITED
HKSAR
Environmental Protection Department


Notes :
1. All dimensions are in millimetres unless otherwise stated.
2. All levels are in metres above Principal Datum.
Legend :
EP/SP/45/03
Pillar Point Valley Landfill Restoration
Route for Surface Emission Monitoring
PPVL - DG001
N. T. S.
SWIRE SITA WASTE SERVICES LIMITED
HKSAR
Environmental Protection Department


MONG FAT STREET
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EP/SP/45/03
Route for Surface Emission Monitoring
PPVL - DG001
N. T. S.
SWIRE BTA WASTE SERVICES LIMITED
HKSAR

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1 - Surface Gas Monitoring

Weather conditions: Sunny

Ambient air temp. (°C): 27.9°C

Sampling equipment	Dates calibrated
GEM2000	12/10/2006
ppm gas surveyor	7/4/2006

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
1	9:38	998	0	0.0	20.5	
2	9:39	998	0	0.0	20.5	
3	9:39	998	0	0.0	20.5	
4	9:41	998	0	0.0	20.5	
5	9:44	998	0	0.0	20.4	
6	9:46	998	0	0.0	20.5	
7	9:50	998	5	0.0	20.5	
8	9:51	998	20	0.0	20.5	
9	9:53	998	5	0.0	20.5	
10	9:55	998	0	0.0	20.5	
11	9:57	998	0	0.0	20.5	
12	9:59	998	0	0.0	20.5	
13	10:01	998	0	0.0	20.5	
14	10:03	998	0	0.0	20.5	
15	10:05	998	0	0.0	20.5	
16	10:07	998	0	0.0	20.6	
17	10:10	998	0	0.0	20.6	
18	10:13	998	0	0.0	20.5	
19	10:16	998	0	0.0	20.6	
20	10:18	998	0	0.0	20.6	
21	10:20	998	0	0.0	20.6	
22	10:21	998	5	0.0	20.7	
23	10:23	998	0	0.0	20.7	
24	10:25	998	0	0.0	20.7	
25	10:27	998	0	0.0	20.8	
26	10:30	998	0	0.0	20.7	
27	10:31	998	0	0.0	20.8	
28	10:33	998	0	0.0	20.8	
29	10:34	998	0	0.0	20.8	
30	10:35	998	0	0.0	20.8	
31	10:39	998	0	0.0	20.7	
32	10:46	998	0	0.0	20.8	
33	10:48	998	0	0.0	20.8	
34	10:50	998	0	0.0	20.8	
35	10:51	998	0	0.0	20.8	
36	10:54	998	0	0.0	20.9	
37	10:55	998	0	0.0	20.9	
38	10:55	998	0	0.0	20.9	
39	10:57	998	0	0.0	21.0	
40	11:00	998	0	0.0	21.0	
41	11:03	998	0	0.0	20.9	
42	11:04	998	0	0.0	21.0	
43	11:06	998	0	0.0	21.0	
44	11:15	998	0	0.0	21.0	
45	11:19	998	0	0.0	20.9	
46	11:24	998	0	0.0	21.0	
47	11:26	998	0	0.0	21.0	
48	11:31	998	0	0.0	21.1	
49	14:06	996	0	0.0	21.0	

Remarks: Compliance limit of methane is 10,000 ppm (1% by volume).

Date of measurement: 12/10/2006

Prepared by: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1 - Surface Gas Monitoring

Weather conditions: Sunny

Ambient air temp. (°C): 29.5°C

Sampling equipment	Dates calibrated
GEM2000	18/10/2006
ppm gas surveyor	7/4/2006

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
A1	14:19	997	0	0.0	20.4	
A2	14:20	997	0	0.0	20.3	
A3	14:27	997	0	0.0	20.3	
A4	14:31	997	0	0.0	20.3	
A5	14:35	997	0	0.0	20.3	
A6	14:37	997	10	0.0	20.3	
A7	14:41	997	0	0.0	20.3	
A8	14:45	997	5	0.0	20.3	
A9	14:50	997	0	0.0	20.4	
A10	14:58	997	0	0.0	20.4	
A11	15:04	997	0	0.0	20.5	
A12	15:09	997	0	0.0	20.5	
A13	15:11	997	0	0.0	20.5	
A14	15:16	997	0	0.0	20.7	
A15	15:24	997	5	0.0	20.7	
A16	15:25	997	0	0.0	20.7	
50	15:37	997	0	0.0	20.7	
51	15:38	997	0	0.0	20.6	
52	15:40	997	5	0.0	20.7	
53	15:42	997	5	0.0	20.7	
54	15:45	997	5	0.0	20.7	
55	15:48	997	0	0.0	20.7	
56	15:50	997	0	0.0	20.7	
57	15:51	997	0	0.0	20.7	
58	15:51	997	0	0.0	20.7	
59	15:51	997	0	0.0	20.7	
60	15:52	997	0	0.0	20.7	
61	15:52	997	0	0.0	20.8	
62	15:53	997	0	0.0	20.9	
63	15:54	997	0	0.0	20.9	
64	15:56	997	0	0.0	20.8	
65	15:58	997	0	0.0	20.8	
66	15:58	997	0	0.0	20.8	
67	15:59	997	0	0.0	20.8	
68	15:59	997	0	0.0	20.9	
69	15:59	997	0	0.0	20.9	
70	16:01	997	0	0.0	20.8	
71	16:03	997	0	0.0	20.8	
72	16:05	997	0	0.0	20.9	
73	16:07	997	0	0.0	20.9	
74	16:09	997	0	0.0	20.8	
75	16:11	997	0	0.0	20.8	
76	16:13	997	0	0.0	20.9	

Remarks: Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 18/10/2006

Prepared by: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1a - Surface Gas Monitoring

Weather conditions: Cloudy

Ambient air temp. (°C): 22.5°C

Sampling equipment	Dates calibrated
GEM2000	13/11/2006
ppm gas surveyor	7/4/2006

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
1	9.33	997	0	0.0	20.0	
2	9.36	997	0	0.0	20.0	
3	9.39	997	0	0.0	20.0	
4	9.41	997	0	0.0	20.1	
5	9.42	997	0	0.0	20.1	
6	9.44	997	0	0.0	20.2	
7	9.46	997	0	0.0	20.1	
8	9.50	997	0	0.0	20.1	
9	9.52	997	0	0.0	20.2	
10	9.54	997	0	0.0	20.2	
11	9.55	997	0	0.0	20.1	
12	9.56	997	0	0.0	20.1	
13	9.57	997	0	0.0	20.2	
14	9.59	997	0	0.0	20.2	
15	10.02	997	0	0.0	20.3	
16	10.04	997	0	0.0	20.3	
17	10.06	997	0	0.0	20.2	
18	10.06	997	0	0.0	20.3	
19	10.10	997	0	0.0	20.2	
20	10.14	997	0	0.0	20.3	
21	10.15	997	0	0.0	20.3	
22	10.16	997	0	0.0	20.3	
23	10.17	997	0	0.0	20.4	
24	10.18	997	0	0.0	20.3	
25	10.19	997	0	0.0	20.3	
26	10.23	997	0	0.0	20.3	
27	10.25	997	0	0.0	20.2	
28	10.27	997	0	0.0	20.3	
29	10.40	997	0	0.0	20.3	
30	10.43	997	0	0.0	20.3	
31	10.44	997	0	0.0	20.3	
32	10.46	997	0	0.0	20.3	
33	10.49	997	0	0.0	20.3	
34	10.51	997	0	0.0	20.3	
35	10.52	997	0	0.0	20.3	
36	10.55	997	0	0.0	20.3	
37	10.56	997	0	0.0	20.3	
38	10.57	997	0	0.0	20.3	
39	10.59	997	0	0.0	20.3	
40	11.03	997	0	0.0	20.2	
41	11.06	997	5	0.0	20.2	
42	11.07	997	5	0.0	20.3	
43	11.09	997	0	0.0	20.3	
44	11.16	997	10	0.0	20.2	
45	11.19	997	0	0.0	20.3	
46	11.24	997	0	0.0	20.3	
47	11.27	997	0	0.0	20.3	
48	11.38	997	5	0.0	20.3	
49	15.03	996	0	0.0	19.8	

Remarks Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 13/11/2006

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1b - Surface Gas Monitoring

Weather conditions: Cloudy

Ambient air temp. (°C): 22.5°C

Sampling equipment	Dates calibrated
GEM2000	13/11/2006
ppm gas surveyor	7/4/2006

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
A1	15.06	996	0	0.0	19.7	
A2	15.06	996	0	0.0	19.7	
A3	15.12	996	0	0.0	19.7	
A4	15.16	996	0	0.0	19.8	
A5	15.20	996	0	0.0	19.8	
A6	15.23	996	0	0.0	19.8	
A7	15.25	996	0	0.0	19.8	
A8	15.27	996	0	0.0	19.8	
A9	15.31	996	0	0.0	19.8	
A10	15.34	996	0	0.0	19.9	
A11	15.37	996	0	0.0	19.9	
A12	15.40	996	0	0.0	19.9	
A13	15.43	996	0	0.0	20.0	
A14	15.45	996	0	0.0	19.9	
A15	15.46	996	0	0.0	20.0	
A16	15.47	996	0	0.0	20.1	
50	15.57	998	0	0.0	19.8	
51	15.58	998	0	0.0	19.8	
52	15.59	998	0	0.0	19.8	
53	16.00	998	0	0.0	19.8	
54	16.00	998	0	0.0	19.8	
55	16.01	998	0	0.0	19.8	
56	16.02	998	0	0.0	19.8	
57	16.03	998	0	0.0	19.7	
58	16.03	998	0	0.0	19.9	
59	16.05	998	0	0.0	19.8	
60	16.06	998	0	0.0	19.9	
61	16.07	998	0	0.0	19.9	
62	16.08	998	0	0.0	19.9	
63	16.09	998	5	0.0	19.9	
64	16.10	998	10	0.0	19.9	
65	16.13	998	0	0.0	19.9	
66	16.14	998	0	0.0	19.9	
67	16.15	998	0	0.0	20.0	
68	16.16	998	0	0.0	20.1	
69	16.17	998	0	0.0	19.9	
70	16.19	998	0	0.0	19.9	
71	16.21	998	0	0.0	20.0	
72	16.22	998	0	0.0	20.0	
73	16.23	998	0	0.0	20.1	
74	16.24	998	0	0.0	19.9	
75	16.25	998	0	0.0	20.0	
76	16.25	998	0	0.0	20.1	

Remarks Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 13/11/2006

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1a - Surface Gas Monitoring

Weather conditions: Hazy

Ambient air temp. (°C): 16.5 C

Sampling equipment	Dates calibrated
GEM2000	11/12/2006
ppm gas surveyor	7/4/2006

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
1	10:08	999	0	0.0	20.4	
2	10:09	999	0	0.0	20.5	
3	10:12	999	0	0.0	20.5	
4	10:12	999	0	0.0	20.5	
5	10:14	999	0	0.0	20.6	
6	10:16	999	0	0.0	20.6	
7	10:18	999	0	0.0	20.6	
8	10:23	999	0	0.0	20.6	
9	10:25	999	0	0.0	20.6	
10	10:27	999	0	0.0	20.6	
11	10:29	999	0	0.0	20.6	
12	10:31	999	0	0.0	20.7	
13	10:33	999	0	0.0	20.7	
14	10:35	999	0	0.0	20.7	
15	10:37	999	0	0.0	20.6	
16	10:40	999	0	0.0	20.7	
17	10:44	999	0	0.0	20.7	
18	10:45	999	0	0.0	20.6	
19	10:49	999	0	0.0	20.8	
20	10:51	999	0	0.0	20.8	
21	10:54	999	0	0.0	20.8	
22	10:55	999	0	0.0	20.8	
23	10:56	999	0	0.0	20.8	
24	10:58	999	0	0.0	20.8	
25	11:00	999	0	0.0	20.9	
26	11:01	999	0	0.0	20.9	
27	11:03	999	0	0.0	20.8	
28	11:05	999	0	0.0	20.9	
29	11:06	999	0	0.0	20.9	
30	11:07	999	0	0.0	20.9	
31	11:09	999	0	0.0	20.8	
32	11:12	999	0	0.0	20.9	
33	11:15	999	0	0.0	20.9	
34	11:16	999	0	0.0	20.9	
35	11:16	999	0	0.0	20.9	
36	11:20	999	0	0.0	20.9	
37	11:21	999	0	0.0	20.9	
38	11:22	999	0	0.0	20.9	
39	11:24	999	0	0.0	20.9	
40	11:25	999	0	0.0	21.0	
41	11:27	999	10	0.0	21.0	
42	11:30	999	0	0.0	20.9	
43	11:31	999	0	0.0	20.9	
44	13:57	998	0	0.0	20.0	
45	13:59	998	0	0.0	20.0	
46	14:02	998	0	0.0	20.0	
47	14:05	998	0	0.0	20.0	
48	14:10	998	25	0.0	20.1	

Remarks: Compliance limit of methane is 10,000 ppm (1% by volume).

Date of measurement: 11/12/2006

Prepared by: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1b - Surface Gas Monitoring

Weather conditions: Hazy

Ambient air temp. (°C): 16.5°C

Sampling equipment	Dates calibrated
GEM2000	11/12/2006
ppm gas surveyor	7/4/2006

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
A1	14:12	998	0	0.0	20.1	
A2	14:17	998	0	0.0	20.2	
A3	14:20	998	10	0.0	20.2	
A4	14:25	998	25	0.0	20.3	
A5	14:28	998	5	0.0	20.5	
A6	14:32	998	0	0.0	20.5	
A7	14:35	998	0	0.0	20.6	
A8	14:37	998	20	0.0	20.6	
A9	14:39	998	0	0.0	20.6	
A10	14:40	998	0	0.0	20.7	
A11	14:41	998	0	0.0	20.7	
A12	14:43	998	0	0.0	20.7	
A13	14:44	998	0	0.0	20.7	
A14	14:47	998	10	0.0	20.7	
A15	14:50	998	0	0.0	20.8	
A16	14:51	998	0	0.0	20.8	
49	15:05	998	5	0.0	20.8	
50	15:07	998	10	0.0	20.8	
51	15:09	998	0	0.0	20.9	
52	15:10	998	25	0.0	20.9	
53	15:12	998	0	0.0	20.9	
54	15:14	998	5	0.0	20.9	
55	15:15	998	20	0.0	20.8	
56	15:17	998	0	0.0	21.0	
57	15:19	998	0	0.0	20.9	
58	15:19	998	0	0.0	20.9	
59	15:20	998	0	0.0	21.0	
60	15:20	998	0	0.0	20.9	
61	15:21	998	0	0.0	20.9	
62	15:22	998	0	0.0	20.9	
63	16:02	1011	0	0.0	20.9	
64	16:04	1011	15	0.0	20.9	
65	16:05	1011	0	0.0	21.0	
66	16:05	1011	0	0.0	20.9	
67	16:06	1011	0	0.0	20.9	
68	16:06	1011	0	0.0	20.9	
69	16:07	1011	0	0.0	20.9	
70	16:08	1011	0	0.0	20.9	
71	16:08	1011	0	0.0	21.0	
72	16:09	1011	5	0.0	21.0	
73	16:10	1011	10	0.0	21.0	
74	16:10	1011	0	0.0	20.9	
75	16:11	1011	0	0.0	20.9	
76	16:12	1011	0	0.0	20.9	

Remarks: Compliance limit of methane is 10,000 ppm (1% by volume).

Date of measurement: 11/12/2006

Prepared by: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Weather conditions: Hazy

Ambient air temp. (°C): 13.0°C

Sampling equipment	Dates calibrated
GEM2000	10/1/2007
ppm gas surveyor	7/4/2006

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
1	9:57	1003	0	0.0	20.4	
2	9:57	1003	0	0.0	20.5	
3	9:59	1003	0	0.0	20.5	
4	10:04	1003	0	0.0	20.5	
5	10:06	1003	0	0.0	20.4	
6	10:07	1003	0	0.0	20.6	
7	10:09	1003	0	0.0	20.6	
8	10:11	1003	0	0.0	20.6	
9	10:15	1003	0	0.0	20.5	
10	10:16	1003	10	0.0	20.6	
11	10:18	1003	0	0.0	20.6	
12	10:20	1003	15	0.0	20.6	
13	10:21	1003	0	0.0	20.7	
14	10:23	1003	0	0.0	20.7	
15	10:25	1003	0	0.0	20.7	
16	10:27	1003	0	0.0	20.7	
17	10:30	1003	0	0.0	20.7	
18	10:32	1003	0	0.0	20.8	
19	10:34	1003	0	0.0	20.7	
20	10:35	1003	0	0.0	20.8	
21	10:41	1003	0	0.0	20.8	
22	10:43	1003	0	0.0	20.9	
23	10:45	1003	0	0.0	20.9	
24	10:47	1003	0	0.0	20.8	
25	10:49	1003	0	0.0	20.8	
26	10:50	1003	0	0.0	20.9	
27	10:52	1003	0	0.0	20.8	
28	10:54	1003	0	0.0	20.9	
29	10:55	1003	0	0.0	20.9	
30	10:56	1003	0	0.0	20.8	
31	11:00	1003	0	0.0	20.9	
32	11:04	1003	0	0.0	21.0	
33	11:05	1003	0	0.0	21.1	
34	11:06	1003	0	0.0	21.0	
35	11:08	1003	0	0.0	21.0	
36	11:09	1003	0	0.0	21.0	
37	11:10	1003	0	0.0	21.0	
38	11:11	1003	0	0.0	21.0	
39	11:13	1003	0	0.0	21.0	
40	11:15	1003	0	0.0	21.0	
41	11:17	1003	0	0.0	21.0	
42	11:22	1003	0	0.0	21.0	
43	11:25	1003	0	0.0	21.1	

Remarks: Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 10/1/2007

Prepared by: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Weather conditions: Hazy

Ambient air temp. (°C): 20.5°C

Sampling equipment	Dates calibrated
GEM2000	10/1/2007
ppm gas surveyor	7/4/2006

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
44	15:48	1012	0	0.0	20.6	
45	15:50	1012	0	0.0	20.6	
46	15:51	1012	0	0.0	20.5	
47	15:52	1012	0	0.0	20.4	
48	15:54	1012	0	0.0	20.6	
A1	15:56	1012	0	0.0	20.6	
A2	15:57	1012	0	0.0	20.6	
A3	15:58	1012	0	0.0	20.6	
A4	15:59	1012	0	0.0	20.4	
A5	16:00	1012	0	0.0	20.5	
A6	16:02	1012	0	0.0	20.4	
A7	16:03	1012	0	0.0	20.4	
A8	16:04	1012	0	0.0	20.6	
A9	16:05	1012	0	0.0	20.6	
A10	16:07	1012	0	0.0	20.6	
A11	16:08	1012	0	0.0	20.6	
A12	16:09	1012	5	0.0	20.6	
A13	16:11	1012	15	0.0	20.6	
A14	16:12	1012	0	0.0	20.6	
A15	16:13	1012	0	0.0	20.6	
A16	16:15	1012	5	0.0	20.7	
49	16:23	1012	0	0.0	20.7	
50	16:25	1012	0	0.0	20.5	
51	16:27	1012	0	0.0	20.5	
52	16:30	1012	0	0.0	20.5	
53	16:32	1012	5	0.0	20.5	
54	16:34	1012	0	0.0	20.5	
55	16:37	1012	0	0.0	20.5	
56	16:39	1012	0	0.0	20.5	
57	16:40	1012	0	0.0	20.4	
58	16:41	1012	0	0.0	20.5	
59	16:42	1012	0	0.0	20.5	
60	16:43	1012	0	0.0	20.4	
61	16:43	1012	0	0.0	20.6	
62	16:44	1012	0	0.0	20.6	
63	16:45	1012	0	0.0	20.6	
64	16:47	1012	0	0.0	20.5	
65	16:47	1012	0	0.0	20.6	
66	16:48	1012	0	0.0	20.6	
67	16:49	1012	0	0.0	20.6	
68	16:49	1012	0	0.0	20.4	
69	16:50	1012	0	0.0	20.4	
70	16:50	1012	0	0.0	20.5	
71	16:51	1012	0	0.0	20.5	
72	16:52	1012	0	0.0	20.5	
73	16:52	1012	0	0.0	20.5	
74	16:53	1012	0	0.0	20.5	
75	16:53	1012	0	0.0	20.4	
76	16:54	1012	0	0.0	20.4	

Remarks: Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 11/1/2007

Prepared by: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager

OC-EMC-010 Rev0 01/09/2006

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1a - Surface Gas Monitoring

Weather conditions: Hazy

Ambient air temp. (°C): 23.5°C

Sampling equipment	Dates calibrated
GEM2000	14/2/2007
ppm gas surveyor	7/4/2006

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
1	10:14	996	0	0.0	21.1	
2	10:14	996	0	0.0	21.2	
3	10:16	996	15	0.0	21.1	
4	10:17	996	10	0.0	21.1	
5	10:20	996	0	0.0	21.1	
6	10:24	996	0	0.0	21.1	
7	10:26	996	0	0.0	21.1	
8	10:28	996	0	0.0	21.2	
9	10:29	996	0	0.0	21.2	
10	10:31	996	0	0.0	21.2	
11	10:34	996	0	0.0	21.2	
12	10:35	996	0	0.0	21.2	
13	10:36	996	0	0.0	21.2	
14	10:39	996	0	0.0	21.2	
15	10:41	996	0	0.0	21.2	
16	10:44	996	0	0.0	21.2	
17	10:46	996	0	0.0	21.2	
18	10:48	996	0	0.0	21.2	
19	10:50	996	0	0.0	21.2	
20	10:55	996	0	0.0	21.2	
21	10:56	996	0	0.0	21.2	
22	10:58	996	0	0.0	21.2	
23	10:59	996	0	0.0	21.2	
24	11:00	996	0	0.0	21.2	
25	11:03	996	0	0.0	21.2	
26	11:04	996	0	0.0	21.2	
27	11:06	996	0	0.0	21.2	
28	11:08	996	0	0.0	21.2	
29	11:09	996	0	0.0	21.2	
30	11:10	996	0	0.0	21.2	
31	11:12	996	5	0.0	21.2	
32	11:14	996	0	0.0	21.2	
33	11:15	996	0	0.0	21.2	
34	11:16	996	0	0.0	21.2	
35	11:18	996	0	0.0	21.2	
36	11:20	996	0	0.0	21.2	
37	11:22	996	0	0.0	21.2	
38	11:23	996	0	0.0	21.3	
39	11:25	996	0	0.0	21.2	
40	11:26	996	0	0.0	21.3	
41	11:28	996	0	0.0	21.3	
42	11:30	996	0	0.0	21.3	
43	11:32	996	0	0.0	21.3	
44	15:00	998	0	0.0	21.3	
45	15:02	998	0	0.0	21.3	
46	15:04	998	0	0.0	21.3	
47	15:06	998	0	0.0	21.4	
48	15:08	998	0	0.0	21.4	

Remarks Compliance limit of methane is 10,000 ppm (1% by volume).

Date of measurement: 14/2/2007

Prepared by: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1b - Surface Gas Monitoring

Weather conditions: Hazy

Ambient air temp. (°C): 23.5°C

Sampling equipment	Dates calibrated
GEM2000	14/2/2007
ppm gas surveyor	7/4/2006

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
A1	15:10	998	0	0.0	21.5	
A2	15:11	998	0	0.0	21.4	
A3	15:12	998	0	0.0	21.5	
A4	15:14	998	0	0.0	21.5	
A5	15:16	998	0	0.0	21.5	
A6	15:17	998	0	0.0	21.6	
A7	15:18	998	0	0.0	21.6	
A8	15:20	998	0	0.0	21.6	
A9	15:22	998	5	0.0	21.6	
A10	15:23	998	0	0.0	21.5	
A11	15:24	998	0	0.0	21.5	
A12	15:25	998	0	0.0	21.5	
A13	15:27	998	0	0.0	21.4	
A14	15:28	998	5	0.0	21.4	
A15	15:29	998	0	0.0	21.5	
A16	15:30	998	0	0.0	21.5	
49	15:32	998	15	0.0	21.6	
50	15:34	998	15	0.0	21.5	
51	15:36	998	0	0.0	21.5	
52	15:37	998	0	0.0	21.5	
53	15:39	998	0	0.0	21.5	
54	15:42	998	0	0.0	21.5	
55	15:45	998	0	0.0	21.5	
56	15:46	998	0	0.0	21.5	
57	15:47	998	5	0.0	21.4	
58	15:47	1010	0	0.0	21.3	
59	15:48	1010	0	0.0	21.2	
60	15:48	1010	0	0.0	21.2	
61	15:48	1010	0	0.0	21.2	
62	15:49	1010	0	0.0	21.2	
63	15:50	1010	0	0.0	21.1	
64	15:51	1010	0	0.0	21.1	
65	15:52	1010	0	0.0	20.9	
66	15:52	1010	0	0.0	21.0	
67	15:53	1010	0	0.0	20.9	
68	15:53	1010	0	0.0	20.9	
69	15:53	1010	0	0.0	20.9	
70	15:55	1010	0	0.0	20.9	
71	15:56	1010	0	0.0	20.9	
72	15:56	1010	0	0.0	20.9	
73	15:57	1010	0	0.0	20.9	
74	15:58	1010	0	0.0	20.9	
75	15:58	1010	0	0.0	21.0	
76	15:59	1010	0	0.0	20.9	

Remarks Compliance limit of methane is 10,000 ppm (1% by volume).

Date of measurement: 14/2/2007

Prepared by: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1a - Surface Gas Monitoring

Weather conditions: Cloudy

Ambient air temp. (℃): 20.3℃

Sampling equipment	Dates calibrated
GEM2000	13/3/2007
ppm gas surveyor	7/4/2006

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
1	9.46	997	0	0.0	19.8	
2	9.47	997	0	0.0	19.8	
3	9.53	997	0	0.0	19.9	
4	9.55	997	0	0.0	19.8	
5	9.56	997	0	0.0	19.8	
6	9.59	997	0	0.0	19.9	
7	10.00	997	0	0.0	19.8	
8	10.03	997	0	0.0	19.8	
9	10.04	997	0	0.0	19.8	
10	10.35	997	0	0.0	19.9	
11	10.38	997	0	0.0	20.0	
12	10.40	997	0	0.0	20.0	
13	10.42	997	0	0.0	20.0	
14	10.43	997	0	0.0	20.1	
15	10.45	997	0	0.0	20.0	
16	10.47	997	0	0.0	20.1	
17	10.50	997	0	0.0	20.0	
18	10.52	997	0	0.0	20.0	
19	10.54	997	0	0.0	20.1	
20	10.56	997	0	0.0	20.1	
21	10.58	997	0	0.0	20.0	
22	10.59	997	0	0.0	20.0	
23	11.00	997	0	0.0	20.0	
24	11.01	997	0	0.0	20.2	
25	11.03	997	0	0.0	20.1	
26	11.04	997	0	0.0	20.1	
27	11.06	997	0	0.0	20.1	
28	11.08	997	0	0.0	20.2	
29	11.10	997	0	0.0	20.2	
30	11.11	997	0	0.0	20.2	
31	11.13	997	0	0.0	20.1	
32	11.15	997	0	0.0	20.2	
33	11.16	997	0	0.0	20.1	
34	11.18	997	0	0.0	20.2	
35	11.19	997	0	0.0	20.1	
36	11.20	997	0	0.0	20.2	
37	11.22	997	0	0.0	20.2	
38	11.23	997	0	0.0	20.2	
39	11.24	997	0	0.0	20.1	
40	11.26	997	0	0.0	20.2	
41	11.29	997	0	0.0	20.2	
42	11.30	997	0	0.0	20.2	
43	11.31	997	0	0.0	20.2	
44	11.33	997	0	0.0	20.1	
45	11.35	997	0	0.0	20.3	
46	11.39	997	0	0.0	20.2	
47	11.42	997	0	0.0	20.3	
48	11.45	997	0	0.0	20.2	

Remarks: Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 13/3/2007

Prepared by: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1b - Surface Gas Monitoring

Weather conditions: Cloudy

Ambient air temp. (℃): 20.3℃

Sampling equipment	Dates calibrated
GEM2000	13/3/2007
ppm gas surveyor	7/4/2006

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
A1	13.41	998	0	0.0	19.8	
A2	13.42	998	0	0.0	19.9	
A3	13.46	998	0	0.0	19.8	
A4	13.48	998	0	0.0	19.9	
A5	13.50	998	0	0.0	19.8	
A6	13.52	998	0	0.0	19.9	
A7	13.55	998	0	0.0	19.9	
A8	13.57	998	0	0.0	19.9	
A9	13.58	998	0	0.0	20.0	
A10	14.00	998	0	0.0	20.0	
A11	14.03	998	0	0.0	20.0	
A12	14.06	998	0	0.0	20.0	
A13	14.08	998	0	0.0	20.0	
A14	14.09	998	0	0.0	20.1	
A15	14.10	998	0	0.0	20.0	
A16	14.11	998	0	0.0	20.1	
49	14.20	998	0	0.0	20.0	
50	14.21	998	0	0.0	20.1	
51	14.22	998	0	0.0	20.1	
52	14.24	998	0	0.0	20.1	
53	14.25	998	0	0.0	20.0	
54	14.26	998	0	0.0	20.1	
55	14.28	998	0	0.0	20.1	
56	14.29	998	0	0.0	20.1	
57	14.30	998	0	0.0	20.1	
58	14.31	998	0	0.0	20.2	
59	14.31	998	0	0.0	20.2	
60	14.32	998	0	0.0	20.2	
61	14.32	998	0	0.0	20.2	
62	14.33	998	0	0.0	20.2	
63	14.35	998	0	0.0	20.1	
64	14.36	998	0	0.0	20.2	
65	14.37	998	0	0.0	20.2	
66	14.37	998	0	0.0	20.3	
67	14.38	998	0	0.0	20.3	
68	14.38	998	0	0.0	20.3	
69	14.39	998	0	0.0	20.3	
70	14.40	998	0	0.0	20.3	
71	14.40	998	0	0.0	20.2	
72	14.41	998	0	0.0	20.3	
73	14.41	998	0	0.0	20.2	
74	14.42	998	0	0.0	20.3	
75	14.42	998	0	0.0	20.3	
76	14.43	998	0	0.0	20.3	

Remarks: Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 13/3/2007

Prepared by: Peggy Lo, E. M. Technician

Checked by: M. H. Law, Deputy Project Manager

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Weather conditions: Sunny

Ambient air temp. (°C): 25.8°C

Sampling equipment	Dates calibrated
GEM2000	16/4/2007
ppm gas surveyor	21/3/2007

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
1	10:12	991	0	0.0	19.5	
2	10:19	991	5	0.0	19.5	
3	10:23	991	0	0.0	19.4	
4	10:25	991	0	0.0	19.3	
5	10:27	991	0	0.0	19.3	
6	10:29	991	0	0.0	19.4	
7	10:31	991	0	0.0	19.5	
8	10:34	991	0	0.0	19.5	
9	10:35	991	0	0.0	19.6	
10	10:37	991	0	0.0	19.5	
11	10:40	991	0	0.0	19.5	
12	10:42	991	0	0.0	19.6	
13	10:43	991	0	0.0	19.6	
14	10:59	991	0	0.0	19.6	
15	11:01	991	0	0.0	19.6	
16	11:03	991	0	0.0	19.6	
17	11:05	991	0	0.0	19.6	
18	11:06	991	0	0.0	19.7	
19	11:08	991	0	0.0	19.7	
20	11:10	991	0	0.0	19.7	
21	11:11	991	0	0.0	19.7	
22	11:13	991	0	0.0	19.8	
23	11:14	991	0	0.0	19.8	
24	11:16	991	0	0.0	19.7	
25	11:18	991	0	0.0	19.8	
26	11:19	991	0	0.0	19.9	
27	11:20	991	0	0.0	19.9	
28	11:22	991	0	0.0	19.8	
29	11:23	991	0	0.0	19.9	
30	11:24	991	0	0.0	19.9	
31	11:26	991	0	0.0	19.9	
32	11:28	991	0	0.0	19.9	
33	11:30	991	5	0.0	19.9	
34	11:32	991	5	0.0	19.9	
35	11:33	991	5	0.0	20.0	
36	11:34	991	0	0.0	20.0	
37	11:35	991	0	0.0	20.0	
38	11:36	991	0	0.0	19.9	
39	11:38	991	0	0.0	19.9	
40	11:40	991	0	0.0	19.9	
41	11:41	991	0	0.0	19.9	
42	11:42	991	0	0.0	20.0	
43	11:44	991	0	0.0	19.9	

Remarks Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 16/4/2007

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Contract No EP/SP/45/01
Pillar Point Valley Landfill Restoration

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Weather conditions: Sunny

Ambient air temp. (°C): 24.0°C

Sampling equipment	Dates calibrated
GEM2000	20/4/2007
ppm gas surveyor	7/4/2006

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
44	15:15	992	0	0.0	19.4	
45	15:17	992	5	0.0	19.6	
46	15:18	992	0	0.0	19.6	
47	15:19	992	0	0.0	19.5	
48	15:21	992	10	0.0	19.7	
A1	15:23	992	10	0.0	19.5	
A2	15:25	992	0	0.0	19.7	
A3	15:27	992	0	0.0	19.8	
A4	15:29	992	0	0.0	19.8	
A5	15:30	992	0	0.0	19.8	
A6	15:31	992	0	0.0	19.9	
A7	15:33	992	15	0.0	20.0	
A8	15:34	992	5	0.0	20.0	
A9	15:36	992	0	0.0	20.1	
A10	15:37	992	0	0.0	20.0	
A11	15:39	992	0	0.0	20.1	
A12	15:41	992	0	0.0	20.2	
A13	15:43	992	0	0.0	20.3	
A14	15:45	992	0	0.0	20.2	
A15	15:46	992	0	0.0	20.3	
A16	15:47	992	10	0.0	20.0	
49	15:55	992	5	0.0	20.3	
50	15:56	992	0	0.0	20.2	
51	15:57	992	0	0.0	20.2	
52	15:58	992	0	0.0	20.2	
53	15:59	992	0	0.0	20.1	
54	16:01	992	0	0.0	20.2	
55	16:04	992	0	0.0	20.2	
56	16:05	992	10	0.0	20.2	
57	16:06	992	0	0.0	20.2	
58	16:06	992	0	0.0	20.3	
59	16:07	992	0	0.0	20.2	
60	16:07	992	0	0.0	20.3	
61	16:08	992	0	0.0	20.3	
62	16:08	992	0	0.0	20.3	
63	16:09	992	0	0.0	20.3	
64	16:10	992	0	0.0	20.3	
65	16:12	992	0	0.0	20.2	
66	16:12	992	0	0.0	20.2	
67	16:13	992	0	0.0	20.2	
68	16:13	992	0	0.0	20.3	
69	16:13	992	0	0.0	20.2	
70	16:15	992	0	0.0	20.3	
71	16:16	992	0	0.0	20.3	
72	16:17	992	0	0.0	20.3	
73	16:17	992	0	0.0	20.2	
74	16:18	992	0	0.0	20.3	
75	16:19	992	0	0.0	20.3	
76	16:19	992	5	0.0	20.3	

Remarks Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 20/4/2007

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

OC-EMC-010 Rev0 01/09/2006

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1a - Surface Gas Monitoring

Weather conditions: Cloudy

Ambient air temp. (°C): 24.0°C

Sampling equipment	Dates calibrated
GEM2000	21/5/2007
ppm gas surveyor	28/2/2007

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
1	9:38	986	0	0.0	20.9	
2	9:39	986	0	0.0	20.8	
3	9:41	986	0	0.0	20.9	
4	9:42	986	0	0.0	20.9	
5	9:43	986	0	0.0	20.8	
6	9:45	986	0	0.0	20.8	
7	9:50	986	0	0.0	20.9	
8	9:53	986	0	0.0	20.9	
9	9:55	986	0	0.0	20.9	
10	9:57	986	10	0.0	20.9	
11	10:00	986	0	0.0	20.9	
12	10:01	986	0	0.0	20.9	
13	10:02	986	0	0.0	20.9	
14	10:05	986	0	0.0	20.9	
15	10:07	986	0	0.0	20.9	
16	10:10	986	0	0.0	20.9	
17	10:13	986	0	0.0	20.9	
18	10:16	986	5	0.0	20.9	
19	10:18	986	5	0.0	20.9	
20	10:20	986	0	0.0	21.0	
21	10:28	986	0	0.0	21.0	
22	10:30	986	0	0.0	21.0	
23	10:32	986	0	0.0	21.0	
24	10:34	986	0	0.0	21.0	
25	10:36	986	0	0.0	21.1	
26	10:38	986	0	0.0	21.0	
27	10:39	986	0	0.0	21.1	
28	10:41	986	0	0.0	21.0	
29	10:43	986	0	0.0	21.1	
30	10:44	986	0	0.0	21.1	
31	10:46	986	0	0.0	21.1	
32	10:48	986	0	0.0	21.1	
33	10:50	986	0	0.0	21.0	
34	10:51	986	0	0.0	21.1	
35	10:53	986	0	0.0	21.0	
36	10:54	986	0	0.0	21.0	
37	10:55	986	0	0.0	21.1	
38	10:56	986	0	0.0	21.1	
39	10:58	986	0	0.0	21.0	
40	11:00	986	0	0.0	21.0	
41	11:04	985	0	0.0	21.0	
42	11:06	985	0	0.0	21.1	
43	11:08	985	0	0.0	21.0	

Remarks: Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 21/5/2007

Prepared by: Peggy Lo, E M Technician

Checked by: M H Law, Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1b - Surface Gas Monitoring

Weather conditions: Sunny

Ambient air temp. (°C): 30.0°C

Sampling equipment	Dates calibrated
GEM2000	30/5/2007
ppm gas surveyor	28/2/2007

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
44	9:00	989	0	0.0	20.4	
45	9:02	989	5	0.0	20.4	
46	9:05	989	5	0.0	20.4	
47	9:09	989	0	0.0	20.3	
48	9:13	989	0	0.0	20.3	
A1	9:16	989	0	0.0	20.3	
A2	9:18	989	15	0.0	20.2	
A3	9:20	989	0	0.0	20.2	
A4	9:23	989	0	0.0	20.1	
A5	9:24	989	0	0.0	20.2	
A6	9:25	989	0	0.0	20.2	
A7	9:26	1004	0	0.0	20.8	
A8	9:27	1004	0	0.0	20.9	
A9	9:30	1004	0	0.0	20.8	
A10	9:32	1004	0	0.0	20.8	
A11	9:33	1004	5	0.0	20.8	
A12	9:35	1004	0	0.0	20.9	
A13	9:37	1004	0	0.0	20.9	
A14	9:38	1004	0	0.0	20.9	
A15	9:40	1004	0	0.0	20.9	
A16	9:41	1004	0	0.0	20.7	
49	9:55	1004	0	0.0	20.6	
50	9:56	1004	10	0.0	20.6	
51	9:57	1004	0	0.0	20.6	
52	9:58	1004	0	0.0	20.6	
53	9:59	1004	0	0.0	20.6	
54	10:01	1004	0	0.0	20.6	
55	10:02	1004	0	0.0	20.6	
56	10:04	1004	0	0.0	20.7	
57	10:06	1004	0	0.0	20.7	
58	10:06	1004	0	0.0	20.7	
59	10:06	1004	0	0.0	20.7	
60	10:07	1004	5	0.0	20.7	
61	10:07	1004	0	0.0	20.7	
62	10:08	1004	5	0.0	20.7	
63	10:10	1004	0	0.0	20.8	
64	10:11	1004	0	0.0	20.8	
65	10:13	1004	0	0.0	20.8	
66	10:13	1004	5	0.0	20.8	
67	10:14	1004	0	0.0	20.8	
68	10:14	1004	0	0.0	20.8	
69	10:15	1004	5	0.0	20.9	
70	10:17	1004	5	0.0	20.9	
71	10:17	1004	0	0.0	21.0	
72	10:18	1004	0	0.0	20.9	
73	10:18	1004	0	0.0	20.9	
74	10:19	1004	0	0.0	20.9	
75	10:20	1004	0	0.0	20.8	
76	10:20	1004	0	0.0	20.9	

Remarks: Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 30/5/2007

Prepared by: Peggy Lo, E M Technician

Checked by: M H Law, Deputy Project Manager

OC-EMC-010 Rev0 01/09/2006

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1a - Surface Gas Monitoring

Weather conditions: Sunny

Ambient air temp. (°C): 32.5°C

Sampling equipment	Dates calibrated
GEM2000	20/6/2007
ppm gas surveyor	28/2/2007

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
1	9:19	987	0	0.0	20.2	
2	9:19	987	0	0.0	20.3	
3	9:21	987	0	0.0	20.3	
4	9:22	987	0	0.0	20.3	
5	9:27	987	0	0.0	20.3	
6	9:30	987	0	0.0	20.3	
7	9:32	987	0	0.0	20.3	
8	9:33	987	0	0.0	20.3	
9	9:35	987	0	0.0	20.2	
10	9:37	987	0	0.0	20.2	
11	9:39	987	0	0.0	20.3	
12	9:40	987	0	0.0	20.3	
13	9:41	987	0	0.0	20.3	
14	9:43	987	0	0.0	20.3	
15	9:45	987	0	0.0	20.3	
16	9:46	987	0	0.0	20.3	
17	9:50	987	0	0.0	20.3	
18	9:51	987	0	0.0	20.3	
19	9:52	987	0	0.0	20.3	
20	9:55	987	0	0.0	20.3	
21	9:56	987	0	0.0	20.3	
22	9:57	987	0	0.0	20.3	
23	9:59	987	0	0.0	20.3	
24	10:35	987	0	0.0	20.1	
25	10:36	987	0	0.0	20.2	
26	10:37	987	0	0.0	20.1	
27	10:38	987	0	0.0	20.1	
28	10:40	987	0	0.0	20.2	
29	10:41	987	0	0.0	20.1	
30	10:42	987	0	0.0	20.1	
31	10:44	987	0	0.0	20.2	
32	10:45	987	0	0.0	20.2	
33	10:46	987	0	0.0	20.1	
34	10:47	987	0	0.0	20.1	
35	10:48	987	0	0.0	20.1	
36	10:50	987	0	0.0	20.1	
37	10:51	987	0	0.0	20.1	
38	10:52	987	0	0.0	20.1	
39	10:54	987	0	0.0	20.1	
40	10:55	987	0	0.0	20.0	
41	10:59	987	15	0.0	20.0	
42	10:59	987	5	0.0	20.1	
43	11:01	987	0	0.0	20.0	

Remarks: Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 20/6/2007

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

Contract No EP/SP/45/03
Pillar Point Valley Landfill Restoration

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1b - Surface Gas Monitoring

Weather conditions: Sunny

Ambient air temp. (°C): 32.5°C

Sampling equipment	Dates calibrated
GEM2000	20/6/2007
ppm gas surveyor	28/2/2007

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
44	14:06	987	0	0.0	20.6	
45	14:09	987	0	0.0	20.5	
46	14:11	987	0	0.0	20.4	
47	14:12	987	0	0.0	20.3	
48	14:14	987	0	0.0	20.6	
A1	14:15	987	0	0.0	20.4	
A2	14:17	987	0	0.0	20.4	
A3	14:19	987	0	0.0	20.5	
A4	14:23	987	0	0.0	20.6	
A5	14:25	987	0	0.0	20.6	
A6	14:28	987	0	0.0	20.6	
A7	14:30	987	0	0.0	20.6	
A8	14:31	987	0	0.0	20.6	
A9	14:33	987	0	0.0	20.6	
A10	14:34	987	0	0.0	20.4	
A11	14:36	987	0	0.0	20.5	
A12	14:38	987	0	0.0	20.5	
A13	14:39	987	10	0.0	20.5	
A14	14:41	987	0	0.0	20.4	
A15	14:43	987	5	0.0	20.3	
A16	14:44	987	0	0.0	20.3	
49	14:58	987	0	0.0	20.6	
50	15:00	987	0	0.0	20.6	
51	15:02	987	0	0.0	20.6	
52	15:04	987	0	0.0	20.3	
53	15:05	987	0	0.0	20.3	
54	15:07	987	0	0.0	20.3	
55	15:10	987	10	0.0	20.4	
56	15:12	987	0	0.0	20.3	
57	15:14	987	0	0.0	20.4	
58	15:14	987	0	0.0	20.4	
59	15:15	987	0	0.0	20.4	
60	15:15	987	0	0.0	20.5	
61	15:16	987	0	0.0	20.3	
62	15:16	987	0	0.0	20.3	
63	15:18	987	0	0.0	20.3	
64	15:19	987	0	0.0	20.3	
65	15:22	987	0	0.0	20.3	
66	15:22	987	0	0.0	20.3	
67	15:23	987	0	0.0	20.3	
68	15:23	987	0	0.0	20.3	
69	15:24	987	5	0.0	20.3	
70	15:26	987	0	0.0	20.5	
71	15:27	987	0	0.0	20.3	
72	15:28	987	0	0.0	20.4	
73	15:29	987	0	0.0	20.4	
74	15:31	987	0	0.0	20.3	
75	15:32	987	0	0.0	20.3	
76	15:33	987	0	0.0	20.3	

Remarks: Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 20/6/2007

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1a - Surface Gas Monitoring

Weather conditions: Sunny

Ambient air temp. (℃): 31.2℃

Sampling equipment	Dates calibrated
GEM2000	18/7/2007
ppm gas surveyor	28/2/2007

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
1	8:57	987	0	0.0	20.0	
2	8:58	987	0	0.0	20.0	
3	9:02	987	0	0.0	19.9	
4	9:02	987	0	0.0	20.0	
5	9:04	987	0	0.0	19.9	
6	9:06	987	0	0.0	19.9	
7	9:08	987	0	0.0	19.9	
8	9:10	987	0	0.0	19.9	
9	9:11	987	0	0.0	19.9	
10	9:14	987	10	0.0	19.9	
11	9:15	987	10	0.0	19.8	
12	9:16	987	0	0.0	19.9	
13	9:17	987	0	0.0	19.9	
14	9:19	987	0	0.0	19.9	
15	9:21	987	0	0.0	19.8	
16	9:23	987	0	0.0	19.9	
17	9:25	987	0	0.0	19.9	
18	9:27	987	0	0.0	19.8	
19	9:29	987	10	0.0	19.8	
20	9:30	987	0	0.0	19.9	
21	9:32	987	0	0.0	19.9	
22	9:34	987	0	0.0	19.9	
23	9:35	987	0	0.0	19.9	
24	9:36	987	0	0.0	19.9	
25	9:38	987	0	0.0	19.9	
26	9:40	987	5	0.0	19.9	
27	9:41	987	5	0.0	20.0	
28	9:42	987	10	0.0	20.0	
29	9:44	987	0	0.0	20.0	
30	9:45	987	0	0.0	19.9	
31	9:46	987	5	0.0	20.0	
32	9:48	987	5	0.0	20.0	
33	9:49	987	0	0.0	20.0	
34	9:50	987	0	0.0	20.0	
35	9:51	987	0	0.0	20.0	
36	9:52	987	0	0.0	20.0	
37	9:54	987	0	0.0	20.0	
38	9:55	987	0	0.0	20.0	
39	9:56	987	0	0.0	20.0	
40	9:57	987	0	0.0	19.9	
41	9:59	987	0	0.0	20.0	
42	10:00	987	0	0.0	20.0	
43	10:04	987	0	0.0	19.9	

Remarks Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 19/7/2007

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

LANDFILL GAS MONITORING -FIELD MEASUREMENT

Section 2.8.1.1b - Surface Gas Monitoring

Weather conditions: Sunny

Ambient air temp. (℃): 31.2℃

Sampling equipment	Dates calibrated
GEM2000	18/7/2007
ppm gas surveyor	28/2/2007

Monitoring location	Time	Barometric pressure (mBar)	Methane (ppm)	Carbon dioxide (%)	Oxygen (%)	Remarks
44	10:35	988	0	0.0	20.1	
45	10:36	988	0	0.0	20.0	
46	10:41	988	0	0.0	20.0	
47	10:43	988	0	0.0	20.1	
48	10:44	988	5	0.0	20.2	
A1	10:46	988	0	0.0	20.2	
A2	10:47	988	0	0.0	20.3	
A3	10:49	988	0	0.0	20.2	
A4	10:52	988	0	0.0	20.3	
A5	10:53	988	5	0.0	20.3	
A6	10:55	988	0	0.0	20.3	
A7	10:56	988	0	0.0	20.3	
A8	10:58	988	0	0.0	20.3	
A9	11:00	988	0	0.0	20.2	
A10	11:03	988	0	0.0	20.3	
A11	11:05	988	0	0.0	20.3	
A12	11:08	988	0	0.0	20.2	
A13	11:11	988	5	0.0	20.2	
A14	11:14	988	10	0.0	20.1	
A15	11:16	988	0	0.0	20.2	
A16	11:17	988	0	0.0	20.2	
49	13:25	987	0	0.0	20.3	
50	13:26	987	0	0.0	20.3	
51	13:27	987	0	0.0	20.2	
52	13:28	987	0	0.0	20.2	
53	13:30	987	0	0.0	20.2	
54	13:32	987	0	0.0	20.2	
55	13:35	987	5	0.0	20.2	
56	13:37	987	5	0.0	20.2	
57	13:39	987	0	0.0	20.1	
58	13:39	987	0	0.0	20.2	
59	13:40	987	0	0.0	20.2	
60	13:40	987	0	0.0	20.2	
61	13:40	987	0	0.0	20.2	
62	13:41	987	0	0.0	20.2	
63	13:43	987	0	0.0	20.2	
64	13:45	987	0	0.0	20.3	
65	13:46	987	0	0.0	20.3	
66	13:46	987	0	0.0	20.3	
67	13:46	987	0	0.0	20.3	
68	13:47	987	0	0.0	20.3	
69	13:47	987	0	0.0	20.3	
70	13:49	987	0	0.0	20.3	
71	13:49	987	0	0.0	20.3	
72	13:50	987	0	0.0	20.3	
73	13:51	987	0	0.0	20.3	
74	13:52	987	0	0.0	20.3	
75	13:53	987	0	0.0	20.3	
76	13:53	987	0	0.0	20.3	

Remarks Compliance limit of methane is 10,000 ppm (1% by volume)

Date of measurement: 19/7/2007

Prepared by: Peggy Lo
E. M. Technician

Checked by: M. H. Law
Deputy Project Manager

APPENDIX E: IMPLEMENTATION SCHEDULE OF THE PROPOSED ENVIRONMENTAL MITIGATION MEASURES

Implementation Schedule of the Environmental Mitigation Measures

Ref #	Environmental Protection Measures/ Mitigation Measures	Location/ Timing	Implementation Agent	Stages			Relevant Legislation and Guidelines
				Des	C	O	
Noise							
4.2.6	The Noise Control Ordinance and its subsidiary regulations will be observed and complied with. Best management practices will be implemented to control and suppress noise generation from the subject site in order to minimize any adverse impact. All plant and equipment to be used onsite will be properly maintained in good operating condition and noisy construction activities shall be effectively sound-reduced by means of silencers, mufflers, acoustic linings or shields, acoustic sheds or screens or other means, to avoid disturbance to any nearby noise sensitive receivers. The Contractor shall devise, arrange methods of working and carry out the Works in such a manner so as to minimise noise impacts on the surrounding environment, and shall provide experienced personnel with suitable training to ensure that these methods are implemented.	Subject Site/ Construction	Contractor		√		NCO
4.2.7	The indoor firing range will be ventilated using window type, split type air conditioning units or/and exhaust fans and provided with proper insulation such as well gasketted windows	Subject Site/ Operation	Proponent & Operator	√	√	√	NCO
4.2.8	No night time operation is permitted for both open and indoor shooting range facilities	Subject Site/ Operation	Operator			√	NCO
4.2.19	The open shooting ranges will be erected with solid fence wall. The fence wall will be 3.5m high including the 1.5m raised platform of the shooting shed. Fence wall in terms of timber baffles will be erected on 3 sides of the open firing ranges.	Subject Site/ Operation	Proponent & Operator	√	√	V	NCO
Air quality							
4.3.6	The Air Pollution Control Ordinance and its subsidiary regulations, particularly the Air Pollution Control (Open Burning) Regulation and Air Pollution Control (Construction Dust) Regulation and Air Pollution Control (Smoke) Regulation will be observed and complied with. Best management practice will be followed at all times to prevent dust nuisance and smoke as a result of the construction activities. That there will be adequate water supply/storage for dust suppression where necessary will be ensured. Methods of working will be devised and arranged and the works will be carried out in such a manner so as to minimise dust impacts on the surrounding environment.	Subject Site/ Construction	Contractor		√		APCO and subsidiary regulations

	Experienced personnel with suitable training will be provided to ensure that these methods are implemented.						
4.3.16	Lead-free primer mixture will be adopted for the firearm used within the proposed shooting range	Subject Site/ Operation	Operator			√	APCO
4.3.17	Backstop of soft materials will be erected behind the target plate to collect the bullets so that the bullet would remain intact, thus eliminating lead dust when hitting the target. Timber baffles with sand bag will be used as the backstop. Fence wall of 3.5m aboveground will be provided to further obstruct and depress possible dispersion of the heavier lead dust within the shooting range area	Subject Site/ Operation	Operator	√	√	√	APCO
Water quality							
4.4.6	The Water Pollution Control Ordinance and its subsidiary regulations will be noted and complied with. Works will be carried out in such a manner as to minimise adverse impacts on the water quality during the execution of the Works and rearrange the working method to minimise water pollution within and outside the site area. The design, construction, operation and maintenance of all the mitigation measures will be carried out in accordance with the practice as specified in the Professional Persons Environmental Consultative Committee Practice Note (ProPECC PN) 1/94 "Construction Site Drainage" issued by the Director of Environmental Protection.	Subject Site/ Construction	Contractor		√		WPCO and subsidiary regulations; ProPECC PN 1/94
4.4.7	Holding tank (aboveground) and chemical toilet facilities will be designed and provided. No sewage will be discharged to the surrounding environment. All wastes will be stored using the holding tank and disposed of by waste disposal agents then. Surface channel will be provided to collect stormwater. No discharge of wastewater will be permitted.	Subject Site/ Operation	Proponent	√	√	√	WPCO and subsidiary regulations
4.4.8	The holding tank facilities will be designed to have about two times of the maximum daily discharge. Arrangement will be made so that the wastewater will be disposed of daily during peak utilization period.	Subject Site/ Operation	Proponent & operator	√	√	√	EIAO-TM
Ecological impact							
4.5.2	Shooting activities will either be carried out within the indoor shooting range or at the outdoor shooting range with fence wall erected on three sides for shielding purpose.	Subject Site/ Operation	Operator	√	√	√	EIAO-TM
Waste management							

4.6.5	Waste Disposal Ordinance and its subsidiary regulations will be observed and complied with	Subject Site/ Construction	Contractor		√		WDO
4.6.5	Contractor shall apply for registration as chemical waste producer	Subject Site/ Construction	Contractor		√		WDO
4.6.6	Generation of waste from his work should be avoided and minimized through changing or improving design and practices, careful planning and good site management. Different types of wastes should be segregated on-site and stored in different containers, skips or stockpiles to facilitate reuse/recycling of waste and, as the last resort, disposal at different outlets as appropriate. The reuse and recycling of waste shall be practised as far as possible. The recycled materials shall include paper/cardboard, timber and metal etc. The C&D waste which comprises metal, timber, paper, glass, junk and general garbage shall be reused or recycled and, as the last resort, disposal of at landfills. The amount of wastes generated, recycled and disposed of (including the disposal sites) should be recorded. A trip ticket system should be used for the disposal of C&D materials, if any, to any designated public filling facility and/or landfill. Training should be provided for workers about the concepts of site cleanliness and appropriate waste management procedure, including waste reduction, reuse and recycling.	Subject Site/ Construction	Contractor		√		EIAO-TM
4.6.7	All cartridge casings and other debris will be collected from the shooting range daily.	Subject Site/ Operation	Operator			√	EIAO-TM
4.6.8	All wastes retained in the holding tank will be disposed of by waste disposal agents.	Subject Site/ Operation	Operator			√	EIAO-TM
Landfill gas hazard							
4.7.28	Precautions should be clearly laid down and rigidly adhered to with respect to trenching and excavation; and creation of confined spaces at, near to or below ground level such that potential hazard on workers from landfill gas/ leachate migration are minimised.	Subject Site/ Construction	Contractor		√		ProPECC PN 3/96 & LFGHAGN
4.7.29	Gas detection equipment and appropriate breathing apparatus should be available and used where necessary when entering confined spaces without proper ventilation. A properly-trained dedicated person (e.g. Safety Officer) should be present on site throughout the construction stage.	Subject Site/ Construction	Contractor		√		ProPECC PN 3/96 & LFGHAGN

4.7.30	All personnel who work on site and all visitors to the site should be made aware of the possibility of ignition of gas in the vicinity of excavations and possibility of asphyxiation in confined area (e.g. deep trench or underground area with only small opening entrance) due to landfill gas migration. Safety notices should be posted warning of the potential hazards.	Subject Site/ Construction	Contractor		√		ProPECC PN 3/96 & LFGHAGN
4.7.31	Those staff who work in, or have responsibility for 'at risk' areas, including all excavation workers, supervisors and engineers working within the Consultation Zone, should receive appropriate training organised by the contractor or other appropriate parties on working in areas susceptible to landfill gas, fire or explosion hazards.	Subject Site/ Construction	Contractor		√		ProPECC PN 3/96 & LFGHAGN
4.7.32	An excavation procedure or code of practice to minimise risks including landfill gas related risk should be devised and carried out by the contractor.	Subject Site/ Construction	Contractor		√		ProPECC PN 3/96 & LFGHAGN
4.7.33	Safe practice should be followed by workers while working in the construction site.	Subject Site/ Construction	Contractor		√		ProPECC PN 3/96 & LFGHAGN
4.7.34	Smoking, naked flames and all other sources of ignition should be prohibited within semi-confined and confined area where possible, and areas in close proximity to the passive vents. 'No smoking' and 'No naked flame' notices should be posted prominently on the construction site and, if necessary, special areas designated for smoking.	Subject Site/ Construction	Contractor		√		ProPECC PN 3/96 & LFGHAGN
4.7.35	Any electrical equipment, such as motors and extension cords, should be intrinsically safe. Construction plant should be fitted with vertical exhaust of sufficient height and with spark arrestors where necessary.	Subject Site/ Construction	Contractor		√		ProPECC PN 3/96 & LFGHAGN
4.7.36	During piping assembly or conduiting construction, all valves/seals should be closed immediately after installation where possible. As construction progresses, all valves/seals should be closed as installed to prevent the migration of gases through the pipeline/conduit. All piping/conduiting should be capped at the end of each working day.	Subject Site/ Construction	Contractor		√		ProPECC PN 3/96 & LFGHAGN
4.7.37	Mobile offices, equipment stores, mess rooms etc. should be located on an area which has been proven to be gas free (by survey with portable gas detectors) and ongoing monitoring should be carried out to ensure that these areas remain gas free. Alternatively, such buildings should be raised clear of the ground with a minimum clear separation distance of 500mm.	Subject Site/ Construction	Contractor		√		ProPECC PN 3/96 & LFGHAGN
4.7.38	During construction, adequate fire extinguishing equipment, fire-resistant clothing and breathing apparatus (BA) sets should be made available on site. The operator should formulate a health and safety policy, standards and instructions for site personnel to follow.	Subject Site/ Construction	Contractor		√		ProPECC PN 3/96 & LFGHAGN
4.7.39	For drilling operations, “Special Advice Relating to the Drilling of Boreholes” in Landfill Gas Hazard Assessment Guidance Note should be referenced to ensure that such operations are properly supervised, and provided with safety equipment and clothing and well-defined working and safety procedures.	Subject Site/ Construction	Contractor		√		ProPECC PN 3/96 & LFGHAGN

4.7.40	Welding, flame-cutting or other hot works, where necessary, should be confined to open areas at least 15m from any trench or excavation if possible. They may only be carried out in trenches or confined spaces when controlled by a 'permit to work' procedure, properly authorized by the Safety Officer or other appropriately qualified person. The 'permit to work' procedure should set down the requirements for continuous monitoring for methane, carbon dioxide and oxygen throughout the period during which the hot works are in progress. The procedure should also require the presence of an appropriately qualified person in attendance outside the 'confined area', who shall be responsible for reviewing the gas measurements, and who shall have executive responsibility to suspend the work in the event of unacceptable or hazardous conditions. Only workers who are appropriately trained and fully aware of the potentially hazardous conditions should be permitted to carry out hot works in confined areas.	Subject Site/ Construction	Contractor		√		ProPECC PN 3/96 & LFGHAGN
4.7.41	For other work in confined space, if any, controlled by the Factories and Industrial Undertakings (Confined Spaces) Regulations of the Factories and Industrial Undertakings Ordinance, the Safety Guide to Working in Confined Spaces should be followed to ensure compliance with the regulations mentioned above. Key issues with regards to confined spaces which are at risk of landfill gas build-up are listed out below: • The entry or access point should be clearly marked with a warning notice (in English and Chinese) which states that there is the possibility of flammable and asphyxiating gases accumulating within. • The warning notice should also give the telephone number of an appropriate competent person who can advise on the safety precautions to be followed before entry and during occupation of the confined space. • Personnel should be made aware of the dangers of entering confined spaces potentially containing hazardous gases and, where appropriate, should be trained in the use of gas detection equipment. • Prior to entry, the atmosphere within the chamber should be checked for oxygen, methane and carbon dioxide concentrations. The chamber may then only be entered if oxygen is greater than 18% by volume, methane is less than 10% of the Lower Explosive Limit (LEL), which is equivalent to 0.5% by volume (approximately), and carbon dioxide is less than 0.5% by volume. • If either carbon dioxide or methane are higher, or oxygen lower, than the values given above, then entry to the chamber should be prohibited and expert advice sought. • Even if conditions are safe for entry, no worker should be permitted to enter the chamber without having another worker present at the surface. The worker who enters the chamber should wear an appropriate safety/recovery harness and, preferably, should carry a portable methane, carbon dioxide and oxygen meter.	Subject Site/ Construction	Contractor		√		ProPECC PN 3/96 & LFGHAGN

	• In general, when work is being undertaken in confined spaces sufficient approved resuscitation equipment, breathing apparatus and safety torches should be available. Persons involved in or supervising such work should be trained and practised in the use of such equipment. A permit-to-work system for entry into confined spaces should be developed by an appropriately qualified person and consistently employed.						
4.7.48	The proposed LFG mitigation measures during the construction of the project (4.7.28-4.7.41) will be followed by the operator of the shooting range when the maintenance work during the operation phase is carried out.	Subject Site/ Operation	Operator			√	ProPECC PN 3/96 & LFGHAGN
4.7.49	The design loading on capping would amount to 60kN/m^2. Such requirement will be observed in design of the facilities. In order not to affect the capping system, there will be no piling for foundation construction. No basement will be constructed and all buildings will have foot rest on ground. All buildings will have single storey only and the loading will be minimized wherever possible and the loading requirement will be met in all circumstances to avoid any damage to the capping layer and other sub-soil piping facilities. The disposition of the facilities will be designed in such a way that the existing landfill site facilities will not be affected. In other words, no demolition, diversion and reprovision of the existing facilities is required. All monitoring and extraction wells located within the 25m/50m shooting range open area will have additional protection provided (e.g. shield at wellhead) to avoid damage due to shooting activities.	Subject Site/ Operation	Proponent	√	√	√	ProPECC PN 3/96 & LFGHAGN
4.7.50	No naked flame and smoking can be allowed onsite. In particular, “No smoking” sign and other signage should be provided close to passive vent.	Subject Site/ Operation	Operator	√	√	√	ProPECC PN 3/96 & LFGHAGN
4.7.52	A raised floor design will be adopted for the office-cum-clubhouse, indoor shooting range and other enclosed room, with vertical clearance between the floor slab and the ground not less than 500mm.	Subject Site/ Operation	Proponent	√	√	√	ProPECC PN 3/96 & LFGHAGN
4.7.53	1mm HDPE geo-membrane or equivalent materials (with hydraulic conductivity of less than 10^{-12}m/s) will be lined on the floor slab of the office-cum-clubhouse, indoor shooting range and other enclosed room to minimize possibility of landfill gas (LFG) migration into enclosed rooms. The annulus around any service entry points into the buildings will effectively be blocked by means of sealant, collars or puddle flanges as appropriate to prevent the ingress of gas into a building via service entry points. With collar seal applied, HDPE collar will be fitted around the HDPE pipe (sealed with the pipe entering the building) and welded to the membrane line on floor slab. Water seal will be provided in water pipes and sewers, if any, to prevent ingress of landfill gas (by retaining water within the section of the “U” tube to block passage of air).	Subject Site/ Operation	Proponent	√	√	√	ProPECC PN 3/96 & LFGHAGN

	All utilities connecting to offsite area is proposed to be laid aboveground instead of buried underground, subject to the final design of the utilities service entries to the site.						
4.7.54	For enclosed buildings including indoor shooting ranges, clubhouse and lavatory/beverage house, mechanical ventilation of 5 air change per hour will be provided so as to avoid accumulation of LFG even when it penetrates into the enclosed room.	Subject Site/ Operation	Operator	√	√	√	ProPECC PN 3/96 & LFGHAGN
4.7.55	Detection system will be installed at clubhouse, 2 indoor shooting ranges and lavatory/beverage house. Both methane and carbon dioxide will be monitored.	Subject Site/ Operation	Operator	√	√	√	ProPECC PN 3/96 & LFGHAGN
4.7.56	The project proponent will maintain good communication with the landfill restoration and aftercare contractor with respect to landfill gas management at the restored landfill.	Subject Site/ Operation	Proponent & Operator			√	ProPECC PN 3/96 & LFGHAGN
4.7.57	A contingency plan/evacuation procedure to deal with LFG incidents should be developed	Subject Site/ Operation	Proponent & Operator			√	ProPECC PN 3/96 & LFGHAGN
4.7.60	The operator of the proposed shooting range will closely liase with EPD and the aftercare contractor to ensure that the construction and operation of the proposed shooting range would not result in adverse impact on the existing landfill facilities. The operator of the proposed shooting range has the responsibility to ensure the safety of EPD and the aftercare contractor staff who will have the right to access the site to carry out their aftercare duties.	Subject Site/ Construction & Operation	Proponent, Contractor & Operator		√	√	ProPECC PN 3/96 & LFGHAGN

EIAO-TM – Technical Memorandum on Environmental Impact Assessment Process

NCO – Noise Control Ordinance

APCO – Air Pollution Control Ordinance

WPCO - Water Pollution Control Ordinance

WDO – Waste Disposal Ordinance

FAR - Firearms and Ammunition Regulations (Cap. 238A)

ProPECC PN 1/94 - ProPECC PN 1/94 "Construction Site Drainage"

ProPECC PN 3/96 - ProPECC PN 3/96 "Landfill Gas Hazard Assessment for Development Adjacent to Landfill"

LFGHAGN – Landfill Gas Hazard Assessment Guidance Note