

14 CONCLUSION

This EIA Report has provided an assessment of the potential environmental impacts associated with the construction, operation, restoration and aftercare phases of the Project. Baseline conditions, sensitive receivers, potential environmental impacts, mitigation measures and EM&A requirements were identified and assessed throughout the course of the EIA study. The recommended mitigation/precautionary measures are summarised in an Implementation Schedule for further enforcement.

14.1 Option Evaluation

Five layout options for the WENT Landfill Extension with different footprints were considered during the option evaluation stage. After detailed evaluation of engineering aspects, environmental issues and community responses, Option 4 for developing the WENT Landfill Extension was adopted.

14.2 Air Quality Impact

The potential air quality impacts during construction, operation, restoration and aftercare phases of the Project have been assessed.

14.2.1 Construction Phase

Construction dust modelling results show that the 1-hr and 24-hr average TSP concentrations at all the receivers would comply with the legislative requirements. The cumulative annual TSP concentration would however, due to the high background level, exceed the respective criterion. Further analysis suggests that the contribution from the WENT Landfill Extension Project would nevertheless be insignificant, especially for the neighbouring village houses. For other areas that are provided with air-conditioning, it is anticipated typical dust filters would be able to reduce the dust level by 50% and hence would be sufficient to ensure acceptable air quality.

14.2.2 Operation Phase

14.2.2.1 Stack Gas Emission

Dispersion modelling results show that gaseous emissions from ammonia stripping plant, LFG power generator and flaring system of the WENT Landfill Extension will have no adverse impact on the ASRs throughout the operation period of the WENT Landfill Extension, except the annual RSP concentration. However, further analysis revealed that the annual RSP contribution from the Project (WENT Landfill Extension), Existing WENT Landfill and marine emissions is less than 1% of the annual AQO. In addition, the background RSP concentration of $64 \mu\text{g}/\text{m}^3$ adopted from Air Monitoring Station at Yuen Long has already exceeded the AQO criteria of $55 \mu\text{g}/\text{m}^3$. Air quality impact arisen from the Project is therefore insignificant.

Subject to the subsequent EPD's requirement on chimney installation, regular stack monitoring of air pollutants, including NO_x , SO_2 , RSP, NMOCs, vinyl chloride, and benzene shall be carried out at a quarterly interval (i.e. once every 3 months), and the operating conditions, including exhaust gas temperature and velocity shall be monitored continuously in order to demonstrate compliance during the operations.

14.2.2.2 Odour

Odour assessment results show that some operational constraints on the locations of tipping faces (ie only one tipping face within certain distance from some sensitive receivers (1100m from West Ha Pak Nai, 1200m from office of Black Point Power Station & 1200m from Lung Kwu Sheung Tan)) are required to ensure compliance of the odour limits for the receivers. For the office at the STF office, some odour removal facilities would be installed to reduce the odour level accordingly. Other odour control measures (eg application of daily cover) would be implemented to minimise the odour impact.

14.2.3 Restoration and Aftercare Phases

The scale of construction activities during the restoration and aftercare phases of the WENT Landfill Extension will be smaller when compared with its construction phase. Construction

dust is therefore not anticipated to be an issue. The impact of stack gas emissions from treatment facilities will be much reduced during these phases given the gradual reduction in leachate and LFG generation rates over time. Odour in restored landfill will not be a concern. The air quality conditions will not be worse than the operation phase and hence no adverse impact is anticipated.

14.3 Noise Impact

The potential noise impacts during construction, operation, restoration and aftercare phases of the Project have been assessed.

14.3.1 Construction, Restoration and Aftercare Phases

Potential construction noise impacts are likely caused by various construction activities on site, such as, site clearance and formation, soil excavation, installation of lining system, construction of leachate treatment facilities, installation of final capping system, etc. Construction noise assessment concluded that the construction noise impacts associated with the construction activities on the Project site would not exceed the noise criteria as specified in the TM-EIAO. No adverse construction noise impact is anticipated.

14.3.2 Operation Phase

Road traffic noise assessment results indicate that the WENT Landfill Extension would not significantly increase the traffic noise impacts on the residential premises along Lung Kwu Tan Road and hence mitigation measures are not required.

A 3.5m high noise bund (about 150m long) along the existing eastern seawall of the existing WENT Landfill would be required to comply with the noise criteria during daytime, evening and night-time periods.

14.4 Water Quality

The potential water quality impacts during construction, operation, restoration and aftercare phases of the Project have been assessed.

14.4.1 Construction Phase

With proper implementation of construction site runoff control measures, adverse water quality impact during construction phase is not anticipated. Sewage will be generated by workforce on-site during the construction period. Temporary sanitary toilets will be provided for on-site construction workforce. No sewage will be allowed to discharge directly into the surrounding water body without treatment, and hence the sewage generation during the construction phase of the Project would not cause water quality impact after undertaking all required measures.

14.4.2 Operation, Restoration and Aftercare Phases

Given that the WENT Landfill Extension will only be in operation after the closure of the existing landfill, no cumulative water quality impact due to the operation of the two landfills will occur. Nonetheless, cumulative impact will occur when restoration in existing WENT Landfill and operation in the WENT Landfill Extension take place concurrently. With the implementation of surface water and groundwater management control measures, adverse water quality impact on surface water and groundwater during operation phase is not expected.

The treated effluent from the new leachate treatment plant will be discharged via the existing submarine outfall at Urmston Road. This submarine outfall serves not only the existing effluent from the existing WENT Landfill, but all the effluent from other sources including but not limited to the San Wai Sewage Treatment Works (STW). According to the information from DSD, the San Wai STW will be upgraded to a capacity of 246,000m³/day for discharge into the existing WENT Effluent Tunnel and Urmston Road Submarine Outfall. The quantity of effluent from existing WENT Landfill (~2,600m³/day) for discharge to the Urmston Road Submarine Outfall only constitutes about 1%. Given that the discharge limit

of the leachate treatment for WENT Landfill Extension will be maintained, the impact of leachate on the environment will be minimal.

Under normal installation and operation conditions, the rate of leachate seepage due to manufacturing defects of geomembrane is assessed to be negligible. With the implementation of the measure proposed in the Contingency Plan on Accidental Leakage of Leachate (including active pumping of leachate from leachate and groundwater collection layers to the on-site leachate treatment plant), impact on the groundwater quality is insignificant.

Sewage will be generated by workforce on site during operation phase. Adverse impact is not anticipated as both portable toilets and permanent toilets at the site office will be provided to collect all sewage generated.

For STF and IWMF, wastewater generated will be reused within the facilities for washdown water and landscape irrigation. Hence, there would be no discharge into the Deep Bay and no adverse cumulative impact on water quality is anticipated.

During the restoration and aftercare phases of the WENT Landfill Extension, leachate will continue to be generated but the amount of the leachate generated is expected to be sufficiently reduced. The established leachate control measures and treatment will continue to operate throughout the restoration and aftercare phases of the WENT Landfill Extension.

Proper site maintenance will be undertaken during the restoration and aftercare phases to ensure that the capping system, leachate collection and treatment systems will be performed to comply with the design requirements. Surface water, groundwater and effluent quality monitoring will also be undertaken during the restoration and aftercare phases in accordance to the monitoring plan. With the provisions of all these control and monitoring systems, no cumulative impacts are expected to occur during the restoration and aftercare phases.

14.5 Waste Management

The waste management assessment has reviewed the potential impacts from various types of wastes generated from the construction, operation, restoration and aftercare stages of the WENT Landfill Extension. Through the analysis of the Project activities, the quantity, quality and timing of waste arising have been identified, including excavated materials from site preparation, chemical waste arising from maintenance of plant and equipment, general waste from daily activities, and sludge from leachate treatment plant. By adopting a material balance approach (e.g. balance cut-and-fill in site formation design, general waste from daily activities to be collected and recycled, etc.) and with the appropriate mitigation measures in place, no adverse environmental impact is anticipated.

14.6 Landfill Gas Hazards

The results of this qualitative risk assessment for LFG hazards associated with the construction, operation, restoration and aftercare phases indicate that the overall risks to the receivers within the WENT Landfill Extension would be categorised as “**Medium**” to “**High**” and that to the receivers outside the WENT Landfill Extension would be “**Low**” to “**Medium**”. The sensitive receivers falling within the newly proposed 250m consultation zone shall be prone to LFG potential risk and appropriate protective and precautionary measures including engineering design and monitoring programme have been proposed to reduce such risk to acceptable levels. With these measures in place, no adverse impact would be anticipated.

14.7 Landscape and Visual Impact

The Project site of the WENT Landfill Extension is mainly made up largely by the Stockpile and Borrow Area (SBA) and haul roads, in terms of area. Furthermore, the existing WENT

Landfill Site is located immediately adjoining to the east of the WENT Landfill Extension. It is noted the landscape resources and landscape characters of the Project site of the WENT Landfill Extension have already largely deteriorated by the SBA of the existing WENT landfill site. Due to their proximity, the existing landfill site, its SBA and the WENT Landfill Extension will affect the similar group of visually sensitive receivers. It is noted that the existing WENT landfill site and its associated SBA have altogether also deteriorated the existing views of the Project site.

The existing landscape resources and landscape characters to be affected by the WENT Landfill Extension are mainly those of disturbed land associated with the SBA and haul roads. The landscape value of the disturbed land is low and its sensitivity is low too. Yet, it is noted that natural vegetation on the hillside to the periphery of the SBA will be affected by the WENT Landfill Extension. It is noted that some valuable landscape resources will be affected in terms of permanent change and loss. The residual impact during construction & operation phases is still significant.

The existing visual quality of the majority of the WENT Landfill Extension is that of the disturbed land associated with the SBA. The visual quality is considered poor. Relatively, the key visual impact during the construction & operation phases is arising from the loss of the natural vegetation on hillside outside the existing landfill boundary. The loss of the natural vegetation on hillside will be carried out phase by phase in line with the operation of WENT Landfill Extension. Thus the visual obstruction caused by the loss of natural vegetation will be changed phase by phase. It is also presumed that the higher the final level of landfill, the larger the visual impact near the end of construction & operation phases.

The WENT Landfill Extension will be restored and vegetated to match with its surroundings in terms of landform and vegetation patterns in restoration and aftercare phases. Loss of landscape resources and change in landscape characters in construction & operation phases will be compensated and enhanced. Visual impact in construction & operation phases will be eliminated with provision of vegetation all over the final surface. Visual intrusion of new visual element (the final landform of the WENT Landfill Extension) would be minimized by careful design of the final level and final landform to match the surroundings.

In summary, the potential impact during construction and operation phases shall be significant due to large scale of site formation phase by phase in terms of site area. Within this period, the natural vegetation will be portionally loss for each phase of site area and advanced planting will be provided as mitigation measures. During restoration phase, the mature advanced planting can act as screening effect for the proposed development in human eye level. During aftercare phase, the compensatory planting as mitigation shall be under germination, which provides preliminary vegetation cover for site area of the proposed development. At that time, the potential impact shall be marginally acceptable with mitigation measures. Finally after the whole period of restoration and aftercare phases, the potential impact would be greatly mitigated by semi-mature compensatory woodland, shrubland and grassland with the proper mitigation maintenance, e.g. thinning of pioneer trees and enhancement planting of native tree species. Although there will be permanent loss of some landscape resources, the residual impact would be mitigated during restoration & aftercare phases in long run. It is anticipated the residual landscape and visual impact during the restoration & aftercare phases would not be significant.

In conclusion, the particular impacts can be reduced to a large extent by implementing the proposed mitigation measures during construction & operation phases and restoration & aftercare phases. The overall residual impacts would be treated as “acceptable with mitigation measures” after implementing the mitigation measures.

14.8 Cultural Heritage Impact

Built heritage survey and archaeological survey have been conducted within the study area of the WENT Landfill Extension. During the built heritage survey, the Hung-Shing and Dragon Mother Temple (Hung-Shing Temple) was investigated for its dating and heritage value, and nine graves were investigated for their dating and current status. During the archaeological survey, 15 test pits and 24 auger holes were excavated in the confined study area on the Government land within the identified boundary of the Tsang Tsui Archaeological Site.

14.8.1 Built Heritage

As for the built heritage impact assessment, the Hung-Shing Temple was completely rebuilt in 1988, and graves G5 and G6 have been rebuilt in the past two decades; therefore, the cultural heritage value of these structures is relatively low. Before the relocation of these structures, it is unnecessary to take further mitigation measures on the two graves; the Hung-Shing Temple, however, should be duly surveyed for record purpose prior to the relocation.

14.8.2 Archaeology

As for the archaeological impact assessment, the original boundary of the TTAS has been revised based on the discovery of the 2008 survey. Since the WENT Landfill Extension would cover the area of the TTAS, a rescue excavation shall be conducted before the commencement of the construction. Subject to the findings of an additional archaeological survey, the rescue excavation shall cover the revised site boundary in order to protect the potential archaeological heritage of the TTAS comprehensively in record.

14.9 Ecological Impact

Ecological resources recorded within the 500m study area of WENT Landfill Extension include woodland, plantation, orchard/village, grassland/shrubland, fish pond, mangroves/mudflats, stream/channel, ash lagoon, artificial seawall, urbanised/disturbed areas and coastal waters and its associated flora and fauna species. Apart from mangroves/mudflat habitat which had moderate ecological values, other habitats had low or low to moderate ecological values. Species of conservation interest recorded within the study area included four flora and thirty-eight fauna species (including bats, birds, butterflies and other fauna).

The WENT Landfill Extension will largely occupy existing grassland/shrubland habitat. The overall impacts to terrestrial and freshwater habitats are ranked as low to moderate for woodland and ash lagoon habitat for Little Grebe, and low to negligible for other habitats and associated wildlife. This project would not involve any marine works and there would be no direct marine or intertidal habitat loss from the project. Mitigation measures include transplantation of species of conservation interest, compensatory woodland planting, and creation of pond habitats. With the implementation of the above mitigation measures, the residual impacts are considered minimal and acceptable.

14.10 Pulverized Fuel Ash Impact

An evaluation of previous health risk assessments of radon emission from PFA has been conducted. Based on the findings from various literature researches, the radon health risk for construction, operation, restoration and aftercare of the WENT Landfill Extension is concluded to be of insignificant level, and hence mitigation measures are not required.

14.11 Summary of Environmental Outcome

14.11.1 Population and Environmental Sensitive Areas Protected

The WENT Landfill Extension would influence a population of about 100 people living in Ha Pak Nai Village. With the implementation of relevant mitigation measures, these people would not be significantly affected by the Project.

No recognised sites of conservation importance are located within the Study Area. The nearest Protected Areas are the Sha Chau and Lung Kwu Chau Marine Park which is over 4km to the south west and Pak Nai SSSI located at 3.5km to the north east.

Major habitat types recorded include woodland, plantation, orchard/village, grassland/shrubland, fish pond, mangroves/mudflats, stream/channel, ash lagoons, artificial seawall, urbanised/disturbed areas and coastal waters. With the implementation of mitigation measures including transplantation of species of conservation interest, compensatory woodland planting and creation of pond habitats, the residual impacts are considered minimal and acceptable.

14.11.2 Environmental Friendly Design and Benefit

Environmental friendly design and benefit adopted in this EIA study are summarised below:

- The layout of the WENT Landfill Extension was chosen such that the void space of the landfill could be optimised whilst causing acceptable impacts on air, noise, water, landscape and visual, ecology, etc.
- A bentonite conductivity of 10^{-11} m/s was proposed for the liner system of the WENT Landfill Extension to protect the quality of surface water and groundwater around the site.
- A comprehensive leachate collection, monitoring, interception and diversion system will be provided for the WENT Landfill Extension.
- A comprehensive surface water management system including erosion control, dry weather flow interceptor, sedimentation tank, etc. will be provided for the WENT Landfill Extension.
- To compensate for the loss of existing trees on the Project site, approximate 107,100 nos. of tree seedlings / whips planting at 1500mm spacing are proposed to be planted in 21ha (Advanced woodland mix planting (5ha) at existing WENT Landfill for advanced screening effect and the remaining 16ha to be planted at WENT Landfill Extension). Approximate 10% of quantity of woodland mix planting would be of light standard trees.
- To mitigate the loss of 5ha of water body including 3ha of breeding habitats for Little Grebe, a total of 5ha of freshwater ponds, with 3ha will be created after the restoration phase of the existing WENT Landfill, and 2ha provided after the restoration phase of the WENT Landfill Extension.

14.11.3 Key Environmental Problem Avoided

The Project Study Area is located immediately to the west of the existing WENT Landfill site, which are away from the villages at the Ha Pak Nai to reduce the environmental impacts on these sensitive receivers.

The WENT Landfill Extension will be developed in six phases to allow progressive use of the overall landfill area. Each phase will be constructed, operated and restored at a rate dependent on the actual delivery of waste and sufficient areas should be maintained to stockpile the excavated materials for subsequent filling process to avoid disposal of surplus excavated materials by vehicles resulting in additional environmental impacts on other sensitive receivers en-route.

The WENT Landfill Extension's development-phasing and landfilling –sequence is designed to keep Clan Grave to be resumed in the latest phases. This allows ample time for the negotiation process for clearance/removal of this grave. On the other hand, the ash lagoons have been leased to CLP until 2047 and are currently occupied by CLP for storage of coal ash. For prudence sake, the implementation of WENT Landfill Extension could be planned in such a way that the west lagoon (the one nearest to CLP's Black Point Power Station) is given more time for land acquisition. To this, the site formation works will commence at the eastern perimeter.

The existing berthing facilities of the existing WENT Landfill will be used for the WENT Landfill Extension. There is no additional berthing facilities and no dredging will be required.

14.11.4 Environmental Protection Measures and Precautionary Measures

Precautionary measures and good site practices were recommended throughout the impact assessments of air quality, noise, water quality, waste management, landfill gas hazard, pulverized fuel ash, landscape and visual, archaeology and ecology. These measures were consolidated in an Implementation Schedule which specifies the responsibility, methodology and timing of implementation, such that effective and appropriate implementation of the measures can be assured.

14.12 Environmental Monitoring and Audit

Details of the EM&A programme and monitoring requirements are described in the EM&A Manual. Measurements and activities are summarised as follows:

- Baseline monitoring on groundwater, surface water, dust, ambient emissions of odour, VOC and ammonia, and ecology (flora and fauna);
- Impact monitoring on leachate, LFG, groundwater, surface water, dust, ambient emissions of odour, VOC and ammonia, meteorological data, volume and density of waste, settlement, waste type, and ecology (flora and fauna);
- Remedial actions in accordance with the Event and Action Plan within the timeframe in cases the specified criteria in the EM&A Manual are exceeded;
- Logging and keeping records of monitoring results; and
- Preparation and submission of Monthly, Quarterly and Annual EM&A Reports.

14.13 Overall Conclusion

An EIA Report has been prepared to satisfy the requirements given in the EIA Study Brief No.: ESB-117/2004 and the TM-EIAO. All the latest design information has been incorporated into the EIA process. Aspects that have been considered in this EIA Report include:

- Layout option evaluation
- Description of construction, operation and aftercare activities
- Air Quality Impact
- Noise Impact
- Water Quality Impact
- Waste Management Implications
- Landfill Gas Hazards
- Landscape and Visual Impact
- Impact on Cultural Heritage
- Ecological Impact
- Pulverized Fuel Ash Impact
- Environmental Monitoring and Audit

Overall, the EIA Report has predicted that the Project would be environmentally acceptable with the implementation of the proposed mitigation measures for construction, operation, restoration and aftercare phases. An environmental monitoring and audit programme has been recommended to ensure the effectiveness of recommended mitigation measures.