Hong Kong Government
Environmental Protection
Department

Restoration of North-West New Territories Landfills

Agreement No. CE 10/92

Initial Environmental Impact Assessment

Executive Summary

April 1995

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INTRODUCTION

As part of an integrated strategy for environmental improvement in Hong Kong, the Environmental Protection Department (EPD) is giving a high priority to the restoration of old landfills. In November 1992, EPD appointed consultants to carry out a study on the restoration and aftercare of four landfills in the North-West New Territories:

- Pillar Point Valley Landfill
- Siu Lang Shui Landfill
- Ma Tso Lung Landfill
- Ngau Tam Mei Landfill

Except for PPVL which will remain in operation for a few more years, the other three landfills are all closed. The locations of the landfills are shown in Figure 1.

Similar to other landfills in Hong Kong, these landfills have not been put to any productive use after closure. Landfill gas (LFG) and leachate are continuously released into the environment. Ground settlement, which is the result of degradation of the waste, encourages rain water infiltration and causes more gas and leachate generation. LFG is asphyxiating, malodorous, and at certain concentrations can be flammable and even explosive. Leachate is a highly polluting liquid and can adversely affect the quality of nearby surface and ground water.

In order to restore the sites to an environmentally acceptable condition for community or other uses, the environmental impacts of each landfill due to LFG, leachate and ground settlement were examined. A conceptual restoration scheme was prepared for each site, and measures to reduce or limit potential hazards, and air and water pollution were proposed.

An initial environmental impact assessment (IEIA) has been carried out to consider the environmental impacts during restoration and the residual impacts after the sites have been restored. The IEIA considered the details of potentially adverse and beneficial impacts of each of the restoration schemes, and provided recommendations for monitoring and auditing during the construction and operating stages of the restoration. More recently it has been recognised that ecological issues should also be addressed and these have been commented on.

The proposed restoration schemes and the results of the environmental assessment are described. Although some aspects of the descriptions and assessment are similar, each of the four sites is dealt with separately.

PILLAR POINT VALLEY LANDFILL

Local Setting and Site History

Pillar Point Valley Landfill (PPVL) is an operating landfill on the western outskirts of Tuen Mun. The site is located in a deep, steep-sided valley; the stream which originally flowed in the valley has been diverted around the landfill. When fully developed, the landfill will cover an area of about 53 hectares. The northern part of the landfill extends into the British Forces' Castle Peak Firing Range. The Pillar Point Vietnamese Refugee Camp and a temporary container storage area are located south of the landfill site. The coastline is only about 500 metres south of the site.

Planned infrastructure developments in the area include a Special Industrial Area and a River Trade Terminal on reclaimed land to the south of the site. A dual 3-lane trunk road and a Light Rapid Transit (LRT) extension route which cross the southern part of the site on elevated structures have also been proposed.

The landfill has been operated since 1983, and has received about 7 million tonnes of mainly domestic, industrial and construction wastes. Site development work has been undertaken to increase the landfill's ultimate capacity, allowing its operation to continue for several more years.

Since its inception, separate surface water, groundwater and leachate drainage systems have been built. A liner was constructed over part of the base of the landfill and its design has evolved over the years. At present, collected leachate is not treated but is piped to the nearby Pillar Point Sewage Treatment Works (PPSTW) for disposal. Landfill gas venting facilities have recently been installed.

Proposed Restoration Works

The preferred afteruse for this site is to plant trees on the slopes and upper platform, with public access provisions for passive recreational uses. A conceptual restoration plan is shown in Figure 2. It is proposed that the following works should be undertaken to restore the landfill:

- placing a final capping layer over the existing temporary soil capping layer
- hydroseeding and tree planting on the restored surface
- constructing an active landfill gas extraction system
- constructing a leachate treatment plant

Potential Impacts & Proposed Mitigation Measures during the Construction of Restoration Works

Landfill gas and odour

The proposed active LFG extraction system will be constructed in association with the landfill cap, in order to relieve the build-up of LFG pressure in the landfill, and to prevent lateral migration of LFG in off-site directions.

LFG released during construction and excavation activities is a potential hazard as it can accumulate in poorly ventilated spaces such as manholes and on-site offices. This potential hazard can be avoided by good site management, the use of detection equipment, and proper ventilation of work areas. Emission of LFG can also cause offensive odour nuisance. Direct emission of landfill gas into the atmosphere can occur for short periods through construction activities on the landfill, particularly when waste is exposed. The air quality impact due to direct

release of LFG during construction can be minimised using suitable mitigation measures such as avoiding significant direct exposure of waste, and controlling excessive vehicle movements on newly restored areas.

Construction activities will not cause the release of significantly greater volumes of LFG compared to the volumes that will be released prior to the construction activities. As a result, no adverse environmental impacts are expected.

Water and leachate

Marine water quality south of PPVL is not affected by the landfill, and no evidence of groundwater contamination exists off-site. However, surface water to the south of the landfill is contaminated. At present, the combined discharge of leachate and contaminated groundwater from the landfill to the nearby PPSTW does not always comply with the statutory standards, and a leachate treatment plant is necessary in the future.

This leachate treatment plant will be built on-site, and can also take leachate from other landfills such as SLSL. A surface water drainage system will be built progressively to control run-off and erosion.

Extensive tree planting on the capped landfill will reduce effective rainfall (ie infiltration and runoff) over the site by enhancing evaporation, and will further reduce the volumes of leachate generated at the site.

Construction activities will not cause any detrimental impact on water quality.

Dust

The construction of the capping layer will involve considerable earth-moving activities that will require dust control and mitigation measures, to ensure no dust nuisance to the nearest sensitive receiver, the Vietnamese Refugee Camp. These measures include wetting of surfaces, controlling vehicular speeds and movements, using side enclosures and coverings where practicable for storage piles, and restricting the area on which construction works are active at any one time. The modelling results indicate that dust emissions from the construction works are significantly below the relevant Air Quality Objective.

Noise

At present, the main sources of noise in the area are related to operations in the landfill and in the nearby container storage area. The nearest noise sensitive receiver is the Vietnamese Refugee Camp. However, the construction of the leachate and landfill gas control measures do not involve significant earth-moving activities, and therefore discernible noise levels are not expected from these sources.

The construction of the capping layer will however involve significant earth-moving activities. The adoption of noise reduction measures such as the use of quieter equipment, the erection of temporary screening, and the control of the number of plant in use at any one time will ensure that construction noise does not exceed the target level of 75 dB(A).

Potential Impacts & Proposed Mitigation Measures during the Operation of Restoration Works

The main activities throughout the operational period of the restoration works will be:

- extraction and flaring of LFG
- treatment and discharge of leachate

Landfill gas and odour

During operation, LFG will be controlled by means of an active extraction system where the gas collected will be burned off by a high temperature flare, or used directly for energy production. Based on the modelling assumptions adopted, the results indicate that if a flaring system is used, its exhaust gas is likely to be within established standards. Nonetheless the contractor will be required to carry out a detailed EIA to support his design of the LFG management works.

Other pollutants not included in the Hong Kong air quality standards may exist in the landfill gas flare exhaust. As a prudent measure, it may be necessary to limit public access to an area around the flare of about 50 metres in radius. This restriction should be imposed until and unless the Contractor can demonstrate that the flare emission is safe with respect to air quality. It is possible that with a high standard flare, the emissions of pollutants would be low enough such that no restriction to public access is necessary.

Odour caused by LFG would be mitigated by means of the proposed active extraction and ultimate burning of the gases. Based on available data, the modelling assumptions and subsequent results, the exhaust from the LFG flare will not exceed the odour threshold.

Odour problems associated with the proposed leachate treatment works are not expected, as the aerobic biological treatment process proposed will result in the oxidation of potentially odorous compounds.

Water and leachate

The final surface water drainage system will be designed to ensure that it does not receive any contamination from the landfill. The system will discharge to the existing stream channel to the south of the landfill, and will not cause any adverse environmental impacts.

Operation of the restoration works will not result in any discharges to groundwater, nor to marine water.

The leachate treatment plant will be designed and operated to ensure that the effluent complies with the statutory standards. The effluent will then be discharged to PPSTW.

Dust

Operation of the restoration works will not result in any emission of dust.

Noise

After the site has been restored and the leachate and LFG control measures are operational, noise reduction measures such as the use of screening or quiet plant will be necessary to ensure compliance with relevant noise criteria, particularly in respect of the Vietnamese Refugee Camp which will remain to be a sensitive receptor during the afteruse and aftercare period, for as long as the camp itself remains operational. The afteruse facilities will not be affected by noise arising from the proposed leachate and LFG control measures.

Potential Impacts during Construction and Operation of the Preferred Afteruse Facilities

Construction impacts

Provided high standards of civil construction works are adopted, and precautions are taken to ensure that the restoration works are not damaged, the construction of the afteruse facilities is not expected to result in any adverse environmental impacts. The visual impact during the construction of the afteruse facilities will be short-term and transitory.

Operational impacts

The proposed afteruse will have no adverse impacts on the environment. On the contrary, the afteruse should be selected and designed so as to ensure a significant improvement to the environment, and to be of benefit to the community so far as is practically possible on an old landfill. The operation of the proposed afteruse facilities will cause no adverse environmental impacts with respect to water, air, dust or noise.

Settlement

The preferred afteruse focuses on low intensity land use such that the anticipated future settlement of the restored landfill will not be critical to the activities proposed. No buildings are proposed in the landfilled areas.

Visual impact

The visual amenity value of the area will be significantly enhanced following the completion of landscape and planting works.

High tension power lines

The existing high tension power lines do not represent any discernible risk, as no major structure will be built in their vicinity.

Recommended Scope of the Detailed EIA

The following key issues are identified in the IEIA for further study in the detailed EIA to be undertaken by the contractor to ensure that the detailed design of the restoration works and afteruse comply with the appropriate environmental standards.

(i) *Air quality*

- An assessment on the possible impacts of flare emissions (including but not limited to carcinogens) is required to support the flare design with respect to the active LFG extraction plant at PPVL.
- Evaluation of the possible odour impacts at the proposed leachate treatment plant at PPVL.
- Predictions of the dust arisings and impact in the light of the detailed construction programme of the restoration works.

(ii) *Water quality*

- Identification and evaluation of leachate generated from the landfill and wastewater produced from the restoration works with due consideration for adequate reception, handling, treatment and disposal.

(iii) *Noise*

- Evaluation of construction noise impacts by examining the plant items to be employed by the contractor.
- Assessment of noise impacts and development of mitigation measures if required on sensitive on-site and off-site receivers from the construction activities, and operation of LFG and leachate management systems.

(iv) *Environmental monitoring and audit*

- Confirmation of environmental monitoring and audit requirements arising from the feasibility study.

SIU LANG SHUI LANDFILL

Local Setting and Site History

Siu Lang Shui Landfill (SLSL) is a closed landfill, located on the western outskirts of Tuen Mun and about 1.5 kilometres west of PPVL. It was operational between 1978 and 1983, and received about 1.2 million tonnes of mainly domestic, industrial and construction wastes, with incinerator ash and a variety of miscellaneous special wastes.

The landfill has an area of about 12 hectares. It is a valley in-fill, with a stream culverted beneath the waste. Separate leachate and groundwater collection systems were installed above and below a liner, and leachate was originally drained to two filtration tanks with soakaways. More recently, it

appears that leachate has been drained to a third soakaway. Contaminated groundwater discharges to the stream, and onto the beach which is only about 120 metres to the south.

As at PPVL, planned infrastructure developments in the area include a Special Industrial Area and a River Trade Terminal on reclaimed land to the south of the site. A dual 3-lane trunk road and a Light Rapid Transit (LRT) extension route which cross the southern part of the site on elevated structures have also been proposed.

The site is proposed to be designated as a Countryside Conservation Area. The site consists of steep uniform slopes rising up to three platform areas. Tree seedlings which were planted in 1987 are now well established, and the site has the appearance of naturally vegetated slopes which merge well with the less vegetated higher hill slopes.

Proposed Restoration Works

A range of opportunities, constraints and afteruse options were assessed. The proposed afteruse is a go-kart circuit and associated support facilities such as spectator seating, service buildings and parking. The proposed afteruse has been suggested to satisfy a known demand for a recreational activity for which it is difficult to find a suitable site. A picnic area is also proposed, but barbecues will not be permitted. The existing vegetation would be protected as far as possible during restoration. However, future infrastructure developments will result in some disturbance. A conceptual design is shown in Figure 3. It is proposed that the following works should be undertaken to restore the landfill:

- the existing vegetation will be protected as far as possible
- the existing LFG venting pipes will be reinstated
- additional LFG venting pipes will be installed particularly around the site boundary
- a LFG venting trench will be constructed along the southern boundary
- leachate and contaminated groundwater, if needed, will be intercepted and pumped along Lung Mun Road towards the leachate treatment plant at PPVL

Potential Impacts & Proposed Mitigation Measures during the Construction of Restoration Works

Landfill gas and odour

During construction, direct emission of LFG into the atmosphere can occur for short periods through activities on the landfill, particularly when waste is exposed. Impacts due to such emissions can be minimised using suitable mitigation measures such as avoiding significant direct exposure of waste, and controlling excessive vehicle movements on newly restored areas.

Construction activities will not cause the release of significantly greater volumes of LFG compared to the volumes that will be released prior to the construction activities. As a result, no adverse environmental impacts with respect to either LFG or odour are expected.

Water and leachate

The proposed construction works to control leachate discharges consist only of reinstatement of existing collection tanks (or replacement with new or additional tanks if the existing tanks are beyond repair), and the construction of a pipe along Lung Mun Road. If further investigation and monitoring indicate that a full length interception system is required along the southern boundary of the site, this will be combined with the LFG vent trench. These construction works will not result in any adverse impacts on water quality.

Dust

It is not considered necessary or appropriate to strip the existing vegetation and place a new landfill cap. As such, a major potential source of dust impacts will not be included in the restoration works at SLSL. Works areas for the construction of other restoration features will be small, thus ensuring a limited potential for significant dust emissions. Nonetheless mitigation measures should be undertaken, including wetting of surfaces, controlling vehicular speeds and movements, using side enclosures and coverings where practicable for storage piles, and restricting the area on which construction works are active at any one time.

Noise

At present, the main sources of noise in the area are from activities of the Castle Peak Power Station to the west of the site, road traffic and occasional aeroplanes. There is no sensitive receiver in the vicinity. The limited restoration-related construction activities will cause no significant noise impacts.

Visual impact

The visual impact of the restoration works will be negligible, as the site is enclosed by hills on three sides, and tall trees or a thick screen on the south side.

Potential Impacts & Proposed Mitigation Measures during the Operation of Restoration Works

The only on-going operational elements of the restoration works which might cause an environmental impact are:

- the venting of LFG
- the pumping of leachate

Landfill gas and odour

LFG will be released from passive gas vents within the landfill, around the boundary and along the southern perimeter venting trench. The proposed LFG management system will control lateral gas movement and direct gas emissions to vent stacks, thus providing protection to the proposed afteruse facilities. Long-term maintenance and

monitoring of the venting trenches and vent pipes will be required.

LFG emitted from the proposed passive gas management system will not be a significant contributor to ambient levels of undesirable pollutants. Based on the modelling assumptions adopted the results indicate that after restoration, the air quality impacts from pollutants emitted from the passive vents on the proposed afteruse and the Special Industrial Area will be within established standards. Similarly, odour nuisance is not expected. Nonetheless the Contractor will be required to carry out a detailed EIA to support his design of the restoration works.

Water and leachate

When long-term arrangements for the interception, collection, treatment and disposal of leachate and contaminated groundwater are in place, the problems associated with continued pollution of the beach and groundwater will be resolved. The proposed low intensity land use will not pose any significant impacts on the adjacent water bodies.

Leachate and contaminated water from SLSL will be piped and pumped to PPVL, to be treated in the proposed leachate treatment plant at that site, and the discharge to PPSTW will comply with the statutory standards.

Dust

Operation of the restoration works will not result in any emissions of dust.

Noise

The only possible source of noise from the operational activity will be from small pumps on the leachate pipe to PPVL. As these will be located along the Lung Mun Road, any noise emissions will be minimal compared to traffic noise.

Potential Impacts during Construction and Operation of the Preferred Afteruse Facilities

Construction impacts

Provided high standards of civil construction works are adopted, and precautions are taken if any minor re-profiling penetrates through the existing capping layer, the construction of the afteruse facility is not expected to result in any adverse environmental impacts.

Operational impacts

The only environmental impact from go-karting activities which might cause nuisance is noise. However increased noise levels would be transient and are not expected to be a problem, as there are no sensitive receivers nearby. In order to further reduce afteruse-related noise impacts, on-site buildings will be located in less sensitive areas and vegetation screening will be used where possible.

Settlement

The proposed afteruse will result in a low proportion of the site being occupied by building structures. The small anticipated settlement in the landfilled area is not considered significant to the activities proposed. Correct use of flexible paving materials and flexible surface drainage channels which would remain functional in settling ground, and siting of the structures in original ground, where possible, will further minimise potential settlement-induced problems.

Visual impact

The go-kart circuit will introduce a central flat area but its visual impact will be minimal. Overall the visual amenity value of the area will be further enhanced following the restoration.

High tension power lines

Health hazards associated with proximity to high tension power lines at SLSL are not considered to be significant, as the nature of the afteruse is such that any exposure to the public will be short-term and transient. Above-ground structures will be constructed with enough clearance from high tension power lines.

Recommended Scope of the Detailed EIA

The following key issues are identified in the IEIA for further study in the detailed EIA to be undertaken by the contractor to ensure that the detailed design of the restoration works and afteruse comply with the appropriate environmental standards.

(i) *Air quality*

- Predictions of dust arisings and impact in the light of the detailed construction programme of the restoration works.
- An assessment on the possible impacts of gas emissions and odour impacts from passive LFG vents.
- Evaluation of the possible odour impacts at the proposed leachate holding tank at SLSL.

(ii) *Water quality*

- Identification and evaluation of leachate generated from the landfill and wastewater produced from the restoration works with due consideration for adequate reception, handling, treatment and disposal.

(iii) *Noise*

- Evaluation of construction noise impacts by examining the plant items to be employed by the contractor.
- Assessment of noise impacts and development of mitigation measures if required on sensitive on-site and off-site receivers from the construction

activities, and operation of LFG and leachate management systems.

(iv) *Environmental monitoring and audit*

- Confirmation of environmental monitoring and audit requirements arising from the feasibility study.

MA TSO LUNG LANDFILL

Local Setting and Site History

Ma Tso Lung Landfill (MTLL) is a closed landfill located to the north of Pak Shek Au near the closed border area. The site has an area of about 2 hectares. To the east of the landfill is a sports field, and a few village houses and an orchard are located to the north. The site received less than 200,000 tonnes of domestic, industrial and commercial wastes between 1976 and 1979.

The landfill was originally in a small valley. A low grade liner was installed on the site base, a bund was constructed across the lowest area, and sprayed concrete was also used in this area. Leachate and groundwater were collected separately. The site is not currently restored, with no capping layer, limited LFG vents, and uncontrolled leachate seepages. Limited regrading has been undertaken in the past.

Proposed Restoration Works

The site is currently leased to Community Sports Limited who operate the sports ground east of the landfill. However, under a land exchange proposal between the present operator and Tung Wah Group of Hospitals, the restored landfill and the sports field will be developed as a holiday camp. The majority of the camp buildings will be located beyond the landfilled areas. The conceptual design provided by the holiday camp architect is shown in Figure 4.

It is proposed that the following works should be undertaken to restore the landfill:

- re-profiling of landfill slopes to improve stability and comply with afteruse requirements
- placing a new final cap to reduce rainwater infiltration and leachate generation
- constructing LFG vents within the site area, and barriers around the site boundary
- constructing leachate interception drains and a leachate holding tank
- leachate to be pumped out periodically for off-site treatment and disposal

Potential Impacts and Proposed Mitigation Measures during the Construction of Restoration Works

Landfill gas and odour

During re-profiling and capping works, direct emission of LFG into the atmosphere can occur for short periods, particularly when waste is exposed. The impact due to direct release of LFG during construction can be minimised using suitable mitigation measures such as avoiding significant direct exposure of waste, and controlling excessive vehicle movements on newly restored areas. In addition, temporary covers should be used to cover exposed waste, and any necessary temporary stockpiles of waste should be located away from sensitive receptors.

Water and leachate

Re-profiling, capping and leachate interception works may result in a temporary increase in leachate generation. Appropriate leachate holding measures have been recommended. Measures for controlling sediments carried in runoff should also be adopted.

Dust

Predictive air modelling indicates that restoration of this small landfill should not result in an exceedance of air quality criteria for dust concentrations if mitigation measures are adopted. Mitigation measures such as wetting of surfaces, controlling vehicular speeds and movements, using side enclosures and coverings where practicable for storage piles, and restricting the area on which construction works are active at any one time will ensure that dust impacts are minimised.

Noise

The proposed restoration will involve few items of construction equipment, and only daytime operation is anticipated. Currently, there are few receptors sensitive to noise from the landfill site, and by the use of noise reduction measures, it will be possible to control construction noise to within established standards. The adoption of noise reduction measures such as the use of quieter equipment, the erection of temporary screening, and the control of the number of plant in use at any one time, will ensure that construction noise does not exceed the target level of 75 dB(A).

Potential Impacts and Proposed Mitigation Measures during the Operation of Restoration Works

The main activities during the operational period of the restoration works will be:

- the venting of LFG
- the periodic tankering of leachate

Landfill gas and odour

LFG will be released from passive gas vents within the landfill, around the boundary and along the perimeter venting trench. The proposed LFG management system will control lateral gas movement and direct gas emissions to vent stacks, thus providing protection to the proposed afteruse facilities. Long-term maintenance and monitoring of the venting trenches and vent pipes will be required.

LFG emitted from the proposed passive gas management system will not be a significant contributor to ambient levels of undesirable pollutants. Based on the modelling assumptions adopted the results indicate that after restoration, the air quality impacts from pollutants emitted from the passive vents on the proposed holiday camp development and other sensitive receptors nearby will be within established standards. Similarly, odour nuisance is not expected. Nonetheless the Contractor will be required to carry out a detailed EIA to support his design of the restoration works.

Gas vent pipes will be installed as part of the passive LFG management system at locations away from the majority of the holiday camp activities. For a properly designed and operated gas management system this would not cause any LFG related odour impacts at any sensitive receptors.

With proper design of the leachate holding tank, odour from the leachate management measures is not expected to be a concern to the proposed afteruse and adjacent sensitive receptors.

Water and leachate

Following restoration, the existing uncontrolled leachate flows to the surrounding lowlands and the stream will be eliminated, resulting in a general improvement in the conditions of the playing field and water quality of the stream. With adequate precautions to contain any leakage or spillage from the leachate holding tank, no adverse impacts on water quality are expected.

Dust

Operation of the restoration works will not result in any emissions of dust.

Noise

The only possible sources of noise from the operational activity will be from the periodic trips of a tanker to and from the leachate holding tank, which will not result in noise related nuisance.

Potential Impacts during Construction and Operation of the Preferred Afteruse Facilities

Construction impacts

Provided high standards of civil construction works are adopted, and precautions are taken to ensure that the restoration works are not damaged, the construction of the afteruse facilities is not expected to result in any adverse environmental impacts.

Operational impacts

There should not be any significant sources of noise associated with the future use of the site as a holiday camp. Any source of noise associated with this afteruse can be effectively mitigated using appropriate noise control measures such as acoustic insulation and screening of the buildings, and tree screening along the boundary of noise emitters.

Settlement

The proposed afteruse focuses on low intensity land use. No heavy buildings are proposed in landfilled areas. The anticipated settlement will not affect the proposed activities.

Visual impact

Following profiling, recapping and planting there will be a great improvement in the visual quality of the site, and facilities should be designed to blend within the landscape in order to be unobtrusive.

Recommended Scope of the Detailed EIA

The following key issues are identified in the IEIA for further study in the detailed EIA to be undertaken by the contractor to ensure that the detailed design of the restoration works and afteruse comply with the appropriate environmental standards:

(i) *Air quality*

- Predictions of dust arisings and impact in the light of the detailed construction programme of the restoration works.
- An assessment on the possible impacts of gas emissions and odour impacts from passive LFG vents.
- Evaluation of the possible odour impacts of the proposed leachate holding tank.

(ii) *Water quality*

- Identification and evaluation of leachate generated from the landfill and wastewater produced from the restoration works with due consideration for adequate reception, handling, treatment and disposal.

(iii) *Noise*

- Evaluation of construction noise impacts by examining the plant items to be employed by the contractor.
- Assessment of noise impacts and development of mitigation measures if required on sensitive on-site and off-site receivers from the construction activities, and operation of LFG and leachate management systems.

(iv) *Environmental monitoring and audit*

- Confirmation of environmental monitoring and audit requirements arising from the feasibility study.

NGAU TAM MEI LANDFILL

Local Setting and Site History

Ngau Tam Mei Landfill (NTML) is a closed landfill of only 2 hectares, located northeast of Yuen Long adjacent to the New Territories Circular Road and close to a large residential development.

The landfill has been restored as a series of platforms. The surrounding hills are covered with wood and scrubland. No planting programme has been carried out upon landfill closure, although the site itself has developed a sparse cover of self-seeded vegetation.

From 1973 to 1975 about 30,000 tonnes of mainly domestic and industrial wastes were deposited. However, the site was used for waste disposal before any records were available, and the total waste inputs are not known. The site is in a small valley. No base liner was constructed, but a leachate collection drain was installed in the waste.

No LFG venting pipes have been installed. The landfill has been covered with a compacted capping layer of completely decomposed granite which appears to be in good condition.

Proposed Restoration Works

The preferred afteruse is a baseball field with associated building facilities which are mainly located near the lower end of the site. A conceptual restoration plan is shown in Figure 5. It is proposed that the following works should be undertaken to restore the landfill:

- the existing vegetation will be protected as far as possible
- gas vents will be installed within the waste, and a venting trench combined with gas wells along the site boundary
- leachate from the existing collection drain and the contaminated surface water will be directed to a holding tank
- the holding tank will be pumped out periodically for off-site treatment and disposal.

Potential Impacts and Proposed Mitigation Measures during the Construction of Restoration Works

Landfill gas and odour

There are currently no proposals to reconstruct the capping layer and as a result there should not be a significant release of LFG due to earthmoving activities during the construction of the restoration works.

Water and leachate

Leachate holding and disposal arrangements should be in place before leachate interception works are carried out, as these activities will cause a temporary increase in leachate generation. Mitigation measures for controlling the leachate seepages and sediment loads in runoff during the construction phase should be adopted.

Dust

Predictive air modelling indicates that restoration of this small site should not result in an exceedance of air quality criteria for dust concentrations. However, mitigation measures are required to further minimise dust nuisance to adjacent land users. Such measures include wetting of surfaces, controlling vehicular speeds and movements, using side enclosures and coverings where practicable for storage piles, and restricting the area on which construction works are active at any one time.

Noise

At present, road traffic from the New Territories Circular Road is the main source of noise. The restoration will involve very limited earth moving activities, and therefore the increase in construction noise should be minimal. Currently, no noise sensitive receivers are located within 100 metres from the site boundary, and any transient significant increase in construction noise should not cause any unacceptable nuisance. The adoption of noise reduction measures such as the use of quieter equipment, the erection of temporary screening, and the control of the number of plant in use at any one time, will ensure that construction noise does not exceed the target level of 75 dB(A).

Potential Impacts and Proposed Mitigation Measures during the Operation of the Restoration Works

The main activities during the operational period of the restoration works will be:

- the venting of LFG
- the periodic tankering of leachate

Landfill gas and odour

LFG will be released from passive gas vents within the landfill, around the boundary and along the perimeter venting trench. The proposed LFG management system will control lateral gas movement and direct gas emissions to vent stacks, thus providing protection to the proposed afteruse facilities. Long-term maintenance and monitoring of the venting trenches and vent pipes will be required.

LFG emitted from the proposed passive gas management system will not be a significant contributor to ambient levels of undesirable pollutants. Based on the modelling assumptions adopted the results indicate that after restoration, the air quality impacts from pollutants emitted from the passive vents on the proposed afteruse and sensitive receptors nearby will be within established

standards. Similarly, odour nuisance is not expected. Nonetheless the contractor will be required to carry out a detailed EIA to support his design of the restoration works.

Gas vent pipes will be installed as part of the passive LFG management system at locations away from the areas of the baseball activities. For a properly designed and operated gas management system this would not cause any LFG related odour impacts on the afteruse.

With proper design of the leachate collection tank, odour from the leachate management measures is not expected to be a concern to the proposed afteruse and adjacent sensitive receptors.

Water and leachate

Leachate interception and holding of leachate in a containment tank will substantially reduce the uncontrolled seepage of leachate into surface water, thereby resulting in improved local water quality. As the leachate tank will be underground and adequately bunded to contain any leakage or spillage, no adverse impacts on water quality are expected.

The proposed low intensity land use of the site will not involve any adverse impact on the adjacent water bodies, as proper sewage facilities will be provided to on-site buildings.

Dust

Operation of the restoration works will not result in any emissions of dust.

Noise

The only possible sources of noise from the operational activity will be from the periodic trips of a tanker to and from the leachate holding tank, which will not result in noise related nuisance.

Potential Impacts during Construction and Operation of the Preferred Afteruse Facilities

Construction impacts

Provided high standards of civil construction works are adopted, and precautions are taken to ensure that the restoration works are not damaged, the construction of the afteruse facilities is not expected to result in any adverse environmental impacts.

Operational impacts

Areas proposed for car parking on the landfill will be constructed with appropriate under-venting to ensure controlled dissipation of any LFG which migrates through the capping layer. The vegetated area of the baseball field will be similarly protected against any vertical gas migration. LFG protection measures such as gas barriers, underfloor void spaces and gas detection systems will be installed for buildings structures.

There should be no significant sources of noise associated with the development of the site as a baseball field. Any source of noise associated with this afteruse can be effectively mitigated using appropriate noise control measures on buildings such as acoustic insulation and screening, and using tree screening along the boundary of noise emitters.

Settlement

The proposed afteruse focuses on low intensity land use and no heavy structures are proposed to be built on-site. The small anticipated settlement will not affect the activities proposed.

Visual impact

Physical changes to this site due to afteruse development will not be noticeable from the outside. The overall visual impact is regarded as insignificant as the construction of the afteruse facilities is of a short-term and transitory nature. Following the completion of landscape and planting works, the visual quality of the site will be greatly improved.

Recommended Scope of the Detailed EIA

The following key issues are identified in the IEIA for further study in the detailed EIA to be undertaken by the contractor to ensure that the detailed design of the restoration works and afteruse comply with the appropriate environmental standards:

(i) *Air quality*

- Predictions of dust arisings and impact in the light of the detailed construction programme of the restoration works.
- An assessment on the possible impacts of gas emissions and odour impacts from passive LFG vents.
- Evaluation of the possible odour impacts at the proposed leachate holding tank.

(ii) *Water quality*

- Identification and evaluation of leachate generated from the landfill and wastewater produced from the restoration works with due consideration for adequate reception, handling, treatment and disposal.

(iii) *Noise*

- Evaluation of construction noise impacts by examining the plant items to be employed by the contractor.
- Assessment of noise impacts and development of mitigation measures if required on sensitive on-site and off-site receivers from the construction activities, and operation of LFG and leachate management systems.

(iv) *Environmental monitoring and audit*

- Confirmation of environmental monitoring and audit requirements arising from the feasibility study.

ON-GOING ENVIRONMENTAL MONITORING

Requirements for monitoring and audit during and after the restoration have been established as part of this study. Key environmental parameters of concern, leachate, surface and groundwater, LFG migration, LFG emissions, air quality and noise, should be regularly monitored to a prescribed schedule and established protocols. In addition, site stability and settlement should be monitored as part of the post-restoration audit programme.

The monitoring data collected by the restoration contractor should be audited by an independent body on a periodic basis, during and after the restoration works. Agreed action plans of mitigation measures should also be established in the event that trigger, action and target limits for key environmental parameters have been exceeded.

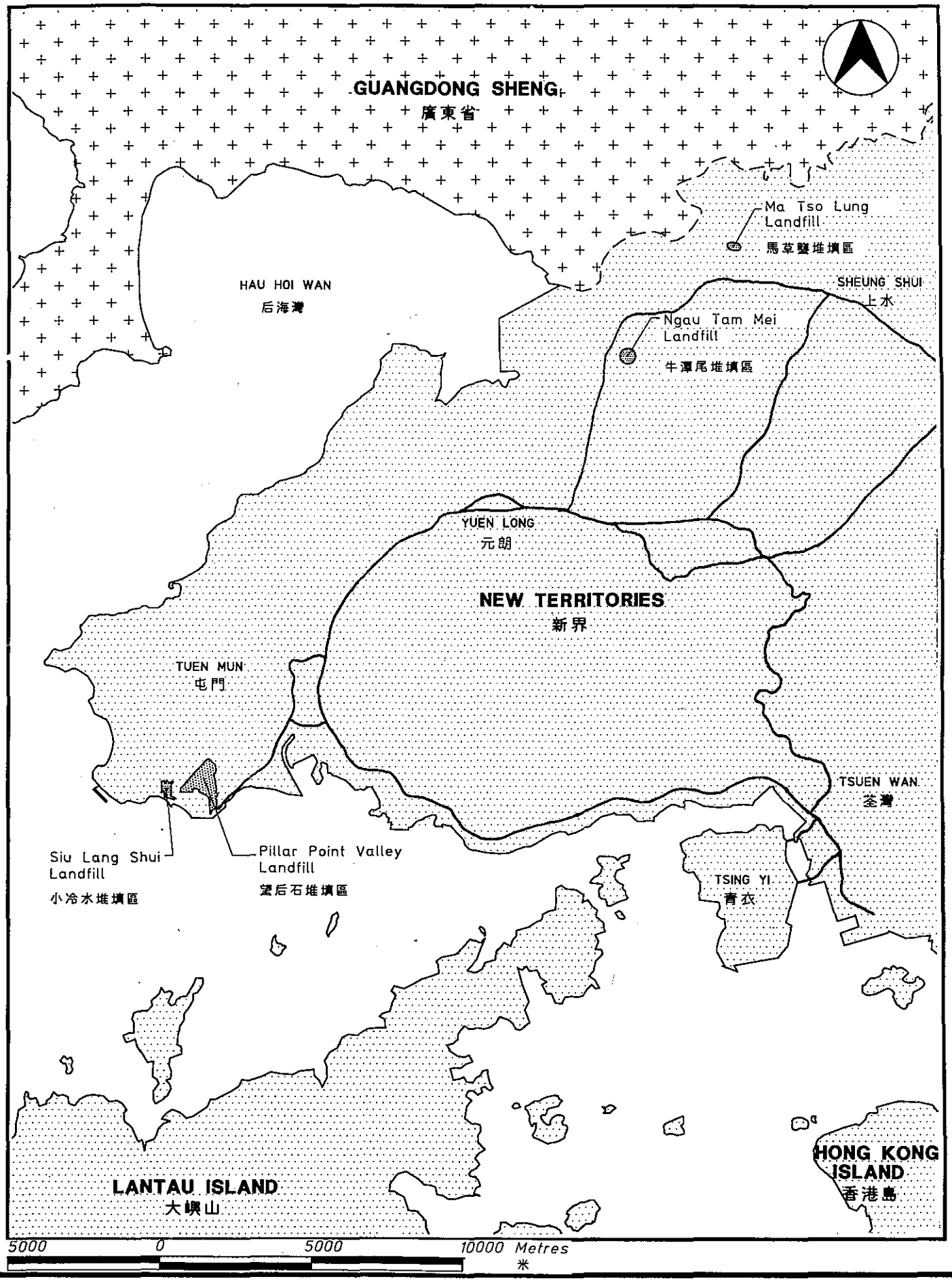
An additional monitoring programme should also be carried out before the restoration works are undertaken, to provide data for detailed design, and to establish baseline conditions prior to restoration in order to provide the necessary data to ensure suitable mitigation measures are implemented.

CONCLUSIONS

The IEIA has assessed the potential environmental impacts at each of the four landfills, on sensitive on-site and off-site receivers during the construction and operation phases of the restoration works and of the proposed afteruses, based on the conceptual design of the restoration works and afteruses and on limited data obtained during the feasibility study and in consideration of the preferred afteruse. Issues of concern are considered to be capable of being resolved, provided the recommended mitigation measures are adopted where required.

Based on general observations and provided that good construction practice is followed, the proposed restoration works should not cause undesirable ecological impacts at any of the four landfill sites. A detailed ecological impact assessment is recommended as part of the afteruse contracts for each site.

All mitigation measures and performance requirements identified as necessary for environmental protection will be incorporated into the tender documents for the design and construction of the restoration works, and the aftercare activities. Compliance with these measures and requirements will be a condition of the contract.

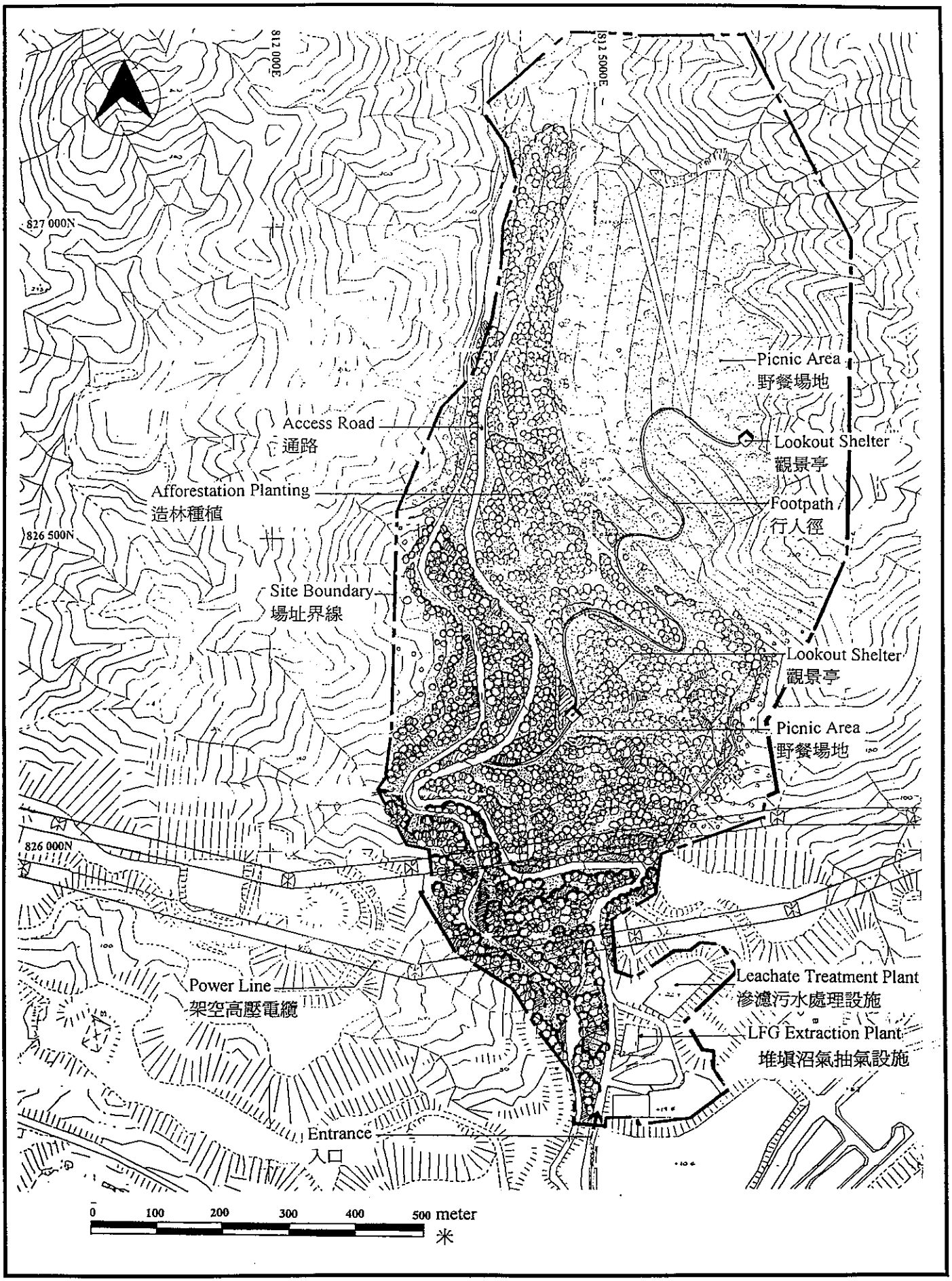


圖一

新界西北堆填區位置圖

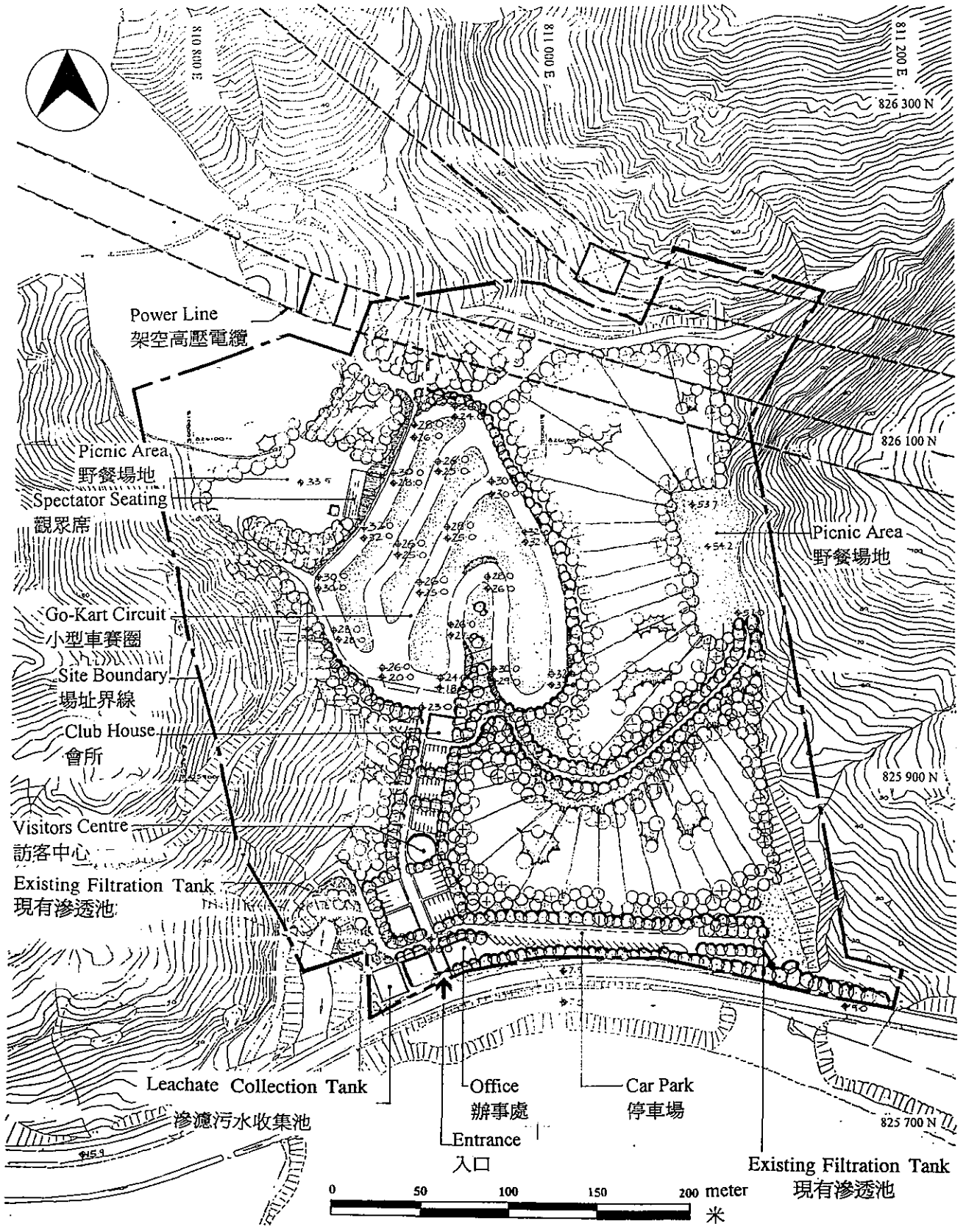
Figure 1

Location of North-West New Territories Landfills



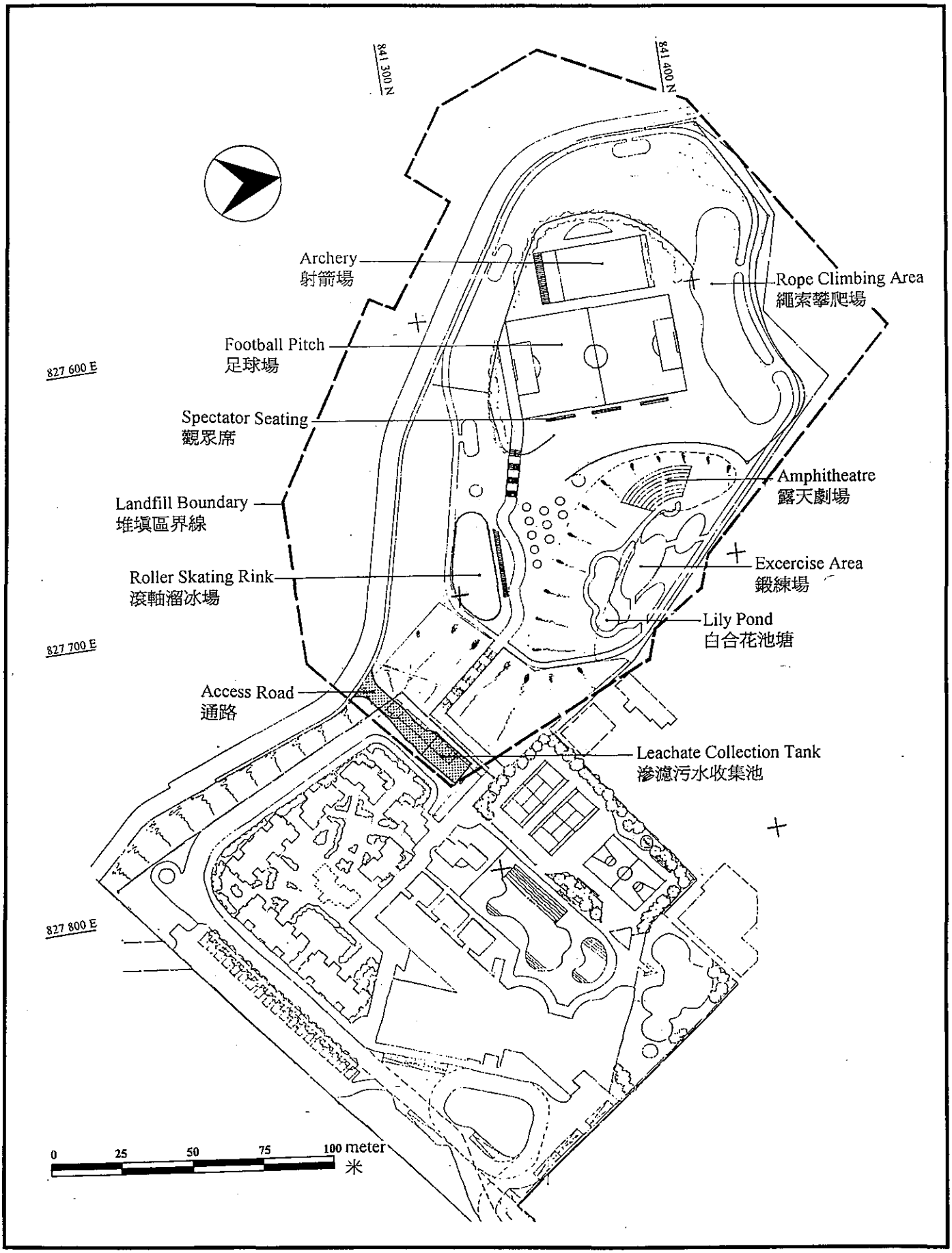
圖二
望后石堆填區
總發展藍圖

Figure 2
Pillar Point Valley Landfill
Master Development Plan



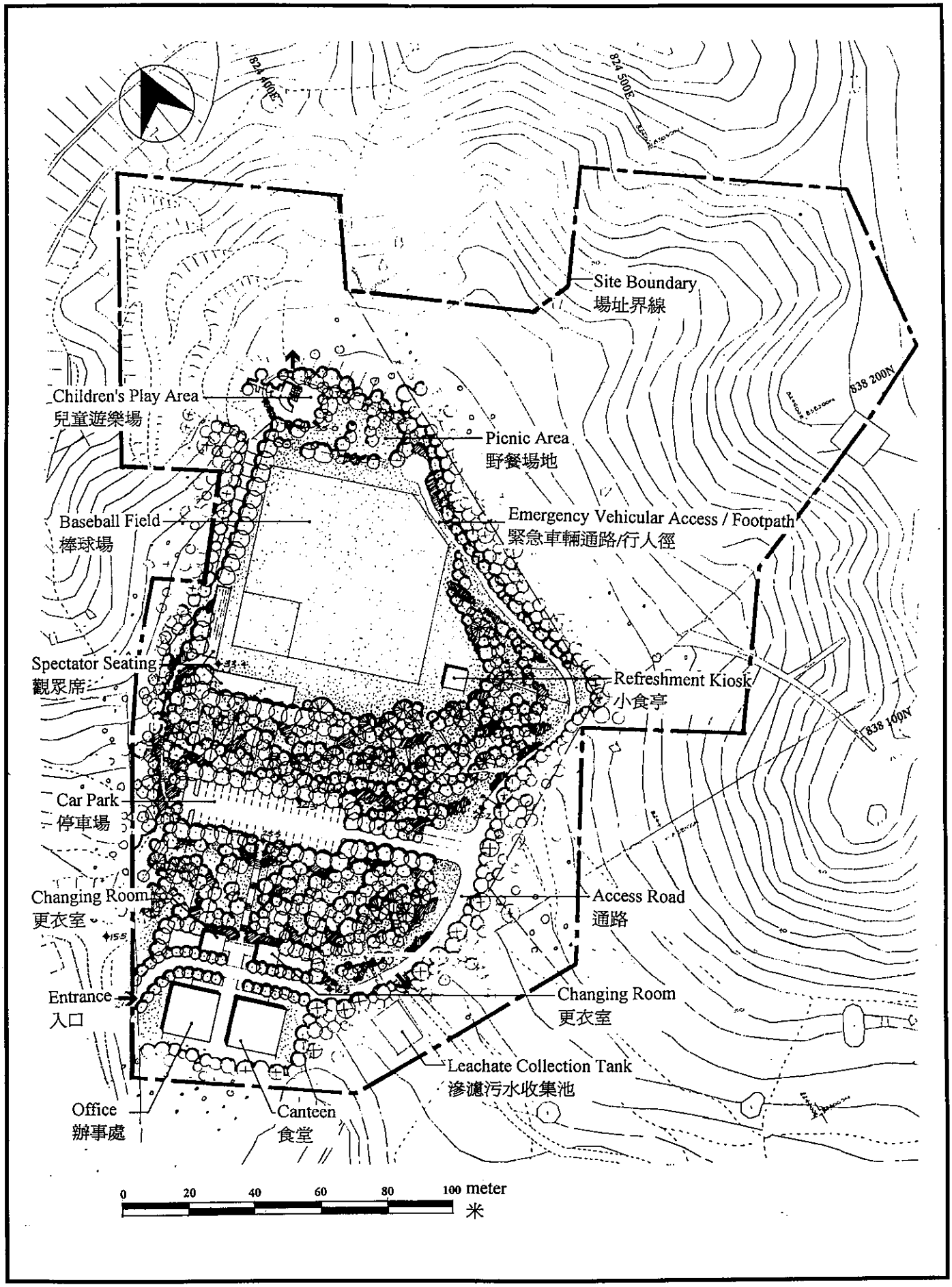
圖三
小冷水堆填區
總發展藍圖

Figure 3
Siu Lang Shui Landfill
Master Development Plan



圖四
馬草壟堆填區
總發展藍圖

Figure 4
Ma Tso Lung Landfill
Master Development Plan



圖五
牛潭尾堆填區
總發展藍圖

Figure 5
Ngau Tam Mei Landfill
Master Development Plan

新界西北堆填區修復研究
初步環境影響評估報告
摘要

一九九五年四月

引言

環境保護署十分重視修復舊堆填區的工作，視之爲改善香港環境的綜合策略其中一環。一九九二年十一月，環境保護署委任顧問公司，展開新界西北區四個堆填區的修復和修復後養護之研究。這四個堆填區分別爲：

- 望后石堆填區
- 小冷水堆填區
- 馬草壟堆填區
- 牛潭尾堆填區

除望后石堆填區仍將繼續運作幾年外，其餘三個堆填區均已關閉。各堆填區的位置見圖一。

這些堆填區和香港其他堆填區一樣，在關閉後並無用作任何用途。堆填沼氣會不斷散發入空氣中，而滲濾污水也會不斷向外流。廢物分解導致地面下陷，助長雨水滲透入廢物，導致更多堆填沼氣和滲濾污水產生。堆填沼氣發出惡臭，可令人缺氧窒息，在某個濃度時具有易燃特性，甚至會引起爆炸。滲濾污水是高度污染性液體，會污染堆填區附近的地面水及地下水。

爲修復堆填區至環境標準可接受情況以便用作社區或其他用途，顧問公司對每個堆填區由於堆填沼氣、滲濾污水和土地下陷等造成的影響均進行審查，並就每個堆填區的修復工程制定概念設計，以及就減少或限制潛在危害和空氣及水污染等措施提出建議。

本研究進行了初步環境評估，考慮了修復期間的環境影響和修復後的剩餘影響。初步環境評估除考慮了每個修復計劃的詳細潛在不良和有利影響外，還就修復期間的興建和運作階段之監察和審核提出建議。此外，鑒于最近一般均認爲也應探討有關的生態問題，因而本研究亦就此作出討論。

以下將會對建議中的修復計劃和環境評估作出敘述。雖然這些敘述和評估部分有相似之處，但會就該四個堆填區進行個別探討。

望后石堆填區

當地環境及堆填區歷史

望后石堆填區是一個運作中的廢物堆填區，位於屯門西外圍的「綠化地帶」。堆填區座落於一個很深和陡峭的山谷內，原來流經山谷的溪流已經改道至環繞堆填區。堆填區在充分發展後其覆蓋面積可達五十三公頃，其北部延展至英軍操炮區，而在堆填區的南面則是望后石越南難民營和一個臨時貨柜存放場。海岸線距堆填區南部僅約五百米。

該地區計劃中的基礎建設發展項目包括在堆填區以南填海土地上的一個特別工業區和內河貨運碼頭。此外，亦曾建議興建一條架空雙程三線分隔主幹路以及輕便鐵路支線，跨越堆填區的南部。

堆填區自一九八三年開始運作，現時共接收了約七百萬噸主要爲住宅、工業和建築廢物。爲增加堆填區的容量，政府曾進行若干發展工程，以便繼續運作多幾年。

該堆填區自啓用以來已建有排水系統，分開收集地面水、地下水和滲濾污水。此外，在堆填區底部部分地方舖設了一層墊料，其設計在過去幾年來已有所改進。目前而言，收集到的滲濾污水會不經處理而通過管道送往鄰近的望后石污水處理廠棄置，並在最近安裝了堆填沼氣通氣設施。

修復工程建議

該場址的優選土地再用方案爲在山坡和較高的地台上種植樹木，附設公眾小徑，作爲靜態康樂活動用途。圖二爲有關的概念修復設計。建議作出以下的工程以修復本堆填區：

- 在現時的臨時土壤覆蓋一層上舖設一層最後覆蓋層
- 在修復表面上噴草和植樹
- 建造一套動態的堆填沼氣抽氣系統
- 建造一組滲濾污水處理設施

修復工程興建期間的預期影響及緩解措施建議

堆填沼氣及氣味

建議的動態堆填沼氣抽氣系統連同覆蓋層應同時建造，以解除堆填區內累積的沼氣壓力，以及防止沼氣橫向擴散至區外。

建築及挖土期間所釋放的堆填沼氣，可能會在通風較差的地方例如沙井和地盤辦事處積聚，構成潛在危險。透過良好的地盤管理、檢測設備的使用以及在工作地方裝設妥善的通風設施等，即可避免這項潛在危險。堆填沼氣的排放，亦可構成難聞的氣味滋擾。修復期間由於堆填區內的建造活動，或會出現堆填沼氣短期直接擴散至空氣中的情況，特別是廢物曝露的時候。興建期間因堆填沼氣直接排放而產生的影響可透過適當的緩解措施予以減少，例如避免大量廢物直接曝露以及對新修復地區上過多的行走車輛作出控制等。除此以外，還將使用臨時覆蓋物覆蓋暴露廢物，以及將任何必要的臨時堆存廢物遠離易受影響的地方。

建造活動不會導致堆填沼氣的釋放增多，因而預計不會有重大的環境影響。

水及滲濾污水

望后石堆填區對其南面的海水質素並無任何影響，而區外亦沒有任何地下水污染的現象。不過，堆填區南面的地面水卻受到污染。現時共同排放至鄰近望后石污水處理廠的堆填區滲濾污水及污染地下水，很多時侯都不符合法定標準，因而在將來需要興建一組滲濾污水處理設施。

該滲濾污水處理設施將在現場興建，並可接收來自例如小冷水堆填區的其他堆填區之滲濾污水。滲濾污水將處理至符合法定標準，然後排放往望后石污水處理廠。地面排水系統將分段建造，以控制徑流和沖蝕情況。

在覆蓋好的堆填區上廣泛種植的樹木，將加強蒸發作用從而減少堆填區上的有效雨水量(即滲透和徑流)，更進而減少堆填區所產生的滲濾污水量。

建造活動將不會對水質有嚴重影響。

塵埃

覆蓋層的建造將涉及大量搬運泥土的活動，需要採取塵埃控制及緩解措施，以確保不會對鄰近最易受影響的越南難民營造成滋擾。這包括地面洒水、控制車輛速度和流量、在實際可行的情況下爲儲存的堆填物加上側邊圍板和覆蓋物，以及對任何同時進行建造工程的面積作出限制。根據模擬結果顯示，建造工程所排放的塵埃遠遠低於有關聯的空氣質素標準。

噪音

現時該地區的主要噪音來源均與堆填區的運作以及附近的貨柜存放場有關。最近的噪音敏感地方是越南難民營。不過，滲濾污水和堆填沼氣控制措施的建造，不會涉及大量的泥土搬運活動，因而估計不會有太多噪音來自這些來源。

然而，建造覆蓋層時卻會涉及十分大量的泥土搬運活動，因而將使用諸如滅音裝置、興建臨時隔音屏，以及控制在任何同一時間內使用機械數量等的減低噪音設施，以確保建築噪音不會超越75分貝(A)的目標水平。

修復設施運作期間的預期影響及緩解措施建議

修復設施運作期間的主要活動將爲如下：

- 抽取和燃燒堆填沼氣
- 處理和排放滲濾污水

堆填沼氣及氣味

運作期間，可透過動態堆填沼氣抽氣系統以高溫火焰將堆填沼氣直接燒掉或直接用作能源生產用途，從而對堆填沼氣作出控制。按照模擬結果顯示，如使用火焰系統，其廢氣將不會超越空氣質素標準。儘管如此，承辦商仍需進行詳盡的環境影響評估，爲其堆填沼氣管理工程設計提供支持。

鑒於堆填沼氣的燃燒廢氣中仍可能存有香港空氣質素標準中沒有包括的其他污染物，爲謹愼起見，有必要限制公眾人士走近燃燒範圍約五十米半徑以內的地方。這項限制應予以實施，直至承

辦商能証明火焰燃燒時排出的氣體對於人體是安全的。如用高標準的火焰燃燒，排放的污染物很可能會低至不需要限制公眾人士接近。

堆填沼氣的氣味，可透過建議中的動態抽取堆填沼氣系統和燃燒堆填沼氣而予以緩解。根據現有資料，模擬假設及其後之結果，燃燒堆填沼氣所產生的廢氣，將不會構成氣味。

建議中的滲濾污水處理設施不大可能會引起任何氣味問題，因爲所提議的耗氧生物處理程序將會氧化可能帶有氣味的化合物。

水及滲濾污水

最終的地面水排水系統，其設計應足以確保不會從堆填區接收任何污染水。該系統將不會對現時堆填區南面的溪流水道造成任何不良的環境影響。

修復設施的運作將不會導致有水排放至地下水或海水。

滲濾污水處理設施的設計和運作，將足以確保污水符合法定標準，然後再排放往望后石污水處理廠。

塵埃

修復設施的運作不會導致塵埃飛揚。

噪音

在修復堆填區後以及滲濾污水和堆填沼氣控制措施進行運作後，即須採用噪音減低措施例如使用屏障或滅音裝置等，以確保符合有關的噪音標準，特別是在實施土地再用計劃後和修復後護養期間，越南難民營只要繼續運作，將仍爲噪音敏感地方。土地再用設施將不會受到建議中的滲濾污水及堆填沼氣控制措施的噪音影響。

興建及運作土地再用設施期間的預期影響

興建期間的影響

只要採用高水平的建造工程，並採取預防措施，以確保不會損壞修復設施，土地再用設施的建造預計將不會造成任何重大的不良環境影響。興建土地再用設施期間的景觀影響將會是短期和暫時性的。

運作期間的影響

建議中的土地再用方案對環境將不會有不良影響，反之，土地再用方案的選擇和設計應該對環境有重大改善，並且只要這方案(以一個有多年歷史的堆填區來說)是實際可行，它應該給社區提供益處。該土地再用設施的運作將不會造成諸如水、空氣、塵埃或噪音等的不良環境影響。

沉陷

優選土地再用方案著重於低密度土地使用，修復後的堆填區之預期未來土地下陷情況，將不會對建議中的活動有所影響。此方案並無建議在堆填區內興建任何建築物。

景觀影響

在完成土地美化及種植樹木後，該地區的景觀美化價值將大爲提高。

高壓電纜

現有的高壓電纜不會構成任何可察覺的危險，因爲其附近不會興建任何主要建築物。

詳細環境影響評估範圍建議

下列各主要問題已在初步環境評估中確定，以便由承辦商作出的詳細環境影響評估就此進一步研究，以確保修復工程和土地再用方案的詳細設計能符合相應的環境標準。

(i) 空氣質素

- 需要對火焰廢氣(包括但不限於致癌物質)的可能影響作出評估，以對望后石堆填區的動態堆填沼氣抽氣設施之火焰設計提供支持。
- 對望后石堆填區建議中的滲濾污水處理設施可能造成的氣味影響進行評估。
- 根據修復工程的詳細建造計劃，預測塵土飛揚的情況及影響。

(ii) 水質

- 確認和評估堆填區所產生的滲濾污水以及修復工程所造成的廢水，並適當考慮有否充分接收、處理和棄置。

(iii) 噪音

- 檢查承辦商所使用的機械，藉以評估興建期間噪音影響。
- 評估建造活動及堆填沼氣和滲濾污水管理系統的運作對區內和區外噪音敏感地方的噪音影響，並在有需要時制定緩解措施。

(iv) 環境監察及審核

- 確認可行性研究中提出的環境監察及審核規定。

小冷水堆填區

當地環境及堆填區歷史

小冷水堆填區爲已關閉的廢物堆填區，位於屯門西面的偏遠地方及望后石堆填區以西約一點五公里。它於一九七八至一九八三年間運作，共接收了一百二十萬噸主要爲住宅、工業及建築廢物，以及焚化爐灰燼和多種特殊廢物。

該堆填區面積約爲十二公頃，屬山谷堆填方式。原山谷內的小溪已包涵於一條暗渠內，并置於廢物下面。墊料上和下面分別舖設了滲濾污水和地下水收集系統。滲濾污水原來是排往兩個設有滲水系統的滲透池，但最近滲濾污水似乎排往第三個滲透池。受污染的地下水先排往溪流再流入南面僅約一百二十米外的海灘。

和望后石堆填區一樣，該地區計劃中的基礎建設發展項目包括在堆填區以南填海土地上的一個特別工業區和內河貨運碼頭。此外，亦曾建議興建一條架空雙程三線分隔主幹路以及輕便鐵路支線，跨越堆填區的南部。

政府建議該場址用作郊野保護地區。它擁有劃一的陡峭山坡和三個平台。一九八七年栽種的樹苗現時已良好生長，形成自然綠化的山坡景觀，與較高和較少樹木的山坡融爲一體。

修復工程建議

在衡量多種土地再用方案的可能性和限制後，建議中的土地再用方案爲小型賽車場及有關設施例如觀眾看台、供賽車維修的建築物以及停車場等。提出該土地再用方案的目的，是用以滿足此項確有所需但卻難以尋找適當場地的娛樂活動之需要。亦建議設置野餐場地，但禁止野火燒烤。現有的樹木在修復期間將盡可能予以保護。然而，未來的基礎建設發展將會對此造成一些影響。圖三爲其概念設計。建議應作出下列工程以修復本堆填區：

- 盡可能保護現有樹木
- 修復現有的堆填沼氣通氣管
- 安裝額外的堆填沼氣通氣管，特別是沿著場址界線
- 沿著南面邊界建造一條堆填沼氣通氣坑
- 如有需要，阻截滲濾污水和污染地下水，再沿著龍門路泵往望后石堆填區的滲濾污水處理設施。

修復工程興建期間的預期影響及緩解措施建議

堆填沼氣及氣味

興建期間由於堆填區內的活動，或會出現堆填沼氣短期直接擴散至空氣中的情況，特別是廢物曝露的時候。因此等排放而產生的影響可透過適當的緩解措施予以減少，例如避免大量廢物直接曝露以及對新修復地區上過多的行走車輛作出控制等。

建造活動不會導致堆填沼氣的釋放增多，因而預計不會造成重大的空氣環境影響。

水及滲濾污水

建議中的控制滲濾污水排放建造工程，包括修復現時的收集水池(或如現有水池無法修補，以新的替換或加建水池)，以及沿著龍門路建造一條水管。如進一步的研究和監察顯示有需要沿著堆填

區整個南面邊沿裝設阻截系統，這將與堆填沼氣通氣坑槽結合。該等建造工程將不會對水質造成任可不良影響。

塵埃

鑒於砍伐現有的樹木和裝置新的堆填區覆蓋層既無必要亦不適當，因而在小冷水堆填區的修復工程將不會成爲主要潛在塵埃影響的來源。建造其他修復設施的工程面積將會很小，從而確保了限制大量塵埃擴散的潛在可能。儘管如此，仍應採取緩解措施，包括地面洒水、控制車輛速度和流量、在實際可行的情況下爲儲存的堆填物加上側邊圍板和覆蓋物，以及對任何同時進行建造工程的面積作出限制。

噪音

現時該地區的主要噪音來源爲場址西面的踏石角發電廠、道路交通和間中經過的飛機。附近並無噪音敏感地方。與修復有關的建築工程亦會很少，因而所導致的噪音影響僅屬有限。

景觀影響

由於場址三面被山圍繞，而南面亦擁有高聳樹木構成厚厚的屏障，修復時的景觀影響可謂很少。

修復設施運作期間的預期影響及緩解措施建議

與修復設施持續運作有關唯一可能造成環境影響的因素包括如下：

- 堆填沼氣的排放
- 滲濾污水的泵離

堆填沼氣及氣味

堆填沼氣將從堆填區內的靜態通氣管和沿著四周及南面邊沿的通氣坑槽釋放出來。建議中的堆填沼氣管理系統將控制堆填沼氣的橫向流動，并將堆填沼氣引導往通氣處，從而爲建議中的土地再用方案設施提供保障。通氣坑槽及通氣管將需要進行長期維修和監察。

從建議中的靜態堆填沼氣管理系統所排放的堆填沼氣中的污染物，將不會導致周圍空氣質素下降。根據模擬結果顯示，修復後從靜態排氣管所釋放出來的污染物對建議中的土地再用方案及其他鄰近的特別工業區所造成的空氣質素影響是在已確立的標準之內，而因氣味造成的滋擾亦同樣地預期不會產生。不過，承辦商將需要進行詳盡的環境影響評估，爲其修復工程設計提供支持。

水及滲濾污水

在完成爲滲濾污水和污染地面水作好阻截、收集、處理及棄置等長期安排後，海灘和地下水的持續污染問題將可解決。建議中的低密度土地用途將不會對鄰近的水體造成任何重大影響。

小冷水堆填區的滲濾污水和污染水將透過水管泵往望后石堆填區，以在該區建議中的滲濾污水處理設施進行處理。往望后石污水處理廠的排放將符合法定標準。

塵埃

修復設施的運作將不會導致塵埃飛揚。

噪音

唯一可能產生噪音的修復設施運作活動，將來自連接望后石堆填區的滲濾污水管上之小型水泵。由於它們將位於龍門路旁，比起交通噪音其發出的噪音僅屬微不足道。

興建和運作土地再用設施期間的預期影響

興建期間的影響

只要採用高水平的建造工程，並在如有任何小規模地形重整穿越現有覆蓋層時採取預防措施，土地再用設施的建造預計將不會造成任何重大的不良環境影響。

運作期間的影響

小型賽車活動的環境影響唯一可能構成滋擾的是噪音，但所增加的噪音水平將是短暫的，應該不成問題，因爲現時附近只有很少易受影響的地方。爲進一步減少與土地再用方案有關的噪音影

響，場址內的建築物將位於較不受影響的地方，並在可能情況下種植樹木作爲屏障。

沉陷

按照建議中的土地再用方案，場址內只有小部分面積將用作興建建築物。堆填區預期將只有輕微的土地下陷，對建議中的活動將無關重要。透過使用柔性鋪設材料及柔性路面排水溝渠，以及在可能情況下將建築物興建於原來地面之上，將可進一步減少因土地下陷而可能帶來的問題。

景觀影響

小型賽車場將弄平中央一幅土地，但對景觀的影響亦屬有限。整體而言，該區的景觀美化價值將在修復後進一步增強。

高壓電纜

由於高壓電纜遠離堆填區，因鄰近高壓電纜而帶來的健康危害遂無關痛癢。再者，按照土地再用方案的性質，公眾人仕暴露於高壓電纜下將會是短期和暫時性的。至於興建在地面上的建築物，將會與高壓電纜保持充分距離。

詳細環境影響評估範圍建議

下列各主要問題已在初步環境評估中確定，以便由承辦商作出的詳細環境影響評估就此進一步研究，以確保修復工程和土地再用方案的詳細設計能符合相應的環境標準。

(i) 空氣質素

- 根據修復工程的建造計劃，預測塵土飛揚的情況及影響。
- 評估靜態堆填沼氣通氣管之沼氣排放的可能影響以及氣味影響。
- 評估在小冷水堆填區建議中的滲濾污水儲水池可能造成的氣味影響。

(ii) 水質

- 確認和評估堆填區所產生的滲濾污水以及修復工程所造成的廢水成份，並適當考慮有否充分接收、處理和棄置。

(iii) 噪音

- 檢查承辦商所使用的機械，藉以評估興建期間噪音影響。
- 評估建造活動及堆填沼氣和滲濾污水管理系統的運作對區內和區外噪音敏感地方的噪音影響，並在有需要時制定緩解措施。

(iv) 環境監察及審核

- 確認可行性研究中提出的環境監察及審核規定。

馬草壟堆填區

當地環境及堆填區歷史

馬草壟堆填區位於白石坳北部，鄰近邊界禁區，是一個面積約爲二公頃的已關閉堆填區。堆填區東面爲運動場，另在北面有少數村屋和一個果園。一九七六至一九七九年間，該堆填區共接收了不超過二十萬噸的住宅、工業及商業廢物。

堆填區原先位於一個小山谷內。堆填區的底部鋪設了一層低級墊料，在橫跨最低地區建造了一條堤壆，以及在區內採用噴射混凝土。滲濾污水和地下水乃分開收集。現時該堆填區並無修復，也無覆蓋層，堆填沼氣的排氣管道僅屬有限，而污水滲濾亦沒有控制。在過去只曾作出很少的坡度重整工作。

修復工程建議

該堆填區現時由政府租予經營堆填區東面運動場之展能運動村。不過，按照現時展能運動村與東華三院磋商的一項換地建議，修復後的堆填區和運動場將發展爲渡假營，大多數營房設施將位於堆填區範圍以外。圖四是渡假營建築師所提供的概念設計。

建議作出以下工程以修復本堆填區：

- 重整堆填區斜坡地形，以改善穩定程度以及符合土地再用需要。
- 鋪設一層新的覆蓋層，以減少雨水的滲透和滲濾污水的產生。

- 在堆填區內建造堆填沼氣通氣管，以及沿著場址界線建造屏障。
- 建造滲漏污水阻截排放設施，以及一個滲濾污水儲水池。
- 定期泵走滲濾污水，以作區外處理和棄置。

修復工程興建期間的預期影響及緩解措施建議

堆填沼氣及氣味

重整地形和覆蓋工程期間，由於堆填區內的建造活動，或會出現堆填沼氣短期直接擴散至空氣中的情況，特別是廢物曝露的時候。興建期間因堆填沼氣直接排放而產生的影響可透過適當的緩解措施予以減少，例如避免大量廢物直接曝露以及對新修復地區上過多的行走車輛作出控制等。除此以外，還將使用臨時覆蓋物覆蓋曝露廢物，以及將任何必要的臨時堆存廢物遠離易受影響的地方。

水及滲濾污水

重整坡度、覆蓋層和滲濾污水堵截工程很可能導致滲濾污水暫時性增加，因而應先實行滲濾污水收集措施。此外，亦將採取措施以控制徑流內的沉澱物。

塵埃

據預計空氣模擬研究顯示，這一細小堆填區的修復工程應該不會導致超逾空氣質素標準的塵埃濃度。儘管如此，透過緩解措施例如地面洒水、控制車輛速度和流量、在實際可行的情況下爲儲存的堆填物加上側邊圍板和覆蓋物，以及將在同一時間所進行工程的面積作出限制等，將可確保把累積廢埃影響維持於最低水平以內。

噪音

建議中的修復工程將涉及很少的建築機械，以及預計只在日間進行。目前而言，只有很少容易對堆填區噪音敏感的地方。透過使用減低噪音措施，可將建築噪音降至已確立的水平以內。將使用諸如滅音裝置、興建臨時隔音屏，以及控制在任何同一時間內使用機械數量等的減低噪音設施，以確保建築噪音不會超越75分貝(A)的目標水平。

修復設施運作期間的潛在影響及緩解措施建議

修復設施運作期間的主要活動包括如下：

- 堆填沼氣的排放
- 將滲濾污水定期以水車運走

堆填沼氣及氣味

堆填沼氣將從堆填區內和四周的靜態通氣管以及沿著其邊沿的通氣坑槽排放。建議中的堆填沼氣管理系統將控制了堆填沼氣的橫向流動，將排放氣體引導至通氣管組，從而爲建議中的土地再用設施提供保障。需要對通氣坑槽和通氣管進行長期維修和監管。

從建議中的靜態堆填沼氣管理系統所排放的堆填沼氣中的污染物，將不會導致周圍空氣質素下降。根據模擬結果顯示，修復後從靜態排氣管所釋放出來的污染物對建議中的渡假營及其他鄰近易受影響的地方所造成的空氣質素影響是在已確立的標準之內，而因氣味造成的滋擾亦同樣地預期不會產生。不過，承辦商將需要進行詳盡的環境影響評估，爲其修復工程設計提供支持。

作爲靜態堆填沼氣管理系統一部分的排氣管，將安裝於遠離大部分渡假營活動的地點，而且，在妥善設計和運作堆填沼氣管理系統下，土地再用方案將不會因堆填沼氣而受到氣味影響。

透過滲濾污水儲水池的妥善設計，預計來自滲濾污水管理措施的氣味將不會對建議中的土地再用方案和鄰近易受影響的地方構成關注。

水及滲濾污水

修復完成後，現時沒有控制地流往鄰近低地和河流的滲濾污水將不會出現，整體改善了運動場的情況和河流水質。在充分防止了滲濾污水儲水池有任何漏水或滿溢的情況下，預期將不會有任何水質影響。

塵埃

修復設施的運作將不會導致塵埃飛揚。

噪音

修復設施運作活動的唯一可能噪音來源將來自定期往返滲濾污水儲水池的水車，而這將不會構成噪音滋擾。

興建和運作土地再用設施期間的預期影響

興建期間的影響

只要採用高水平的建造工程，並採取預防措施以確保不會損壞修復設施，土地再用設施的建造預計將不會造成任何重大的不良環境影響。

運作期間的影響

堆填區將來所建的渡假營，不應成爲任何重大的噪音來源。與該土地再用方案有關的任何噪音來源，均可透過採用適當的減低噪音措施而有效地予以緩解，例如建築物的隔聲裝置及隔音屏以及在發出噪音的地方周圍栽種樹木作爲屏障等。

沉陷

建議中的土地再用方案著重於低密度的土地使用，並無建議在堆填區內興建任何重型建築物。預期土地下陷的情況對建議中的活動不會構成影響。

景觀影響

完成重整坡度、重新覆蓋和種植植物後，堆填區的景觀會大爲改善，設施應設計爲與風景地形融爲一體，和諧一致。

詳細環境影響評估範圍建議

下列各主要問題已在初步環境評估中確定，以便由承辦商作出的詳細環境影響評估就此進一步研究，以確保修復工程和土地再用方案的詳細設計能符合相應的環境標準。

(i) 空氣質素

- 根據修復工程的詳細建造計劃，預測塵土飛揚的情況及影響。
- 評估靜態堆填沼氣通氣管之沼氣排放的可能影響以及氣味影響。
- 評估建議中的滲濾污水儲水池可能造成的氣味影響。

(ii) 水質

- 確認和評估堆填區所產生的滲濾污水以及修復工程所造成的廢水成份，並適當考慮有否充分接收、處理和棄置。

(iii) 噪音

- 檢查承辦商所使用的機械，藉以評估興建期間噪音影響。
- 評估建造活動及堆填沼氣和滲濾污水管理系統的運作對區內和區外噪音敏感地方的噪音影響，並在有需要時制定緩解措施。

(iv) 環境監察及審核

- 確認可行性研究中提出的環境監察及審核規定。

牛潭尾堆填區

當地環境及堆填區歷史

牛潭尾堆填區是一個只有二公頃的已關閉堆填區，位於元朗東北部新界環迴公路旁，並鄰近一個大型住宅發展項目。

該堆填區已修復爲一連串的平台。圍繞著的山坡長滿樹木和灌木叢。雖然場址在關閉後沒有進行植樹計劃，但本身卻自行生長了稀疏植物。

一九七三年至一九七五年間，共接收了約三萬噸主要爲住宅及工業廢物。不過，該堆填區在有任何記錄前已用作棄置廢物，以致總廢物接收量並

不清楚。場址位於一個小山谷內。此堆填區並無鋪設底墊，但有裝設滲濾污水排水管于廢物堆內。

該堆填區並無裝設堆填沼氣排氣管。堆填區上面覆蓋了一層已壓實的由花崗岩風化而成的泥土覆蓋層，其狀況似乎良好。

修復工程建議

優選的土地再用方案爲棒球場及其有關的建築設施，而這些設施主要位於場址的下半部。圖五爲其概念設計。

建議應作出下列工程以修復本堆填區：

- 盡可能保護現有樹木。
- 在廢物堆內安裝通氣管，以及沿著場址界線裝設附有氣井的通氣坑槽。
- 改善滲濾污水和污染水的表面排放，並引導往儲水池。
- 定期泵走池內的水，以作區外處理和棄置。

修復工程興建期間的預期影響及緩解措施建議

堆填沼氣及氣味

目前並無任何重建覆蓋層的建議，因此，在修復工程興建期間的泥土搬運活動應該不會引致堆填沼氣的大量釋放。

水及滲濾污水

在進行滲濾污水阻截工程前，由於這些工程將導致滲濾污水暫時性增加，因而應先作好滲濾污水儲存和棄置安排。此外，亦將採取緩解措施以控制興建期間的滲濾污水滲透情況和徑流內的沉澱物。

塵埃

據預計空氣模擬研究顯示，這一細小堆填區的修復工程應該不會導致超逾空氣質素標準的塵埃濃度。儘管如此，還需採取緩解措施，以進一步減少塵埃對鄰近土地使用者的滋擾。該等措施包括地面洒水、控制車輛速度和流量、在實際可行的情況下爲儲存堆積物加上側邊圍板和覆蓋物，以及將在同一時間所進行工程的面積作出限制等。

噪音

現時噪音的主要來源爲附近的新界環迴公路之路面交通。修復工程將涉及很少的泥土搬運活動，因此建築噪音的增加應不重要。目前而言，場地周圍一百米內並無噪音敏感的地方，暫時顯著增加的建築噪音不應造成難以接受的滋擾。而且，將使用諸如滅音裝置、興建臨時隔音屏，以及控制在任何同一時間內使用機械數量等的減低噪音設施，以確保建築噪音不會超越75分貝(A)的目標水平。

修復設施運作期間的預期影響及緩解措施建議

修復設施運作期間的主要活動包括如下：

- 堆填沼氣的排放
- 將滲濾污水定期以水車運走

堆填沼氣及氣味

堆填沼氣將從堆填區內和四周的靜態通氣管以及沿著場址界線的通氣坑槽排放。建議中的堆填沼氣管理系統將控制了堆填沼氣的橫向流動，將排放氣體引導至通氣管組，從而爲建議中的土地再用設施提供保障。需要對通氣坑槽和通氣管長期維修和監管。

從建議中的靜態堆填沼氣管理系統所排放的堆填沼氣中的污染物，將不會導致周圍空氣質素下降。根據模擬結果顯示，修復後從靜態排氣管所釋放出來的污染物對建議中的土地再用方案及其他鄰近易受影響的地方所造成的空氣質素影響是在已確立的標準之內，而因氣味造成的滋擾亦同樣地預期不會產生。不過，承辦商將需要進行詳盡的環境影響評估，爲其修復工程設計提供支持。

作爲靜態堆填沼氣管理系統一部分的排氣管，將安裝於遠離棒球活動的地點。而且，在妥善設計和運作堆填沼氣管理系統下，土地再用方案將不會因堆填沼氣而受到氣味影響。

透過滲濾污水儲水池的妥善設計，預計來自滲濾污水管理措施的氣味將不會對建議中的土地再用方案和鄰近易受影響的地方構成關注。

水及滲濾污水

對滲濾污水的阻截和以密封水池裝載滲濾污水的做法，將大爲減少滲濾污水滲入地面水，從而改善了當地水質。由於滲濾水池位於地下並充分密封以防止任何漏水或滿溢，預期將不會有任何水質影響。

堆填區建議中的低密度土地用途將不會對鄰近水體有任何重大影響，因爲區內的建築物將設有妥善的污水排放設施。

塵埃

修復設施的運作將不會導致塵埃飛揚。

噪音

修復設施運作活動的唯一可能噪音來源將來自定期往返滲濾污水儲水池的水車，而這將不會構成噪音滋擾。

興建和運作土地再用設施期間的預期影響

興建期間的影響

只要採用高水平的建造工程，並採取預防措施以確保不會損壞修復設施，土地再用設施的建造預計將不會造成任何重大的不良環境影響。

運作期間的影響

堆填區上所建議的停車場，將建造適當的地下通風系統，以確保任何透過覆蓋層擴散的堆填沼氣受到控制。棒球場的綠化地方亦會有類似的保護措施，以防止任何堆填沼氣垂直擴散。建築物將裝置堆填沼氣保障措施例如堆填沼氣屏障、地板下面設疏氣空間以及堆填沼氣探測系統等。

堆填區用作棒球場不應成爲任何重大的噪音來源。與該土地再用方案有關的任何噪音來源，均可透過採用適當的減低噪音措施而有效地予以緩解，例如建築物的隔聲裝置及隔音屏以及在發出噪音的地方周圍栽種樹木作爲屏障等。

沉陷

建議中的土地再用方案著重於低密度的土地使用，並無建議在堆填區內興建任何重型建築物。預期少許的土地下陷情況對建議中的活動不會構成影響。

景觀影響

該堆填區在發展土地再用方案期間的外在改變，從外面看會難以察覺。由於修復工程的建造爲短期及臨時性質，對整體景觀的影響不會很大。完成園林和種植工作後，該場址的景觀將會大爲改善。

詳細環境影響評估範圍建議

下列各主要問題已在初步環境評估中確定，以便由承辦商作出的詳細環境影響評估就此進一步研究，以確保修復工程和土地再用方案的詳細設計能符合相應的環境標準。

(i) 空氣質素

- 根據修復工程的詳細建造計劃，預測塵土飛揚的情況及影響。
- 評估靜態堆填沼氣通氣管之沼氣排放的可能影響以及氣味影響。
- 評估建議中的滲濾污水儲水池可能造成的氣味影響。

(ii) 水質

- 確認和評估堆填區所產生的滲濾污水以及修復工程所造成的廢水成份，並適當考慮有否充分接收、處理和棄置。

(iii) 噪音

- 檢查承辦商所使用的機械，藉以評估興建期間噪音影響。
- 評估建造活動及堆填沼氣和滲濾污水管理系統的運作對區內和區外 噪音敏感地方的噪音影響，並在有需要時制定緩解措施。

(iv) 環境監察及審核

- 確認可行性研究中提出的環境監察及審核規定。

持續環境監察

在本研究的其中一部分，顧問公司已確立修復期間及其後的環境監察及審核規定。對於滲濾污水、地面和地下水、堆填沼氣的擴散、堆填沼氣的排放、空氣質素及噪音等的主要環境參數，會按照規定程序表和已確立的草案定期監察。此外，還將監察堆填區的穩定性和土地下陷情況，作爲修復後審核計劃的一部分。

由修復承辦商收集的監察數據，應由一個獨立組織在修復期間及其後定期審核。另外，亦應制定實施緩解措施的行動計劃，以備在主要環境參數超越了戒備、行動及目標界線時之需。

在進行修復工程前亦應執行一套額外的監測計劃，一爲詳細設計提供數據，二爲確立修復前的基線情況，提供必要數據，以確保適當緩解措施的實施。

結論

根據可行性研究期間所獲得的有限數據以及在考慮到優選土地再用方案後，本初步環境影響評估對四個堆填區的堆填工程和土地再用建議方案在建造和運作期間，對區內和區外易受影響的地方之潛在環境影響分別作出評估。我們認爲，只要在有需要時採用了所建議的緩解措施，各須要關注的事項均可順利解決。

根據整體觀察以及只要遵守良好的建造慣例，建議中的修復工程應該不會對該四個堆填區任何之一造成不良的生態影響。顧問公司建議對每個堆填區進行詳盡的生態影響評估，作爲其土地再用方案合同的一部分。

所有被確認爲對於環境保護份屬必要的緩解措施和執行規定，將會納入投標文件內，以便設計和建造修復工程以及其後的護養活動。對於這些措施和規定的遵守，將作爲合同的一項條件。

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