AECOM

Food and Environmental Hygiene Department

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Mui Wo Lai Chi Yuen Cemetery Extension

Environmental Impact Assessment Report

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List of Abbreviations

AECOM	AECOM Asia Company Limited
AFCD	Agriculture, Fisheries and Conservation Department
ALARP	As Low As Reasonably Practicable
ANL	Acceptable Noise Levels
APCO	Air Pollution Control Ordinance
AQOs	Air Quality Objectives
ArchSD	Architectural Services Department
ASRs	Air Sensitive Receivers
ASRs	Area Sensitivity Ratings
ATC	Annual Traffic Census
BAT	Best Available Technology
BC	Barrier Correction
BM Model	Britter and McQuaid Model
BMP	Best Management Practices
BOD ₅	5-day Biochemical Oxygen Demand
C&D	Construction and Demolition
C&DMMP	Construction and Demolition Material Management Plan
C&SD	Census and Statistics Department
СА	Conservation Area
СВА	Cost-Benefit Analysis
CBR	Chemical, Biological and Radiological
CEDD	Civil Engineering and Development Department
CNP	Construction Noise Permit
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
СР	Country Park
CWTC	Chemical Waste Treatment Centre
CZ	Consultation Zone
DBH	Diameter at Breast Height
DC	Distance Attenuation
DP	Designated Project
EcolA	Ecological Impact Assessment
EIA	Environmental Impact Assessment
EIAO	Environmental Impact Assessment Ordinance
EM&A	Environmental Monitoring and Audit
EMP	Environmental Management Plan
EPD	Environmental Protection Department
F	Frequency
FC	Façade Correction
FEHD	Food and Environmental Hygiene Department
FSP	Fine Suspended Particulates
GB	Green Belt

GLTM	Greening, Landscape and Tree Management
GRG2	Generalized Reduced Gradient
GS	General Specification for Civil Engineering Works
GW-TM	Technical Memorandum on Noise from Construction Work Other Than Percussive Piling
НА	Hazard to Life Assessment
HKPSG	Hong Kong Planning Standards and Guidelines
HKRG	Hong Kong Government Risk Guidelines
ICAF	Implied Cost of Averting a Fatality
IND-TM	Technical Memorandum for the Assessment of Noise from Places Other Than Domestic Premises, Public Places or Construction Sites
IR	Individual Risk
IUCN	International Union for Conservation of Nature and Natural Resources
LCA	Landscape Character Area
LD ₅₀	Median Lethal Dose
LR	Landscape Resources
Max. SWLs	Maximum Permissible Sound Power Levels
MHIDAS	Major Hazard Incident Data Service
Ν	Number of fatalities
NCO	Noise Control Ordinance
NO ₂	Nitrogen Dioxide
NRMMs	Non-road Mobile Machinery
NSRs	Noise Sensitive Receivers
OVTs	Old and Valuable Trees
OZPs	Outline Zoning Plans
PATH	Pollutants in the Atmosphere and the Transport over Hong Kong
PFAs	Public Filling Areas
PFC	Public Fill Committee
PFRF	Public Filling Reception Facilities
PGC	Potential Global Concern
PGLA	Permanent Government Land Allocation
PHI	Potentially Hazardous Installation
PlanD	Planning Department
PLL	Potential Loss of Life
PME	Powered Mechanical Equipment
ProPECC PN	Professional Persons Environmental Consultative Committee Practice Notes
Q(t)	Release rates
QRA	Quantitative Risk Assessment
RO	Regional Office
RSP	Respirable Suspended Particulates
SMBWTW	Silvermine Bay Water Treatment Works
SO ₂	Sulphur Dioxide
SPLs	Sound Pressure Levels
SSSIs	Sites of Special Scientific Interest

SWLs	Sound Power Levels
Т	Release duration
TD	Transport Department
TIA	Traffic Impact Assessment
ТМ	Technical Memorandum
TM-DSS	Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters
TM-EIAO	Technical Memorandum on Environmental Impact Assessment Ordinance
TPU	Tertiary Planning Unit
TPZ	Tree Protection Zone
TSP	Total Suspended Particulates
UDM2	Universal Dispersion Model 2
VSRs	Visually Sensitive Receivers
WBTC	Works Branch Technical Circular
WCZs	Water Control Zones
WDO	Waste Disposal Ordinance
WMP	Waste Management Plan
WPCO	Water Pollution Control Ordinance
WQOs	Water Quality Objectives
WSRs	Water Sensitive Receivers

1 INTRODUCTION

1.1 Project Background

- 1.1.1 With a growing and aging population in Hong Kong, the numbers of deaths and cremations have been rising gradually year by year, leading to a corresponding increase in the demand for public niches. Based on past data, the annual average number of deaths and cremations from 2016 to 2035 is estimated to be about 57,000 and 54,000, respectively. The supply of public niches was unable to meet demand in recent years.
- 1.1.2 In this connection, there is a genuine need for the Government to increase the supply of public columbarium facilities so as to relieve the shortage of niches and to meet the public demand. According to the views collected in the public consultation on "Review of Columbarium Policy" from July to September 2010, the community in general supported the idea that all the 18 districts should collectively share the responsibility for developing new columbarium facilities to meet the overall public demand. The batch one sites, which were first announced by the Government on 6 July 2010 when it launched the first public consultation on review of columbarium policy, comprise 12 sites in seven districts and the Lai Chi Yuen Cemetery site is one of the sites.
- 1.1.3 The columbaria at Peng Chau, Cheung Chau and Lamma Island provide 490, 3,335 and 490 public niches respectively to the local villagers and residents on the islands. There is currently no public columbarium facility on Lantau Island. Local villagers and residents in Lantau Island of Islands District can only choose from public niches in Peng Chau or Lamma Island (in addition to NT/Urban niches) if cremation is adopted, although there are two public cemeteries on the Island, namely, Tai O Cemetery and Lai Chi Yuen Cemetery where only coffin burial or urn burial are available. It is against this background that Members of Islands District Council and Mui Wo Rural Committee strongly requested public niches be provided on Lantau Island to cope with the need of local villagers and residents.
- 1.1.4 In this regard, the Food and Environmental Hygiene Department (FEHD) proposed an extension of the Mui Wo Lai Chi Yuen Cemetery (hereafter referred to as "the Project") to construct an elevated platform of around 225m² within the existing Lai Chi Yuen Cemetery boundary to accommodate the outdoor niches and the ancillary facilities including one joss paper burner (with a fresh water tank and a sewage holding tank for supporting its operation) and planters. Also, a site access of 7.5m², which is indispensable for the development, will be constructed just outside the cemetery boundary due to lack of suitable space for accommodating it in the cemetery. Location and works boundary of the Project are shown in **Figure 2.1**.

1.2 Designated Projects under the EIA Ordinance

- 1.2.1 The Project is classified as a Designated Project (DP) under Category Q.1 the Project is wholly within an existing country park, Part I in Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO).
- 1.2.2 An application for an Environmental Impact Assessment (EIA) Study Brief under Section 5(1) of the EIAO was made to Environmental Protection Department (EPD) and the EIA Study Brief No. ESB-288/2015 for the Project was issued under the EIAO. AECOM Asia Company Limited (AECOM) was commissioned by Architectural Services Department (ArchSD) as the Consultant to conduct this EIA study for the Project.

1.3 Objectives of the EIA Study

- 1.3.1 The purpose of the EIA Study is to provide information on the nature and extent of environmental impacts arising from the construction and operation of the Project and related activities that take place concurrently. This information provided in the EIA Study will contribute to decisions on:
 - a) the overall acceptability of any adverse environmental consequences that are likely to arise as a result of the Project;
 - b) the conditions and the requirements for the detailed design, construction and operation of the Project to mitigate against adverse environmental consequences wherever practicable; and

- c) the acceptability of residual impacts after the proposed mitigation measures is implemented.
- 1.3.2 The objectives of the EIA study are to:
 - (i) to describe the Project and associated works together with the requirements and environmental benefits for carrying out the Project;
 - to identity and describe elements of community and environment likely to be affected by the Project and/or likely to cause adverse impacts to the Project, including both the natural and manmade environment and the associated environmental constraints;
 - (iii) to identity and quantity emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;
 - (iv) to identity and quantify any potential losses or damage to flora, fauna and natural habitats;
 - (v) to propose the provision of infrastructure or mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction and operation of the Project;
 - (vi) to investigate the feasibility, effectiveness and implications of the proposed mitigation measures;
 - (vii) to identity, predict and evaluate the residual (i.e. after practicable mitigation) environmental impacts and the cumulative effects expected to arise during the construction and operation phases of the Project in relation to the sensitive receivers and potential affected uses;
 - (viii) to identity, assess and specify methods, measures and standards, to be included in the detailed design, construction and operation of the Project which are necessary to mitigate these residual environmental impacts and cumulative effects and reduce them to acceptable levels;
 - (ix) to design and specify environmental monitoring and audit requirements; and
 - (x) to identity any additional studies necessary to implement the mitigation measures or monitoring and proposals recommended in the EIA report.

1.4 Report Structure

- 1.4.1 Following this introductory Section, the remainder of this EIA Report is arranged as follows:
 - Section 2 Project Description
 - Section 3 Air Quality Impact
 - Section 4 Noise Impact
 - Section 5 Hazard to Life
 - Section 6 Water Quality Impact
 - Section 7 Waste Management Implications
 - Section 8 Ecological Impact
 - Section 9 Landscape and Visual Impacts
 - Section 10 Environmental Monitoring and Audit Requirements
 - Section 11 Implementation Schedule of Recommended Mitigation Measures
 - Section 12 Conclusions

2. PROJECT DESCRIPTION

2.1 Location and Scale of Project

- 2.1.1 The Project site is located at a slope next to the entrance staircase of the existing Lai Chi Yuen Cemetery with a total area of 232.5m². An elevated platform of around 225m² supported by structural columns will be constructed to accommodate some 790 niches (one 46 columns x 10 tiers and one 33 columns x 10 tires), with internal dimension of each niche being 200mm(W) x 210mm(H) x 410mm(D). All the niches will be in outdoor setting. The ancillary facilities like a joss paper burner (with a fresh water tank and a sewage holding tank for supporting its operation) and planters will be provided as well.
- 2.1.2 A site access of 7.5m² will be constructed just outside the cemetery boundary. The site access area has however been minimized to allow only pedestrian access without compromising the wheelchair access requirement.
- 2.1.3 To minimize nuisance to the surrounding sensitive receivers, the operation hour of the joss paper burner will be from 8:30am to 5:30pm. No other fixed plant is expected during operation.
- 2.1.4 The location plan and preliminary layout plan of the Project are shown in **Figures 2.1** and **2.2**, respectively.

2.2 Site History

2.2.1 The existing Permanent Government Land Allocation (PGLA) of around 8,400 m² for the Lai Chi Yuen Cemetery was granted in March 1987 and designated for public cemetery use. The existing PGLA for the Lai Chi Yuen Cemetery, as well as the proposed enlargement of the PGLA to construct the site access, fall within the Lantau South Country Park and are zoned "Country Park (CP)" on the Approved South Lantau Coast Outline Zoning Plan No. S/SLC/19.

2.3 The Need and Justification of the Project

- 2.3.1 Since the 1970s, the Government has been encouraging cremations instead of coffin burials, resulting in a rising demand for columbarium facilities and an upsurge of private columbaria. As mentioned in **Section 1.1**, with a growing and ageing population in Hong Kong, the numbers of deaths and cremations have been rising gradually year by year, leading to a corresponding increase in the demand for public niches. In recent years, there have been public concerns over the shortage in supply of public niches. The Legislative Council also expressed grave concern about the supply of public niches in Hong Kong and urged the Government to substantially increase the supply in the light of demographic changes.
- 2.3.2 There is currently no public columbarium facility on Lantau Island. Local villagers and residents in Lantau Island of Islands District can only choose from public niches in Peng Chau or Lamma Island (in addition to NT/Urban niches) if cremation is adopted. In view of the great demand of public niches in Mui Wo and Lantau Island at large, the Islands District Council Members and the Mui Wo Rural Committee strongly requested public niches be provided on Lantau Island to cope with the need of local villagers and residents.
- 2.3.3 Lai Chi Yuen Cemetery site is one of the 12 batch one sites that were announced by the Government on 6 July 2010 when it launched the first public consultation on review of columbarium policy. The site is supported by the Islands District Council, the Lantau Area Committee and the Mui Wo Rural Committee.

2.3.4 In this regard, FEHD proposed the Project to cope with the need of local villagers and residents in Lantau Island. The benefit of the Project is described in **Section 2.6** and scenarios with and without the Project are provided in **Section 2.7**.

2.4 Consideration of Alternative Options

New Sites in Lantau Island

2.4.1 In the course of studying the feasibility of columbarium development at Lai Chi Yuen Cemetery, FEHD has explored with the locals the feasibility of building niches at a number of alternative sites in Lantau Island, including sites identified in Luk Wu, Wong Lung Hang (2 sites), old Tung Chung Road Cheung Sha Waterworks Ex-quarter, near Tai O Cemetery (2 sites) and helipad at Mui Wo. However, they were all found unsuitable for columbarium development owing to different reasons such as incompatibility with the surroundings, potential adverse impacts on the natural environment, traffic management and road safety concerns, geotechnical constraints, difficulty to provide Barrier Free Access (BFA), etc. After a series of site visits, preliminary feasibility studies and prolonged discussions, the locals insist further exploring the feasibility of developing columbarium at the original Lai Chi Yuen Cemetery site and press FEHD to forge ahead with the Project. The proposed niches development in Lai Chi Yuen Cemetery has been fully supported by the local community, the Islands District Council, the Lantau Area Committee and the Mui Wo Rural Committee.

Sites outside Lantau Island

2.4.2 Lai Chi Yuen Cemetery site is one of the 12 batch one sites that were announced by the Government on 6 July 2010 when it launched the first public consultation on review of columbarium policy, the niches to be provided in the Project are targeted for local villagers and residents on Lantau Island. To consider other sites outside Lantau Island for the Project is thus not applicable.

Extension of Existing Lai Chi Yuen Cemetery

- 2.4.3 Even if other suitable new sites in the Lantau Island can be identified, it is not expected that new niches in these areas can be developed within a short time as around two-thirds of land on Lantau is delineated as country park area. By contrast, the existing Lai Chi Yuen Cemetery site is a developed site supported with the necessary transport network requirement.
- 2.4.4 The development of new niches at a new or remote site will carry environmental dis-benefits. By comparison, the impact of such dis-benefits is relatively less significant for development of the existing Lai Chi Yuen Cemetery and will result in additional environmental benefits.
- 2.4.5 Human activities already exist at the current site in Lai Chi Yuen Cemetery and in the vicinity. As such, the impact of the proposed Project on the local environment would be minimal, compared with a new development on a greenfield site. The presence of a new small scale columbarium with minimal ancillary facilities will have insignificant effect to the existing Lai Chi Yuen area.
- 2.4.6 FEHD has once explored a number of development options for the extension of Lai Chi Yuen Cemetery (refers to **Appendix 2.1**) but the BFA requirement involves substantial encroachment onto the virgin country park area. On the advice of Agriculture, Fisheries and Conservation Department (AFCD) that the columbarium should be built within the cemetery boundary as far as possible, FEHD eventually identified the currently proposed site within the Lai Chi Yuen Cemetery with minimal area outside the cemetery boundary. The proposed development options (Schemes 1 to 4) and the major concerns of each option are summarised in **Table 2.1**. Owing to the limited footprint of the site and

the BFA requirement, terraced platform design was not proposed to avoid the need of bulky ramps connecting the platforms to provide a barrier free access.

Table 2.1	Summary of the Designs Schemes of the Proposed Extension of the Existing
	Lai Chi Yuen Cemetery

	Scheme 1 Scheme 2		Scheme 3	Scheme 4	
Proposed Period	~ Feb 2011	~ Oct 2014	~ Apr 2015	~ Oct 2015	
Design	Provide the columbarium on the existing vacant platform within the Lai Chi Yuen Cemetery by connecting with bulky ramps	Construct a raised platform adjacent to the entrance of the cemetery	Modify Scheme 2 to minimize the footprint outside the boundary of the cemetery	Modify Scheme 3 to address CMPB's concerns	
Key Concerns of the Design	In order to fulfil the BFA criteria, a ramp would need to be provided along the slope (largely outside the boundary of the existing cemetery) to connect the proposed columbarium. Due to site/engineering constraints (e.g. the gradient of slope), the ramp would be extensive with a relatively large footprint.	AFCD suggested that the extension should be kept within the boundary of the existing cemetery as far as possible.	As the joss paper burner was proposed to be located along the boundary adjacent to the country park, committee members of Country and Marine Parks Board (CMPB) raised concerns over the visual impact and the risk of hill fire incident during operation of the Project.	of the extension outside boundary of the existing cemetery has been minimized. The slayout of the scheme has considered visual impacts and risk of hill fire incident during the operational phase.	
Area outside the Existing Cemetery	At least 275 m ²	~212 m ²	7.5 m ²	7.5m ²	
Area inside the existing Cemetery	~ 485 m²	~128 m ²	225 m ²	225 m ²	
Total Area of the Site	At least 760 m ²	~340 m ²	232.5 m ²	232.5 m ²	

2.5 Selection of Preferred Scenario

- 2.5.1 Based on the findings as described above, the preferred scenario is the extension of the Lai Chi Yuen Cemetery to accommodate some 790 niches and ancillary facilities. It is selected for the following reasons:
 - a) Provision of new niches at the Project site has a much less significant environmental impact in comparison with introducing new niches to a new site;
 - b) The Project site is mainly confined to the boundary of the Lai Chi Yuen Cemetery which is considered of compatible use;
 - c) It is the most suitable option for early implementation to meet the great demand for public niches as soon as possible; and
 - d) The footprint is minimized and the layout design is optimized to minimize environmental impacts.

2.6 Benefits of the Project

- 2.6.1 The Project will help to meet the great public demand for public niches, to relieve the shortage of niches in Hong Kong and to cope with the need of local villagers and residents on Lantau Island.
- 2.6.2 More than 96% project site area is within the existing Lai Chi Yuen Cemetery. Only the access of 7.5m² is proposed to be constructed just outside the cemetery boundary due to lack of suitable space for accommodating it in the cemetery. Environmental impacts on surrounding sensitive receivers are minimised.

2.7 With and Without the Project Scenarios

- 2.7.1 As discussed in **Section 2.3**, the Project is to cope with the great demand of public niches in Lantau Island. If the Project does not proceed, the need of local villagers and residents existing public cannot be met. Alternative options including alternative sites in Lantau Island and outside Lantau Island have been considered as described in **Section 2.4**. Nevertheless, the alternative options are considered unfavourable due to the reasons such as potential adverse impacts on the natural environment and nuisance (e.g. air quality, noise, visual, etc.) to the nearby communities, incompatibility with the surroundings, etc.
- 2.7.2 The implementation of the Project would inevitably induce potential environmental impacts during construction and operational phases. Nevertheless, through careful consideration of various development options for the extension of Lai Chi Yuen Cemetery, the preferred option would pose much less significant environmental impacts and would be the most suitable option for early implementation to meet the demand of public niches in Lantau Island. The potential environmental impacts associated with the Project have been assessed in **Sections 3** to **9** and mitigation measures have been recommended if necessary to alleviate the impacts to acceptable levels.
- 2.7.3 If the Project cannot be implemented, the absence of public columbarium facility on Lantau Island will continue. The Government will fail to meet the great demand for public niches from the local villagers and residents on Lantau Island, and severe criticism from the public is thus expected.

2.8 Construction Methodology

- 2.8.1 The main access to the Site is through the existing single track access road (two ways) connecting to the South Lantau Road. No widening is required for this access road.
- 2.8.2 The elevated platform will be constructed by in-situ concrete casting. The area of the proposed barrier-free site access is very small (i.e. around 7.5m²) and the required depth of excavation is expected to be less than 1.5m. The construction can be achieved by simple open cut followed by insitu casting of the reinforced concrete retaining wall/slab. Good site practice will be adopted in order to minimize the impact to the environment during construction stage.
- 2.8.3 The outdoor niches will also be formed by in-situ concrete casting, with the niches block modules either in the form of prefabricated stone or precast concrete.

2.9 Works Programme

2.9.1 Construction of the Project will commence tentatively in February 2018 with completion in September 2019. The tentative construction programme of the Project is shown on **Appendix 2.2**.

2.10 Interactions with Other Projects

2.10.1 According to the latest plan, there is no concurrent project to be constructed and operated in the vicinity of the Project.

3. AIR QUALITY

3.1 Introduction

3.1.1 This section presents an assessment of potential air quality impacts associated with construction and operation of the extension of Mui Wo Lai Chi Yuen Cemetery. The assessment was conducted in accordance with the requirements in Annexes 4 and 12 of the Technical Memorandum on Environmental Impact Assessment Ordinance (EIAO-TM) and the requirements in Section 3.4.3 of the EIA Study Brief.

3.2 Environmental Legislation, Standards and Guidelines

- 3.2.1 The relevant legislation, standards and guidelines applicable to the present study for the assessment of air quality impacts are:
 - Air Pollution Control (Amendment) Ordinance 2013 (APCO) (Cap 311) this provides the power for controlling air pollutants from a variety of stationary and mobile sources and encompasses a number of Air Quality Objectives (AQOs);
 - Environmental Impact Assessment Ordinance (EIAO) (Cap 499), Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM), Annex 4 and Annex 12;
 - Air Pollution Control (Construction Dust) Regulation (Cap 311R); and
 - Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation.

Air Pollution Control Ordinance (APCO)

3.2.2 The prevailing AQO, as tabulated in **Table 3.1** below has been in forced since 1 January 2014.

Pollutant	Averaging Time	Concentration Limit, µg/m ^{3 (1)}	No. of Exceedances Allowed per Year
Fine Suspended Particulates	24-hour	75	9
(PM _{2.5} / FSP) ⁽³⁾	Annual ⁽²⁾	35	Not applicable
Respirable Suspended Particulates	24-hour	100	9
(PM ₁₀ / RSP) ⁽⁴⁾	Annual ⁽²⁾	50	Not applicable
Sulphur Dioxida (SO.)	10-minute	500	3
	24-hour	125	3
Nitrogon Diavida (NO.)	1-hour	200	18
	Annual ⁽²⁾	40	Not applicable
Photochemical Oxidants (as Ozone)	8-hour	160	9
Carbon Manavida (CO)	1-hour	30,000	0
	8-hour	10,000	0
Lead (Pb)	Annual ⁽²⁾	0.5	Not applicable

Table 3.1Hong Kong Air Quality Objectives

Notes:

(1) Measured at 293 K and 101.325 kPa.

(2) Arithmetic mean.

- (3) Suspended particulates in air with a nominal aerodynamic diameter of 2.5 μ m or less.
- (4) Suspended particulates in air with a nominal aerodynamic diameter of 10 μ m or less.

EIAO-TM

3.2.3 The Annex 4 of EIAO-TM stipulates that hourly Total Suspended Particulate (TSP) level should not exceed 500µg/m³ measured at 298K and 101.325kPa (one atmosphere) for the construction dust impact assessment.

Air Pollution Control (Construction Dust) Regulation

3.2.4 With reference to the Air Pollution Control (Construction Dust) Regulation, it specifies processes that require special dust control. The Contractors are required to inform the EPD and adopt proper dust suppression measures while carrying out "Notifiable Works" (which requires prior notification by the regulation) and "Regulatory Works" to meet the requirements as defined under the regulation.

Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation

3.2.5 The Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation comes into operation on 1 June 2015. Under the Regulation, Non-road mobile machinery (NRMMs), except those exempted, are required to comply with the prescribed emission standards. From 1 September 2015, all regulated machines sold or leased for use in Hong Kong must be approved or exempted with a proper label in a prescribed format issued by EPD. Starting from 1 December 2015, only approved or exempted NRMMs with a proper label are allowed to be used in specified activities and locations including construction sites. The Contractor is required to ensure the adopted machines or non-road vehicle under the Project could meet the prescribed emission standards and requirement.

3.3 Description of the Environment

Baseline Conditions

3.3.1 The Project site is located in rural area at a slope next to the entrance staircase of the existing Lai Chi Yuen Cemetery in Mui Wo, Lantau Island and is within the Lantau South Country Park. No major air emission source is identified in the area. The EPD air quality monitoring station closest to the Project site is Tung Chung Station. The latest available five-year air quality data measured at Tung Chung Station are summarised in **Table 3.2**.

Air	Averaging Time		Concentration, µg/m ³					
Pollutant			Year 2011	Year 2012	Year 2013	Year 2014	Year 2015	AQO
DM	24-hour	10 th Highest	<u>78</u>	74	<u>76</u>	65	65	75
F IVI2.5	An	nual	32	28	26	24	22	35
DM.	24-hour	10 th Highest	<u>109</u>	<u>106</u>	<u>108</u>	<u>101</u>	93	100
F IVI10	Annual		47	45	42	39	36	50
SO ₂	10-minute	4 th Highest	_(1)	_(1)	_(1)	86	88	500
	24-hour	4 th Highest	38	33	39	35	22	125
NO	1-hour	19 th Highest	184	166	177	198	162	200
NO ₂	An	nual	<u>51</u>	<u>43</u>	<u>49</u>	<u>45</u>	40	40
O3	8-hour 10 th Highest		<u>189</u>	<u>197</u>	<u>171</u>	<u>175</u>	<u>176</u>	160
со	1-hour	1 st Highest	2290	2660	1810	2230	1780	30,000
	8-hour	1 st Highest	2188	2461	1640	1692	1416	10,000

Table 3.2Summary of the Latest Available Five-Year Air Quality Data at Tung Chung
Station (2011 to 2015)

Notes:

(1) No monitoring data is available for 10-minute SO₂ from 2011 to 2013.

(2) Monitoring results exceeding AQOs are shown as bold and underlined characters.

(3) All calculated provided EPD's data was from the hourly data in website (http://epic.epd.gov.hk/EPICDI/air/station/?lang=en) and extracted from EPD's Air Quality Reports - Annual Air Quality Monitorina Results (http://www.aghi.gov.hk/en/download/air-gualityreportse469.html?showall=&start=1).

(4) Reference conditions of gaseous pollutants concentration data: 298K and 101.325 kPa.

- 3.3.2 As shown in **Table 3.2**, the 10th highest daily PM_{2.5} and PM₁₀, and annual average NO₂ exceeded the AQO criteria in some years during 2011 to 2014, while the concentrations of these pollutants were in a decreasing trend and complied with the AQO criteria in 2015. For O₃, exceedances of the AQO criterion were observed from 2011 to 2015, but its concentration was decreased from 189 µg/m³ in 2011 to 176 µg/m³ in 2015. It is considered that the high O₃ level is a regional air quality problem within the Pearl River Delta Region.
- 3.3.3 For other pollutants such as SO₂ and CO, the measured concentrations at Tung Chung Station during 2011 to 2015 were well below the AQO criteria.
- 3.3.4 The construction of the Project will commence in February 2018 and complete in September 2019 while the operation of the proposed Lai Chi Yuen Cemetery extension will commence in late 2019. Hence, the air pollutant concentrations in 2018 and 2019 at the Project area have been adopted as the background concentration for the construction and operation of the Project. Future background air quality concentrations can be predicted from the Pollutants in the Atmosphere and the Transport over Hong Kong-2016 (PATH-2016) model. PATH-2016 model with Years 2018 and 2019 emission inventory was released by EPD. Air pollutants concentrations for 2018 and 2019 predicted from PATH-2016 in the Project area have been extracted, and are presented in **Table 3.3**.

			Future Background (Concentration, µg/m ³
Air Pollutant	Aver	aging Time	Year 2018	Year 2019
DM2.5	24-hour	10 th Highest	57	57
P1V12.5	Annual		24	24
PM10	24-hour	10 th Highest	76	75
FIVITO		Annual	33	33
SO ₂	24-hour	4 th Highest	28	28
NO.	1-hour	19 th Highest	92	89
NO2	Annual		17	17
O3	8-hour	10 th Highest	<u>164</u>	<u>165</u>
CO	1-hour	1 st Highest	993	992
	8-hour	1 st Highest	816	814

Table 3.3	Air Pollutants	Concentrations	in	2018	and	2019	Predicted	from	PATH-2016
	Model								

Notes:

(1) Extracted from PATH grid (22, 26) in which the Project site is located.

- (2) Predicted concentrations exceeding AQOs are shown as bold and underlined characters.
- (3) With reference to the EPD's *Guidelines on Choice of Models and Model Parameters*, PATH-2016's output of RSP concentration are adjusted as follows:
 - 10th highest daily RSP concentration: add 26.5 μg/m³
 - Annual RSP concentration: add 15.6 μg/m³
- (4) With reference to the *EPD's Guidelines on the Estimation of PM2.5 for Air Quality Assessment in Hong Kong*, the following conservative formulae are adopted to calculate background FSP concentration from the RSP concentration extracted from the PATH model:
 - Annual (μg/m³): PM2.5 = 0.71 × PM10
 - Daily (μ g/m³): PM2.5 = 0.75 × PM10
- (5) Predicted concentration exceeding AQOs are shown as bold and underlined characters.
- 3.3.5 As shown in **Table 3.3**, the predicted background concentrations of all concerned air pollutants except ozone (O₃) would be well within their respective AQOs upon the commencement of the construction and operation of the proposed new niches. The high O₃ level is a regional air quality problem within the Pearl River Delta Region.

Air Sensitive Receivers

3.3.6 The Study Area for the air quality assessment is defined by a distance of 500m from the boundary of the Project and the works of the Project within the Study Area as shown in **Figure 3.1**. Four representative air sensitive receivers (ASRs) located at the north and northwest of the Project site were identified based on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans and Layout Plans and other relevant published land use plans. The identified representative ASRs within the Study Area of the Project are described in **Table 3.4** and their locations are shown in **Figure 3.1**.

Table 3.4	nepresentative All Se	IISILIVE NECEIVE	513	
ASR	Description	Land Use	Approximate Distance from the Nearest Site Boundary (m)	No. of Storey
A1	Scattered Village Houses	Residential	209	1
A2	Lai Chi Yuen Tsuen	Residential	274	2 - 3
A3	Scattered Village Houses	Residential	82	1
A4	Ngau Koo Wan Hill Court	Recreational	307	1

Table 3.4	Representative	Air Sensitive	Receivers
1 aute 3.4	nepresentative	All Selisitive	neceiveis

3.4 Identification and Evaluation of Environmental Impacts

Construction Phase

- 3.4.1 Potential sources of air quality impacts during construction of the Project would be related to dust emission from site formation, erection of retaining walls and construction of proposed new niches and the ancillary facilities including a joss paper burner and planters.
- 3.4.2 As described in **Section 2**, the proposed extension works will involve construction of an elevated platform of around 225m² supported by structural columns within the existing Lai Chi Yuen Cemetery and a site access of around 7.5m² just outside the cemetery connecting to the existing Lantau Trail for pedestrian access only. The elevated platform will be constructed by in-situ concrete casting. The proposed site access will be constructed by simple open cut followed by in-situ casting of reinforced concrete retaining wall/slab and the required depth of excavation for the site access construction would be less than 1.5m. With these construction would be expected. Since only small amount of construction and demolition materials (approximately 500m³) would be generated from the Project, potential impacts associated with the transportation of dusty materials would be negligible. In view of the minor and small scale of the construction works, dust emission from the construction of the Project would be insignificant. With the implementation of dust suppression measure stipulated under the Air Pollution (Construction Dust) Regulation and good site practice, no adverse air quality impact would be anticipated.
- 3.4.3 Since there is no other construction activity identified within 500m of the Project at the time of this EIA preparation, cumulative air quality impact from other construction activity is not expected during construction phase.

Operational Phase

3.4.4 South Lantau Road and the local access road to/from the Lai Chi Yuen Cemetery are the major roads to the Project site. South Lantau Road is a closed road which requires valid Lantau Closed Road Permit for vehicles to access, such that the number of other vehicles induced by the Project would be limited. The single track local access road leading to Lai Chi Yuen would be prohibited for entry of any vehicles except emergency vehicles such as police car and ambulance during Ching Ming and Chung Yeung Festivals. It is estimated that only 28 additional bus trips per hour (2-way) would be induced by the proposed cemetery extension, giving rise to a total of 373 vehicles per hour travelling on South Lantau Road during the Ching Ming Festival and Chung Yeung Festival. In view of the limited increase in traffic flow due to the Project and the low background pollutants concentrations of the study area based on EPD's PATH data as shown in **Table 3.3**, adverse air quality impact arising from road traffic within the study area is not anticipated. No mitigation measure is therefore deemed necessary.

- 3.4.5 There is no joss paper burner in the existing Lai Chi Yuen Cemetery, while grave sweepers are allowed to use iron buckets or containers for burning joss paper or incense in the existing cemetery. Under this Project, a joss paper burner will be installed near the new niches as shown in **Figure 2.2**. There will be emissions from the joss paper burner during the operation of the Project. According to the latest design of the Project, the proposed joss paper burner would adopt the Best Available Technology (BAT), including a water scrubber, an electrostatic precipitator and an exhaust fan connected in series to effectively remove the air pollutants in the emissions. Adequate air flow would be supplied to the furnace chamber in order to allow sufficient oxygen for complete combustion and avoid production of carbon monoxide (CO) and soot. Upon the multi-stage air treatment, the smokeless clean air would be discharged via an extraction fan to the atmosphere. Moreover, the good operational practices and administrative measures as stipulated in EPD's *Guideline on Air Pollution Control for Joss Paper Burning at Chinese Temples, Crematoria and Similar Places* would also be adopted.
- According to the information provided by FEHD, the operation hours of the proposed joss paper burner 3.4.6 would be 8:30am to 5:30pm. Based on the experience of the operator of Lai Chi Yuen Cemetery, iron buckets are infrequently used, except during Ching Ming Festival and Chung Yeung Festival periods. With reference to the approved Environmental Impact Assessment Reports for Provision of Cremators at Wo Hop Shek Crematorium (Register No.: AEIAR-119/2008) and Phased Reprovisioning of Cape Collinson Crematorium (Register No.: AEIAR-137/2009), the duration of a typical joss burning memorial ceremony is 10 minutes and the joss paper offerings are assumed to be 0.5 kg per ceremony. Within the operation period of the joss paper burner, maximum 54 sessions of typical 10-minute joss burning memorial ceremonies could be conducted in one day. Thus, 27 kg of joss paper offerings are estimated to be combusted in the joss paper burner in one day. This estimation could be considered as the worst-case scenario, since, based on experience of the operator of Lai Chi Yuen Cemetery, most grave sweepers use the iron buckets between 10am and 3pm. The iron buckets are very seldom in use outside 10am to 3pm. The pattern of activities at the proposed joss paper burner of the Project is estimated to be similar to that at the existing Lai Chi Yuen Cemetery. Thus, it is predicted that far less than 54 sessions of joss burning memorial ceremonies would be conducted each day.
- 3.4.7 Considering the amount of offerings that would be burnt each day would be small (less than 27 kg), the infrequent use of the joss paper burner and with the flue gas treatment system incorporated and the implementation of the good operational practices and administrative measures, adverse air quality impact arising from the joss paper burning would not be anticipated.
- 3.4.8 With the provision of the joss paper burner (with control device) under this Project, FEHD would direct the users of the existing Lai Chi Yuen Cemetery to adopt the proposed burner for joss paper burning. As such, with the installation of the proposed burner, potential emissions from joss paper burning activities in the existing Lai Chi Yuen Cemetery would be minimized.
- 3.4.9 Since there was no major industrial emission identified within 500m of the Project at the time of this EIA preparation, no cumulative air quality impact from industrial emission would therefore be expected.

3.5 Recommended Mitigation Measures

Construction Phase

- 3.5.1 Sufficient dust suppression measures as stipulated under the *Air Pollution Control (Construction Dust) Regulation* and good site practices should be properly implemented in order to minimize the construction dust generated.
 - a) Use of regular watering, to reduce dust emissions from exposed site surfaces and unpaved roads particularly during dry weather;
 - b) Use of frequent watering of particular dusty construction areas close to ASRs;
 - c) Side enclosure and covering of any aggregate or dusty material storage piles to reduce emissions. Where this is not practicable owing to frequent usage, watering should be applied to aggregate fines;
 - d) Open temporary stockpiles should be avoided or covered. Prevent placing dusty material storage

plies near ASRs;

- e) Tarpaulin covering of all dusty vehicle loads transported to, from and between site locations;
- f) Establishment and use of vehicle wheel and body washing facilities at the exit point of the site;
- g) Imposition of speed control for vehicles on unpaved site roads. 8 km/hr is the recommended limit;
- h) Routing of vehicles and positioning of construction plant should be at the maximum possible distance from ASRs.

Operational Phase

3.5.2 Apart from the adoption of BAT to the proposed joss paper burner, the following good operational practices and administrative measures as well as good maintenance practices as stipulated in EPD's *Guideline on Air Pollution Control for Joss Paper Burning at Chinese Temples, Crematoria and Similar Places* should be strictly followed in order to ensure proper operation of the joss paper burner:

Good Operational Practices and Administrative Measures

- (i) Before burning joss paper, the operator should make sure that the air pollution control equipment has been turned on and running normally. Joss paper burning should never be carried out without operation of the air pollution control equipment.
- (ii) The operator should ensure only offerings made with paper materials are burnt in the furnace. Other wrapping materials, in particular plastic materials, should be removed.
- (iii) It is essential to employ trained operators to control the feeding rate of joss paper to the furnaces. In case visible emissions are observed at the flue gas discharge, the feeding rate should be reduced as appropriate, and if visible emissions persist, the operator should immediately stop the burning activities and call for maintenance of the air pollution control equipment if necessary.
- (iv) Whenever there is a sign of deterioration in performance of the electrostatic precipitator, the operator should arrange cleaning of the electrostatic precipitator. For those electrostatic precipitators with automatic self-cleaning function, the operator should ensure self-cleanings are carried out at frequencies recommended by manufacturers.
- (v) The operator should regularly clean the burning chamber and clear away ash remains inside the burning chamber, preferably at least once a day. To prevent emissions during ash clearing process, the ash should be wetted sufficiently by water spraying.

Good Maintenance Practices

- (i) Maintenance and repair of air pollution control equipment should only be carried out by competent personnel with sufficient training and relevant skills in accordance with manufacturer's recommendations.
- (ii) Air pollution control equipment should be maintained regularly to ensure optimum performance. All components should also be inspected, cleaned and serviced regularly.
- (iii) Any defective parts of the air pollution control equipment should be replaced as soon as possible. To facilitate immediate replacement, sufficient stick of spare parts should be kept on-site.
- (iv) Operators should keep a copy of the operation and maintenance manual and should maintain a proper log of maintenance records on-site to facilitate maintenance of the equipment.

3.6 Evaluation of Residual Impacts

Construction Phase

3.6.1 With the implementation of dust suppression measures stipulated in *Air Pollution Control* (*Construction Dust*) Regulation, no adverse residual dust impact would be anticipated during construction phase.

Operational Phase

3.6.2 With the incorporation of flue gas treatment system and the implementation of the good operational practices and administrative measures for the proposed joss paper burner, no adverse residual impact would be anticipated.

3.7 Environmental Monitoring and Audit Requirements

Construction Phase

3.7.1 Since no adverse dust impact would be anticipated at the ASRs with the implementation of sufficient dust suppression measures as stipulated under *the Air Pollution Control (Construction Dust) Regulation* and good site practices, no air quality monitoring is considered necessary. Regular site environmental audit during the construction phase of the Project should be conducted to ensure the recommended dust suppression measures are properly implemented.

Operational Phase

3.7.2 By incorporating flue gas treatment system in the proposed joss paper burner and limiting joss paper burning activities through administration procedures, adverse air quality impact arising from joss paper burning would not be anticipated. Therefore, no EM&A requirement for air quality during operation of the Project is deemed necessary. Nonetheless, it should be noted that trained operators should be employed to control the feeding rate of joss paper to the furnaces, regularly clean the burning chamber, observe flue gas discharge, and ensure normal operation of the joss paper burner to avoid abnormal air pollutant emissions.

3.8 Conclusion

The potential air quality impacts arising from the construction and operation of the Project were assessed. Adverse construction phase air quality impact would not be anticipated with the implementation of dust suppression measures as stipulated in the *Air Pollution Control (Construction Dust) Regulation* and good site practices. With the incorporation of flue gas treatment system and the implementation of the good operational practices and administrative measures as well as good maintenance practices for the proposed joss paper burner, no adverse air quality impact would be expected during operation of the Project.

4. NOISE

4.1 Introduction

4.1.1 This section presents an assessment of the potential noise impact associated with the construction and operation of the Project. The noise impact assessment was conducted in accordance with the requirements set out under Section 3.4.4 of the EIA Study Brief. Recommendation for mitigation measures have been made, where necessary and appropriate.

4.2 Environmental Legislation, Standards and Guidelines

General

4.2.1 Noise impacts were assessed in accordance with the criteria and methodology given in the Technical Memoranda (TMs) under the Noise Control Ordinance (NCO), and Annexes 5 and 13 in the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).

Construction Noise

- 4.2.2 The currently envisaged construction programme will not require any works using powered mechanical equipment (PME) during restricted hours (i.e. the hours of 1900 to 0700 hours or at any time on a general holiday) nor percussive piling works. On the above-mentioned basis, the criteria stipulated in Table 1B of Annex 5 to the EIAO-TM, namely Leq (30 minutes) 75 dB(A) at the façades of dwellings and 70 dB(A) at the façade of schools (65 dB(A) during examinations), are relevant to the assessment of construction noise impacts.
- 4.2.3 In case of any construction activities during restricted hours, it is the Contractor's responsibility to ensure compliance with the Construction Noise Permit (CNP) and the relevant TMs. The Contractor will be required to submit CNP application to the Noise Control Authority and abide by any conditions stated in the CNP, should one be issued.

Fixed Plant Noise

4.2.4 Fixed noise sources associated with the Project would be controlled by the NCO and *Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites* (IND-TM). The Acceptable Noise Levels (ANL) is a function of the type of area within which the noise sensitive receivers (NSRs) are located, and the degree of the effect on the NSRs of influencing factors such as major roads and industrial areas. According to the IND-TM, the ANLs for different Area Sensitivity Ratings (ASRs) are given in **Table 4.1**.

Table 4.1Acceptable Noise Levels (ANL)

Time Period	Area Sensitivity Rating (ASR)					
Time Period	Α	В	С			
Day (0700 to 1900 hours)	60	<u>CE</u>	70			
Evening (1900 to 2300 hours)	00	CO	70			
Night (2300 to 0700 hours)	50	55	60			

4.2.5 Since the Project is located in rural area and no influencing factors (i.e. industrial activities or major roads) affect the NSRs, an ASR of "A" has been assigned. The EIAO-TM recommends that the level of the intruding noise at the façade of the nearest sensitive use should be at least 5 dB(A) below the appropriate ANL or, in the case of background noise being 5 dB(A) lower than the ANL, the predicted noise level arising from the operation of the proposed Project at the façade of the nearest sensitive use should not exceed the background noise level. In this regard, noise measurement was undertaken in the vicinity of the representative NSRs to study the prevailing noise level (see **Appendix 4.1**). The assessment criteria for the proposed fixed noise sources of the Project, as adopted in this EIA Study, are presented in **Appendix 4.2**.

4.3 Description of the Environment

Existing Environment

4.3.1 The project site is located the existing Lai Chi Yuen Cemetery at Mui Wo, Lantau Island. It falls within the Lantau South Country Park. Some scattered village houses and Lai Chi Yuen Tsuen are located to the north-west of the project site. The existing noise climate of the Study Area was quiet and no major noise source was identified.

Noise Sensitive Receivers

- 4.3.2 The Study Area for the noise assessment is defined by a distance of 300m from the boundary of the Project and the works of the Project as shown in **Figure 4.1**. Representative NSRs were selected within the Study Area according to the criteria set out in the EIAO-TM, through site visits and a review of relevant land use plans including the Outline Zoning Plans (OZP), Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans. According to OZP No. S/SLC/19, no planned/committed noise sensitive developments were identified. Noise sensitive uses in the close vicinity of the project site, as shown in the OZP, have been duly represented by the existing representative noise sensitive receivers.
- 4.3.3 **Figure 4.1** shows the locations of the representative NSRs. Details of the representative NSRs are presented in **Table 4.2**. Photographs of the representative NSRs are shown in **Appendix 4.3**. These identified noise assessment points were sent to Environmental Protection Department for agreement prior to the quantitative assessment (see **Appendix 4.4**).

NSR ID	Description	Land Use	No. of storey	Distance between NSR and nearest Project Boundary, m
N1	Scattered Village Houses	Residential	1	209
N2	Lai Chi Yuen Tsuen	Residential	2-3	274
N3	Scattered Village Houses	Residential	1	82

Table 4.2 Representative Noise Sensitive Receivers

4.4 Identification of Potential Environmental Impacts

Construction Phase

- 4.4.1 The potential source of noise impact during construction phase of the Project would be the use of PME for various construction activities. The Project would involve the major construction activities, including slope works, substructure works, superstructure works, fitting out works and landscape works. As confirmed with the Project Proponent, percussive piling and blasting work would not be required, and the works would be carried out by general construction methods.
- 4.4.2 Generally, the construction activities of the Project would be carried out in non-restricted hours (0700-1900 hours) during normal working days. In case of any construction activities during restricted hours, it is the Contractor's responsibility to ensure compliance with the NCO and the relevant TMs. The Contractor will be required to submit CNP application to the Noise Control Authority and abide by any conditions stated in the CNP, should one be issued.
- 4.4.3 Based on current available information, no concurrent projects have been identified within 300m of the project boundary. Hence, cumulative construction noise impact due to the construction works of the Project and other concurrent projects was not expected and assessed in this EIA Study.

Operational Phase

4.4.4 According to information provided by the Project Proponent, the fixed plants to be installed for the new niches include two water pumps and a joss paper burner. The joss paper burner would be comprised of a water scrubber, an electrostatic precipitator and an exhaust fan, which would generate noise during operation. In view of the buffer distance of around 82m from the nearest village houses and

the screening of natural terrain around the site, the potential fixed plant noise impact arising from the Project would not be insurmountable.

4.4.5 Since there is no fixed noise source in the existing Lai Chi Yuen Cemetery, cumulative noise impact arising from the operation of the existing cemetery and the Project would not be expected.

4.5 Assessment Methodology

Construction Noise

- 4.5.1 In accordance with the EIAO-TM, the methodology outlined in the *Technical Memorandum on Noise from Construction Work other than Percussive Piling* (GW-TM) issued under the NCO was used for the construction noise assessment. The general approach is summarized below:
 - Locate the NSRs which would most likely be affected by noise from the construction work;
 - Determine the items of Powered Mechanical Equipment (PME) for each discrete construction activity, based on available information or agreed plant inventories;
 - Assign sound power levels (SWLs) to the proposed PME according to the GW-TM or other sources;
 - Calculate distance attenuation and screening effects to NSRs from notional noise source;
 - Predict construction noise levels at NSRs in the absence of any mitigation measures; and
 - Include a 3 dB(A) façade correction to the predicted noise levels in order to account for the façade effect at each NSR.
- 4.5.2 The assessment of construction noise was undertaken based on standard acoustic principles. SWLs of the equipment were taken from Table 3 of GW-TM. Where no SWL was given in the GW-TM, reference was made to EPD's *Sound power levels of other commonly used PME*. Groups of PME were assigned for various construction activities of the proposed Project. The proposed plant inventory with appropriate on-time percentage for all items of PME for the construction works of the Project is presented in **Appendix 4.5**. The Project Proponent has confirmed the proposed plant inventories as being practical and adequate for completing the works within the scheduled timeframe.
- 4.5.3 The assessment was undertaken based on the assumption that all items of construction equipment would be located at a notional noise source point for each phase of works and that all items of equipment would be operating simultaneously.

Operational Fixed Plant Noise

4.5.4 The type and model of the water pumps and joss paper burner to be installed were not confirmed at the time this report was prepared. For the assessment of noise from the fixed plants, the total maximum permissible sound power level (Max. SWL) of the identified fixed noise sources were determined by adopting standard acoustics principles. The following formula was used for calculating the Max. SWL of the fixed plants.

SPL = Max. SWL - DC + FC - BC

where

Sound Pressure Level (SPL) in dB(A) Maximum Permissible Sound Power Level (Max. SWL) in dB(A) Distance Attenuation (DC) in dB(A) = 20 log D + 8 [where D is distance in metres] Facade Correction (FC) in dB(A) = 3 dB(A) Barrier Correction (BC) in dB(A)

4.5.5 Both the joss paper burner and the water pumps should be free of characteristics of tonality, impulsiveness and intermittency. A negative correction of 10 dB(A) was adopted to include the screening effect of topographical features.

- 4.5.6 Noise impact was assessed on the basis of the following conservative assumptions:
 - The distance is assumed to be the minimum distance between the NSR and the Project boundary; and
 - All items of operational plant to be operated simultaneously during the operation period.

4.6 Prediction and Evaluation of Environmental Impacts

Construction Phase

4.6.1 For normal daytime working hours, the predicted noise levels at the representative NSRs would be in the range of 58 to 75 dB(A) in the absence of mitigation measures. Exceedances of the construction noise criteria (L_{eq (30 minutes)} 75 dB(A) for residential uses were not predicted and hence noise mitigation measures would not be required. Details of construction noise calculations and results are presented in **Appendix 4.6**. A summary of the unmitigated construction noise levels of the representative NSRs during normal daytime working hours is shown in **Table 4.3**.

Table 4.3Summary of Predicted Unmitigated Construction Noise Levels at
Representative Noise Sensitive Receivers during Normal Daytime Working
Hours

NSR ID	Description	Use	Predicted Noise Level, dB(A)	Noise Criteria, dB(A)
N1	Scattered Village Houses	Residential	60 – 68	75
N2	Lai Chi Yuen Tsuen	Residential	58 – 65	75
N3	Scattered Village Houses	Residential	68 – 75	75

4.6.2 According to Annex 13 of the EIAO-TM, Lantau South Country Park is a potential NSR. However, in view of the transient nature of visitors to the Country Park, any potential construction noise impact on the visitors would not be considered insurmountable and hence was not identified as a noise assessment point in the assessment.

Operational Phase

4.6.3 The total maximum permissible sound power levels (Max. SWL) of the water pumps and joss paper burner at the extension area was determined by adopting the methodology described in **Section 4.5.4**. The result is shown in **Table 4.4** and detailed calculation is presented in **Appendix 4.7**.

Table 4.4Predicted Total Maximum Permissible Sound Power Level of the Water Pumps
and Joss Paper Burner

NSR ID	Description	Noise Criteria (daytime), dB(A) ⁽¹⁾	Max. SWL, dB(A)
N1	Scattered Village Houses	41	
N2	Lai Chi Yuen Tsuen	44	94
N3	Scattered Village Houses	41	

Notes:

(1) As the fixed plants would only operate from 8:30am to 5:30pm, only the daytime noise criteria are considered in this assessment.

4.6.4 No adverse operational noise impact would be expected arising from the water pumps and proposed joss paper burner if they are designed to not exceed the Max. SWL. As confirmed by the Project Proponent, the total Max. SWL as shown in **Table 4.4** above could be achieved by incorporated with the sound attenuators such as silencers and muffler, for reduction of the operation noise emission levels so as to comply with relevant noise criteria.

4.6.5 According to Annex 13 of the EIAO-TM, Lantau South Country Park is also a potential noise sensitive receiver. Providing that the fixed plants would be designed to not exceed the Max. SWL, operational noise impact to Lantau South Country Park would be insignificant.

4.7 Recommended Mitigation Measures

Construction Phase

- 4.7.1 Although no exceedance of the construction noise criteria was predicted without mitigation measures, good site practice listed below and the noise control requirements stated in EPD's "*Recommended Pollution Control Clauses for Construction Contracts*" should be implemented to further minimise the potential noise nuisance during construction phase.
 - Only well-maintained plant to be operated on-site and plant should be serviced regularly during construction works;
 - Machines and plant that may be in intermittent use to be shut down between work periods or should be throttled down to a minimum;
 - Plant known to emit noise strongly in one direction, should, where possible, be orientated to direct noise away from the NSRs;
 - Mobile plant should be sited as far away from NSRs as possible; and
 - Material stockpiles and other structures to be effectively utilized, where practicable, to screen noise from on-site construction activities.

Operational Phase

4.7.2 Since the predicted noise levels at all representative NSRs would comply with the noise criteria, no mitigation measure for the operation of the Project is required.

4.8 Evaluation of Residual Impacts

Construction Phase

4.8.1 No residual impact is anticipated during construction of the Project.

Operational Phase

4.8.2 No residual impact is anticipated during operation of the Project.

4.9 Environmental Monitoring and Audit Requirements

- 4.9.1 No construction noise monitoring is considered necessary. Regular site environmental audit during the construction phase of the Project as specified in the separate EM&A Manual should be conducted to ensure the good site practices are properly implemented.
- 4.9.2 No adverse operational noise quality impact is anticipated. Operation noise monitoring is not considered necessary.

4.10 Conclusion

4.10.1 This assessment has predicted the construction noise impacts of the Project during normal daytime working. The predicted unmitigated noise levels at representative NSRs would range from 58 to 75 dB(A). The noise levels at all representative NSRs would comply with the construction noise criterion of 75 dB(A).

The noise impact associated with the operation of the Project was assessed. No adverse operational noise quality impact on all representative NSRs would be anticipated provided that the water pumps and joss paper burner would be designed to not exceed the total Max. SWL of 94 dB(A).

5. HAZARD TO LIFE

5.1 Introduction

- 5.1.1 This section presents a summary of the analysis and findings of the Hazard to Life Assessment (HA) undertaken for the proposed construction and operation for this Project, in accordance with Section 3.4.5 of the EIA Study Brief (ESB-288/2015).
- 5.1.2 This HA aims to achieve the objectives specified in the Section 2.1 of the EIA Study Brief. Technical requirements in the Study Brief are listed in the following:
 - 3.4.5 Hazard to Human Life
 - 3.4.5.1 The Applicant shall follow the criteria for evaluating hazard to human life as stated in section 2 of Annex 4 of the TM.
 - 3.4.5.2 The hazard to human life assessment shall follow the detailed technical requirements given in Appendix C.

Appendix C - Requirements for Assessment of Hazard to Human Life

- The Applicant shall carry out hazard assessment to evaluate potential hazard to life during construction and operation stages of the Project due to Silvermine Bay Water Treatment Works (SMBWTW). The hazard assessment shall include the following:
 - (i) Identify hazardous scenarios associated with the transport, storage and use of chlorine at SMBWTW and then determine a set of relevant scenarios to be included in a Quantitative Risk Assessment (QRA);
 - (ii) Execute a QRA of the set of hazardous scenarios determined in (i), expressing population risks in both individual and societal terms;
 - (iii) Compare individual and societal risks with the criteria for evaluating hazard to life stipulated in Annex 4 of the TM; and
 - (iv) Identify and assess practicable and cost-effective risk mitigation measures.
- 2. The methodology to be used in the hazard assessment shall be agreed with the Director and should be consistent with previous studies having similar issues (e.g. Integration of Siu Ho Wan and Silver Mine Bay Water Treatment Works)

5.2 Environmental Legislation, Standards and Guidelines

- 5.2.1 The key legislation and guidelines that are considered relevant to the Project are as follows:
 - Dangerous Goods Ordinance, Chapter 295; and
 - Environmental Impact Assessment Ordinance (EIAO), Chapter 499.
 - EIAO Technical Memorandum (EIAO-TM)
 - Hong Kong Government Risk Guidelines (HKRG), EIAO TM Annex 4

5.3 Study Approach

- 5.3.1 The overall approach to the assessment is represented in **Figure 5.1**.
- 5.3.2 The major phases in the HA are:
 - (i) **Hazard Identification:** Identify hazard scenarios associated with the transport, storage and use of chlorine, and then determine a set of relevant scenarios to be included in a QRA.
 - (ii) **Frequency Assessment:** Assess the likelihood of occurrence of the identified hazard scenarios.
 - (iii) **Consequence Assessment:** Assess the consequences and impact to the surrounding population.
 - (iv) **Risk Summation and Assessment:** Evaluate the risk level, in terms of individual risk and societal risk. The risks will be compared with the criteria stipulated in Annex 4 of the Environmental Impact Assessment Ordinance Technical Memorandum (EIAO-TM)^[1] to determine their acceptability.

- (v) Identification of Mitigation Measures: Identify and assess practicable and cost-effective risk mitigation measures. The risks of mitigated cases will then be reassessed to determine the level of risk reduction.
- 5.3.3 When conducting the HA, reference to studies of similar nature or facility in Hong Kong will be made, so as to maintain consistency with similar studies in Hong Kong. The studies proposed to be collected and reviewed are:
 - (i) An Environmental Impact Assessment (EIA) Report for "Integration of Siu Ho Wan and Silver Mine Bay Water Treatment Works" (Register No.: AEIAR-158/2011) (the "Previous Report")^[2] was prepared in 2010 and approved by EPD in 2011. Hazardous scenario identified and assessed in the Hazard Assessment of this report will be adopted as a basis for the current HA.
 - (ii) In 2009, a feasibility study was carried out for a Potential Housing Site in Tuen Mun East Area by the Planning Department (PlanD) and Civil Engineering and Development Department (CEDD)^[3]. In that report the Tai Lam Chung No.2 Chlorination Station (now called Tai Lam Chung Chlorination Store) was studied in form of a QRA. Since the methodology and modelling approach of the report is very similar to that used in the Previous Report, that report will be studied and referenced where applicable.
- 5.3.4 The overall approach and methodology of the assessment were discussed in detail in Methodology Paper and was agreed by Environmental Protection Department.

5.4 Risk Acceptability Criteria

- 5.4.1 As stipulated in the Annex 4 of the EIAO-TM, the risk guidelines comprise two measures shown as follows:
 - i. **Individual Risk:** the maximum level of off-site individual risk should not exceed 1 x 10⁻⁵ / year, i.e. 1 in 100,000 per year.
 - ii. **Societal Risk:** it can be presented graphically as in **Figure 5.2**. The Societal Risk Guideline is expressed in terms of lines plotting the frequency (F) of N or more fatalities in the population from accidents at the facility of concern. In the figure, ALARP means As Low As Reasonably Practicable. Risk in this region should be mitigated to As Low As Reasonably Practicable.

5.5 Cases to be Studied

5.5.1 Four cases were considered in this study to demonstrate the changes in risk level caused by the proposed development:

Calibration Case (year 2018)

5.5.2 In the calibration case, all the available parameters in the Previous Report were adopted. Individual risk contour and societal risk FN curve were generated using the in-house risk summation software RISKSUM, so as to demonstrate that the simulation approach is able to produce similar result as the Previous Report.

Baseline without proposed Project (year 2020)

5.5.3 The baseline study assessed the risk at the operation year (year 2020) without the proposed project, i.e. without the Lai Chi Yuen Cemetery extension.

Construction Stage (year 2019)

5.5.4 The construction case assessed the risk of increased construction workers at the proposed site. Year 2019 is the tentative final year of construction of the proposed project.

Operation Stage (year 2020)

5.5.5 The operation case assessed the increase of risk due to the increase of population in Lai Chi Yuen Cemetery as well as the associated roads due to the operation of the Lai Chi Yuen Cemetery extension.

5.6 Meteorological Data

- 5.6.1 The meteorological conditions affect the consequence of release in particular the wind direction, speed and stability, which influences the direction and degree of turbulence of gas dispersion.
- 5.6.2 For consistency, meteorological data used in the Previous Report was adopted for calibration case. It is summarized in **Table 5.1** and **Table 5.2**. Although the sum of the frequencies is 0.5 in those tables, during actual calculation the frequencies were automatically normalized to 1 for day time and night time respectively.

Sector	Degree from North	В	D	D	D	Е	F	Total
1	0°	0.0025	0.00125	0.02574	0.0085	0	0	0.03798
2	22.5°	0.00545	0.0019	0.01519	0.00265	0	0	0.02519
3	45°	0.0062	0.00265	0.01854	0.01035	0	0	0.03773
4	67.5°	0.0034	0.00215	0.04223	0.06362	0	0	0.11141
5	90°	0.00165	0.00105	0.03264	0.04323	0	0	0.07857
6	112.5°	0.00085	0.0007	0.00805	0.00755	0	0	0.01714
7	135°	0.0009	0.00055	0.0039	0.003	0	0	0.00835
8	157.5°	0.00065	0.0008	0.01364	0.0039	0	0	0.01899
9	180°	0.0007	0.00085	0.01529	0.0025	0	0	0.01934
10	202.5°	0.0007	0.0006	0.0071	0.002	0	0	0.01040
11	225°	0.00115	0.00115	0.007	0.00165	0	0	0.01095
12	247.5°	0.00305	0.00155	0.01614	0.00065	0	0	0.02139
13	270°	0.0067	0.0017	0.02064	0.00125	0	0	0.03029
14	292.5°	0.00675	0.0009	0.01574	0.00445	0	0	0.02784
15	315°	0.0039	0.0009	0.00875	0.0041	0	0	0.01765
16	337.5°	0.0036	0.001	0.01619	0.006	0	0	0.02679
Тс	otal	0.04813	0.01969	0.26679	0.16538	0	0	0.5
Wind (m	Speed n/s)	15	1	4	7	3	1	

Table 5.1 Statistics of Frequencies of Different Weather Categories (Day Time - SMBWTW)

Sector	Degree from North	В	D	D	D	E	F	Total
1	0°	0	0.00066	0.0099	0.00413	0.00388	0.00434	0.02291
2	22.5°	0	0.00087	0.01668	0.00582	0.01056	0.0077	0.04163
3	45°	0	0.00133	0.00949	0.00184	0.00832	0.01031	0.03129
4	67.5°	0	0.00179	0.01143	0.00709	0.01	0.01454	0.04485
5	90°	0	0.00148	0.02683	0.04357	0.01643	0.01888	0.10719
6	112.5°	0	0.00071	0.02112	0.01939	0.01602	0.01454	0.07178
7	135°	0	0.00046	0.005	0.00515	0.00403	0.00826	0.0229
8	157.5°	0	0.00036	0.00224	0.00204	0.00189	0.00668	0.01321
9	180°	0	0.00056	0.00826	0.0027	0.00679	0.00944	0.02775
10	202.5°	0	0.00061	0.00959	0.00173	0.00832	0.00867	0.02892
11	225°	0	0.00041	0.00423	0.00138	0.00413	0.00525	0.0154
12	247.5°	0	0.00077	0.00393	0.00112	0.00301	0.00622	0.01505
13	270°	0	0.00107	0.00571	0.00046	0.00138	0.00531	0.01393
14	292.5°	0	0.00117	0.00668	0.00082	0.00128	0.00454	0.01449
15	315°	0	0.00061	0.00724	0.00301	0.00173	0.00275	0.01534
16	337.5°	0	0.00061	0.0051	0.00281	0.00209	0.00275	0.01336
Тс	otal	0	0.01347	0.15345	0.10305	0.09984	0.13019	0.5
Wind (m	Speed n/s)	15	1	4	7	3	1	

 Table 5.2
 Statistics of Frequencies of Different Weather Categories (Night Time - SMBWTW)

- 5.6.3 Other than the "Calibration Case" (i.e. "baseline", "construction' and "operation" cases), the average meteorological data from Peng Chau automatic weather station from year 2006 to year 2015 was adopted from Hong Kong Observatory. Peng Chau automatic weather station is the nearest station in Hong Kong Observatory that has similar altitude to the Mui Wo Area to best represent the meteorological condition of the area.
- 5.6.4 In order to maintain consistency with the Previous Report, the number of wind directions and weather classes were followed. The average wind speeds and wind directions were classified as daytime (0700-1900 hrs) and night time (1900-0700 hrs) and are summarized in the following tables and wind roses (**Figure 5.3** and **Figure 5.4**). As illustrated by the wind roses, the prevailing wind directions in the area are from east (E) followed by from north north-west.

Sector	Degree from North	В	D	D	D	Е	F	Total
1	0°	0.01631	0.00463	0.01573	0.01442	0.00485	0.00633	0.06227
2	22.5°	0.00716	0.00217	0.00236	0.00179	0.00088	0.00227	0.01664
3	45°	0.00805	0.00208	0.00501	0.00136	0.00155	0.00198	0.02003
4	67.5°	0.01824	0.00246	0.01509	0.01533	0.00306	0.00222	0.05640
5	90°	0.08947	0.00487	0.04634	0.11857	0.00559	0.00489	0.26973
6	112.5°	0.03522	0.00320	0.00595	0.00702	0.00179	0.00339	0.05656
7	135°	0.04350	0.00401	0.00599	0.00148	0.00177	0.00435	0.06110
8	157.5°	0.04377	0.00456	0.00776	0.00086	0.00205	0.00442	0.06342
9	180°	0.05188	0.00929	0.00941	0.00062	0.00246	0.00707	0.08073
10	202.5°	0.05515	0.00795	0.00766	0.00014	0.00196	0.00602	0.07889
11	225°	0.02075	0.00346	0.00489	0.00043	0.00141	0.00399	0.03493
12	247.5°	0.00122	0.00081	0.00050	0.00007	0.00029	0.00122	0.00411
13	270°	0.00267	0.00107	0.00050	0.00010	0.00029	0.00186	0.00649
14	292.5°	0.02225	0.00131	0.00568	0.00296	0.00153	0.00420	0.03794
15	315°	0.02414	0.00239	0.01382	0.01263	0.00313	0.00544	0.06155
16	337.5°	0.02125	0.00363	0.02731	0.02509	0.00614	0.00578	0.08920
Тс	otal	0.46103	0.05790	0.17404	0.20288	0.03873	0.06542	1.00000
Wind (m	Speed n/s)	15	1	4	7	3	1	

Table 5.3	Average Wind Statistics for Daytime (Peng Chau 2006-2015)
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	Table 5.4	Average Wind Statistics for N	Night-time (Peng Chau 2006-20	15)
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Sector	Degree from North	В	D	D	D	Е	F	Total
1	0°	0.00000	0.00007	0.02584	0.01628	0.01495	0.02478	0.08192
2	22.5°	0.00000	0.00012	0.00284	0.00125	0.00217	0.00698	0.01336
3	45°	0.00000	0.00010	0.00864	0.00147	0.00578	0.00708	0.02307
4	67.5°	0.00000	0.00010	0.02904	0.02018	0.00987	0.00867	0.06786
5	90°	0.00000	0.00012	0.09186	0.13521	0.02290	0.01705	0.26714
6	112.5°	0.00000	0.00012	0.01471	0.00660	0.00946	0.01864	0.04953
7	135°	0.00000	0.00005	0.01026	0.00154	0.00867	0.02155	0.04207
8	157.5°	0.00000	0.00007	0.01081	0.00065	0.01074	0.02463	0.04691
9	180º	0.00000	0.00010	0.01731	0.00075	0.02032	0.04801	0.08649
10	202.5°	0.00000	0.00005	0.00809	0.00034	0.01382	0.04226	0.06456
11	225°	0.00000	0.00007	0.00602	0.00084	0.00778	0.02463	0.03935
12	247.5°	0.00000	0.00005	0.00082	0.00010	0.00089	0.01009	0.01194
13	270°	0.00000	0.00005	0.00017	0.00014	0.00031	0.01233	0.01300
14	292.5°	0.00000	0.00002	0.00320	0.00205	0.00178	0.02023	0.02728
15	315°	0.00000	0.00012	0.01700	0.01043	0.00848	0.02374	0.05977
16	337.5°	0.00000	0.00024	0.03942	0.02601	0.01842	0.02167	0.10576
Тс	otal	0.00000	0.00144	0.28604	0.22382	0.15635	0.33235	1.00000
Wind (m	Speed n/s)	15	1	4	7	3	1	

5.7 Review of the Current Site

- 5.7.1 Lai Chi Yuen Cemetery is located at the south of Mui Wo. It is in the middle of Nam Shan and is at about +100mPD. Surrounding the site is mostly hilly area. There is only one small access road connecting the project site to the South Lantau Road. A photo of the Lai Chi Yuen Cemetery is shown in **Figure 5.5**. The entrance is at the top of the slope and the Cemetery span downhill with burial spaces arranged in levels along the slope.
- 5.7.2 The proposed project is an extension of current Cemetery. It is located at the entrance of the Lai Chi Yuen Cemetery, in form of an elevated platform to accommodate 790 outdoor niches and ancillary facility including a joss paper burner and planters.
- 5.7.3 The location of the Lai Chi Yuen Cemetery and its relative location to SMBWTW is shown in Figure 5.6. The chlorine store within SMBWTW is separated from the project site for about 700m. The consultation zone of SMBWTW as stipulated in the Potentially Hazardous Installations (PHI) register is illustrated in Figure 5.7.
- 5.7.4 No Dangerous Goods is stored and will be stored in the Lai Chi Yuen Cemetery site.

5.8 Review of SMBWTW

Design parameter of SMBWTW

- 5.8.1 Chlorine is used in this water treatment works to disinfect the water before sending out to the potable water network. During operation, two chlorine drums are moved to the designated loading area, where they are connected to fixed pipework for chlorination process. One drum is the duty drum and another one is in standby. When the chlorine in the duty drum is depleted, the standby drum will automatically kick in to replace the duty drum, by the auto-changeover system in the pipework.
- 5.8.2 Chlorine is transported to SMBWTW by truck in form of 1-tonne chlorine drums. The chlorine in the drum is stored in liquid form at equilibrium pressure inside the drum which varies with ambient temperature.
- 5.8.3 A site visit to SMBWTW was carried out on 23rd Nov. 2015. WSD has confirmed that there is no change in plant operation parameters compared to the Previous Report. The design parameters are summarized in the following table:

Table 5.5	Design Parameters of SMBWTW
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Parameter	Value		
Design treatment capacity	159,000 m ³ /day		
Form of chlorine storage	1-tonne drum		
Chlorine inventory	Max. 17 tonnes		
Number of evaporators	2		
Number of Chlorinators	3		
Chlorine dosage rate	2-5ppm		
Number of chlorine drums delivered per truck	6		

- 5.8.4 Layout of SMBWTW is shown in **Figure 5.8**.
- 5.8.5 The delivery of chlorine is calculated based on the design dosage rate of chlorine into the water. It is assumed that the chlorine delivery is carried out during daytime.

Contain and Absorb System

5.8.6 The chlorine store is equipped with chlorine detection system and "Contain-and-Absorb" system. The chlorine detection system can detect the presence of chlorine as low as 3 ppm and automatically

activate alarms as well as the "Contain-and-Absorb" system. Once it is activated, the air inside the chlorine store will be directed to a chlorine scrubber which can absorb the gaseous chlorine and the treated air will be circulated back to the chlorine store.

- 5.8.7 The scrubber is a packed tower with sodium hydroxide solution as the absorbing media. The sodium hydroxide solution in the chlorine scrubber is designed to treat 1-tonne of chlorine release.
- 5.8.8 Unloading of chlorine from truck to the store is carried out within the store with the roller shutter shut off.

5.9 Population Assumptions Adopted in this Study

General Approach

<u>Scope</u>

5.9.1 Population data to be considered include the 2010 population assumption from the past report (for the calibration case), and population around SMBWTW which may be affected by the hazardous scenarios of SMBWTW. This would cover the 1km Consultation Zone (CZ), as well as population outside the CZ which might be affected by potential chlorine releases. The population area considered in this study is illustrated in **Appendix 5.1**.

Data Sources

- 5.9.2 Estimation of future population is based on the following sources:
 - i. Assumptions made in "Integration of SHW and SMBWTW EIA" report
 - ii. Hong Kong Population Census and other population statistics published by Census and Statistics Department (C&SD)
 - iii. Traffic Impact Assessment (TIA) by traffic consultant
 - iv. Desktop search conducted by consultants
 - v. Site surveys undertaken by the consultants

General Population Growth Rate

- 5.9.3 The growth rate of residential population was estimated from the "*Projections of Population Distribution 2015-2024*" published by Planning Department and C&SD. Other populations such as those in the commercial area would follow the assumption in Previous Report with additional population growth to account for the major civil works in the area (the Mui Wo Facelift, further discussed in **Section 5.9.13**).
- 5.9.4 The population projection of Tertiary Planning Unit (TPU) 962 is representing the Mui Wo area (**Figure 5.9**). Projected population by TPU at units 961 and 962 is listed in the following table:

Table 5.6	Population	Projection	for	TPU 961	and 962

Tertiary Planning	Projected Population ⁽¹⁾							
Units, TPU(s)	2014	2015	2016	2017	2018	2019	2020	
961 & 962	5 900	6 000	6 000	6 000	6 100	7 800	7 800	
% change from past year	N/A	2%	0%	0%	2%	28%	0%	

Note:

(1) Data extracted from Table 15 of the "Projections of Population Distribution 2015-2024" Report

5.9.5 The general population trend is about stagnant or a 2% annual increase in some years (year 2015 and year 2018). The sudden jump in year 2019 corresponds to the new public housing development in Mui Wo. From the above data, an annual population growth rate of 1.5% is approximated for residential population in the study area.

Major Population Groups within the Study Area

Lai Chi Yuen Cemetery

- 5.9.6 At present, FEHD manages the existing 276 coffin burial spaces and 332 urn burial spaces provided in Lai Chi Yuen Cemetery. Among which, 149 coffin burial spaces and 224 urn burial spaces are occupied as in May 2014.
- 5.9.7 The current project proposes to construct a platform next to the entrance of Lai Chi Yuen Cemetery to accommodate some 790 niches. Hence, there will be a total of 1398 burial spaces/niches in Lai Chi Yuen Cemetery upon full development of the cemetery.
- 5.9.8 In this study, it is conservatively assumed that the number of visitors to the Cemetery on Festival Day and the following Sunday equals to the number of burial spaces/niches.
- 5.9.9 During the site survey carried out by traffic consultant in year 2014 Ching Ming Festival, there were about 361 visitors visited the cemetery, which corresponded to about 1 visitor per occupied niche. This ratio was used to project the population pattern of the Cemetery after the construction of new niches.
- 5.9.10 During construction stage 50 construction workers is assumed to be working on site.

Mui Wo Town Centre

- 5.9.11 Mui Wo town centre can be briefly divided into two parts. The southern part is the area around the Mui Wo public pier. The area comprises of pier, bus terminal, carparks, restaurants and mixed commercial/ residential buildings (Location ID: 21, 14B, 15). The northern part is mainly residential and municipal facilities such as garden, playground, public swimming pools and sport complexes. There is also a hotel along the Silver Mine Bay Beach and a number of rental houses scattered in this area. Compared with the Previous Report, there are a number of public housing development near Ngan Wan Estate (Location ID: 10 and 4E) which will increase the population in the area.
- 5.9.12 The population groups in the Mui Wo town centre area as listed in the Previous Report were checked individually through site survey and desktop study.

Mui Wo Facelift (The Improvement Works in Mui Wo)

- 5.9.13 CEDD has commenced Mui Wo Improvement Works which aimed at improving the Mui Wo Town Centre in various aspects. According to CEDD, the Phase 1 and Phase 2 (stage 1) Works are now in construction stage and will be completed by year 2018. The remaining work (Phase 2 (stage 2)) is targeted to be commenced after Phase 2 (stage 1), i.e. in year 2018. However, there is no definite schedule of the work and is subjected to funding approval.
- 5.9.14 The major works in Mui Wo town area involve the following:
 - Phase 1 works:
 - 1. a 230-metre (m) long and 11.5-m wide segregated pedestrian walkway and cycle track along the waterfront between Mui Wo Cooked Food Market and River Silver
 - 2. a 35-m long and 4.8-m wide footbridge across River Silver
 - 3. a civic square near Mui Wo old town with associated landscaped area, recreational and leisure facilities and a performance venue
 - 4. seven amenity areas in villages at Mui Wo
 - 5. ancillary works including signage, landscaping, drainage and utilities works
 - Phase 2 Stage 1 works:
 - 1. realignment of Mui Wo Ferry Pier Road and extension of existing car park
 - 2. ancillary works including slope works, signage, landscaping, drainage and utilities works
- Remaining phases include:
 - 1. Re-provisioning of new cooked food market and covered cycle parking area
 - 2. improvement to south waterfront promenade
 - 3. re-provisioning of cargo loading and unloading area
 - 4. enhancement of Entrance Plaza
 - 5. improvement/provision of cycle tracks and heritage trails in Mui Wo
- 5.9.15 The population of the above new/improved facilities were either obtained from the user departments or assumed based on the best available information.
- 5.9.16 Although there is no new commercial area to be developed under the "Mui Wo Facelift", a 3% annual population growth, which is in-line with the increase in transient population, is assumed for the existing commercial population in the Mui Wo town area.

Facilities for children and elderly

- 5.9.17 In the "Integration of SHW and SMBWTW EIA" study, there was a Home for the elderly (Location ID: 26) near Mui Wo River Silver Garden. However according to the latest government map and the site visit carried out by consultant on 23 Nov 2015, the home of the elderly has been relocated. The home of the elderly is confirmed to be located inside Silver Plaza (Location ID: 26)
- 5.9.18 Another elderly home identified within the site is the Silver View Center for the Aged (Location ID: 4C_EH), which is in the Block 5-8 of Silver View Center (Location ID: 4C). The maximum capacity is 32 residents. Maximum capacity is assumed in this study. Number of staff is approximated according to the staff requirement as set out by Social Welfare Department.
- 5.9.19 There are a number of kindergartens within the Consultation Zone:
 - (i) The Lick Hang Kindergarten (Leafy Branch) is in Ling Tsui Tau (Location ID: 4G) and in Ma Po Village (as part of Location ID: 18E).
 - (ii) The Little Lamb Education is next to Lick Hang Kindergarten in Ma Po Village (part of Location ID: 18E).
 - (iii) The Mui Wo OWLS School is in Mui Wo South (Location ID: 14D)
 - (iv) The Little Lantau Montessori Kindergarten is in Silver View Center (Location ID: 4C_K)
 - (v) The Kind Hing Trinity International Kindergarten is near the Mui Wo Ferry Pier car park (Location ID: 14E)
- 5.9.20 The populations of these kindergartens were collected through the datasheets from Education Bureau or from site survey carried out by Consultant.

Primary Schools

5.9.21 The only primary school within the consultation zone is Mui Wo School which is located in Tai Tei Tong. Another school The Heung Yee Kuk Southern District Secondary School included in "Integration of SHW and SMBWTW EIA" (Location ID: 15) has been discontinued since year 2007.

Area affected by Ching Ming / Chung Yeung Festival

5.9.22 Mui Wo South (Bus Terminus, Ferry Pier, restaurants (Location ID: 21) as well as the Commercial Area (Location ID: 14C) near the pier were expected to have increase in population due to the Ching Ming / Chung Yeung Festival. The number of visitors per day on Festival Day and the following Sunday were assumed to be equal to the number of available niches in the cemetery (as discussed in Section 5.9.27). Each visitor is further assumed to stay in the area (pier and the commercial area) for a total of 2 hours. By using these assumptions, the population increase during Festival Day for base case, construction case and operation case can be deduced respectively. It would be added to the Sunday population to derive the Festival Day population.

Variation of Population

5.9.23 The population may vary within the day. To account for this, the following time periods would be adopted.

ID	Time Period	Period	Weighing per day	% Distribution per year
TM1	Working Day	Monday to Friday	12 hours	33.38%
TM2	Saturday Day	Saturday	12 hours	7.14%
TM3	Holiday Day	Sunday and public holidays (except Ching Ming and Chung Yeung)	12 hours	8.93%
TM4	Night	Monday to Sunday	12 hours	50%
TM5	Ching Ming and Chung Yeung (Dav)	4 days - daytime	12 hours	0.55%

Table 5.7Definition of Time Periods

Note:

It is assumed that there are 52 weeks a year, and 17 public holidays in Hong Kong per year which are all on weekdays

- 5.9.24 The following shows the details on how the Time Periods are defined:
 - TM1 = (52 weeks * 5 weekdays per week 17 public holidays) / 365 * 0.5 = 0.3338
 - TM2 = (52 weeks * 1 Saturday per week) / 365 * 0.5 = 0.0714
 - TM3 = (52 weeks * 1 Sunday per week + 17 public holidays Ching Ming & Chung Yeung and following Sundays (4 days)) / 365 * 0.5 = 0.08929
 - TM4 = 12 hours per 24 hours = 0.5

TM5 = 4 days per year / 365 * 0.5 = 0.00548

- 5.9.25 Time period 5 (TM5), which represents the population during Ching Ming and Chung Yeung Festival, as well as the Sunday following these festivals, is added to this study compared with the time period assumption in Previous Report.
- 5.9.26 During TM5 the majority of the population will have the same population fraction as Sunday (TM3), plus some additional population (608 for base case, 1392 for operation case, derived from the number burial places in their respective phase) to the relevant population group such as the pier and bus terminus (Location ID: 21) and the commercial area near the pier (Location ID: 14C).
- 5.9.27 TIA has carried out a survey in 2014 Ching Ming Festival and summarized that for Lai Chi Yuen Cemetery the number of visitors on Ching Ming Day was approximately equal to the number of occupied niches. And the Sunday following the Ching Ming Day would have visitors approximately equal to 20% of the number of occupied niches. In this study, Festival Day and the following Sunday were assumed to attract number of visitors equal to the total number of available niches, which is a very conservative assumption. As a result, 4 days per year for TM5 is assumed, as shown in the above calculation.

Indoor Fraction

5.9.28 Each population is assigned with an indoor fraction which indicates the portion of population which can receive extra protection by staying indoor. The indoor fraction used in this study generally followed the assumption of the Previous Report based on the population type.

Transient Population

5.9.29 In Previous Study, for the modelling of Siu Ho Wan Water Treatment Works, the road population was modelled as 95% indoor and "normal indoor population" as indicated in Table 9.8.2 and Section 9.7.10 of Previous Report. However, considering that the traffic speed in the current study is relatively low

(50km/hr or 30km/hr), it is more conservative to assume that the population in vehicle as 100% outdoor. Population associated with the road vehicles as well as pedestrian were modelled as 100% outdoor, which is consistent with other similar studies.^[4]

- 5.9.30 There is only one major transient population within the consultation zone which is the South Lantau Road. Other roads such as the access road to Lai Chi Yuen Cemetery/Lai Chi Yuen Tsuen, Ngan Kwong Wan Road etc. were also considered in this study although they have significantly fewer population.
- 5.9.31 Road traffic as well as pedestrian population were assumed based on the findings in Traffic Impact Assessment (TIA) and Annual Traffic Census (ATC) conducted by Transport Department (TD).
- 5.9.32 The ATC counting station used in this assessment is Core Station 5015 (South Lantau Road (from Mui Wo Ferry Pier to Chi Ma Wan Road)). For roads other than South Lantau Road, the traffic characteristics (peak hour traffic flow w.r.t. normal hour traffic flow, distribution of traffic between weekday and weekend, day and night, etc.) were assumed to also follow South Lantau Road since all other roads receive the traffic from this road, unless specific data is available in TIA.
- 5.9.33 The TIA has calculated the total trip generations by the existing cemetery as well as the proposed development. The result can be summarized in the following table:

Table 5.8Peak hour trip Generation (Person/Hour) for Existing Cemetery and Proposed
Development in TIA

Existing (vacant plus occupied coffin burial or urn burial)	Existing plus proposed development
748	1713

- 5.9.34 The numbers in the above table were used to derive the transient population in festival days (TM5). The population in other time periods was derived using the weekly traffic flow variation graph correlation in ATC.
- 5.9.35 The peak hour trip generation (person/hour) is preferred instead of the number of vehicle per hour forecast (both data can be found from TIA) because the traffic in Ching Ming/Chung Yeung peak hour with the Special Bus services has a much higher occupancy ratio. Direct addition of the vehicle trip generation figure to the ATC based AADT figure will lead to a relatively not conservative figure.
- 5.9.36 The TIA also analysed the annual traffic growth rate. It has assumed that the annual growth rate is 3% for weekdays (starting from year 2014) and 6% for weekends (the extra 3% growth rate is due to the public housing development in Mui Wo). These factors were used to calculate traffic population in year 2019 and year 2020 from the ATC data in year 2014.
- 5.9.37 Since occupancy per vehicle data was not available in both ATC and TIA for South Lantau Road, in this assessment it is assumed to be similar to the pattern of traffic station 5014 (Route Twisk from Chuen Lung to Cheung Pei Shan Road), which is a major rural road similar to South Island Road. 2.0 passengers per vehicle is thus conservatively assumed in order to calculate the road population from traffic data.

South Lantau Road (Location ID: R1)

- 5.9.38 South Lantau Road is the only major road connecting Mui Wo to other part of the Lantau Island. Annual Traffic Census (ATC) has been conducted on this road by Transport Department (Core station 5015). The daily variation graph showed that about 80% of traffic happens in daytime (0700-1900) and 20% of traffic in night time (1900-0700). It also showed that the normal hour traffic flow is about 80% of peak hour traffic flow.
- 5.9.39 The speed of vehicle is assumed to be 50 km/hr at all times^[5].

The access road to Lai Chi Yuen Tsuen (Location ID: R2)

- 5.9.40 The road is used to access Lai Chi Yuen Tsuen and surrounding areas. However, during Ching Ming / Chung Yeung Days many private cars/taxis and other buses make use of the road to assess Lai Chi Yuen Cemetery. There is also substantial increase in pedestrian population on the road during Ching Ming / Chung Yeung Day. The TIA finding is used to calculate the population.
- 5.9.41 The speed of vehicle is assumed to be 30 km/hr at all times conservatively, due to the relatively poor road condition.

The footpaths at the junction of South Lantau Road and access road to Lai Chi Yuen Cemetery (Location ID: P1, P2, P3)

5.9.42 TIA has carried out site survey in year 2014 to count the pedestrian flow in Ching Ming Day, weekday and Sunday for the footpath P1, P2 and P3, which are the major footpaths that will be affected by the proposed project. The result can be summarized in the following table:

Table 5.9Site Survey for Peak Hour Pedestrian Population (Person/Hour) in Year 2014

Road	Ching Ming Day	Sunday	Weekday
South Lantau Road (between the bus stops)	69	49	10
Single track access road	69	49	10
From junction of single track access road to Lai Chi Yuen	459	139	10
Cemetery			

- 5.9.43 The traffic survey shows that during festival days, the pedestrian population for the section of footpath from the junction of the access road to Lai Chi Yuen Cemetery (Lantau Trail Section 12) is significantly increased.
- 5.9.44 The annual growth rate of pedestrian accessing P1, P2 and P3 on non-festival days is assumed to be 3%, in order to be in-line with the general road traffic growth rate (without the additional effect of public housing in Silvermine Bay as described in **Section 5.9.36**).
- 5.9.45 Additional population will be added for festival days (TM5) by using the percentage increase in niches in Lai Chi Yuen Cemetery in operation phase.
- 5.9.46 The moving speed of pedestrian is conservatively assumed to be 3 km/hr considering the hilly road.

Ngan Kwong Wan Road (Location ID: R3) and Mui Wo Ferry Pier Road (Location ID: R4)

- 5.9.47 No ATC or TIA data is available for estimation of traffic in these roads. Based on site survey carried out by Consultant in Nov 2016, it was observed that all the buses (Route 1 and 3M) from South Lantau Road would first go to the bus stop at Ngan Kwong Wan Road before returning to the bus terminus at the pier via Mui Wo Ferry Pier Road. Based on Consultant's observation, 50% of the traffic of South Lantau Road is assumed heading to Ngan Kwong Wan Road, and 50% of traffic is assumed heading to Mui Wo Ferry Pier Road.
- 5.9.48 Special speed limit of 30km/hr is imposed on Ngan Kwong Wan Road and it is used in this study for population calculation.

5.10 Modelling Approach and Calibration

Proposed Risk Modelling Approach

5.10.1 This assessment made use of the consequence modelling results in the Previous Report as well as the consultant's in-house risk summation software, RISKSUM, to assess the level of risk.

- 5.10.2 For the toxic chlorine cloud dispersion upon an accidental release, cloud dispersion contours from consequence modelling results in the Previous Report will be adopted. The consequence modelling in Previous Report was based on the Britter and McQuaid dense gas dispersion model.
- 5.10.3 Occurrence frequencies, population, wind speed and other parameters are then entered into RISKSUM for risk summation process to obtain the Individual Risk and Societal Risk and will be presented in Individual Risk Contour Plots and FN Curves respectively.

Calibration of Model

- 5.10.4 In order to ensure compatibility in using different models in evaluating the risk associated with the SMBWTW, a calibration exercise is necessary.
- 5.10.5 In Previous Report, a dense gas dispersion model called Britter and McQuaid was adopted to simulate the extent of effect of chlorine dispersion. The dispersion results together with population information were then further processed in consultant's in-house risk summation tools, to assess the level of risk.
- 5.10.6 A model calibration exercise has been carried out using in-house risk summation software RISKSUM and is attached in the Methodology Paper of this Study.

5.11 Hazard Identification

Review of identified Hazards in SMBWTW

- 5.11.1 SMBWTW is a typical water treatment works in Hong Kong equipped with similar chlorination facilities as other water treatment works except that SMBWTW is relatively small in scale. By summarizing the hazard identification exercises carried out for the QRA of other similar water treatment works in Hong Kong^[3], the following hazardous scenarios can be identified:
 - 1. Hazardous scenario inside the chlorination store
 - i. Spontaneous tank failure
 - ii. Dropped container
 - iii. Spontaneous failure of larger bore manifold pipework
 - iv. Spontaneous failure of pigtail
 - v. Drive away whilst the truck is still unloading
 - vi. Failure to identify faulty connection (human error)
 - vii. Failure to tighten connections (human error)
 - viii. Isolation error (human error)
 - ix. Failure to identify faulty valve (human error)
 - x. Fire (internal or external)
 - xi. Failure of QA procedure allowing water ingress, or presence of NCI3 causing severe corrosion to the drum / pipework, following pressure low alarm failure
 - xii. Missile domino effect
 - 2. Hazardous scenario happens on road
 - i. Road accident leading to load shedding
 - ii. Road accident leading to roll over
 - iii. Road accident leading to vehicle fire
 - iv. Road accident leading to truck being crushed in rear
 - v. Road accident leading to truck being crushing at the side
 - vi. Spontaneous failure
 - vii. Spontaneous truck fire
 - viii. Missile domino effect

- 3. Hazardous scenario happens at the store which can lead to direct release of chlorine to atmosphere
 - i. Air crash
 - ii. Earthquake
 - iii. Subsidence/landslides
 - iv. Dropped container
 - v. Spontaneous drum failure
 - vi. Impact while manoeuvring to enter the chlorine store
 - vii. Road accident leading to truck being crushed in rear
 - viii. Road accident leading to truck being crushing at the side
 - ix. Spontaneous truck fire
 - x. Missile domino effect

Review of Past Incidents

- 5.11.2 Past Incidents regarding use, storage and transport of chlorine has been extensively reviewed by various recent EIA studies in Hong Kong for water treatment works. In particular, the world wide accident database Major Hazard Incident Data Service (MHIDAS), was independently reviewed in order to update the Hazard Identification conclusions (**Appendix 5.2**). However, only a few relevant chlorine incidents occurred worldwide since the previous review, and after examination of their nature was concluded that no revision of the previously identified hazard scenario is necessary.
- 5.11.3 The primary causes of worldwide chlorine release incidents identified from previous 8 WTWs Reassessment Study include:
 - i. Equipment Failure
 - ii. Human Error
 - iii. Corrosion
 - iv. Fire/Overheating
 - v. Contamination
 - vi. Road accident
 - vii. Marine Accident
 - viii. Rail accident
- 5.11.4 Since the design and operation of SMBWTW is very similar to other Water Treatment Works in Hong Kong having chlorine disinfection facility, their findings will generally be adopted.

Review of Existing Chlorine Facilities

5.11.5 Site visit to SMBWTW was performed on 23rd Nov 2015. The operators of SMBWTW confirmed that the general arrangement of the use, storage and transport of chlorine is similar to other Water Treatment Works in Hong Kong, and there is no change in chlorine store design, chlorine inventory, unloading and procedures, etc. compared to the Previous Report.

Hazard associated with the Construction and Operation of the Project to SMBWTW

5.11.6 Since the project site is away from the SMBWTW for at least 300m, the construction and operation of the Project will not create any additional hazard to SMBWTW.

5.12 Frequency Assessment

5.12.1 With the potential hazards identified, the likelihood of each hazardous scenario is then determined. The occurrence frequencies were adopted directly from Previous Study, which is supplemented by statistics from historical data if necessary. For some of the cases where historical accident data is not fully available or insufficient, a Poisson distribution can be assumed to derive the future occurrence rate of such events, by using the number of "no occurrences". Or in other cases, Fault Tree Analysis technique can be used to derive the frequency using best available equipment failure data.

5.12.2 As discussed in **Section 5.8.3**, there is no change to the operating parameters of SMBWTW since Previous Study, thus the event frequencies used in the Precious Report are still valid and can be used in the current study. The Event frequencies from Table 9.6.3 of the Previous Study were extracted and presented in the table below.

Consequence	Hole Size	Isolation	Confinement	Event Frequency (per year)
Internal Release				
Leak from single 1 tonne drum	Small	No	Vent On	3.39x10 ⁻⁷
	Large	No	Vent On	1.99x10 ⁻⁷
	Rupture	No	Vent On	1.87x10 ⁻⁸
Leak from single 1 tonne drum	Small	No	Vent Off	7.42x10 ⁻⁶
	Large	No	Vent Off	4.34x10 ⁻⁶
	Rupture	No	Vent Off	4.09x10 ⁻⁷
Leak from pipework, 100% drum level	Small	3 min.	Vent On	2.53x10 ⁻⁶
		10 min.	Vent On	8.54x10 ⁻⁷
		No	Vent On	3.42x10 ⁻⁸
Leak from pipework, 100% drum level	Small	3 min.	Vent Off	5.52x10 ⁻⁵
		10 min.	Vent Off	1.87x10⁻⁵
		No	Vent Off	7.46x10 ⁻⁷
Leak from pipework, 25% drum level	Small	3 min.	Vent On	5.13x10 ⁻⁶
		10 min.	Vent On	1.73x10 ⁻⁶
		No	Vent On	6.94x10 ⁻⁸
Leak from pipework, 25% drum level	Small	3 min.	Vent Off	1.12x10 ⁻⁴
		10 min.	Vent Off	3.79x10⁻⁵
		No	Vent Off	1.51x10 ⁻⁶
Leak from 7 drums in store	Large	No	Vent On	6.00x10 ⁻¹¹
Leak from 7 drums in store	Large	No	Vent Off	1.31x10 ⁻⁹
Leak from 6 drums in store	Large	No	Vent On	6.00x10 ⁻¹¹
Leak from 6 drums in store	Large	No	Vent Off	1.31x10 ⁻⁹
Rupture of second drum due to missile	Rupture	No	Vent On	1.87x10 ⁻⁹
Rupture of second drum due to missile	Rupture	No	Vent Off	4.09x10 ⁻⁸
External Release at the Store			1	
Leak from single 1 tonne drum on truck or	Small	No	External	7.82x10 ⁻⁵
storage within building	Large	No	External	2.11x10 ⁻⁵
	Rupture	No	External	1.40x10 ⁻⁶
Leak from 7 drums in store on storage within	Large	No	External	5.00x10 ⁻⁷
building	Rupture	No	External	6.09x10 ⁻⁸
Leak from 6 drums in store on storage within	Large	No	External	5.00x10 ⁻⁷
building	Rupture	No	External	6.09x10 ⁻⁸
Leak from three 1 tonne drums on truck stationary at store	Large	No	External	1.56x10 ⁻⁷
Rupture of second drum due to missile	Rupture	No	External	1.55x10 ⁻⁷
External Release from the Road				
Leak from 3 1-tonne drums on road	Large	No	External	2.65x10 ⁻⁶
Leak from single 1 tonne drum on road	Small	No	External	1.60x10 ⁻⁵
	Large	No	External	2.89x10 ⁻⁵
	Rupture	No	External	1.68x10 ⁻⁷
Rupture of second drum due to missile	Rupture	No	External	1.68x10 ⁻⁸

Table 5.10Event Frequency adopted in this Study

5.13 Consequence Assessment

Chlorine Toxicity

5.13.1 Chlorine is a greenish yellow gas in room temperature and pressure, and is considered highly toxic. Contact by inhalation will cause irritation, damage to respiratory organs or even death depending on the chlorine concentration and contact time. The following table summarize the toxic effect of chlorine to human^[6]:

Concentration (ppm)	Effects
1000	May be fatal with brief exposure
400-300	A predicted average lethal concentration for 50% of active healthy people for 30 minutes
150-100	More vulnerable people might suffer fatality from 5-10 minute exposure
20-10	Causes immediate irritation of nose, throat and eyes with coughing and lachrymation for half to 1 hour exposure
10	Causes coughing in less than 1 minutes exposure
3-6	Causes stinging or burning sensation but can be tolerated without undue ill effect for up to 1 hour

Table 5.11	Toxic Effect of	Chlorine
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Initial Discharge

- 5.13.2 In order to be consistent with the Previous Report, the rate of discharge, i.e. the chlorine release rate from chlorine drum to the atmosphere is adopted from the Previous Report. In summary, there are mainly 3 types of releases, which are:
 - i. Internal release in the chlorine store
 - ii. External release on road during transportation
 - iii. External release at the store

Internal Releases

- 5.13.3 For internal releases, the final release rate to the atmosphere depends greatly on the status of the ventilation system and the Contain and Absorb system at the time the release occurs:
 - i. Contain and Absorb system functions properly (which results in no off-site impact)
 - ii. Ventilation on, scrubber system on, or failure (forced ventilation)
 - iii. Ventilation off, scrubber failed and the chlorine escape from the store from ineffective door and window seals (release due to expansion)

Forced ventilation

- 5.13.4 In the event of the normal ventilator failing to switch off, the emission rate is determined by the normal ventilation rate. Success or failure of the absorber has minimal effect on the emission rate if normal ventilation is ongoing. Under the perfect mixing assumption, the released chlorine will perfectly mix with the air inside the store, and will be extracted to the atmosphere by the normal ventilation system.
- 5.13.5 The release rate to the atmosphere for internal releases with forced ventilation are calculated using the following equation^[7, 8]:

$$Q(t) = R(1 - e^{-Nt})$$

Where

R is the release rate in the building N is the number of air changes per hour t is the time elapsed (in hours)

5.13.6 The above equation is a solution of the differential equation obtained from first principles consideration of the mass balance of chlorine in the air in the store, the air and the chlorine in the store is assumed to be effectively mixed.

Ventilation driven by expansion of release

5.13.7 For cases that the ventilation is off while scrubber failed to start, the liquid chlorine released will quickly evaporate into gaseous phase and trapped inside the store. Due to the increase in gas pressure inside the store, chlorine is assumed to leak and escape from the store to the atmosphere through the weak points such as window and door seals. In these cases the mass release rate will be lower compared with the cases with ventilation on.

Variation in Inventory

5.13.8 In reality, the inventory of chlorine inside the store varies with time. Following the assumption of "Hazard Assessment for Uprating of Silvermine Bay Treatment Works to 200Mld: Final Assessment Report", the chlorine inventory is modelled as following ^[7]:

Duty Container Level

- Full for 33.3% of the time
- Quarter full for 66.7% of the time

Number of container in store

- Store full 50% of the time
- Store at minimum stock level (i.e. 1 truckload less than full capacity of the store) 50% of the time

Average release rate

The average release rates used in the consequence calculation, is calculated by analytical integration of the above time-dependent release rates Q(t) over the release duration (T):

$$Q = \frac{1}{T} \int_0^T Q(t) dt$$

5.13.9 The effect of these scenarios has been accounted for in the Previous Report as a resultant effective release rate to the atmosphere. These release rates were adopted directly in this study. They are summarized in the following table:

Table 5.12	Discharge Rates and Their Duration of Each Internal Release Scenario
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Consequence	Hole Size	Isolation	Confinement	Release Rate to the Atmosphere (kg/s)	Duration (s)
Leak from single 1 tonne	Small	No	Vent On	2.5x10 ⁻¹	3443
drum	Large	No	Vent On	5.5x10 ⁻¹	1244
	Rupture	No	Vent On	7.1x10 ⁻¹	827
Leak from single 1 tonne	Small	No	Vent Off	6.1x10 ⁻²	3600
drum	Large	No	Vent Off	4.2x10 ⁻¹	1565
	Rupture	No	Vent Off	7.1x10 ⁻¹	827
Leak from pipework,	Small	3 min.	Vent On	4.3x10 ⁻²	1006
100% drum level		10 min.	Vent On	1.1x10 ⁻¹	1426

Consequence	Hole Size	Isolation	Confinement	Release Rate to the Atmosphere (kg/s)	Duration (s)
		No	Vent On	2.5x10 ⁻¹	3443
Leak from pipework,	Small	3 min.	Vent Off	5.6x10 ⁻³	3600
100% drum level		10 min.	Vent Off	1.8x10 ⁻²	3600
		No	Vent Off	6.1x10 ⁻²	3600
Leak from pipework, 25%	Small	3 min.	Vent On	4.3x10 ⁻²	1006
drum level		10 min.	Vent On	1.1x10 ⁻¹	1426
		No	Vent On	1.2x10 ⁻¹	1488
Leak from pipework, 25%	Small	3 min.	Vent Off	5.6x10 ⁻³	3600
drum level		10 min.	Vent Off	1.8x10 ⁻²	3600
		No	Vent Off	2.0x10 ⁻²	3600
Leak from 7 drums in store	Large	No	Vent On	3.3	1244
Leak from 7 drums in store	Large	No	Vent Off	3.3	1244
Leak from 6 drums in store	Large	No	Vent On	3.3	1244
Leak from 6 drums in store	Large	No	Vent Off	3.3	1244
Rupture of second drum due to missile	Rupture	No	Vent On	7.1x10 ⁻¹	827
Rupture of second drum due to missile	Rupture	No	Vent Off	1.4	827

External Releases

5.13.10 Hazardous events relate to building collapse are classified as external releases which can be caused either by an incident during transportation of the chlorine by truck or by major damage of building due to earthquake or aircraft. In these scenario the building is assumed to be unable to contain the chlorine and the initial chlorine discharge rate will become the effective release rate to the atmosphere.^[2]

Table 5.13	Summar	y of External	Releases
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Consequence	Hole Size	Release Rate to the Atmosphere (kg/s)	Duration (s)
Leak from single 1 tonne drum on truck or storage	small	0.38	2618
within building	large	2.4	419
	rupture	1000	1
Leak from 7 drums in store within building	large	17	419
	rupture	7000	1
Leak from 6 drums in store within building	large	14	419
	rupture	6000	1
Leak from three 1-tonne drums on truck stationary at store	large	7.2	419
Rupture of second drum due to missile domino effect	rupture	2000	1

Releases during Chlorine Transportation

5.13.11 Loss of containment scenarios during transportation will lead to a direct release of chlorine to atmosphere. The following table, referenced from Table C1a of the Previous Report, summarizes the release scenarios and their respective release rates and mass released which are adopted in the current study:

Table 5.14Summary of Release Sizes during Chlorine Transportation

Hole Size	Release Rate (kg/s)	Mass Released
Small Leak (single drum)	0.38	1 tonne
Large Leak (single drum)	2.4	1 tonne
Catastrophic Failure (single drum)	1 tonne	1 tonne
	instantaneous	
Missile Domino Effect causing rupture of second	2 tonnes	2 tonnes
drum	instantaneous	
Large Leak (3 drums on truck)	7.2	3 tonnes

5.13.12 The chlorine releases on road cannot be contained or isolated.

Dispersion of Chlorine in Atmosphere

- 5.13.13 In the Previous Study, Britter and McQuaid Model (The BM Model) for dense gas dispersion was used. The BM Model is an empirical model which has been detailed in Workbook written by Britter and McQuaid in 1988^[9]. The aims of developing the co-relation was to enable non-specialists to prepare estimates of the dispersion of pollutant dense gas emissions. The primary aim of the model is to enable estimate of:
 - (i) Average concentration levels along the plume axis, for continuous release, and
 - (ii) Maximum concentration levels along the down-wind cloud path, for instantaneous releases.
- 5.13.14 In addition, Britter and McQuaid give rules of thumb to estimate iso-concentration contours.
- 5.13.15 The BM model consists of a collection of curves for down-wind maximum concentrations in form of nomograms. The nomograms were derived from widely-accepted field test data and from wind tunnel data.^[10]
- 5.13.16 The dispersion results, in form of LD90, LD50 and LD03 contours were summarized in Table C1a of the Previous Report. These contours were represented by d/c/s/m parameters which can be explained in **Figure 5.10**.

Toxic Impact Assessment

- 5.13.17 The toxic effect of chlorine is implicitly expressed in the dispersion modelling in the Previous Report. Three toxic levels (contours) were used to express the lethality of the chlorine gas cloud:
 - LD90 90% of healthy people outdoor will die within this contour
 - LD50 50% of healthy people outdoor will die within this contour
 - LD03 3% of healthy people outdoor will die within this contour

Indoor Gas Build-up

5.13.18 The typical ventilation rate of 0.5 air exchanges per hour and 600 seconds tail time was adopted in the Previous Report. These assumptions would lead to an approximate 90% reduction of risk indoor. It is adopted in the current study.

Escape and Protection Factors

5.13.19 The possibility of persons out of doors escaping to a less exposed location indoors and thus reducing their dose from the outdoor to the indoor rate was reviewed. The escape rate is related to the chlorine concentration of the dispersion cloud. Referring to the Previous Report, it was considered that 80% of persons out of doors in areas of LD03 contour would escape indoors, 20% of persons in areas of LD50 would escape indoors and 0% in LD90 contour can escape indoors. As a result, the percentage of fatality against chlorine concentration can be summarized in the following table:

Table 5.15Fatality Rate for Indoor and Outdoor Population Considering EscapeProbability

Chlorine Cloud Concentration (LD)	Fatality for Outdoor Population	Fatality for Indoor Population
90	0.9	0.09
50	0.41	0.05
3	0.0084	0.003

5.13.20 Since there is no high speed transportation service such as railway in this Study, all road traffic population in this study were thus modelled without additional protection factor, which is in line with Previous Report.

Chlorine Cloud Height

5.13.21 Information on the heights of chlorine clouds were adopted from the Previous Report Table C1a. It is assumed that the population above the chlorine cloud is not affected. For population in high-rise buildings such as Ngan Wan Estate, a protection factor is assumed based on the chlorine cloud height and the height of the building.

Sensitive Population Consideration

5.13.22 Vulnerable population factor of 3.3, as used in the Previous Report and in line with data published by Withers and Lees in 1985^[11], is adopted in current Study. The fatality rate for indoor and outdoor population is summarized in the following table:

Table 5.16Fatality Rate for Indoor and Outdoor Population Considering Escape
Probability (Vulnerable Population)

Chlorine Cloud Concentration (LD)	Fatality for Outdoor Population	Fatality for Indoor Population
90	1	0.297
50	1	0.165
3	0.099	0.0099

5.14 Risk Assessment

Risk Summation

5.14.1 By combining the results of frequency estimation and consequence analysis, risk levels of the assessment scenarios were characterised in terms of individual risk (presented in individual risk contours plot) and societal risk (presented in FN curves and Potential Loss of Life). This integration of risk was processed by the RISKSUM software.

Determination of Risk Acceptability

- 5.14.2 The level of risk in terms of Individual Risks and the FN curves determined from the risk summation process were compared with the criteria stipulated in Annex 4 of the TM to determine their acceptability.
- 5.14.3 The off-site risk level was checked whether it is less than 1×10^{-5} / year (i.e. 1 in 100,000 per year).
- 5.14.4 The determination of acceptability of societal risk in the form of FN curves is based on the following criteria:
 - i. **Unacceptable** where risks are so high that they should usually be reduced regardless of the cost or else the hazardous activity should not proceed;
 - ii. ALARP (As Low As Reasonably Practicable) where the risks associated with the hazardous activity should be reduced to a level "as low as reasonably practicable", in which

the priority of measures is established on the basis of practicability and cost to implement versus risk reduction achieved; and

iii. **Acceptable** where risks are so low that no action is necessary.

Individual Risk Result

5.14.5 The individual risk result of SMBWTW is illustrated in **Figure 5.11**. It showed that the region with individual risk higher than 1x10⁻⁵ /year (brown area) is slightly outside the boundary of the SMBWTW. The Risk Guidelines in Hong Kong states that when utilizing risk contours, the estimated duration of exposure of a person to the PHI should be taken into consideration to determine the individual risk for comparison with the Risk Guidelines. Since the brown area outside site boundary only covers hillside and a small section of road only used by SMBWTW, the individual risk result is compliant with the criteria stipulated in Annex 4 of EIAO-TM.

Societal Risk Result

- 5.14.6 The societal risk results were summarized in the form of F-N curve in **Figure 5.12**.
- 5.14.7 Result showed that the F-N curve for base case, construction case and operation case in this study all lie within the ALARP region. A comparison of these curves indicated that the additional risk by the proposed project (either construction or operation phase) is not significant.
- 5.14.8 Societal risk can also be represented in the form of Potential Loss of Life (PLL). It expresses the risk to the population as a whole and for each scenario and its location. The PLL is an integrated measure of societal risk obtained by summing the product of each F-N pair:

$$PLL = f_1 N_1 + f_2 N_2 + \dots + f_n N_n$$

5.14.9 The PLLs in all the cases studied are summarized in the following table:

Table 5.17Summary of PLLs

Case	Overall PLL (/year)	PLL of Lai Chi Yuen Cemetery (/year)	% of PLL to overall PLL
Base Case (Population ID: 28)	1.443x10 ⁻⁴	3.034x10 ⁻⁷	0.210%
Construction Case (Population ID: 28+ 28_C)	1.426X10 ⁻⁴	5.706x10 ⁻⁷	0.400%
Operation Case (Population ID: 28 + 28_O)	1.445X10 ⁻⁴	7.699x10 ⁻⁷	0.533%

5.14.10 The result shows that the PLL contribution of Lai Chi Yuen Cemetery is very minimal. The PLL increase due to the proposed project is less than 1%, which is also insignificant. It can be concluded that the risk contribution of the proposed project is not significant.

5.15 Uncertainty Analysis

- 5.15.1 This analysis was based on a number of assumptions and was based on 'cautious best estimates':
 - 1. The cemetery population was assumed conservatively. The number of visitors corresponded to the maximum capacity of the cemetery (with extension) was assumed. In fact, the cemetery now is still far from fully occupied. It was also conservatively assumed that the Sunday following the Ching Ming/Chung Yeung Festival will have the same number of visitors as the Festival Day.
 - 2. The traffic flow was assumed to be the peak hour flow for the whole day during Tsing Ming / Chung Yeung Festival
 - 3. Many population is conservatively assumed to a higher value. For example, the future civic square is assumed to have 2000 people (maximum capacity as provided by CEDD) in every Sunday, and 200 people over the night.

5.15.2 These assumptions will effectively push the resultant FN-curve to the conservative side. It is considered that the FN curve shown in **Figure 5.12** is reasonably conservative and the curve will stay in the current ALARP region even uncertainty is considered.

5.16 Risk Mitigation Measures Identification and Analysis

Identification of Risk Mitigation Measures

- 5.16.1 Since the societal risk of the SMBWTW is within the ALARP region, Cost-Benefit Analysis (CBA) is required to select and analyse risk mitigation measures.
- 5.16.2 Operation and Construction stage risk mitigation measures of the Lai Chi Yuen Cemetery project are reviewed and consulted with relevant stakeholders. Measures that are relevant and applicable to the current project are selected for CBA and presented in **Table 5.18**.

 Table 5.18
 Candidate Risk Mitigation Measures

Option	Measures	Remarks
Operation	stage	
A	Prepare face masks at every level of the Cemetery as well as the Extension	To be assessed in CBA
В	Setting up temporary shelter at the cemetery during the Ching Ming and Chung Yeung Festival	To be assessed in CBA
С	Enhance communication with WSD and Police and identify emergency response in case of major chlorine incident	Recommended to implement as a good practice
Construct	ion Stage	
D	Prepare 50 face masks for construction workers	Since the number of face masks involved will not be significant, this mitigation measure will be implemented by contractor without the need of CBA assessment
E	Enhance emergency response arrangements, e.g. provision of visual and audible alarms, training etc.	Provision of a means of alerting construction workers in case of chlorine release is considered an effective mitigation measure. Therefore, it is recommended to implement as a good practice.

5.16.3 Assumptions of the relevant measures for further analysis by CBA are listed in **Table 5.19**.

Table 5.19 Assumptions for Candidate Mitigation Measures

Option	Detail provisions	Project Stage
A	Chemical, Biological and Radiological (CBR) Gas Mask can be place at every level of the existing cemetery as well as at the cemetery extension. 2000 of the gas masks should be prepared to cater for the maximum capacity of the Cemetery with Extension. Such gas masks cabinets can also be found in some large metro/subway stations in Seoul. Due to the site condition, it is expected that only 10% of the visitors can have enough time to access the gas masks and put them on timely and properly before the chlorine gas cloud arrives the cemetery.	Operation stage
В	One or two temporary shelters can be set up during Ching Ming / Chung Yeung Festival so that in case of chlorine release some visitors can stay in the shelter and wait for evacuation by Fire Services Department/ Police. The temporary shelter should be able to sustain a filtered fresh air supply for a certain period of	Operation stage

Option	Detail provisions	Project Stage
	time. Due to the space available and the site constraints, 10% of visitors during festival days are assumed to be able to be protected by the shelter.	

Analysis of Mitigation Measures

5.16.4 Cost Benefit Analysis (CBA) is a widely used method for evaluating the cost-effectiveness of mitigation measures. The method can also be used to demonstrate that all reasonably practicable measures have been taken to reduce risk. The Implied Cost of Averting a Fatality (ICAF), which was adopted previously in the Reassessment Study, will be used in this HA. The ICAF is calculated as follows.

Cost of mitigation measures

$ICAF = \frac{1}{Reduction in PLL \times Design life of mitigation measures}$

- 5.16.5 The ICAF can be compared with the value of life to determine whether the implementation of the identified mitigation measures is reasonably practicable. In line with other similar studies in Hong Kong^[4, 13], a value of HK\$33M will be used in this HA.
- 5.16.6 Aversion factor may be applied to adjust the value of life, usually upward, to reflect the public's aversion to high risk. The same methodology, as adopted in the Reassessment Study of Eight Existing Water Treatment Works in Hong Kong^[4], will be used, which is to determine the factor on a sliding scale from 1 for risk near the lower boundary of the ALARP region, up to a maximum of 20 for risk near the upper boundary of the ALARP region. The ICAF can be compared with the value of life (proposed to be HK\$33M in this study) to determine whether the implementation of the identified mitigation measures is reasonably practicable. Aversion factor of 20 (Maximum Aversion Factor for risks at the upper region of the Risk Guidelines) is proposed to adjust the Value of Life to reflect people's aversion to high risk. This is a conservative factor adopted even though the FN curves located at the low ALARP region. With this factor applied, the adjusted Value of Life of HK\$660M will be adopted.
- 5.16.7 In Option A, it is assumed that 10% of the population will be protected by correctly wearing the Gas Mask. The PLL reduction (for cemetery population) of this mitigation is from 7.70x10⁻⁷/year to 6.93 x10⁻⁷/year.
- 5.16.8 In Option B, it is assumed that 10% of the population during Ching Ming / Chung Yeung Festival can be protected by staying in the temporary shelter. The PLL of the cemetery population will drop from 7.70x10⁻⁷/year to 7.64x10⁻⁷/year.
- 5.16.9 The result of CBA is summarized in the following table (**Table 5.20**):

Option	Estimated Cost (HK\$M)	PLL Reduction	Design Life (Years)	ICAF (HK\$M)	Cost-effective Measures
A	1	7.70x10 ⁻⁸	5	2.60x10 ⁶	No (>HKD 660M)
В	5	5.89x10 ⁻⁹	10	8.49x10 ⁷	No (>HKD 660M)

- 5.16.10 It can be easily seen that both Option A and Option B are not cost-effective measures to reduce PLL. It also agrees with the fact that the total PLL contribution of Lai Chi Yuen Cemetery is very low compared with the overall PLL of SMBWTW, that only very low cost mitigation measures can be justified under the ALARP principle.
- 5.16.11 On the other hand, during construction stage some recommendations (Option E) are made which can effectively reduce the risk to construction workers, it is summarized in **Section 5.16.13**.

5.16.12 The CBA exercise above has identified all practicable risk reduction measures and the risk has been reduced to As Low As Reasonably Practicable.

Recommended Good Practices

- 5.16.13 There are a number of measures recommended during construction stage, which include:
 - 1. The number of workers on site during construction stage should be kept within the level as assessed in this report.
 - 2. FEHD/ArchSD/the responsible personnel of the construction site should keep effective communication with Police or relevant authorities to ensure a proper evacuation/emergency response in case of a gas release incident. FEHD/ArchSD/the responsible personnel of the construction site should ensure all workers on site to be familiar with the route to escape. Diagram showing the escape routes to a safe place should be posted in the site notice boards and at the entrance/exit of site.
 - 3. Specific means of providing a rapid and direct warning (e.g. Siren and Flashing Light) to construction workers in the event of chlorine gas release in the SMBWTW should be determined and made known to the construction workers.
 - 4. The construction site officer should establish a communication channel with the SMBWTW operation personnel during construction stage. Upon receiving the notice of an external gas leak at the SMBWTW, the construction site officer should direct the workers to evacuate by following the instructions of Police or relevant authorities as appropriate.
 - 5. Induction Training should be provided to any staff before working on site.
 - 6. The responsible officer of the construction site should ensure all construction staff are familiar with the evacuation routes and /or location of the protective gears (if available).
- 5.16.14 During operation stage, due to the nature of the site (many visitors are not familiar with the place and many visitors may be slow in walking), emergency public announcement and evacuation etc. are not recommended. FEHD should keep effective communication with Police or relevant authorities to ensure a proper emergency response in case of a gas release incident (Option C in **Table 5.18**).

5.17 Conclusion

- 5.17.1 Hazard to Life Assessment has been carried out for the proposed Lai Chi Yuen Cemetery Extension. The aim of the study was to assess the effect of the proposed Cemetery Extension on the overall risk level of the nearby Silvermine Bay Water Treatment Works (SMBWTW) due to the increased population in the area.
- 5.17.2 After analysing all the possible events of chlorine release of SMBWTW, the Individual Risk (IR) contours and the F-N Curves were generated and compared against the requirement as stipulated in the Annex 4 of EIAO-TM.
- 5.17.3 It has been concluded that both the societal risk and individual risk of SMBWTW are compliant to the Annex 4 of EIAO-TM. The increase of population in the proposed Cemetery Extension will induce a very slight increase in the overall risk of the SMBWTW. Since the overall societal risk is in the ALARP region, mitigations measures were proposed and Cost-Benefit Analysis was performed. Other recommended practices to reduce the overall risk were also proposed. After implementing all the recommended risk mitigation measures, the overall risk is in compliance with the ALARP principles and Risk Guidelines (Annex 4 of EIAO-TM).

5.18 Reference

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6. WATER QUALITY IMPACT

6.1 Introduction

6.1.1 This chapter presents an assessment of the potential water quality impact from the construction and operation of the Project. Recommendations for mitigation measures have been provided to minimize the identified water quality impacts.

6.2 Environmental Legislation, Policies, Plans, Standards and Criteria

Environmental Impact Assessment Ordinance (EIAO) (Cap. 499)

6.2.1 The Environmental Impact Assessment Ordinance (EIAO) provides a legislative framework to safeguard the environment by reducing and minimizing adverse environmental impacts from designated projects. The Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) was issued by Environmental Protection Department (EPD) under Section 16 of the EIAO. Annexes 6 and 14 of EIAO-TM specify the criteria and guidelines for water quality impact assessment.

Water Quality Objectives

6.2.2 The Water Pollution Control Ordinance (WPCO) provides major statutory framework for the protection and control of water quality in Hong Kong. According to the Ordinance and its subsidiary legislation, Hong Kong waters are divided into ten Water Control Zones (WCZs). Corresponding statements of Water Quality Objectives (WQOs) are stipulated for different water regimes (marine waters, inland waters, bathing beaches subzones, secondary contact recreation subzones and fish culture subzones) in the WCZs based on their beneficial uses. The study area for this water quality impact assessment covers the Southern WCZ. The corresponding WQOs are listed in **Table 6.1**.

Table 6.1 Summary of Water Quality Objectives for Southern Water Control Zone

Water Quality Objectives	Sub-Zone
AESTHETIC APPEARANCE (a) Waste discharges shall cause no objectionable odours or discolouration of the water.	Whole zone
(b) Tarry residues, floating wood, articles made of glass, plastic, rubber or of any other substance should be absent.	Whole zone
(c) Mineral oil should not be visible on the surface. Surfactants should not give rise to a lasting foam.	Whole zone
(d) There should be no recognisable sewage-derived debris.	Whole zone
(e) Floating, submerged and semi-submerged objects of a size likely to interfere with the free movement of vessels, or cause damage to vessels, should be absent.	Whole zone
(f) Waste discharges shall not cause the water to contain substances which settle to form objectionable deposits.	Whole zone
BACTERIA	
(a) The level of <i>Escherichia coli</i> should not exceed 610 per 1000	Secondary Contact
mL, calculated as the geometric mean of all samples collected	Recreation Subzones and
(b) The level of <i>Escherichia coli</i> should not exceed 180 per 100 mL,	Bathing Beach Subzones

Water Quality Objectives	Sub-Zone
calculated as the geometric mean of all samples collected from March to October inclusive in one calendar year. Samples should be taken at least 3 times in a calendar month at intervals of between 3 and 14 days.	
 DISSOLVED OXYGEN (a) Waste discharges shall not cause the level of dissolved oxygen to fall below 4 milligrams per litre for 90% of the sampling occasions during the year; values should be calculated as the water column average (arithmetic mean of at least 3 measurements at 1 metre below surface, mid-depth, and 1 metre above seabed). In addition, the concentration of dissolved oxygen should not be less than 2 milligrams per litre within 2 metres of the seabed for 90% of the sampling occasions during the year. 	Marine waters excepting Fish Culture Subzones
(b) The dissolved oxygen level should not be less than 5 milligrams per litre for 90% of the sampling occasions during the year; values should be calculated as water column average (arithmetic mean of at least 3 measurements at 1 metre below surface, mid- depth and 1 metre above seabed). In addition, the concentration of dissolved oxygen should not be less than 2 milligrams per litre within 2 metres of the seabed for 90% of the sampling occasions during the year.	Fish Culture Subzones
(c) Waste discharges shall not cause the level of dissolved oxygen to be less than 4 milligrams per litre.	Inland waters of the Zone
pH (a) The pH of the water should be within the range of 6.5-8.5 units. In addition, waste discharges shall not cause the natural pH range to be extended by more than 0.2 units.	Marine waters excepting Bathing Beach Subzones; Mui Wo (A), Mui Wo (B), Miu Wo (C), Mui Wo (E) and Mui Wo (F) Subzones.
(b) The pH of the water should be within the range of 6.0-9.0 units.	Mui Wo (D) Sub-zone and other inland waters.
 (c) The pH of the water should be within the range of 6.0-9.0 units for 95% of samples. In addition, waste discharges shall not cause the natural pH range to be extended by more than 0.5 units. 	Bathing Beach Subzones
TEMPERATURE Waste discharges shall not cause the natural daily temperature range to change by more than 2.0 degrees Celsius.	Whole zone
SALINITY Waste discharges shall not cause the natural ambient salinity level	Whole zone

Water Quality Objectives	Sub-Zone
to change by more than 10%.	
 SUSPENDED SOLIDS (a) Waste discharges shall neither cause the natural ambient level to be raised by 30% nor give rise to accumulation of suspended solids which may adversely affect aquatic communities. 	Marine waters
(b) Waste discharges shall not cause the annual median of suspended solids to exceed 20 milligrams per litre.	Mui Wo (A), Mui Wo (B), Mui Wo (C), Mui Wo (E) and Mui Wo (F) Subzones.
(c) Waste discharges shall not cause the annual median of suspended solids to exceed 25 milligrams per litre.	Mui Wo (D) Subzone and other inland waters.
AMMONIA The ammonia nitrogen level should not be more than 0.021 milligram per litre, calculated as the annual average (arithmetic mean), as unionised form.	Whole zone
 NUTRIENTS (a) Nutrients shall not be present in quantities sufficient to cause excessive or nuisance growth of algae or other aquatic plants. 	Marine waters
(b) Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.1 milligram per litre, expressed as annual water column average (arithmetic mean of at least 3 measurements at 1 metre below surface, mid-depth and 1 metre above seabed).	Marine waters
5-DAY BIOCHEMICAL OXYGEN DEMAND Waste discharges shall not cause the 5-day biochemical oxygen demand to exceed 5 milligrams per litre.	Inland waters of the Zone
CHEMICAL OXYGEN DEMAND Waste discharges shall not cause the chemical oxygen demand to exceed 30 milligrams per litre.	Inland waters of the Zone
 DANGEROUS SUBSTANCES (a) Waste discharges shall not cause the concentrations of dangerous substances in marine waters to attain such levels as to produce significant toxic effects in humans, fish or any other aquatic organisms, with due regard to biologically cumulative effects in food chains and to toxicant interactions with each other. 	Whole zone
 (b) Waste discharges of dangerous substances shall not put a risk to any beneficial uses of the aquatic environment. 	Whole zone

Technical Memorandum on Effluent Discharge Standard

6.2.3 Besides setting the WQOs, the WPCO controls effluent discharging into the WCZs through a licensing system. Guidance on the permissible effluent discharges based on the type of receiving waters (foul sewers, stormwater drains, inland and coastal waters) is provided in the *Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS)*. The limits given in the TM-DSS cover the physical, chemical and microbial qualities of the effluents. Any effluent discharge during the construction and operational stages should comply with the relevant standards as stipulated in the TM-DSS.

Practice Notes

6.2.4 The Practice Note (PN) for Professional Persons on Construction Site Drainage (ProPECC PN 1/94) issued by EPD provides good practice guidelines for dealing with various types of discharge from a construction site. Practices outlined in the PN should be followed as far as possible during construction to minimize the water quality impact due to construction site drainage.

6.3 Water Sensitive Receivers

6.3.1 A stream course located at about 250m from the project site was identified. This stream course originates from a small hill to the southeast of the Silver Mine Bay Water Treatment Works and runs through the Lai Chi Yuen Tsuen, crosses South Lantau Road via an underground culvert, continues via a concrete channel, and finally joins the Luk Tei Tong Stream which is one of the three major branches of the Mui Wo River going into Silver Mine Bay. There were also several minor stream courses located more than 90m from the project site boundary. These stream courses are generally flowing in south direction and eventually joining together before ends at Chi Ma Wan. Locations of the identified stream courses are shown in **Figure 6.1**.

6.4 Description of the Environment and Baseline Conditions

6.4.1 The Luk Tei Tong Stream as part of Mui Wo River is continuously monitored by EPD at MW4 downstream of the Project. Mui Wo River flows down the south-eastern slopes of Lantau and drains into Silver Mine Bay in the Southern WCZ. According to EPD's Annual River Water Quality Report (2014), Mui Wo River generally displayed satisfactory water quality and achieved full compliance rates of WQO. The 2014 river water quality at EPD monitoring station MW4 is presented in **Table 6.2**.

Table 6.2	Summary of Water Quality	y Monitoring Data for Mui Wo River in 2014	1

Parameters	Unit	Sampling Station MW4
Dissolved oxygen	mg/L	7.5 (5.2 – 10.0)
рН	-	7.1 (6.5 – 7.5)
Suspended solids	mg/L	5 (1 – 24)
5-day Biochemical Oxygen Demand (BOD₅)	mg/L	<1 (<1 – 2)
Chemical Oxygen Demand (COD)	mg/L	9 (3 – 12)
Oil & grease	mg/L	<0.5 (<0.5 – 0.8)
Faecal coliforms	cfu/100mL	1,900 (200 – 11,000)
E. coli	cfu/100mL	560 (34 – 2,100)
Ammonia-nitrogen	mg/L	0.22

Deremetere	Linit	Sampling Station	
Farameters	Unit	MW4	
		(0.06 - 1.60)	
Nitrate-nitrogen	mg/L	0.23	
Nitiate-Introgen		(0.13 – 0.54)	
Total Kieldahl nitrogan	mg/L	0.46	
rotai Kjeidani hitrogen		0.19 – 2.00)	
Ortha phaaphata	ma/l	0.04	
Ortno-phosphate	mg/L	(0.02 - 0.17)	
Total phaepharus	mg/L	0.10	
i otal priospriorus		(0.05 - 0.28)	
Tatal aulphida	mg/L	<0.02	
i otal sulphide		(<0.02 - <0.02)	
Flow	L/s	45	
FIUW		(10 - 140)	

Notes:

- (1) Data presented are in annual medians of monthly samples; except those for faecal coliforms and *E. coli* which are in annual geometric means.
- (2) Figures in brackets are annual ranges.
- (3) cfu colony forming unit.
- (4) Values at or below laboratory reporting limits are presented as laboratory reporting limits.
- (5) Equal values for annual medians (or geometric means) and ranges indicate that all data are the same as or below laboratory reporting limits

6.5 Assessment Methodology

- 6.5.1 The study area for the water quality impact assessment covers the Southern WCZ as designated under the WPCO and the water quality sensitive receivers in the vicinity of the Project.
- 6.5.2 The Water Sensitive Receivers (WSRs) that may be affected by the Project have been identified. Potential sources of water quality impact that may arise during the construction and operational stages of the Project were described. This task included identifying pollutants from point discharges and nonpoint sources that could affect the quality of surface water bodies. All the identified sources of potential water quality impact were then evaluated and their impact significance determined. The need for mitigation measures to reduce any identified adverse impacts on water quality to acceptable levels was determined.

6.6 Identification of Potential Impacts

Construction Phase

- 6.6.1 Potential sources of key water quality impact associated with the construction phase of the Project have been identified and include:
 - Construction site runoff;
 - Wastewater generated from general construction activities;
 - Accidental spillage of chemicals; and
 - Sewage effluent produced by on-site workforce.
- 6.6.2 No other major concurrent project related to water quality impact is identified within the study area. All the project works would be land-based and the water quality impact generated from the projects would be localized and would be controlled with proper mitigation measures in place.

Operational Phase

6.6.3 The potential source of water quality impact during operation of the new niches would be the sewage generated from staff and visitors as well as other site runoff (e.g. storm drainage) from the Project, which may affect the water quality, if not proper controlled.

6.7 Prediction and Evaluation of Environmental Impacts

Construction Phase

Construction Site Runoff

- 6.7.1 Runoff from the construction works may increase sediment loads and contaminants to the nearby WSRs. Potential sources of pollutants arising from the construction site include:
 - Runoff and erosion from exposed soil surfaces, earthwork areas and dusty stockpiles;
 - Release of cement materials during rain wash;
 - Wash water from dust suppression sprays; and
 - Fuel and lubricants from construction vehicles and mechanical equipment maintenance area.
- 6.7.2 Site runoff may carry pollutants and be washed into the nearby streams. Associated effects which may arise include increased suspended solids concentrations and contaminants in the receiving water bodies. It is important that proper site practice and good site management (as specified in the *ProPECC PN 1/94 "Construction Site Drainage"*) to be followed to prevent run-off with high level of SS from entering the surrounding waters. With the implementation of appropriate measures to control run-off and drainage from the construction site, disturbance of water bodies would be avoided and deterioration in water quality would be minimal. Thus, unacceptable impacts on the water quality are not expected, provided that the relevant mitigation measures as specified in the *ProPECC PN 1/94 "Construction Site Drainage"* are properly implemented.

General Construction Activities

6.7.3 Effluent discharged from temporary site facilities should be controlled to prevent direct discharge to the neighbouring water bodies. Such effluent may include wastewater resulting from wheel washing of site vehicles at site entrances. Debris and rubbish such as packaging, construction materials and refuse generated from the construction activities should also be properly managed and controlled to avoid accidental release to the local storm system and inland waters. Adoption of the guidelines and good site practices for handling and disposal of construction discharges as specified in **Section 6.8** would minimize the potential impacts.

Accidental Spillage of Chemicals

6.7.4 The use of engine oil and lubricants, and their storage as waste materials has the potential to create impacts on the water quality if spillage occurs and enters adjacent water environment. Waste oil may infiltrate into the surface soil layer, or run-off into the nearby water environment, increasing hydrocarbon levels. The potential impacts could however be mitigated by practical mitigation measures and good site practices (as given in **Section 6.8**).

Sewage Arising from Workforces

6.7.5 Domestic sewage generated from the workforce during the construction phase would be forbidden to be directly discharge into public drainage systems or adjacent waterbodies. Temporary sanitary facilities, such as portable toilets, should be provided on-site where necessary to handle sewage from the workforce. Contractual desludging service would be responsible for appropriate disposal of waste matter and maintenance of these facilities.

Operational Phase

6.7.6 The identified potential source of impact on water quality during the operational phase of the Project would be the sewage generated from the visitors as well as other site runoff from the Project. It is expected that the amount of sewage to be generated by the visitors and staff and site effluent as well as runoff of the new niches would be limited in view of the small scale of the Project. With adoption of proper control measures as specified in **Section 6.8**, no adverse water quality impact is anticipated.

6.8 Mitigation of Environmental Impacts

Construction Phase

Construction Site Runoff

- 6.8.1 The practices outlined in *ProPECC PN 1/94 Construction Site Drainage* should be adopted to minimize the potential water quality impacts from site runoff and other construction activities. The following measures are recommended to protect water quality sensitive uses, and when properly implemented should be sufficient to adequately control site discharges so as to avoid water quality impact:
 - Surface run-off from construction sites should be discharged into storm drains via adequately designed sand/silt removal facilities such as sand traps, silt traps and sedimentation basins. Channels or earth bunds or sand bag barriers should be provided on site to properly direct stormwater to such silt removal facilities. Perimeter channels at site boundaries should be provided on site boundaries where necessary to intercept storm run-off from outside the site so that it will not wash across the site. Catchpits and perimeter channels should be constructed in advance of site formation works and earthworks.
 - Silt removal facilities, channels and manholes should be maintained and the deposited silt and grit should be removed regularly, at the onset of and after each rainstorm to ensure that these facilities are functioning properly at all times.
 - Construction works should be programmed to minimize soil excavation works in rainy seasons (April to September). If excavation in soil cannot be avoided in these months or at any time of year when rainstorms are likely, for the purpose of preventing soil erosion, temporary exposed slope surfaces should be covered e.g. by tarpaulin, and temporary access roads should be protected by crushed stone or gravel, as excavation proceeds. Intercepting channels should be provided (e.g. along the crest / edge of excavation) to prevent storm runoff from washing across exposed soil surfaces. Arrangements should always be in place in such a way that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm.
 - Earthworks final surfaces should be well compacted and the subsequent permanent work or surface protection should be carried out immediately after the final surfaces are formed to prevent erosion caused by rainstorms. Appropriate drainage like intercepting channels should be provided where necessary.
 - Construction materials (e.g. aggregates, sand and fill material) on sites should be covered with tarpaulin or similar fabric during rainstorms.
 - Manholes (including newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris from getting into the drainage system, and to prevent storm run-off from getting into foul sewers. Discharge of surface run-off into foul sewers must always be prevented in order not to unduly overload the foul sewerage system.

General Construction Activities

6.8.2 Good site practices should be adopted to remove rubbish and litter from construction sites so as to prevent the rubbish and litter from spreading from the site area. It is recommended to clean the construction sites on a regular basis.

Site Effluent

6.8.3 There is a need to apply to EPD for a discharge licence for discharge of effluent from the construction site under the WPCO. The discharge quality must meet the requirements specified in the discharge licence. All the runoff and wastewater generated from the works areas should be treated so that it satisfies all the standards listed in the TM-DSS. The beneficial uses of the treated effluent for other on-site activities such as dust suppression, wheel washing and general cleaning etc., can minimise water consumption and reduce the effluent discharge volume. If monitoring of the treated effluent quality from the sites is required during the construction phase of the Project, the monitoring should

be carried out in accordance with the relevant WPCO licence which is under the ambit of regional office (RO) of EPD.

Accidental Spillage of Chemicals

- 6.8.4 Contractor must register as a chemical waste producer if chemical wastes would be produced from the construction activities. The *Waste Disposal Ordinance (Cap 354) (WDO)* and its subsidiary regulations in particular the *Waste Disposal (Chemical Waste) (General) Regulation*, should be observed and complied with for control of chemical wastes.
- 6.8.5 Any service shop and maintenance facilities should be located on hard standings within a bunded area, and sumps and oil interceptors should be provided. Maintenance of vehicles and equipment involving activities with potential for leakage and spillage should only be undertaken within the areas appropriately equipped to control these discharges.
- 6.8.6 Disposal of chemical wastes should be carried out in compliance with the Waste Disposal Ordinance. The *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes* published under the WDO details the requirements to deal with chemical wastes. General requirements are given as follows:
 - Suitable containers should be used to hold the chemical wastes to avoid leakage or spillage during storage, handling and transport;
 - Chemical waste containers should be suitably labelled, to notify and warn the personnel who are handling the wastes, to avoid accidents; and
 - Storage area should be selected at a safe location on site and adequate space should be allocated to the storage area.

Sewage Arising from Workforces

- 6.8.7 The construction workforce on site will generate sewage. It is recommended to provide sufficient portable toilets in the works areas. Contractual desludging service should be deployed to clean the portable toilets on a regular basis.
- 6.8.8 Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the surrounding environment. Regular environmental audit of the construction site will provide an effective control of any malpractices and can encourage continual improvement of environmental performance on site. It is anticipated that sewage generation during the construction phase of the project would not cause water pollution problem after undertaking all required measures.

Operation Phase

- 6.8.9 Following the current practice of the existing Lai Chi Yuen Cemetery, sanitary facilities such as portable toilets should be provided for the visitors and staff during operation of the Project. Sewage generated from the sanitary facilities should be collected and disposed of to a sewage treatment works for proper treatment by contractual desludging service employed by FEHD for handling sewage from the existing sanitary facilities.
- 6.8.10 Best Management Practices (BMPs) to reduce storm water and non-point source pollution have been proposed for the Project as follows:

Design Measures

- Exposed surface shall be avoided within the Project site to minimize soil erosion. The development site shall be either hard paved or covered by landscaping area where appropriate.
- The streams and channelized nullahs near the Project site should be retained to maintain the original flow path. The drainage system should be designed to avoid flooding.
- Evergreen trees species, which in general generate relatively smaller amount of fallen leaves, should be selected where possible.

Devices/ Facilities to Control Pollution

- Screening facilities such as standard gully grating and trash grille, with spacing which is capable of screening off large substances such as fallen leaves and rubbish should be provided at the inlet of drainage system.
- Road gullies with standard design and silt traps and oil interceptors should be incorporated during the detailed design to remove particles present in stormwater runoff, where appropriate.

Administrative Measures

- Good management measures such as regular cleaning and sweeping of road surface/ open areas are suggested. The open area cleaning should also be carried out prior to occurrence rainstorm.
- Manholes, as well as stormwater gullies, ditches provided at the Project site should be regularly inspected and cleaned (e.g. monthly). Additional inspection and cleansing should be carried out before forecast heavy rainfall.

6.9 Evaluation of Residual Impacts

6.9.1 With effective controls through good site and management practices, no residual impact on water quality is anticipated during the construction and operational phases of the Project.

6.10 Environmental Monitoring and Audit

6.10.1 No specific water quality monitoring is deemed necessary. It is recommended that regular site inspections during the construction phase should be undertaken to inspect the construction activities and works areas in order to ensure the recommended mitigation measures are properly implemented. No EM&A requirement is considered necessary during the operational phase.

6.11 Conclusion

Construction Phase

6.11.1 The key issue from the construction activities of the Project would be the potential for release of wastewater from surface works areas and open cut excavation. Minimization of water quality deterioration could be achieved through implementing adequate mitigation measures, such as control of site run-off of different general construction activities. Regular site inspections should be undertaken routinely to inspect the construction activities and works areas in order to ensure the recommended mitigation measures are properly implemented.

Operational Phase

6.11.2 The potential source of water quality impact during operation of the new niches would be the sewage generated from staff and visitors as well as runoff from the Project. It is anticipated that the water quality impact associated with the operational phase would be minimal and acceptable, provided that the recommended mitigation measures and best management practices are properly implemented.

7. WASTE MANAGEMENT IMPLICATIONS

7.1 Introduction

- 7.1.1 This section identifies the types of wastes that are likely to be generated during construction and operational phases of the Project, and evaluates the potential environmental impacts that may result from these wastes.
- 7.1.2 The primary waste arising will be generated during the construction phase would mainly be construction and demolition (C&D) materials from the works. During operational phase, general refuse is expected to be generated by the visitors and staffs, ash and other non-combustible residue generated from the burning of joss paper. Mitigation measures and good site practices, including waste handling, storage and disposal, are recommended with reference to the applicable waste legislation and guidelines.
- 7.1.3 This assessment is based on the criteria and guidelines stated in Annexes 7 and 15 of the *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM) for evaluation and assessment of waste management implications, and have covered the scope outlined in Section 3.4.7 of the EIA Study Brief.

7.2 Environmental Legislation, Standards & Guidelines

- 7.2.1 The criteria and guidelines for assessing waste management implications are outlined in Annex 7 and 15, respectively, of the EIAO-TM.
- 7.2.2 The following legislation, which has been used in assessing potential impacts, relates to the handling, treatment and disposal of wastes in the Hong Kong SAR:
 - Waste Disposal Ordinance (Cap.354);
 - Waste Disposal (Chemical Waste)(General) Regulation (Cap.354C);
 - Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap.354N);
 - Land (Miscellaneous Provisions) Ordinance (Cap.28); and
 - Public Health and Municipal Services Ordinance (Cap.132BK) Public Cleansing and Prevention of Nuisances Regulation.

Waste Management

- 7.2.3 The *Waste Disposal Ordinance* (WDO) prohibits the unauthorized disposal of wastes. Construction waste is defined as any substances, matter or thing that is generated from construction work and abandoned, whether or not it has been processed or stockpiled before being abandoned, but does not include any sludge, screenings or matter removed in or generated from any desludging, desilting or dredging works. Under the WDO, wastes can be disposed of only at designated waste disposal facilities licensed by the Environmental Protection Department (EPD).
- 7.2.4 Under the WDO, the *Chemical Waste (General) Regulation 1992* provides regulations for chemical waste control, and administers the possession, storage, collection, transport and disposal of chemical wastes. EPD has also issued a guideline document, the *Code of Practice on Packaging, Labelling and Storage Wastes* (1992), which details how the contractor should comply with the regulations on chemical wastes.
- 7.2.5 The *Public Cleansing and Prevention of Nuisances Regulation* provides control on littering in any street, on public place, any water courses, stream, channel, ditch or reservoir.

Construction and Demolition (C&D) Materials

7.2.6 The current policy related to the disposal of C&D materials is documented in the *Works Branch Technical Circular (WBTC) No. 2/93, Public Dumps.* C&D materials that are wholly inert, namely public fill, should not be disposed of to landfill, but taken to public filling areas (PFAs), which usually form part of reclamation schemes. The *Land (Miscellaneous Provisions) Ordinance* requires that dumping licences be obtained by individuals or companies who deliver public fill to public filling areas. The licences are issued by Civil Engineering and Development Depart (CEDD) under delegated powers from the Director of Lands.

- 7.2.7 In addition to the WBTC, EPD and CEDD have produced a leaflet titled 'New Disposal Arrangements for Construction Waste' (1992) and together with the approved Construction Waste Disposal Charging Scheme (2005) by the Legislative Council that C&D materials with less than 50% by weight of inert materials will be accepted at landfill. If the C&D materials contain more than 50% inert materials, the waste must be sorted with inert materials sent to a public filling area and the non-inert materials (that is, C&D wastes) sent to landfill for final disposal.
- 7.2.8 According to the *Paragraph 4.1.3 of Chapter 4 of the Project Administration Handbook for Civil Engineering Works*, for Designated Projects, a Construction and Demolition Material Management Plan (C&DMMP) has to be submitted to the Public Fill Committee (PFC) for approval in case of C&D materials disposal exceeding 50,000m³.
- 7.2.9 *ETWB TCW No. 19/2005 Environmental Management on Construction Site* introduces additional measures to enhance waste management on construction sites. The circular sets out the policy, procedures and requirements for contractor to prepare and implement an Environmental Management Plan (EMP) for on-site sorting and minimizing generation of C&D materials during the course of construction.

Chemical Waste

7.2.10 Under the regulation of WDO, the *Waste Disposal (Chemical Waste)(General) Regulation* provides regulations of chemical waste control, and administers the possession, storage, collection, transport and disposal of chemical wastes. EPD has also issued a guideline document, the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (1992)*, which details how the Contractor should comply with the regulations on chemical wastes.

7.3 Assessment Methodology

- 7.3.1 The assessment of waste management impacts arising from this Project during construction phase and operation phase has been undertaken in accordance with the EIA Study Brief and criteria given in Annexes 7 and 15 of the EIAO-TM.
 - Estimation of types and quantities of waste generated;
 - Examination of opportunities for waste reduction and re-use (both on-site and off-site) and the required disposal options for each type of waste;
 - Evaluation of potential environmental impacts from the management of solid waste with respect to potential hazards, air and odour emissions, noise, wastewater discharges and public transport; and
 - Identification of impacts on the capacity of waste collection, transfer and disposal facilities.

7.4 Identification of Potential Environmental Impacts

Construction Phase

- 7.4.1 The construction activities to be carried out under the Project would be generate a variety of wastes that can be divided into distinct categories based on their composition and ultimate method of disposal. The identified wastes types are:
 - Construction and demolition (C&D) materials;
 - General refuse; and
 - Chemical waste.

Operational Phase

- 7.4.2 During the operation phase of the Project, major types of waste to be generated are as follows:
 - Ash and non-combustible residue generated from joss paper burner; and
 - General refuse generated by visitors and staff.

7.5 Predicted and Evaluation of Environmental Impacts

Construction Phase

C&D Materials

- 7.5.1 C&D materials would be generated from site clearance, slope excavation works, construction of site access and retaining walls for the Project construction. These C&D materials comprise both inert and non-inert components, such as vegetation, soil, artificial hard materials (i.e. broken concrete, etc.), rocks, wood and metals. In view of the nature and small scale of the Project, the amount of C&D materials to be generated would be limited. It is estimated the total quantity of C&D materials generated from the works to be approximately 500 m³, of which approximately 450 m³ would be inert materials (i.e. public fill) and approximately 50 m³ would be non-inert materials (C&D waste). There is no sediment present requiring marine disposal. Details of the estimated quantity of C&D materials generated from different construction stages of the Project are provided in **Appendix 7.1**.
- 7.5.2 The C&D materials would be sorted on-site. The inert C&D materials would be re-used on-site as far as possible. It is estimated that approximately 100 m³ of inert C&D materials would be reused on-site as backfill materials. The estimated quantity of inert C&D materials to be disposed of would be approximately 350 m³. Final destinations of the inert C&D materials will be determined to the availability of public filling reception facilities (PFRF) and are subject to the agreement with CEDD. A summary of the C&D materials generated from the construction of the Project is shown in **Table 7.1**.

Type of Construction	Total C&D Materials (m ³)	Inert C&D Materials (m ³)	Non-inert C&D Materials (m ³)	Inert C&D Materials to be reused as Backfilling Materials (m ³)	Inert C&D Materials to be Disposed of at PFRF(m ³)
New niches and Site Access	500	450	50	100	350

- 7.5.3 Non-inert C&D materials generated would be reused and recycled as much as possible before disposing to landfills. It is the Contractor's responsibility to separate the inert and non-inert C&D materials on site. Based on the current design information, it is planned to use barges to transport the C&D waste from the barging point of the Outlying Islands Transfer Facilities Mui Wo Station to the designated disposal facilities once per day.
- 7.5.4 With the implementation of proper management for C&D materials and good site practices (Section 7.6), no unacceptable environmental impacts due to handling and disposal of C&D materials arising from the Project are anticipated.

General Refuse

7.5.5 Considering the nature and small scale of the Project, a limited number of workers would involve onsite during construction phase. Thus, the amount of general refuse such as waste papers, plastic packaging and possibly food wastes generated from the construction workforce would be minimal. It is expected there would not be more than 50 workers per day on site during the construction period. Based on the generation rate of 0.65 kg per worker per day, it is estimated no more than 32.5 kg general refuse per day would be generated from the construction of the Project. 7.5.6 The general refuse will be collected on-site on a regular basis, separately from C&D materials by an appropriate waste collector to be employed by the contractor. Prior to disposal off-site, such refuse will be temporarily put in suitably covered storage areas / bins where they will have to be regularly cleaned and maintained to avoid attracting vermin and pests. With proper on-site handling and storage as well as regular disposal of the wastes, no unacceptable environmental impact is anticipated.

Chemical Waste

7.5.7 The maintenance and servicing of construction plant and vehicles may generate a negligibly small amount of chemical wastes such as waste oil/grease, spent solvent / detergents, empty fuel / lubricant drums, used oil filter and scrap batteries. In view of the nature and small scale of the Project, the construction works would involve only a very small number of construction plants and hence the amount of chemical waste to be generated is expected to be minimal. With the implementation of proper handling, storage and disposal of chemicals as described in **Section 7.6.10**, no unacceptable environmental impacts are anticipated.

Operation Phase

Ash and Non-combustible Residues

- 7.5.8 During operation phase, some ash and other non-combustible residues would be generated from the burning of joss paper. Given the small size of the proposed joss paper burner, the amount of such residues would be limited. It is estimated that the quantity of ash and other non-combustible residues would be 1 m³ per month for normal days and 6 m³ per month for festive periods.
- 7.5.9 Such small amount waste generated from visitors using the joss paper burner will be collected and disposed of by contractual service provider engaged by FEHD on a regular basis. Given the small amount of waste requiring disposal of and with the appropriate waste management practice implemented, no adverse environmental impacts are anticipated.

General Refuse

7.5.10 Quantity of general refuse generated by visitors and staff during daily operation of the new niches would not be substantial. It is estimated that the quantity of general refuse would be approximately 10 m³ per month for normal days and 92 m³ per month for festive periods. With proper waste management facilities in place, the potential environmental impacts arising from the handling and disposal of the general refuse would be negligible and would not cause any major environmental concerns.

7.6 Recommended Mitigation Measures for Construction Phase

Construction Phase

Good Site Practices

- 7.6.1 Appropriate waste handling, transportation and disposal methods for all waste arising generated during the construction works for the Project should be implemented to ensure that construction wastes do not enter the nearby streams or drainage channel.
- 7.6.2 Adverse impacts from waste management are not anticipated, provided that good site practices are strictly followed. Recommendations for good site practices during the construction activities include:
 - The contractor shall prepare a Waste Management Plan (WMP) in accordance with the requirements set out in the ETWB TC(W) 19/2005, Waste Management on Construction Site, for the Engineer's Representative approval.
 - Nomination of approved personnel, such as a site manager, to be responsible for good site practices, and making arrangements for collection of all wastes generated at the site and effective disposal to an appropriate facility.

- Training of site personnel in proper waste management and chemical waste handling procedures.
- Provision of sufficient waste reception/ disposal points, of a suitable vermin-proof design that minimizes windblown litter.
- Arrangement for regular collection of waste for transport off-site and final disposal.
- Appropriate measures to minimize windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers.
- Regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors.
- A recording system for the amount of wastes generated, recycled and disposed (including the disposal sites) should be proposed.

Waste Reduction Measures

- 7.6.3 Good management and control of construction site activities/ processes can minimise the generation of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices. Recommendations to achieve waste reduction include:
 - Prior to disposal of C&D waste, wood, steel and other materials should be separated for reuse, recycling to minimize the quality of waste to be disposed of at landfill.
 - Minimize use of wood and reuse non-timber formwork to reduce C&D waste
 - As far as practicable, segregate and store different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal.
 - Encourage collection of aluminum cans, plastic bottles and packaging material and office paper.

C&D Materials

- 7.6.4 With good site management, it can reduce over-ordering of C&D materials such as concrete and mortars. Alternatives such as still frameworks and plastic fencing can be considered to increase the chances for reuse.
- 7.6.5 In order to minimize the potential impacts resulting from collection and transportation of C&D materials for off-site disposal, the excavated materials comprising fill materials should be reused on-site as backfilling materials or for landscaping as far as practicable to avoid disposal off-site.
- 7.6.6 C&D waste, such as wood, plastic, steels and other metals should be reused or recycled and, as a last resort, disposal of to the Outlying Islands Transfer Facilities Mui Wo Station. A suitable area should be designated within the site for temporary stockpiling of C&D materials and to facilitate the sorting process. In order to monitor the disposal of C&D materials at the designated public fill reception facility and landfill and to control fly-tipping, a trip ticket system should be included, with reference to Development Bureau TC(W) 6/2010 for details.
- 7.6.7 The inert C&D materials to be disposed of at public fill reception facilities shall be materials only consists of brick, concrete, cement plaster, soil and inert building debris. The materials shall be free from plastics, chemical waste, industrial metals and other materials that are considered unsuitable at the facility.

General Refuse

7.6.8 General refuse should be stored in enclosed bins or compaction units separate from C&D materials. A reputable waste collector should be employed by the Contractor to remove general refuse from the site regularly, separately from C&D materials. An enclosed and covered area is preferred to reduce the occurrence of "wind-blown" light materials. In addition, a sufficient number of enclosed bins shall be provided on site for containment of general refuse to prevent visual impacts and nuisance to the sensitive surrounding.

7.6.9 The Contractor should carry out an education programme for workers in avoiding, reducing, reusing and recycling of materials generation. Posters and leaflets advising on the use of the bins should also be provided in the site as reminders.

Chemical Waste

7.6.10 For disposal of chemical wastes produced at the construction site, the Contractor is required for register with the EPD as a Chemical Waste Producer and to follow the requirements stated in the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes*. Good quality containers compatible with the chemical wastes should be used. Appropriate labels should be securely attached on each chemical waste container indicating the chemical characteristics of the chemical waste, such as explosives, flammable, oxidizing, irritant, toxic, harmful, corrosive, etc. The Contractor shall also use a licensed waste collector engaged to transport and dispose of the chemical wastes to the Chemical Waste Treatment Centre at Tsing Yi (CWTC) or other licensed facility, in accordance with the *Waste Disposal (Chemical Waste) (General) Regulation*.

Operation Phase

Ash and non-combustible Residues

7.6.11 The ash and non-combustible residues generated from the joss paper burning should be collected and stored in a properly covered refuse containers to avoid dust emission, and final disposed of at landfill site. With these good site practices in place, no adverse environmental impacts are anticipated.

General Refuse

- 7.6.12 To promote recycling of waste paper, aluminum cans and plastic bottles by the visitors, it is recommended to place clearly labeled recycling bins (such as those available from EPD) at convenient locations within the area of new niches or Lai Chi Yuen Cemetery. The recyclable waste materials should then be collected by reliable waste recycling agents on a regular basis.
- 7.6.13 The general refuse (other than those segregated recyclable wastes) should be separated from any chemical wastes and stored in covered refuse containers. FEHD should remove general refuse from the site on daily basis to minimize odour, pest and litter impacts. Burning of refuse must be strictly prohibited.
- 7.6.14 **Table 7.2** provides a summary of the various types of waste to be generated during the construction and operational phases of the Project and the corresponding handling and disposal methods.

Table 7.2	Summary of Waste	Handling Procedures and	Disposal Routes

Waste Type	Estimated Quantity	Handling	Disposal
Construction P	Phase		
Non-inert C&D Materials	50 m³	Where possible should be reused on-site.	Strategic landfill.
Inert C&D Materials	450 m ³		Public Filling Reception Facilities.
Chemical Waste	Negligibly small amount	Recycle on-site or by licensed companies. Store on-site within suitably designed containers.	CWTC
General Refuse	32.5 kg per day	Provide on-site refuse collection facilities.	Employ a reputable waste collector for collection and final disposal of general refuse to landfill site.

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Waste Type	Estimated Quantity	Handling	Disposal
Operation Pha	se		
Ash and Non- Combustible Residue	1 m ³ per month for normal days and 6 m ³ per month for festive periods	Provide on-site refuse collection facilities.	Employ a reputable waste collector for collection and final disposal of ash, non-combustible residue and general refuse to landfill site.
General Refuse	10 m ³ per month for normal days and 92 m ³ per month for festive periods		

7.7 Evaluation of Residual Impacts

7.7.1 With proper handling, storage, collection, transportation and disposal of the identified waste arising, adverse residual impact is not expected to occur during the construction and operation of the Project.

7.8 Environmental Monitoring and Audit Requirements

- 7.8.1 It will be the Contractor's responsibility to ensure that any wastes produced during the construction of the Project are handled, stored and disposed in accordance with good waste management practices and relevant regulations and other legislative requirements. The recommended mitigation measures should form the basis of the site Waste Management Plan to be developed by the Contractor in the construction stage.
- 7.8.2 No EM&A requirement is considered necessary during operation phase.

7.9 Conclusion

7.9.1 Waste management implications associated with the construction and operation of the Project were identified and assessed. In view of the nature and small scale of the Project, insignificant amount of waste would be generated. With implementation of the recommended mitigation measures, adverse impacts on the environment and the potential impacts on the capacity of waste collection, transfer and disposal facilities during construction and operation of the Project would not be anticipated.

8 ECOLOGICAL IMPACT

8.1 Introduction

8.1.1 This section presents an assessment of potential terrestrial and aquatic ecological impacts associated with construction and operation of the extension of Mui Wo Lai Chi Yuen Cemetery. The assessment included areas within 500m distance from the site boundary of the Project. The assessment has followed the criteria and guidelines for evaluating and assessing ecological impact as stated in Annexes 8 and 16 of the TM respectively, and the requirements in Section 3.4.8 of the EIA Study Brief.

8.2 Environmental Legislation, Standards and Guidelines

- 8.2.1 The ecological impact assessment (EcolA) made reference to the following guidelines, standards, documents and HKSAR Government ordinances and regulations:
 - The Country Parks Ordinance (Cap. 208) provides a legal framework for the designation and management of country parks and special areas. Country parks are designated for the purpose of nature conservation, countryside recreation and outdoor education. Special Areas are created mainly for the purpose of nature conservation.
 - The Forests and Countryside Ordinance (Cap. 96) prohibits felling, cutting, burning or destroying of trees and growing plants in forests and plantations on government land. Related subsidiary regulations prohibit the selling or possession of listed, restricted and protected plant species.
 - Under the Wild Animals Protection Ordinance (Cap. 170), designated wild animals are protected from being hunted, whilst their nests and eggs are protected from injury, destruction and removal. All birds and most mammals, including marine cetaceans, are protected under this Ordinance.
 - The Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586) provides protection for certain plant and animal species through controlling or prohibiting trade in the species.
 - The amended Town Planning Ordinance (Cap. 131) provides for the designation of coastal protection areas, Sites of Special Scientific Interest (SSSIs), Conservation Area (CA), Country Park (CP), Green Belt (GB) or other specified uses that promote conservation or protection of the environment.
 - Chapter 10 of the Hong Kong Planning Standards and Guidelines (HKPSG) covers planning considerations relevant to conservation. This chapter details the principles of conservation, the conservation of natural landscape and habitats, historic buildings, archaeological sites and other antiquities. The appendices list the legislation and administrative controls for conservation, other conservation related measures in Hong Kong and government departments involved in conservation.
 - Annex 16 of the EIAO-TM sets out the general approach and methodology for assessment of ecological impacts arising from a project or proposal, to allow a complete and objective identification, prediction and evaluation of the potential ecological impacts. Annex 8 recommends the criteria that can be used for evaluating habitat and ecological impact.
 - EIAO Guidance Note No. 6/2010, "Some Observations on Ecological Assessment from the Environmental Impact Assessment Ordinance Perspective", clarifies the requirements of ecological assessments under the EIAO.
 - EIAO Guidance Note No. 7/2012, "Ecological Baseline Survey for Ecological Assessment", provides general guidelines for conducting ecological baseline surveys in order to fulfil requirements stipulated in the EIAO-TM.

- List of Wild Animals under State Protection details Category I and Category II protected animal species under Mainland Chinese Legislation.
- The International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species provides taxonomic, conservation status and distribution information on taxa that have been evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those taxa that are facing a higher risk of global extinction. The IUCN Red List also includes information on taxa that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation programme.

8.3 Assessment Methodology

Assessment Area

8.3.1 In accordance with Section 3.4.8.2 of the EIA Study Brief (ESB-288/2015), the Assessment Area for the EcoIA shall include areas within 500 m distance from the boundary of the Project and areas likely to be impacted by the Project.

Literature Review

- 8.3.2 Relevant reports, studies, books, scientific papers and available information regarding the ecological characteristics of the Assessment Area were collated and reviewed. The information collected was evaluated to identify any information gaps relating to the assessment of potential ecological impacts. The most recent reports are generally relied upon to provide contemporary information of the ecological characteristics of the Assessment Area.
- 8.3.3 Relevant publications and EIA reports were reviewed. However, no recent EIA study describing the Assessment Area is available for reference. Other relevant literature reviewed included:
 - Hong Kong Biodiversity (AFCD Newsletter) (AFCD, 2002-2015)
 - Check List of Hong Kong Plants (AFCD, 2012)
 - A Field Guide to the Freshwater Fish of Hong Kong (Lee et al., 2004)
 - A Field Guide to the Terrestrial Mammals of Hong Kong (Shek, 2006)
 - A Field Guide to the Amphibians of Hong Kong (Chan et al., 2005)
 - A Field Guide to the Venomous Land Snakes of Hong Kong (Chan et al., 2006)
 - The Avifauna of Hong Kong (Carey et al., 2001)

Field Surveys

- 8.3.4 Based on review of the findings of relevant studies and available information, ecological surveys were carried out to fill information gaps identified and verify the information collected, and to fulfil the requirements of the EIA Study according to Appendix F of the EIA Study Brief No. ESB-288/2015.
- 8.3.5 The ecological surveys were carried out in April 2014, August 2014, February 2015, September 2015, November 2015 and December 2015, covering both dry and wet seasons. Both faunal and floral information was collected during field surveys. The methodologies adopted for the surveys are described below.

Habitats Mapping and Vegetation Surveys

8.3.6 Habitats within the Assessment Area were identified, sized and mapped. Ecological characteristics of each habitat type including size, vegetation type, species present, dominant species found, species diversity and abundance, community structure, seasonal patterns and inter-dependence of the habitats and species, and presence of any features of ecological importance were defined and

characterised. Representative photographs of the habitat types and of important ecological features identified were taken. A desktop review of aerial photographs developed habitat maps of a suitable scale (1:1000 to 1:5000) showing the types and locations of habitats in the Assessment Area. The habitat maps were then verified during ground-truthing.

8.3.7 Vegetation surveys were, also, conducted in parallel by direct observation along the transect routes to record diversity and dominance of plant species present in different habitat types within the Assessment Area, as shown in **Figure 8.1**. Particular attention was paid to the area within and in proximity to the proposed project site. Areas with similar vegetation composition were categorized under the same habitat type. The location of any plant species of conservation interest was recorded. Nomenclature and conservation status of plant species follow Xing et al. (2000), Wu & Lee (2000) and Siu (2000).

Terrestrial Mammals

8.3.8 Mammal surveys were conducted by active searching for all sightings, tracks and signs along the survey transects in all representative habitats. Transect routes for the terrestrial mammals surveys were shown in **Figure 8.1**. For bats, an ultrasonic bat detector was used for acquiring bat acoustic information for species identification. Night survey was conducted for terrestrial mammals but no ultrasonic signal was detected. Nomenclature for mammals follows Shek (2006) and AFCD biodiversity database (AFCD, 2015).

Herpetofauna (Reptiles and Amphibians)

8.3.9 Herpetofauna (reptiles and amphibians) surveys were conducted in habitats and potential hiding places noted through direct observation along the transect routes within the Assessment Area (**Figure 8.1**). Herpetofauna surveys were conducted whenever possible on evenings following or during periods of rainfall, focusing on areas suitable for herpetofauna (e.g. woodlands, shrublands, grasslands, streams, catchwaters, fishponds and marshes, if any). Records of calling amphibians have formed the bulk of the data collected, and supplemented with visual observation of eggs, tadpoles and adult frogs and toads. During reptile surveys, active searches of appropriate microhabitats and refugia (e.g. stones, pond bunds, crevices, leaf litter/debris, and rotten log) were undertaken. All reptiles observed were identified. In addition to active searching, observations of exposed, basking of foraging reptiles were also recorded. Nomenclature and status of herpetofauna follow Hong Kong Biodiversity Database (AFCD, 2015) and Chan et al. (2006).

<u>Avifauna</u>

8.3.10 Avifauna survey was conducted along transect routes in survey area during the proposed survey period. The transect routes for the surveys were shown in **Figure 8.1**, In general, avifauna survey was conducted in the morning or late afternoon when birds are generally active. Night surveys were also undertaken to record nocturnal species of bird. Besides numerical abundance and species identity, notable behaviour such as feeding, nesting and breeding was also recorded. Binoculars and digital camera were the main instrument used. Nomenclature and protection status of the species follow those documented in the AFCD website (AFCD, 2015) and Carey et al. (2001).

Insects (Odonata and Butterflies)

- 8.3.11 The focus of the insect surveys was on dragonfly, damselfly and butterfly groups. These insect groups are generally known to be indicators of high quality habitats. Dragonflies and damselflies were identified and recorded with the aid of binoculars. Surveys for insects were conducted along the transect routes within the Assessment Area as shown in **Figure 8.1**.
- 8.3.12 Butterfly surveys were conducted in tandem with the dragonfly and damselfly surveys, using a similar methodology. Although most butterflies are readily observed, some species are cryptic and stay close to the ground in shady wooded areas. Others tend to stay on top of the canopy, making only short rapid flights before settling out of view. Accordingly, both of these microhabitats were investigated by ground searching. Nomenclature and protection status of the species follow those documented in the AFCD website (AFCD, 2015).
Freshwater Aquatic Fauna

8.3.13 Survey of aquatic fauna was conducted mainly by bankside observations, sometimes with the aid of binoculars and hand nets at the stream course. Three sampling points were selected for the freshwater aquatic fauna as shown in **Figure 8.1**. Species encountered were identified in situ and in lab to the lowest possible taxon and a list of species with abundance has been prepared. Nomenclature and status of freshwater fish and macroinvertebrate follow Lee et al. (2004) and Morse et al. (1984) respectively.

Impact Assessment Methodology

- 8.3.14 Direct and indirect ecological impacts likely to occur during the construction and operation phases of the Project as well as the potential cumulative impact associated with any concurrent projects have been identified and evaluated. The significance of ecological impacts has been evaluated based primarily on the criteria set in Table 1 of Annex 8 of the EIAO-TM, including:
 - Habitat quality;
 - Species affected;
 - Size/Abundance of habitat/organism affected;
 - Duration of impacts;
 - Reversibility of impacts; and
 - Magnitude.

8.4 Description of the Environment

Area of Conservation Importance

8.4.1 The existing Lai Chi Yuen Cemetery and the proposed extension under this Project falls within Lantau South Country Park, which was designated in 1978. Occupying 56.4 km², Lantau South Country Park is the largest country park in Hong Kong. It is mainly covered by plantation woodland, secondary woodland, and shrubland. It harbours native flora species, such as *Dendropanax dentigerus*, *Magnolia championii*, which is scheduled under *Forests and Countryside Ordinance* (Cap. 96), and *Gmelina chinensis*, which is listed in *Illustration of Rare & Endangered Plants in Guangdong Province*. The Country Park provides habitats for various wildlife, such as *Muntiacus muntjak*, which is of potential regional concern (Fellowes et al., 2002), *Callosciurus erythraeus*, which is listed in *Wild Animals Protection Ordinance* (Cap. 170), *Choaspes benjaminii formosanus*, which is of local concern (Fellowes et al., 2002), and *Haliaeetus leucogaster*, which is listed in *Wild Animals Protection Ordinance* (Cap. 170) and *Protection of Endangered Species of Animals and Plants Ordinance* (Cap. 586), and of regional concern (Fellowes et al., 2002). The boundary of Lantau South Country Park within the Assessment Area of the Project is shown in **Figure 8.1**.

Habitats and Vegetation

8.4.2 Six habitats were identified in the Assessment Area, including developed area, plantation woodland, natural woodland, shrubland, inactive agricultural land and stream. The Assessment Area is mainly made up of shrubland, follows by natural woodland. Only plantation woodland and natural woodland are present in the Project Site. A summary of the sizes of the identified habitat types in the Assessment Area and Project Site is shown in **Table 8.1** below. A habitat map of the Assessment Area is shown in **Figure 8.2** and the representative photographs of the identified habitat types are provided in **Appendix 8.7**. Based upon the information obtained during the surveys, a summary of each habitat type is detailed in the following sections.

Habitat Type	Approximate Habitat Size in the Assessment Area (ha)	Approximate Habitat Size in the Project Site (ha)
Developed Area	3.8	0
Plantation Woodland	8.1	0.004
Natural Woodland	24.7	0.0192
Shrubland	45.7	0
Inactive Agricultural Land (Wet)	1.6	0
Stream	3400m	0
Overall	83.9	0.0232

Table 8.1 Sizes of Habitats Recorded within the Assessment Area and Project Site

8.4.3 199 vegetation species were recorded during the surveys (**Appendix 8.1**) and three of them are of conservation interests. They are *Aquilaria sinensis, Gmelina chinensis* and *Nepenthes mirabilis.* Their protection status and photographs are shown in **Table 8.2** and **Appendix 8.7**, respectively.

Developed Area (Photos 1 - 2)

8.4.4 Developed areas include roads and villages, as well as the existing Lai Chi Yuen Cemetery. This habitat supported a total of 30 exotic and native plant species. Most recorded flora species were either weeds or planted for landscaping purpose. *Acacia confusa* and fruit tree of *Dimocarpus longan* were commonly recorded species from this habitat. This habitat was highly disturbed in nature with limited ecological interest. No rare or protected species was recorded within this habitat.

Plantation Woodland (Photo 3)

8.4.5 Plantation woodland mainly comprised orchard, landscape plantation on engineered slope and hillside slope for amenity purpose. *Lophostemon confertus* and *Acacia confusa* were the dominant tree species at this habitat, while other species such as *Acacia mangium, Litchi chinensis, Dimocarpus longan, Cratoxylum cochinchinense, Microcos paniculata, Macaranga tanarius, Mallotus paniculatus* and *Ficus hispida* were commonly recorded within this habitat. Except *Aquilaria sinensis*, most recorded species were common and widespread. *Aquilaria sinensis* was recorded distributed surrounding the existing Lai Chi Yuen Cemetery. *Aquilaria sinensis* is considered with conservation interest in Mainland China and their conservation status was shown in **Table 8.2**. In total, 77 floral species were recorded in this habitat type.

Natural Woodland (Photo 4)

8.4.6 Natural woodland was mainly distributed at the northern side and at the valley within the Assessment Area. These woodlands supported a moderate diversity of plant species with a total of 78 flora species recorded. Flora species such as *Mallotus paniculatus* and *Schefflera heptaphylla* were commonly recorded within this habitat. The dimension of trees was about 0.1 - 0.25m in diameter at breast height (DBH) and 6 to 9m in height. Some individuals of *Aquilaria sinensis* were located within this habitat. The conservation value of *Aquilaria sinensis* is given in **Table 8.2**.

Shrubland (Photo 5)

8.4.7 Shrubland covered most hillside slope of the Assessment Area. In total, 81 floral species were recorded in this habitat type. *Dicranopteris pedata* is the dominated species within this habitat while *Rhodomyrtus tomentosa, Cymbopogon tortilis, Helicteres angustifolia, Phyllanthus cochinchinensis, Cratoxylum cochinchinense* and *Arundinella nepalensis* were commonly recorded within this habitat. *Aquilaria sinensis, Nepenthes mirabilis* and *Gmelina chinensis* were recorded on hillside slope at south of the project site. They were with conservation interest and their details are given in **Table 8.2**.

Inactive Agricultural Land (wet) (Photos 6 - 7)

8.4.8 Inactive agricultural land was located at southern side of the project site which is the lowland area. Soil was observed moist in both dry and wet seasons. In total, 44 floral species were recorded in this habitat type. *Mikania micrantha, Microcos paniculata and Hedychium coronarium* were commonly recorded within this habitat. No rare or protected species was recorded within this habitat.

Stream (Photos 8 - 9)

8.4.9 Several stream courses were recorded within Assessment Area. These stream courses were generally flowing in south direction and eventually joining together before ends at Chi Ma Wan. Lower stream section was observed flowing with clear water in both dry and wet seasons while upper stream section was generally observed dry up during dry season. One of them was found close to project site locating about 90m at northern side and 160m at western side away from the project site. In total, 36 floral species were recorded in this habitat type. *Microstegium ciliatum* was commonly recorded within this habitat. No rare or protected species was recorded within this habitat.

Project Site (Photos 10 - 14)

8.4.10 The Project Area is located at eastern side of the existing cemetery and covered by plantation woodland and natural woodland. The structural complexity of the natural woodland was relatively simple as it is a young woodland. Young trees of approximately 4 – 6 m tall with small crown and trunk sizes were commonly recorded at the top layer (shown in the Photos 9 - 12); and sparse fern/herb species were recorded at the ground layer. Since the majority of trees were young, the tree canopy was semi-shaded. In total, 38 flora species were recorded within project site, in which most of them were common shrubs and weeds in Hong Kong. An individual of *Aquilaria sinensis* was recorded within project site which is a small tree with dimension of 0.02m of DBH and 1.5m height. The conservation value of *Aquilaria sinensis* is given in **Table 8.2**.

Fauna

Terrestrial Mammals

- 8.4.11 One terrestrial mammal species, *Muntiacus muntjak*, which is of conservation interest, was recorded in a previous study within the Assessment Area (Shek, 2006).
- 8.4.12 Except domestic dogs and domestic water buffalos, no other mammal was recorded during the surveys.

Herpetofauna (Reptiles and Amphibians)

- 8.4.13 No amphibian species of conservation interest was recorded inside and in the proximities of the Assessment Area was recorded in previous studies (Chan et al., 2005).
- 8.4.14 Eight herpetofauna species were recorded within Assessment Area during wet season while only *Duttaphrynus melanostictus* was recorded during dry season. Generally, most individuals of herpetofauna were recorded from streams, culverts, shrubland and inactive agricultural land especially after raining. Among the recorded species, *Gekko gecko* is considered with conservation interest which was recorded from shrubland habitat. The conservation status is given in **Table 8.2**. The list of herpetofauna species recorded during current surveys is presented in **Appendix 8.2**

Odonata (Dragonflies, Damselflies)

- 8.4.15 No relevant previous studies for odonata in the Assessment Area were available for reference.
- 8.4.16 Nine odonata species were recorded within Assessment Area during wet season and most of them were found in plantation woodland and stream habitats. Only two common species were recorded during dry season. All recorded species is common and widespread in Hong Kong (Wilson et al., 2003). The list of odonata species recorded during current surveys is presented in **Appendix 8.3**.

Butterflies

- 8.4.17 No relevant previous studies for butterflies in the Assessment Area were available for reference.
- 8.4.18 A total of 21 butterfly species were recorded during wet season while only five species were recorded in dry season. All recorded butterflies are common species in Hong Kong. Generally, butterflies were active under warm temperature and, hence, the species diversity was higher in wet season. The full list of butterfly species recorded during current surveys is presented in **Appendix 8.4**.

<u>Avifauna</u>

- 8.4.19 Some avifauna species of conservation interest were recorded within the Assessment Area in previous studies, including Black Kite (*Milvus migrans*), Bonelli's Eagle (*Aquila fasciata*) and White-shouldered Starling (*Sturnia sinensis*) (Carey et al., 2001; AFCD, 2015).
- 8.4.20 In total, 24 species of avifauna were recorded in which most species were recorded in 500m range Assessment Area. Most birds recorded were resident species in Hong Kong (Carey et al., 2001). *Milvus migrans* and *Centropus sinensis* were recorded outside project site but within 500 m Assessment Area. They were considered with conservation interest and their details were shown in **Table 8.2**. Species list with their status, commonness and relative abundance is given in **Appendix 8.5**.

Freshwater aquatic fauna

- 8.4.21 No fish species of conservation interest was recorded inside and in the proximities of the Assessment Area (Lee et al., 2004).
- 8.4.22 There were natural stream courses with permanent flow of stream water supporting aquatic fauna to survival within Assessment Area. Direct observation and hand netting were adopted for aquatic fauna survey. In total, three freshwater fish species and six aquatic invertebrate species were recorded at the surveyed stream courses. Fish density was observed to be low at the surveyed stream courses. Recorded species are common/uncommon species in Hong Kong. Among the recorded species, only *Nanhaipotamon hongkongense* is an endemic species in Hong Kong and considered as potential global concern by Fellowes *et al.* (2002). The full list of aquatic fauna species recorded during the surveys is presented in **Appendix 8.6**.

Table 8.2 Flora and Fauna Species of Conservation Interest Recorded During Ecological Surveys

Fauna / Flora Species	Protection status	Distribution	Locations Recorded in this study	Rarity
Flora		·	· · · · · ·	·
<i>Aquilaria sinensis</i> (Photo 15)	 Listed as "Vulnerable" in IUCN Red List Listed as "Near Threatened" in Rare and Precious Plants of Hong Kong (Status in China) Recorded in China Red Data Book and Under State protection (Category II) Listed under Protection of Endangered Species of Animals and Plants Ordinance (Cap 586) 	Guangdong, Hainan, Guangxi, Yunnan and Hong Kong	Plantation woodland, shrubland and natural woodland	Common (Xing et al., 2000)
<i>Gmelina chinensis</i> (Photos 16 - 17)	 Listed as "Vulnerable" in Rare and Precious Plants of Hong Kong (Status in China) 	South China	Shrubland	Common (Xing et al., 2000)
Nepenthes mirabilis (Photo 18)	 Listed under Protection of Endangered Species of Animals and Plants Ordinance (Cap 586) Protected under Forests and Countryside Ordinance (Cap 96) Listed as "Vulnerable" in Rare and Precious Plants of Hong Kong (Status in China) 	South China and South Asia	Shrubland	Common (Xing et al., 2000)
Fauna				
Centropus sinensis	- Listed as "Vulnerable" in China Red Data Book	Widely distributed in Hong Kong. (AFCD, 2016)	Plantation woodland and natural woodland	Common resident (AFCD 2016)
Milvus migrans	 Regional Concern (Fellowes et al., 2002) Protection under Endangered Species of Animals and Plants Ordinance (Cap 586) 	Widely distributed in Hong Kong. (AFCD, 2016)	Circling above the Assessment Area	Common resident and Winter visitor (AFCD 2016)
Gekko gecko	 Regional Concern - Fellowes et al. (2002) Listed as "Endangered" at China Red Data Book Status 	Vietnam, Thailand, Laos and China	Shrubland	Uncommon
Nanhaipotamon hongkongense	 Potential Global Concern – Fellowes et al. (2002) Endemic species in Hong Kong 	Hong Kong: Tai Po Kau Reserve, Nai Chung stream in New Territories, and near Victoria peak on Hong Kong Island (IUCN, 2016)	Stream	Uncommon

8.5 Evaluation of Baseline Ecological Value

8.5.1 The ecological importance of the habitats identified within the Assessment Area and the project site has been evaluated in accordance with the criteria stipulated in Annex 8 of the EIAO-TM and is shown in **Tables 8.3** to **8.8** below.

Developed Area

8.5.2 Developed areas (including roads, villages and existing Lai Chi Yuen Cemetery) are associated with intensive human activities. The number of flora species recorded in these habitats was not high, most of them were either cultivated for landscape purpose and for fruit. Moreover, no other rare or protected species was recorded. Thus, the ecological value is considered to be "low". An assessment of the developed area in accordance with the criteria stated in Annex 8 of the EIAO-TM is provided below in **Table 8.3**.

Table 8.3 Ecological Evaluation of Developed area within the Assessment Area

Criteria	Developed Area
Naturalness	Entirely artificial habitat (including roads, villages and existing Lai Chi Yuen Cemetery) with regular human activity
Size	~3.8ha
Diversity	Low floral diversity
Rarity	A very common habitat
Re-creatability	Readily re-creatable
Fragmentation	Fragmented
Ecological linkage	No significant ecological linkage
Potential value	Little enhancement potential due to intensive human disturbance
Nursery/ breeding ground	No significant breeding grounds observed
Age	Young
Abundance/ Richness of wildlife	Fairly low diversity of faunal diversity
Ecological value	Low

Plantation woodland

8.5.3 Plantation woodland mainly comprised of landscape plantation for amenity purposes and distributed on hillside slope within the Assessment Area. A number of *Aquilaria sinensis* with conservation interest were recorded. Thus the ecological value is considered to be moderate. An assessment of the plantation woodland in accordance with the criteria stated in Annex 8 of the EIAO-TM is provided below in **Table 8.4**.

Table 8.4 Ecological Evaluation of Plantation woodland within the Assessment Area

Criteria	Plantation Woodland
Naturalness	Low as most trees were planted for landscape purpose.
Size	~8.1ha
Diversity	Moderate floral diversity
Rarity	A very common habitat but recorded with <i>Aquilaria sinensis</i> which is considered with conservation interest
Re-creatability	High. It would take several years to mature.
Fragmentation	Fragmented
Ecological linkage	Some ecological linkage with natural woodland
Potential value	Potential value for developing into natural woodland

Criteria	Plantation Woodland
Nursery/ breeding ground	No significant breeding grounds observed
Age	Young
Abundance/ Richness of wildlife	Fairly low diversity of faunal diversity
Ecological value	Moderate

Natural woodland

8.5.4 Natural woodland was mainly distributed at the northern side and at the valley within the Assessment Area. These woodlands supported a moderate diversity of plant species with a total of 78 flora species recorded. Some individuals of *Aquilaria sinensis* were located within this habitat. Thus, the ecological value is considered to be "moderate". An assessment of the natural woodland in accordance with the criteria stated in Annex 8 of the EIAO-TM is provided below in **Table 8.5**.

Table 8.5	Ecological Evaluation of Natural Woodland within the Assessment Area
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Criteria	Natural Woodland
Naturalness	Natural
Size	~24.7ha
Diversity	Moderate floral diversity
Rarity	Common habitat in rural area or countryside but recorded with <i>Aquilaria sinensis</i> which is considered with conservation interest
Re-creatability	Not ready to be re-created
Fragmentation	Fragmented
Ecological linkage	Some ecological linkage with adjacent plantation woodland
Potential value	Potential value for developing into more mature woodland
Nursery/ breeding ground	No significant breeding grounds observed
Age	Young
Abundance/ Richness of wildlife	Low abundance and diversity of fauna
Ecological value	Moderate

Shrubland

8.5.5 Shrubland was located on hillside slope and covers most of area within Assessment Area. 81 flora species were recorded within this habitat. Some recorded flora species were of conservation interest. They are *Aquilaria sinensis*, *Nepenthes mirabilis* and *Gmelina chinensis*. However, only 1 individual of *Aquilaria sinensis* and 1 individual of *Gmelina chinensis* were recorded within this habitat. A few individual of *Nepenthes mirabilis* was recorded in a small area of this habitat. Thus, the ecological value is considered to be "low". An assessment of the shrubland in accordance with the criteria stated in Annex 8 of the EIAO-TM is provided below in **Table 8.6**.

Table 8.6Ecological Evaluation of Shrubland within the Assessment Area

Criteria	Shrubland
Naturalness	Natural
Size	~45.7ha
Diversity	Moderate floral diversity.
Rarity	A common habitat in Hong Kong. <i>Aquilaria sinensis, Nepenthes mirabilis</i> and <i>Gmelina chinensis</i> were recorded with conservation interest in this habitat
Re-creatability	Readily re-creatable

Criteria	Shrubland
Fragmentation	Mostly in continuous block with little fragmentation
Ecological linkage	Ecological linkage to nearby woodland.
Potential value	Would convert to woodland by succession.
Nursery/ breeding ground	No significant breeding grounds observed
Age	Young
Abundance/ Richness of wildlife	Moderate diversity of floral diversity
Ecological value	Low

Inactive Agricultural Land

8.5.6 Inactive agricultural land was located at southern side of the project site which is the lowland area. Soil was observed moist in both dry and wet seasons. In total, 44 floral species were recorded in this habitat type. Moreover, no other rare or protected species was recorded. Thus, the ecological value is considered to be "low". An assessment of inactive agricultural land in accordance with the criteria stated in Annex 8 of the EIAO-TM is provided below in **Table 8.7**.

Table 8.7	Ecological Evaluation of	Inactive Agricultural Land within the Assessment Area
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Criteria	Inactive Agricultural Land
Naturalness	Not natural
Size	~1.6ha
Diversity	Low floral diversity
Rarity	Common habitat in Hong Kong.
Re-creatability	Readily re-creatable
Fragmentation	No fragmentation
Ecological linkage	No significant ecological linkage
Potential value	Moderate if abandoned agriculture was promoted to woodland though succession.
Nursery/ breeding ground	No significant breeding grounds observed
Age	Young
Abundance/ Richness of wildlife	Low diversity of faunal diversity
Ecological value	Low

Stream

8.5.7 Several stream courses were recorded within Assessment Area. These stream courses were generally flowing in south direction and then joining together before ending at Chi Ma Wan. Lower stream section was observed flowing with clear water in both dry and wet seasons while upper stream section was generally observed to be dried up during dry season. In total, 36 floral species were recorded in this habitat type. Moreover, no other rare or protected species was recorded. Thus, the ecological value is considered to be "low". An assessment of stream in accordance with the criteria stated in Annex 8 of the EIAO-TM is provided below in **Table 8.8**.

Criteria	Stream		
Naturalness	Naturally occurred streams		
Size	~3400m		
Diversity	Riparian corridor and stream bed show low vegetation diversity and fauna diversity.		

Criteria	Stream
Rarity	Natural streams were reasonably common in Hong Kong.
Re-creatability	Natural streams are difficult to re-create
Fragmentation	Not fragmented from other natural streams
Ecological linkage	No significant ecological linkage
Potential value	The stream would be the breeding site for fauna.
Nursery/ breeding ground	No significant breeding grounds observed
Age	Old (along with geological land formation)
Abundance/ Richness of wildlife	A low diversity of aquatic faunal present
Ecological value	Low

Overall Evaluation

8.5.8 The habitats present within the Assessment Area have been ranked according to their overall ecological value in the **Table 8.9** below. In general, the habitats in the Assessment Area are considered to be of low to moderate ecological value.

Table 8.9 Summary of the Ecological Value of Habitats within the Assessment Area

Habitat	Ecological Value		
Developed Area	Low		
Plantation Woodland	Moderate		
Natural Woodland	Moderate		
Shrubland	Low		
Inactive Agricultural Land	Low		
Stream	Low		

8.6 Impact Assessment and Evaluation

Construction Phase

Direct Impact

- 8.6.1 Habitat loss of young natural woodland and plantation woodland would be resulted due to the land formation for the Project. The habitat loss would be permanent and irreversible but the loss would be small in scale. The estimated loss of habitat arising from the proposed works is summarized in **Table 8.10**.
- 8.6.2 The small portions of natural woodland (approximately 0.0192ha) and plantation woodland (approximately 0.004ha) which would be lost permanently due to the Project are at the edge of the two habitats. The lost areas would not break the habitats or affect the connectivity of the habitats in the vicinity of the project site. Therefore, fragmentation and isolation of the natural woodland and plantation woodland are not anticipated from the land formation for the Project. In addition, the affected area is adjacent to the existing cemetery which is a developed area with frequent human disturbance, such that wildlife is not likely to be present in there.

Table 8.10 Estimated Areas of Permanent and Temporary Habitat Loss

Habitat Type	Approximate Habitat Size in the Project Area (ha)	Approximate Size of Permanent Loss (ha)	Approximate Size of Temporary Loss (ha)	
Natural woodland	0.0192	0.0192	0	
Plantation woodland	0.004	0.004	0	

Habitat Type	Approximate Habitat Size in the Project Area (ha)	Approximate Size of Permanent Loss (ha)	Approximate Size of Temporary Loss (ha)	
Grand Total	0.0232	0.0232	0	

8.6.3 One young tree of *Aquilaria sinensis* was found within the project site and would be subject to direct impact.

Indirect Impact

- 8.6.4 Disturbance to wildlife due to construction works, such as dust and noise nuisance, would be anticipated. Increased human activities would degrade the quality of the nearby habitats including natural woodland, plantation woodland and developed area. Noise disturbance arising from workers and construction activities would cause an indirect impact on wildlife. However, According to results from the field study, there were only a few individuals of common fauna species of high mobility using the area occasionally and transiently such as Black-collared Starling, Chinese Bulbul and Oriental Magpie Robin, as well as some common insects. Thus, it is considered that the severity of disturbance impacts to local wildlife species would be insignificant.
- 8.6.5 A few streams were observed in the vicinity of the project area. Waste oil and other contaminants spilling from the construction site may cause significant impacts to the organisms in the streams and the riparian zone, due to deterioration of the water quality and contamination by toxic substance. Considering that the scale of the Project would be small, the potential spillage could be well-controlled by good site practices.

Overall Impact Evaluation

- 8.6.6 Potential ecological impacts to habitats were evaluated according to Table 1 of Annex 8 of the EIAO-TM and described in the following sections.
- 8.6.7 For the natural woodland habitat, one small tree of *Aquilaria sinensis* was recorded within project site. However, trees were generally young with poor tree form inside the project site. Moreover, tree density was observed to be low within the project site. Thus, the overall impact for natural woodland was considered as "Low". Overall impact evaluation for this habitat was given in **Table 8.11**.

Evaluation Criteria	Natural Woodland
Habitat quality	Moderate
Species	Common flora and fauna species was recorded. 1 individual of <i>Aquilaria sinensis</i> was recorded within project site.
Size/Abundance	~0.0192ha
Duration	The impact would persist during the construction and operation phases.
Reversibility	The impacts of this direct habitat loss would be irreversible.
Magnitude	The scale of the works and the habitat loss and disturbance would be low.
Overall Impact Conclusion	Although 1 small tree of <i>Aquilaria sinensis</i> was recorded within project site, trees were generally young with poor tree form inside the project site. Moreover, tree density was observed to be low within the project site. Thus, the overall impact was considered as "Low".

Table 8.11	Overall Impact Evaluation for Natural Woodland
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8.6.8 Some areas of plantation woodland were recorded within the project site. Only common flora species including trees, shrubs and herbs were recorded. No rare/protected flora species was recorded within the project site. Thus, the impact was considered as "Low". Overall impact evaluation for this habitat was given in **Table 8.12**.

Evaluation Criteria	Plantation Woodland				
Habitat quality	This habitat has been evaluated as "Moderate" within 500m Assessment Area due to the present of <i>Aquilaria sinensis</i> .				
Species	Only common flora species including trees, shrubs and herbs was recorded.				
Size/Abundance	~0.004ha				
Duration	The impact will persist during the construction phases and operation phases.				
Reversibility	The impact would be irreversible.				
Magnitude	The disturbance would be small in scale.				
Overall Impact Conclusion	This habitat has been evaluated as "Moderate" within 500m Assessment Area due to the present of <i>Aquilaria sinensis</i> . However, no <i>Aquilaria sinensis</i> was present within plantation habitat within project site. Moreover, exotic tree species of <i>Lophostemon confertus</i> was commonly recorded within project site. Thus, the overall impact was considered as "Low".				

 Table 8.12
 Overall Impact Evaluation for Plantation Woodland

Operational Phase

- 8.6.9 The potential ecological impacts during operational phase are:
 - Increased human activities / disturbance associated with the operation of the project would disturb surrounding habitats and associated wildlife. As the surrounding areas have already been subjected to considerable human disturbance due to the presence of the existing Lai Chi Yuen Cemetery and associated access road, the disturbance to wildlife is considered insignificant.
 - Burning of joss paper by visitors would potentially lead to hill fire if uncontrolled.

Cumulative impact Assessment

8.6.10 There is no other project in the vicinity of current project. Thus, no cumulative impact would be anticipated.

8.7 Mitigation Measures

8.7.1 According to the EIAO-TM Annex 16 and EIAO Guidance Note No. 3/2010, ecological impacts on important habitats and the associated wildlife caused by the proposed Lai Chi Yuen Cemetery Extension should be mitigated by, in order of priority, avoidance, minimization, and compensation approaches to the maximum practical extent.

Measures to Avoid / Minimize Habitat Loss to Woodland and Plantation

8.7.2 As discussed in **Section 2.4**, a number of development options for the extension of Lai Chi Yuen Cemetery have been considered. In order to avoid woodland of higher ecological value and minimize the loss of woodland / plantation, the currently proposed option has confined the new niches to be

built within the existing Lai Chi Yuen Cemetery and only minimal area (about 7.5m²) outside the cemetery boundary is required for the proposed barrier-free site access, which is indispensable for the development.

- 8.7.3 The natural woodland and plantation woodland within project site boundary would be subject to clearance. Habitat loss could be minimized in the first instance by retaining existing vegetation wherever possible, particularly mature and semi-mature trees present within the works areas. Any trees retained should be adequately protected during the construction phase to promote their health and longevity. Areas which would be temporarily affected by construction activities should be reinstated after completing the construction works.
- 8.7.4 Hoarding or fencing should be erected around the works areas during the construction phase to restrict access to natural habitats adjacent to works areas by site workers to reduce human disturbance. Where minor woodland loss is unavoidable the impact severity is likely to be low and therefore habitat compensation is not typically required. However, the provision of compensatory native tree and shrub planting within the boundary of the existing cemetery as landscape mitigation measures as described in **Section 9.9** would further minimise the impacts identified.

Measures to Avoid / Minimize Impacts to Flora Species of Conservation Importance

- 8.7.5 An individual of *Aquilaria sinensis* located within the project site would be subject to direct impacts. As such, prior to the commencement of the construction works, a vegetation survey should be conducted by a qualified ecologist / botanist within the project site boundary to:
 - Ascertain the presence of, as well as update the conditions, number and locations of the flora species of conservation importance identified.
 - Determine the number and location of the affected individual of flora species of conservation importance and evaluate the suitability and / or practicality of the transplantation.
- 8.7.6 A Transplantation Proposal should be prepared by a qualified ecologist / botanist with detailed findings of the vegetation survey (i.e. number and locations of the affected individuals, assessment of the suitability and / or practicality of the transplantation) and locations of receptor site(s), transplantation methodology, implementation programme of transplantation, post-transplantation monitoring and maintenance programme. The proposal should be submitted to and approved by AFCD prior to commencement of any works (including ground investigation). The approved transplantation works should be carried out before the commencement of any site clearance works and should be supervised by a qualified botanist / horticulturist / Certified Arborist with relevant experience in transplanting flora species of conservation importance.

Measures to Minimize Disturbance Impacts

- 8.7.7 The disturbance impacts to the surrounding habitats and associated wildlife arising from the construction activities could be minimized by adopting the mitigation measures in the sections below.
- 8.7.8 Construction dust should be suppressed to avoid and minimize the dust covering leaves of plants that would affect their photosynthesis, and thus their health and growth (refer to **Section 3.5.1**):
 - Regular watering, to reduce dust emissions from exposed site surfaces and unpaved roads.
 - Proper storage of construction materials.
 - Tarpaulin covering of all dusty vehicle loads transported to, from and between site locations.
- 8.7.9 Noise impact during construction phase should be avoided and minimized to reduce the disturbance to the habitats adjacent to the works areas (refer to **Section 4.7.1**):
 - Machines and plant (e.g. trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum.
 - Machines and plants known to emit strong directional noise should, wherever possible, be orientated so that the noise is directed away from the nearby habitats.

- Material stockpiles and other structures should be effectively utilized, wherever practicable, in screening noise from on-site construction activities.
- 8.7.10 With reference to ETWB TCW No. 5/2005 on "Protection of natural streams/ rivers from adverse impacts arising from construction works" and good site practices (refer to **Section 6.8**), the following good site practices/water control measures should be adopted to minimize any pollution entering the watercourse nearby:
 - General refuse and construction wastes should be collected and disposed of in a timely and appropriate manner.
 - Drainage arrangements should include sediment traps to collect and control construction runoff.
 - All works and storage area should be restricted to the site boundary.
 - Covering of any exposed soil or other loose materials with tarpaulins to prevent erosion.
 - Exposed soil to be covered as quickly as possible following formation works, then seeded and covered with a biodegradable geotextile blanket for erosion control purposes.
 - A temporary sewage treatment system or portable chemical toilets should be designed and installed to collect wastewater and prevent it from entering nearby habitats.
 - The proposed works site inside or in the proximity of nearby habitats should be temporarily isolated, such as by placing of sandbags or silt curtains with a lead edge at the bottom and properly supported props, to prevent adverse impacts on these areas.
 - Construction debris and spoil should be covered up and/or properly disposed of as soon as possible to avoid being washed into nearby habitats by rain.
 - Contractors should adhere to a strict "clean site" policy, with all construction waste transported to predetermined sites for safe disposal. Under no circumstances should there be any disposal of waste oil or other materials on site.
 - Vehicles and other plant should be carefully maintained and properly used to minimise the chance for accidental spillage.
- 8.7.11 Prior to the commencement of any works, the appointed Contractor / Construction Manager should conduct a formal briefing to the workforce to reinforce the message that the works are being conducted within Lantau South Country Park adjacent to environmentally sensitive areas. Workers should also be informed about the locations of any identified rare/ protected plant species adjacent to the project site, concepts of site cleanliness and appropriate waste management procedures, including waste reduction, reuse and recycling.
- 8.7.12 The workforce should be reminded of the need for environmental diligence throughout the duration of works, and in particular to avoid littering, improper disposal of construction waste, avoid unnecessarily damage to vegetation or cause noise or visual disturbance during the works.
- 8.7.13 During operational phase, adequate litter bins, a joss paper burner of proper function and fire-fighting gears should be provided. Regular patrol should be conducted at the open niche area during the Ching Ming Festival and Chung Yeung Festival to ensure no uncontrolled burning occurs.

8.8 Residual Impacts

8.8.1 With the implementation of the recommended mitigation measures during the construction work, no unacceptable residual impact is anticipated.

8.9 Environmental Monitoring and Audit Requirements

8.9.1 No specific monitoring is required. Implementation of the recommended mitigation measures should be regularly audited.

8.10 Conclusion

- 8.10.1 The project site is located at Lai Chi Yuen Cemetery Extension. The area of project site is about 0.0232 ha. Current project is to accommodate the outdoor niches and the ancillary facilities including one joss paper burner (with a fresh water tank and a sewage holding tank for supporting its operation) and planters.
- 8.10.2 Ecological surveys for the project site and its vicinity area have been conducted. The project site is covered by plantation woodland and natural woodland habitat. Approximately 0.0232 ha of these habitats within the proposed works areas would be directly affected. An individual of *Aquilaria sinensis* with conservation interest located within the project site within would also be affected by the construction work. With the adoption of the recommended measures (e.g. transplantation of the small *Aquilaria sinensis*, erection of hoarding/fencing) and native tree and shrub planting as part of the landscaping proposals, the impacts would be minimized.
- 8.10.3 Indirect impacts during the construction phase would comprise human disturbance, construction dust and noise, and construction site runoff. With proper implementation of good site practices, no significant adverse ecological impact would be anticipated. The level of disturbance during the operation phase would be comparable to the existing condition. No significant adverse impact is therefore expected.
- 8.10.4 With the implementation of the recommended mitigation measures (e.g. measures to avoid / minimize habitat loss to woodland and plantation, measures to reduce disturbance from construction activities, etc.), significant adverse direct and indirect ecological impacts would not be anticipated during construction and operational phases.

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9 LANDSCAPE AND VISUAL IMPACT

9.1 Introduction

- 9.1.1 This section presents the findings of the assessment of potential landscape and visual impacts associated with the Project.
- 9.1.2 Landscape and visual impacts assessment are assessed in accordance with the criteria and guidelines as stated in Annexes 10 and 18 of the TM and the EIAO Guidance Note No. 8/2010 on "Preparation of Landscape and Visual Impact Assessment under the Environmental Impact Assessment Ordinance".
- 9.1.3 The assessment area for landscape impact assessment shall include areas within a 500m distance from the site boundary of the Project and any other areas likely to be impacted by the Project. The assessment area for the visual impact assessment shall be defined by the visual envelope of the Project.
- 9.1.4 Detailed description of the Project is discussed in **Section 2** of this Report.

9.2 Environmental Legislation, Standards and Criteria

- 9.2.1 The following legislation, standards and guidelines are applicable to landscape and visual impact assessment associated with the construction and operation of the Project:
 - Environmental Impact Assessment Ordinance (Cap.499 S.16) and the Technical Memorandum on EIA Process (EIAO TM), particularly Annexes 10 and 18;
 - Environmental Impact Assessment Ordinance Guidance Note 8/2010;
 - Town Planning Ordinance (Cap 131);
 - Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);
 - Hong Kong Planning Standards and Guidelines Chapters 4, 10 and 11;
 - AFCD Nature Conservation Practice Note No.2 Measurement of Diameter at Breast Height (DBH);
 - AFCD Nature Conservation Practice Note No.3 The Use of Plant Names;
 - ETWB TCW No. 29/2004 Registration of Old and Valuable Trees, and Guidelines for their Preservation;
 - ETWB TCW No. 8/2005 Aesthetic Design of Ancillary Buildings in Engineering Projects;
 - DEVB TCW No. 2/2012 Allocation of Space for Quality Greening on Roads;
 - DEVB TCW No. 3/2012 Site Coverage of Greenery for Government Building Projects;
 - ETWB TCW No. 6/2015 Maintenance of Vegetation and Hard Landscape Features;
 - DEVB TCW No. 7/2015 Tree Preservation;
 - GEO Publication No. 1/2011 Technical Guidelines on Landscape Treatment and Bio-Engineering for Man-Made Slopes and Retaining Walls;
 - Guidelines on Tree Transplanting (September 2014) issued by Greening, Landscape and Tree Management (GLTM) Section of DevB;

- Guidelines on Tree Preservation during Development (April 2015) issued by GLTM Section of DevB;
- Study on Landscape Value Mapping of Hong Kong; and
- LAO PN 3/2014 Design, Disposition and Height (DDH) Clause under Lease Conditions.

9.3 Assessment Methodology

Landscape Impact Assessment Methodology

- 9.3.1 The landscape impacts have been assessed according to the following procedures.
 - Identification of the baseline landscape resources and landscape characters found within the study area. This is achieved by site visits and desktop study of topographical maps, information databases and photographs. Landscape resources and character areas identified within 500m from the project site will be identified.
 - Assessment of the degree of sensitivity of the landscape resources and landscape character areas. This is influenced by a number of factors including whether the resource/character is common or rare, whether it is considered to be of local, regional, national or global importance, whether there are any statutory or regulatory limitations/ requirements relating to the resource, the quality of the resource/character, the maturity of the resource and the ability of the resource/character to accommodate change.
 - The sensitivity of each landscape feature and character area is classified as follows:
 - **High:** Important landscape character or resource of particularly distinctive character or high importance, sensitive to relatively small change.
 - **Medium:** Landscape character or resource of moderately valued landscape characteristics reasonably tolerant to change.
 - Low: Landscape character or resource, the nature of which is largely tolerant to change.
 - *Identification of potential sources of landscape changes.* These are the various elements of the construction works and operation procedures that would generate landscape impacts.
 - The magnitude of landscape changes is classified as follows:
 - Large: The landscape character or landscape resource would incur a major change.
 - Intermediate: The landscape character or landscape resource would incur a moderate change.
 - **Small:** The landscape or landscape resource would incur slight or barely perceptible change.
 - **Negligible:** The landscape or landscape resource would incur no discernible change.
 - Identification of potential landscape mitigation measures. These may take the form of
 adopting basic scheme design to prevent and/or minimize adverse landscape impacts before
 adopting other mitigation or compensatory measures to alleviate the impacts. Potential
 mitigation measures shall include the preservation of vegetation, transplanting of trees of good
 amenity value, re-provision of screen planting, landscape reinstatement of disturbed lands,
 compensatory planting, design of structure, provision of finishes to structure, colour scheme and
 texture of material used and any measures to mitigate the disturbance of the existing land use.

A programme for the mitigation measures is provided. The agencies responsible for the funding, implementation, management and maintenance of the mitigation measures are identified.

• Prediction of the significance of landscape impacts before and after the implementation of the mitigation measures. By synthesizing the magnitude of the various impacts and the sensitivity of the various landscape resources, it is possible to categorize impacts in a logical, well-reasoned and consistent fashion. Table 9.1 shows the rationale for dividing the degree of significance into four thresholds, namely insubstantial, slight, moderate, and substantial, depending on the combination of a negligible-small-intermediate-large magnitude of change and a low-medium-high degree of sensitivity of landscape resource /character.

Table 9.1Relationship between Landscape Sensitivity and Magnitude of Change in
Defining Impact Significance

		Low	Medium	High
Maç	Negligible	Insubstantial	Insubstantial	Insubstantial
nitude of Change	Small	Insubstantial / Slight	Slight / Moderate	Moderate
	Intermediate	Slight / Moderate	Moderate	Moderate / Substantial
	Large	Moderate	Moderate / Substantial	Substantial

Sensitivity of Landscape Character Area and Resource

Note: All impacts are Adverse unless otherwise noted with Beneficial.

- The significance of landscape impacts is categorized as follows:
 - **Substantial:** Adverse / beneficial impact where the proposal would cause significant deterioration or improvement in existing landscape quality.
 - **Moderate:** Adverse / beneficial impact where the proposal would cause a noticeable deterioration or improvement in existing landscape quality.
 - **Slight:** Adverse / beneficial impact where the proposal would cause a barely perceptible deterioration or improvement in existing landscape quality.

Insubstantial: No discernible change in the existing landscape quality.

• **Prediction of Acceptability of Impacts.** An overall assessment of the acceptability, or otherwise, of the impacts according to the five criteria set out in Annex 10 of the EIAO-TM.

Visual Impact Assessment Methodology

- 9.3.2 The visual impacts have been assessed according to the following procedures.
 - Identification of the Visual Envelope during the construction and operation phases of the **project.** This is achieved by site visit and desktop study of topographic maps, photographs and preparation of cross-sections to determine visibility of the Project from various locations.

- Identification of the VSRs within the Visual Envelope at construction and operation phases. These are the people who would reside within, work within, play within, or travel through, the Visual Envelope.
- Assessment of the degree of sensitivity of the VSRs. Factors considered include:
 - the type of VSRs, which is classified according to whether the person is at home, at work, at play, or travelling. Those who view the change from their homes are considered to be highly sensitive as the attractiveness or otherwise of the outlook from their home will have a substantial effect on their perception of the quality and acceptability of their home environment and their general quality of life. Those who view the impact from their workplace are considered to be only moderately sensitive as the attractiveness or otherwise of the outlook will have a less important, although still material, effect on their perception of their quality of life. The degree to which this applies depends on whether the workplace is industrial, retail or commercial. Those who view the impact whilst taking part in an outdoor leisure activity may display varying sensitivity depending on the type of leisure activity. Those who view the impact whilst travelling on a public thoroughfare will also display varying sensitivity depending on the speed of travel.
 - other factors which are considered (as required by EIAO GN 8/2010) include the number of individuals, value and quality of existing views, the availability and amenity of alternative views, the duration or frequency of view, and the degree of visibility.
- The sensitivity of VSRs is classified as follows:
 - **High:** The VSR is highly sensitive to any change in their viewing experience.
 - **Medium:** The VSR is moderately sensitive to any change in their viewing experience.
 - **Low:** The VSR is only slightly sensitive to any change in their viewing experience.
- *Identification of potential sources of visual changes.* These are the various elements of the construction works and operation that would generate visual changes.
- Assessment of the potential magnitude of visual changes. Factors considered include:
 - the compatibility with the surrounding landscape;
 - o the duration of the impact under construction and operation phases;
 - the reversibility of the impact;
 - the scale of the impact and distance of the source of impact from the viewer; and
 - the degree of visibility of the impact, and the degree of which the impact dominates the field of vision of the viewer.
- The magnitude of visual changes is classified as follows:

Large: The VSRs would suffer a major change in their viewing experience.

Intermediate: The VSRs would suffer a moderate change in their viewing experience.

Small: The VSRs would suffer a small change in their viewing experience.

Negligible: The VSRs would suffer no discernible change in their viewing experience.

- Identification of potential landscape mitigation measures. These may take the form of adopting basic scheme design to prevent and/or minimize adverse visual impacts before adopting other mitigation or compensatory measures to alleviate the impacts. Potential mitigation measures shall include the preservation of vegetation, transplanting of trees of good amenity value, re-provision of screen planting, landscape reinstatement of disturbed lands, compensatory planting, design of structure, provision of finishes to structure, colour scheme and texture of material used and any measures to mitigate the disturbance of the existing land use. A programme for the mitigation measures is provided. The agencies responsible for the funding, implementation, management and maintenance of the mitigation measures are identified.
- Prediction of the significance of visual impacts before and after the implementation of the mitigation measures. By synthesizing the magnitude of the various visual impacts and the sensitivity of the VSRs, and the numbers of VSRs that are affected, it is possible to categorize the degree of significance of the impacts in a logical, well-reasoned and consistent fashion. Table 9.2 shows the rationale for dividing the degree of significance into four thresholds, namely, insubstantial, slight, moderate and substantial, depending on the combination of a negligible-small-intermediate-large magnitude of change and a low-medium-high degree of sensitivity of VSRs.

Table 9.2Relationship between Visually Sensitive Receivers (VSRs) Sensitivity and
Magnitude of Change in Defining Impact Significance

				_
		Low	Medium	High
Mag	Negligible	Insubstantial	Insubstantial	Insubstantial
nitude of Char	Small	Insubstantial / Slight	Slight / Moderate	Moderate
	Intermediate	Slight / Moderate	e Moderate	Moderate / Substantial
ge	Large	Moderate	Moderate / Substantial	Substantial

Sensitivity of Visually Sensitive Receivers (VSRs)

Note: All impacts are Adverse unless otherwise noted with Beneficial.

• The significance of visual impacts is categorized as follows:

Substantial:	Adverse / beneficial impact where the proposal would cause significant deterioration or improvement in existing visual quality.
Moderate:	Adverse / beneficial impact where the proposal would cause a noticeable deterioration or improvement in existing visual quality.
Slight:	Adverse / beneficial impact where the proposal would cause a barely perceptible deterioration or improvement in existing visual quality.
Insubstantial:	No discernible change in the existing visual quality.

• **Prediction of Acceptability of Impacts.** An overall assessment of the acceptability, or otherwise, of the impacts according to the five criteria set out in Annex 10 of the EIAO-TM.

9.4 Review of Planning and Development Control Framework

- 9.4.1 Relevant outline development plan(s), outline zoning plan(s), layout plan(s) or planning briefs and studies which may identify areas of high landscape value, e.g. green belt and woodland areas with sensitive landscape designations and visually sensitive areas/receivers are reviewed. Any guidelines on landscape strategy, landscape framework, urban design concept, building height profiles, designed view corridors, open space network and landscape link that may affect the appreciation of the Project shall also be reviewed. The aim is to gain an insight to the future outlook of the area affected so as to assess whether the Project can fit into the surrounding setting. Any conflict with statutory town plan(s) shall be highlighted and appropriate follow-up action shall be recommended.
- 9.4.2 The existing Lai Chi Yuen Cemetery as well as the proposed extension fall within the Lantau South Country Park and are zoned "Country Park" ("CP") on the Approved South Lantau Coast Outline Zoning Plan No. S/SLC/19. The planning intention of the "CP" is to protect natural features and to provide outlets for outdoor recreation for public enjoyment of the countryside. The proposed extension consists of an elevated platform of around 225m² to accommodate some 790 niches and ancillary facilities. The extension is small and localized as well as is located immediately to the east of the existing Lai Chi Yuen Cemetery. To a large extent, the Project Site is surrounded by natural terrain and hence not easily noticeable. Subject to no adverse comment from Country and Marine Parks Board, the proposed extension would not be in conflict with the Approved Outline Zoning Plan.

9.5 Baseline Study

Landscape Resources (LR)

- 9.5.1 The details of Baseline Landscape Resources which would be potentially affected by the Project, together with their sensitivity are described below. The locations of baseline landscape resources and their photos are illustrated in **Figure 9.1**.
- 9.5.2 LR1 Lantau Trail (Section 12) This is hiking trail with approximately 9km in distance from Mui Wo to Pui O. This Section is at +104mPD locates at the north west of the project site. This is an important trail in Lantau Island which provides outdoor hiking with beautiful views along the coastline of Lantau Island. It is considered to be of territorial importance. The quality of this resource is high and the LR is rare. This landscape resource is mature and the ability to accommodate change is low. The sensitivity of this resource is high.
- 9.5.3 LR2 Vegetation within the Lai Chi Yuen Cemetery This is a heavily vegetated area on man-made slopes between development platforms within the boundary of the existing cemetery. A mix of native trees including few numbers of *Aquilaria sinensis (with trunk diameter less than 95mm)*, exotic trees and shrubs are found on the slopes. It is a common landscape resource. The quality of this resource is medium. The vegetation on the man-made slopes in the cemetery is mature. The ability of this resource to accommodate change is medium. The sensitivity of this resource is medium.
- 9.5.4 LR3 Vegetation on natural terrain and man-made slopes This is a heavily vegetated area on natural hillside and man-made slopes along access roads. Native trees and shrubs are found on natural terrain and exotic species are commonly found on man-made slopes. It is a common landscape resource in Lantau. The quality of this resource is high. The vegetation in the landscape is mature. The ability of this resource to accommodate change is low. The sensitivity of this resource is high.
- 9.5.5 LR4 Stream Courses Several stream courses were recorded within Assessment Area. These stream courses were generally flowing in south direction and eventually joining together before ends at Chi Ma Wan. Lower stream section was observed flowing with clear water in both dry and wet seasons while upper stream section was generally observed dry up during dry season. This is a common landscape resource found in natural hillside with local importance. The quality of this resource is high and ability to accommodate change is low. The sensitivity of this resource is high.
- 9.5.6 The details evaluation of the sensitivities for the above identified landscape resources are presented in following **Table 9.3**.

Landscape Character Areas (LCA)

9.5.7 The details of Baseline Landscape Character Area which would be potentially affected by the Project, together with their sensitivity are described making reference to the Landscape Value Mapping of Hong Kong. Mui Wo Coastal Upland and Hillside Landscape Character Area is the only landscape type identified in accordance with the Landscape Value Mapping of Hong Kong within the study boundary. It is a large-scale upland and hillside landscapes which abut the sea. It consists of hillsides, knolls, ridges and spurs. They are generally covered in scrub or grassland with rocky outcrops or boulder fields. Woodland are found on lower slopes or in sheltered gullies and ravines. Due to its remote location, this landscape contains few human features. Key human feature include Lai Chi Yuen Cemetery and associated access road, a number of scattered village houses and Lantau Trail etc. This type of landscape is commonly found around the coasts of Hong Kong. The landscape is mature. The quality of this LCA is high. The ability of this LCA to accommodate localized changes is low. The sensitivity of this LCA is considered high. The location and photo record of this LCA are illustrated in Figure 9.2. The details evaluation of the sensitivities for the LCA is presented in following Table 9.4.

Broad Brush Tree Survey

- 9.5.8 A broad brush tree survey was carried out in accordance with the EIA Study Brief to identify dominant tree species, maturity, rarity and any plant species of conservation interest, etc. which would be potentially affected to provide baseline information on the landscape resources and landscape character areas.
- 9.5.9 Based on the broad brush tree survey, there were approximately 30 nos. of trees within the project boundary. The dominant tree species include *Acacia confusa*, *Cratoxylum cochinchinense*, *Lophostemon confertus*, *Mallotus paniculatus*, *Rhus succedanea* and *Sapium discolor*. They are generally of mature size with fair form, health and amenity value. Within the project boundary, a young *Aquilaria sinensis* (with dimension of 0.02m of DBH and 1.5m height) was identified. There is no Old and Valuable Trees (OVT) identified within the project boundary. All tree species surveyed are commonly found in Hong Kong. Details of the vegetation survey are identified and assessed in **Section 8**.

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Table 9.3Sensitivities of Landscape Resources

ID	Landscape Resources (LRs)	Quality of LRs (High / Medium / Low)	Maturity of LR (Over-mature / Mature/ Young)	Rarity of LR (Rare / Common / Very Common)	Ability to accommodate change (Low / Medium / High)	Importance of LR (Local / Territorial / Regional / Global)	Sensitivity (High/Medium/Low)
LR1	Lantau Trail (Section 12)	High	Mature	Rare	Low	Territorial	High
LR2	Vegetation within the Lai Chi Yuen	Medium	Mature	Common	Medium	Local	Medium
LR3	Vegetation on natural terrain and man-made slopes	High	Mature	Common	Low	Territorial	High
LR4	Stream Courses	High	Mature	Rare	Low	Local	High

Table 9.4 Sensitivity of Landscape Character Area

ID	Landscape Character Areas	Quality of LCA (HIgh / Medium / Low)	Maturity of LCA (Over-mature / Mature/ Young)	rity of LCA Rarity of LCA Ability to er-mature / (Rare / Common / accommodate of re/ Young) Very Common) (Low / Medium		Importance of LR (Local / Territorial / Regional / Global)	Sensitivity (High/Medium/Low)
LC A	Mui Wo Coastal Upland and Hillside	High	Mature	Common	Low	Territorial	High

Visual Envelope

9.5.10 The proposed extension in the form of elevated platform is located at the slope next to the entrance staircase of the existing Lai Chi Yuen Cemetery. The elevated platform is +97.4mPD. Dense woodland is found on the man-made slopes and natural terrain which screen the view to the existing Lai Chi Yuen and the proposed extension from outside. Lantau Trail (Section 12) at +104mPD locates at the north west of the project site. Based on the finding in the field visit, there is no direct view from the Lantau Trail (Section 12) to the proposed extension because the view is blocked by the existing trees and shrubs on the natural terrain and those vegetation will not be affected by the Project as shown in the **Appendix 9.1**. As such the visual envelope of the Project is relatively localised and small as illustrated in **Figure 9.3**.

Visually Sensitive Receivers (VSRs)

- 9.5.11 Within the Visual Envelope, key VSRs have been identified during construction and operation phases. They are listed and described below, together with their baseline assessment and sensitivity, and mapped in **Figure 9.3**.
- 9.5.12 The sensitivity of VSRs is assessed in accordance with EIAO Guidance Note No. 8/2010. Key factors including type of VSRs, number of individuals within the VSRs, quality of existing view, availability of alternative views, degree of visibility, duration of view and frequency of view of the VSRs are evaluated.
- 9.5.13 The VSRs to be affected by the proposed extension within the visual envelope of the Project would be Visitors to the Cemetery (VSR1). The number of individual within the VSRs is few. The quality of existing views is fair. Alternative views, which are views to the other amenity area, are available. There would be full view to the proposed extension. The duration of view is short and the frequency of the view of the VSRs is rare. The sensitivity of this VSR1 is considered as low.
- 9.5.14 Outside the Visual Envelope, 2 potential VSRs have been identified Hikers along Lantau Trail (VSR2) and Recreational users of Ngau Koo Wan Hill Court (VSR3). The number of individual within the 2 VSRs is few. The quality of existing views is fair. Alternative views, which are views to the other amenity area, are available in the 2 VSRs. The sensitivity of VSR2 and VSR3 is considered as low. Based on the photographic record during site visit, the views from the subject site towards these potential VSRs are blocked by the existing trees and vegetation around the existing Lai Chi Yuen Cemetery.

9.6 Landscape Impact Assessment

Sources of Landscape Impacts

- 9.6.1 The sources of landscape impacts in the construction phase would include:
 - Construction of the elevated platform of around 225m² including structural columns and provision of niches and ancillary facilities; and
 - Temporary Works for the in-situ concrete casting, temporary stockpiling etc.
- 9.6.2 The source of landscape impacts in the operation phase would be limited to the operation of facilities at the Cemetery Extension.

Magnitude of Landscape Impacts

9.6.3 Under the construction of the elevated platform and the site access for the cemetery extension, approximately 232.5m² of vegetation within the Lai Chi Yuen Cemetery will be removed. Based on a broad brush estimate, approximate 30 nos. of existing trees on the slope will be felled. Affected trees include *Acacia confusa*, *Cratoxylum cochinchinense*, *Lophostemon confertus*, *Mallotus paniculatus*, *Rhus succedanea* and *Sapium discolor*. They are generally of fair form and amenity value. Affected trees are in the range of 5-14m high, 3-9m spread and 100-250mm trunk diameter. Based on the findings in ecological impact assessment in **Section 8**, 1 no. of young *Aquilaria sinensis*

(with dimension of 0.02m of DBH and 1.5m height) would be affected by the proposed works. The magnitude of change is considered as intermediate during construction. During operation, the magnitude of irreversible unmitigated impact will be the same as the construction phase.

- 9.6.4 Apart from LR2, there would not be any impact on other landscape resources identified within the study boundary.
- 9.6.5 During construction, approximately 232.5m² of woodland vegetation in the Mui Wo Coastal Upland and Hillside Landscape Character Area will be removed due to the construction of the elevated platform and the site access. The scale of work is small and the work is permanently irreversible. The impact is very small and localized. It is barely noticeable within this LCA. The proposed work is compatible with the adjacent landscape context as it is considered as a localized extension to the existing cemetery. It is predicted that the magnitude of change to this LCA is considered negligible. During operation, the magnitude of irreversible change will be the same as the construction phase. The evaluation of magnitude of change on the identified LRs are presented in **Table 9.5**.

Significance of Unmitigated Landscape Impacts

- 9.6.6 It is predicted that there would be intermediate magnitude of change to the Vegetation within Lai Chi Yuen Cemetery (LR2) during the construction and operation phase. The sensitivity of the vegetation within Lai Chi Yuen Cemetery is medium. The resultant significance of unmitigated landscape impact is considered moderate during construction and operation.
- 9.6.7 There would be negligible magnitude of change to the Mui Wo Coastal Upland and Hillside Landscape Character Area. It is predicted that the resultant significance of unmitigated landscape impact on this LCA is insubstantial during construction and operation.
- 9.6.8 The evaluation of significance of unmitigated landscape impact on both LRs and LCA are presented in **Tables 9.5** and **9.6**.

Table 9.5 Magnitude of Change on Landscape Resources

ID	Landscape Resources (LR)	Scale of Development	Reversibility of Change	Duration of Impact	Compatibility of the project with the surrounding landscape	Magnitude of Change
LR1	Lantau Trail (Section 12)	None	N/A	N/A	High	Negligible
LR2	Vegetation within the Lai Chi Yuen	Small	Irreversible	Permanent	Medium	Intermediate
LR3	Vegetation on natural terrain and man-made slopes	None	N/A	N/A	Medium	Negligible
LR4	Stream Courses	None	N/A	N/A	N/A	Negligible

Table 9.6 Magnitude of Change on Landscape Character Area

ID	Landscape Character Area (LCA)	Scale of Development	Reversibility of Change Duration of Impa		Duration of Impact Compatibility of the project with the surrounding landscape		
LCA	Mui Wo Coastal Upland and Hillside	Small	Irreversible	Permanent	High	Negligible	

9.7 Visual Impact Assessment

Sources of Visual Impacts

- 9.7.1 The sources of visual impacts in the construction phase would include:
 - Site formation work for the proposed platform and associated facilities;
 - Construction of the site access of 7.5m²;
 - Construction of the elevated platform of around 225m² including structural columns and provision of niches and ancillary facilities; and
 - Temporary Works for the in-situ concrete casting, temporary stockpiling etc.
- 9.7.2 The source of visual impacts in the operation phase would be limited to the operation of facilities at the Cemetery Extension.

Magnitude of Visual Impacts

9.7.3 During construction, it is considered the proposed platform is a localised extension from the existing cemetery. The compatibility of the Project during construction phase is medium. The construction period will last for 2 years and the duration is considered as short. The scale of development is very small and localized. The works constructed are irreversible. There would not be any potential blockage of view during construction. In view of the short distance from the project site, it is predicted that the magnitude of visual change for VSR1 is considered as intermediate. For VSR2 and VSR 3, it is predicted that the magnitude of visual change is considered as negligible as there is no direct view from these VSRs. During operation, the irreversible unmitigated impact will be the same as the construction phase.

Significance of Unmitigated Visual Impacts

- 9.7.4 It is predicted that there would be intermediate magnitude of visual change on the visitors to the Cemetery (VSR1). The sensitivity of VSR1 is low. The resultant significance of unmitigated visual impact on VSR1 would be slight during construction and operation.
- 9.7.5 It is predicted that there would be negligible magnitude of visual change on the hikers along Lantau Trail (VSR2) and Recreational users of Ngau Koo Wan Hill Court (VSR3). The sensitivity of VSR2 and VSR3 is low. The resultant significance of unmitigated visual impact on VSR2 and VSR3 would be insubstantial during construction and operation.

Recommended Photomontage Viewpoints

- 9.7.6 Computer generated photomontages will be prepared to illustrate the potential landscape and visual impact of the Project. The criteria for the selection of representative viewpoints for photomontages include: -
 - the viewpoints which cover the aboveground structure viewed from major public viewpoint represents key VSRs or VSR groups who would be potentially affected by the proposed Project; and
 - the viewpoints which shall be able to represent the worst case scenarios and demonstrate the compatibility of the aboveground structures to the adjacent visual context and illustrate the visual effect during Day 1 without mitigation measures, Day 1 with mitigation measures and Year 10 with mitigation measures.
- 9.7.7 Based on the location of the proposed extension, one photomontage from a vantage point taken from the existing Lai Chi Yuen Cemetery is recommended to illustrate the potential landscape and visual

impact due to the Project. The computer generated photomontage to illustrate the potential landscape and visual impact of the Project is shown in **Figure 9.5**.

9.8 Landscape and Visual Mitigation Measures

- 9.8.1 The proposed extension has been designed to minimize any potential landscape and visual impact as much as possible. Unavoidably, there would be some potential landscape and visual impact. Landscape and Visual Mitigation Measures are therefore proposed to alleviate the potential adverse landscape and visual impact.
- 9.8.2 The proposed landscape and visual mitigation measures in the construction and operation are listed in **Tables 9.7** and **9.8** below, together with an indication of Funding, Implementation and Maintenance Agencies and illustrated in **Figure 9.4**.

Table 9.7	Landscape and	Visual Mitigation	Measures for	Construction Phase

ID No.	Landscape and Visual Mitigation Measures	Funding Agency	Implementation Agency
CM1	Preservation of Existing Vegetation All the existing Trees to be retained within the site and not to be affected by the Project shall be carefully protected during construction accordance with DEVB TCW No. 7/2015 - Tree Preservation and the latest Guidelines on Tree Preservation during Development issued by GLTM Section of DevB. Any existing vegetation on existing man-made slope and natural terrain not to be affected by the Project shall be carefully preserved.	ArchSD	ArchSD
CM2	Compensatory Tree Planting Any Trees to be felled under the Project shall be compensated in accordance with DEVB TCW No. 7/2015 - Tree Preservation. Native species will be proposed. Compensatory trees shall be in heavy standard size.	ArchSD	ArchSD
СМЗ	Control of Night-time Lighting Glare Any lighting provision of the construction works at night shall be carefully control to prevent light overspill to the nearby VSRs and into the sky.	ArchSD	ArchSD
CM4	Erection of Screen Hoarding in Visually Unobtrusive Colour Screen hoarding in visually unobtrusive colour, which is compatible with the surrounding settings, shall be erected during construction to minimize the potential landscape and visual impacts due to the construction works and activities.	ArchSD	ArchSD
CM5	Management of Construction Activities and Facilities The facilities and activities at works sites and areas, which include site office, temporary storage areas, temporary works etc., shall be carefully managed and controlled on the height, deposition and arrangement to minimize any potential adverse landscape and visual impacts.	ArchSD	ArchSD

ID	Landscape and Visual Mitigation Measures	Funding	Implementation
No.		Agency	Agency
CM6	Reinstatement of Temporarily Disturbed Landscape Areas All hard and soft landscape areas disturbed temporarily during construction due to temporary excavations, temporary works sites and works areas shall be reinstated to equal or better quality, to the satisfaction of the relevant Government Departments.	ArchSD	ArchSD

Table 9.8 Landscape and Visual Mitigation Measures for Operation Phase

ID No.	Landscape and Visual Mitigation Measures	Funding Agency	Implementation Agency	Maintenance/ Management Agency*
OM1	Aesthetically pleasing design of Aboveground Structures The Aboveground Structures of the Project including proposed elevated platform, structural columns, niches and ancillary facilities in the regard of layouts, forms, materials and finishes shall be sensitively designed so as to blend in the structures to the adjacent landscape and visual context.	ArchSD	ArchSD	ArchSD
OM2	Amenity Tree and Shrub Planting Amenity tree and shrub planting shall be provided at the edge of the platform to provide green transition between the proposed extension and the existing natural terrain.	ArchSD	ArchSD	ArchSD
OM3	Screen Planting to soften the Structural Columns of the elevated platform Shade Tolerant species will be selected carefully. Screen planting on slope and vertical screen planting in the form of climbers on wire mesh are proposed in front of the structural columns of the elevated platform to minimize the potential adverse visual impact.	ArchSD	ArchSD	ArchSD

9.8.3 The construction phase mitigation measures listed above shall be implemented as early as possible in order to minimize the landscape impacts in the construction stage. The operation phase mitigation measures listed above shall be adopted during the detailed design and be built as part of the construction works at the last stage of the construction period so that they are in place at the date of commissioning of the Project. The plant species, which shall be of low maintenance and self-sustained which would not require regular ongoing maintenance, shall be carefully selected to ensure that the stilt structure is effectively screened. However, it should be noted that the full effect of the soft landscape mitigation measures would not be appreciated for several years. Photomontages of the proposed project without and with mitigation measures illustrating the appearance after 10 years of the proposed works are shown in **Figure 9.5**.

9.9 Residual Impact

Significance of Residual Landscape Impact after Mitigation Measures

- 9.9.1 Under the proposed works, it is estimated approximately 30 trees will be felled for the works. The affected trees are growing on slopes, their survival rate are generally low after transplanting and therefore they are not recommended to be transplanted. With the implementation of preservation of existing vegetation around the proposed platform and reinstatement of temporarily disturbed landscape areas, it is predicted that there would still be moderate residual impact during construction phase. During operation, 6 trees of native species of heavy standard size will be compensated at the elevated platform and 24 trees of native species of heavy standard size with native shrubs as understory layer will be compensated within the boundary of the existing cemetery (see **Figure 9.6**). It is predicted that there would still be slight residual impact in day 1 and insubstantial residual impact in year 10 of operation when the compensatory tree planting proposed becomes mature.
- 9.9.2 There is only 1 no. of *Aquilaria sinensis* (with dimension of 0.02m of DBH and 1.5m height) identified within the project site that would be affected by the proposed works under the ecological impact assessment. The affected *Aquilaria sinensis* shall be transplanted where possible. Detailed mitigation for transplantation proposal for flora species of conservation importance is described in **Para. 8.7.6**. The tree compensation and transplantation will be carried out by ArchSD. The transplanted and compensated trees will be maintained by ArchSD/FEHD.
- 9.9.3 Under the proposed works, it is predicted that there would be insubstantial significance of impact on Mui Wo Coastal Upland and Hillside Landscape Character Area. With the implementation of proposed mitigation measures, the residual impact would remain insubstantial during construction and operation.
- 9.9.4 The details of the residual impact on LRs and LCA are presented in **Table 9.9** and **9.10**.

Significance of Residual Visual Impacts

9.9.5 With the proposed mitigation measures, which include the preservation of existing trees, compensatory planting, control of night-time lighting glare, erection of screen hoarding in visually unobtrusive colour, management of construction activities and facilities, reinstatement of temporarily disturbed landscape area, it is predicted that there would be slight residual impact during construction as there will be permanent loss of existing trees which are not able to be fully compensated. During operation, with the implementation of mitigation measures, which include aesthetically pleasing design of above ground structures, amenity tree and shrub planting and screen planting (with climber) to soften the structural columns of the elevated platform, as illustrated in the photomontage in Figure 9.5, it is predicted that the residual impact on the visitors to Lai Chi Yuen Cemetery would remain slight in day 1 and year 10 of the operation.

9.10 Environmental Monitoring and Audit

- 9.10.1 The detailed design of the Project shall be undertaken so as to ensure compliance with the landscape and visual mitigation measures described in **Section 9.8**.
- 9.10.2 A baseline review shall be undertaken at the commencement of the construction contracts to update the status of landscape resources, character areas and visually sensitive receivers.
- 9.10.3 Implementation of the recommended mitigation measures would be regularly audited during construction phase. Details of environmental monitoring and audit (EM&A) requirement are discussed in the separate EM&A Manual.

9.11 Conclusion

9.11.1 It is considered that the residual landscape and visual impact is acceptable with mitigation measures implemented during construction and operation phases.

Table 9.9 Impact Significance before and after Mitigation Measures on Landscape Resources

ID No.	Landscape Resources (LR)	Sensitivity (High/Medium/Low)	Magnitude of Impact (Negligible, Small,	Significance of Unmitigated Landscape Impact (Insubstantial Slight Moderate	Recommended Mitigation	Significance of Residual Impact after Mitigation Measure (Insubstantial, Slight, Moderate, Substantial)			
		() ,	Intermediate, Large)	Substantial)	Measures	Day 1	Year 10		
LR1	Lantau Trail (Section 12)	High	Negligible	Insubstantial	None	Insubstantial	Insubstantial		
LR2	Vegetation within the Lai Chi Yuen	Medium	Intermediate	Moderate	CM1 to CM6, OM1 to OM3	Slight	Insubstantial		
LR3	Vegetation on natural terrain and man-made slopes	High	Negligible	Insubstantial	None	Insubstantial	Insubstantial		
LR4	Stream Courses	High	Negligible	Insubstantial	None	Insubstantial	Insubstantial		

Table 9.10 Impact Significance before and after Mitigation Measures on Landscape Character Area

ID No.	Landscape Character Area	Sensitivity (High/Medium/Low)	Magnitude of Impact (Negligible, Small,	Significance of Unmitigated Landscape Impact (Insubstantial Slight Moderate	Recommended Mitigation	Significance of Residual Impact after Mitigation Measure (Insubstantial, Slight, Moderate, Substantial)		
	(LCA)	(Intermediate, Large)	Substantial)	Measures	Day 1	Year 10	
LCA	Mui Wo Coastal Upland and Hillside	High	Negligible	Insubstantial	CM1 to CM6, OM1 to OM3	Insubstantial	Insubstantial	

10. ENVIRONMENTAL MONITORING AND AUDIT REQUIREMENTS

10.1 Introduction

- 10.1.1 This section summarizes the findings in the EIA and evaluates the need for environmental monitoring and audit (EM&A) in construction and operational phases of the Project, based on the findings of this EIA Study.
- 10.1.2 The objectives of conducting the EM&A programme for the Project are as follows:
 - To provide a database against which any short or long-term environmental impacts of the Project can be determined;
 - To provide an early indication should any of the environmental control measures or practices fail to achieve the acceptable standards;
 - To monitor the performance of the Project and the effectiveness of mitigation measures;
 - To verify the environmental impacts predicted in this EIA;
 - To determine project compliance with regulatory requirements, standards and government policy;
 - To take remedial action if unexpected problems or unacceptable impacts arise; and
 - To provide data to enable an environmental audit.
- 10.1.3 The following section summarizes the recommended EM&A requirements for the Project. Details of specific requirements of monitoring work are provided in the EM&A Manual prepared in accordance with Annex 21 of the EIAO-TM.

10.2 Air Quality

Construction Phase

10.2.1 With the implementation of sufficient dust suppression measures as stipulated under *the Air Pollution Control (Construction Dust) Regulation* and good site practices, no unacceptable construction air quality impact is anticipated. No air quality monitoring is therefore considered necessary. Regular site environmental audit during the construction phase of the Project should be conducted to ensure the recommended dust suppression measures are properly implemented.

Operational Phase

10.2.2 No EM&A requirement for air quality during operation of the Project is deemed necessary.

10.3 Noise

Construction Phase

10.3.1 No construction noise monitoring is considered necessary. Regular site environmental audit during the construction phase of the Project as specified in the separate EM&A Manual should be conducted to ensure the good site practices are properly implemented.

Operation Phase

10.3.2 EM&A requirement for noise during operation of the Project is considered not necessary.

10.4 Hazard to Life

10.4.1 No EM&A requirement for hazard to life during both construction and operation of the Project is deemed necessary.

10.5 Water Quality

Construction Phase

10.5.1 No specific water quality monitoring is deemed necessary. It is recommended that regular site inspections during the construction phase should be undertaken to inspect the construction activities and works areas in order to ensure the recommended mitigation measures are properly implemented.

Operation Phase

10.5.2 No EM&A requirement for noise is considered necessary during the operational phase.

10.6 Waste Management Implications

Construction Phase

10.6.1 It will be the Contractor's responsibility to ensure that any wastes produced during the construction of the Project are handled, stored and disposed in accordance with good waste management practices and relevant regulations and other legislative requirements. The recommended mitigation measures should form the basis of the site Waste Management Plan to be developed by the Contractor in the construction stage.

Operation Phase

10.6.2 No EM&A requirement is considered necessary during the operational phase.

10.7 Ecological Impact

Construction Phase

10.7.1 No specific monitoring is required. Implementation of the recommended mitigation measures should be regularly audited during construction phase.

Operation Phase

10.7.2 No EM&A requirement is required during the operational phase.

10.8 Landscape and visual

Construction Phase

- 10.8.1 The detailed design of the Project shall be undertaken so as to ensure compliance with the landscape and visual mitigation measures described in **Section 9.8**.
- 10.8.2 A baseline review shall be undertaken at the commencement of the construction contracts to update the status of landscape resources, character areas and visually sensitive receivers.
- 10.8.3 Implementation of the recommended mitigation measures would be regularly audited during construction phase. Details of environmental monitoring and audit (EM&A) requirement are discussed in the separate EM&A Manual.

Operation Phase

10.8.4 No EM&A requirement is considered necessary during the operational phase.

11. IMPLEMENTATION SCHEDULE AND RECOMMENDED MITIGATION MEASURES

11.1 Introduction

11.1.1 This chapter presents the implementation schedule of the proposed mitigation measures for the Project. **Table 11.1** summarises the details of mitigation measures for all works areas. For each recommended mitigation measures, both the location and timing for the measures have been clearly identified. As well, the parties responsible for implementing the measure and for maintenance (where applicable) have been clearly identified.

Table 11.1 Implementation schedule of Recommended Mitigation Measures

EIA* EM&	&A	Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation Agent	Implementation Stage**				Relevant Legislation and
Ref. Log R	Ref.		of Completion of Measures		Des	С	0	Dec	Guidelines
Air Quality Impac	ct (Constru	iction Phase)					-	_	
3.5.1 A1	l Suff unde <i>Reg</i> prop a) b) c) d)	icicient dust suppression measures as stipulated er the <i>Air Pollution Control (Construction Dust)</i> <i>gulation</i> and good site practices should be perly implemented. Use of regular watering, to reduce dust emissions from exposed site surfaces and unpaved roads particularly during dry weather; Use of frequent watering of particular dusty construction areas close to ASRs; Side enclosure and covering of any aggregate or dusty material storage piles to reduce emissions. Where this is not practicable owing to frequent usage, watering should be applied to aggregate fines; Open temporary stockpiles should be avoided or covered. Prevent placing dusty material storage plies near ASRs;	Active works areas / throughout the construction period / upon completion of all construction activities	Contractor					EIAO-TM, AQOs

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EIA*	EM&A	Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation	Implementation Stage ^{**}			Relevant Legislation and	
Ref.	Log Ref.		of Completion of Measures	Agent	Des	С	ο	Dec	Guidelines
		f) Establishment and use of vehicle wheel and body washing facilities at the exit point of the site;							
		 g) Imposition of speed control for vehicles on unpaved site roads. 8 km/hr is the recommended limit; 							
		 h) Routing of vehicles and positioning of construction plant should be at the maximum possible distance from ASRs. 							
construction plant should be at the maximum possible distance from ASRs. Air Quality Impact (Operational Phase)									
3.4.5	A2	The proposed joss paper burner will adopt the Best Available Technology (BAT), including a water scrubber, an electrostatic precipitator and an exhaust fan connected in series to effectively remove the air pollutants in the emissions. Adequate air flow will be supplied to the furnace chamber in order to allow sufficient oxygen for complete combustion and avoid production of carbon monoxide (CO) and soot. Upon the multi-stage air treatment, the smokeless clean air would be discharged via an extraction fan to the atmosphere.	Joss paper burner / throughout the design stage of the joss paper burner / upon completion of design of the joss paper burner	Project proponent (FEHD/ArchSD)	×		*		EIAO-TM, AQOs, Guideline on Air Pollution Control for Joss Paper Burning at Chinese Temples, Crematoria and Similar Places
3.5.2	A3	Apart from the adoption of BAT to the proposed joss paper burner, the following good operational practices and administrative measures as well as good maintenance practices as stipulated in EPD's <i>Guideline on Air Pollution Control for Joss Paper Burning at Chinese Temples, Crematoria and Similar Places</i> should be strictly followed: <u>Good Operational Practices and Administrative</u> <u>Measures</u> (i) Before burning joss paper, the operator should make sure that the air pollution control equipment has been turned on and running normally. Joss paper burning should never be	Lai Chi Yuen Cemetery Extended Areas / throughout the operation of the Cemetery Extended Areas / upon decommissioning of the Cemetery Extended Areas	Operator (FEHD)					EIAO-TM, AQOs, Guideline on Air Pollution Control for Joss Paper Burning at Chinese Temples, Crematoria and Similar Places

Food and Environmental Hygiene Department

EIA*	EM&A	&A Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation	Implementation Stage**				Relevant Legislation and	and
Ref.	Log Ref.		of Completion of Measures	Agent	Des	С	0	Dec	Guidelines	
		carried out without operation of the air pollution control equipment.								
		(ii) The operator should ensure only offerings made with paper materials are burnt in the furnace. Other wrapping materials, in particular plastic materials, should be removed.								
		(iii) It is essential to employ trained operators to control the feeding rate of joss paper to the furnaces. In case visible emissions are observed at the flue gas discharge, the feeding rate should be reduced as appropriate, and if visible emissions persist, the operator should immediately stop the burning activities and call for maintenance of the air pollution control equipment if necessary.								
		(iv) Whenever there is a sign of deterioration in performance of the electrostatic precipitator, the operator should arrange cleaning of the electrostatic precipitator. For those electrostatic precipitators with automatic self-cleaning function, the operator should ensure self- cleanings are carried out at frequencies recommended by manufacturers.								
		(v) The operator should regularly clean the burning chamber and clear away ash remains inside the burning chamber, preferably at least once a day. To prevent emissions during ash clearing process, the ash should be wetted sufficiently by water spraying.								
		Good Maintenance Practices								
		 Maintenance and repair of air pollution control equipment should only be carried out by competent personnel with sufficient training and relevant skills in accordance with manufacturer's recommendations. 								
EIA*	EM&A	M&A Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation	Impler S		entati ge**	on	Relevant Legislation and	
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Ref.	Log Ref.		of Completion of Measures	Agent	Des	С	0	Dec	Guidelines	
		 (ii) Air pollution control equipment should be maintained regularly to ensure optimum performance. All components should also be inspected, cleaned and serviced regularly. 								
		(iii) Any defective parts of the air pollution control equipment should be replaced as soon as possible. To facilitate immediate replacement, sufficient stick of spare parts should be kept on- site.								
		(iv) Operators should keep a copy of the operation and maintenance manual and should maintain a proper log of maintenance records on-site to facilitate maintenance of the equipment.								
Noise Imp	act (Constr	uction Phase)	1							
4.7.1	N1	 Good site practice listed below and the noise control requirements stated in EPD's "Recommended Pollution Control Clauses for Construction Contracts" is recommended: Only well-maintained plant to be operated onsite and plant should be serviced regularly 	Active works areas / throughout the construction period / upon completion of all construction activities	Contractor		~			EIAO-TM, NCO, EPD's "Recommended Pollution Control Clauses for Construction Contracts"	
		during construction works;Machines and plant that may be in intermittent use to be shut down between work periods or								
		 Plant known to emit noise strongly in one direction, should, where possible, be orientated to direct noise away from the NSRs; 								
		 Mobile plant should be sited as far away from NSRs as possible; and 								
		 Material stockpiles and other structures to be effectively utilized, where practicable, to screen noise from on-site construction activities. 								

EIA* Ref.	EM&A	f. Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation Agent	Impleme Stag		nplementation Stage ^{**}		Relevant Legislation and
Ref.	Log Ref.		of Completion of Measures	Agent	Des	С	0	Dec	Guidelines
Noise Imp	oact (Operat	ional Phase)				-		_	
4.6.3	N2	Properly design the water pumps and joss paper burner to meet the total maximum permissible sound power level of 94 dB(A).	Water pumps and joss paper burner / throughout the design stage of the water pumps and joss paper burner / upon completion of design of the water pumps and joss paper burner	Project proponent (FEHD / ArchSD)	*		*		EIAO-TM, NCO
Hazard to	Life (Const	ruction Phase)							
5.16.12	H1	 There are a number of measures recommended during construction stage, which include: Sufficient number of face masks should be purchased so that the construction workers can be protected during accidental chlorine release The number of workers on site during construction stage should be kept within the level as assessed in this report. FEHD/ArchSD/the responsible personnel of the construction site should keep effective communication with Police or relevant authorities to ensure a proper evacuation/emergency response in case of a gas release incident. FEHD/ArchSD/the responsible personnel of the construction site should ensure all workers on site to be familiar with the route to escape. Diagram showing the escape routes to a safe place should be posted in the site notice boards and at the entrance/exit of site. 	Works area / Entire construction stage / upon completion of construction works	Project proponent (FEHD / ArchSD) and contractor					EIAO-TM

EIA* Ref.	EM&A	Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation	Implen St		entati age ^{**}	on	Relevant Legislation and
Ref.	Log Ref.		of Completion of Measures	Agent	Des	С	0	Dec	Guidelines
		• Specific means of providing a rapid and direct warning (e.g. Siren and Flashing Light) to construction workers in the event of chlorine gas release in the SMBWTW should be determined and made known to the construction workers.							
		 The construction site officer should establish a communication channel with the SMBWTW operation personnel during construction stage. Upon receiving the notice of an external gas leak at the SMBWTW, the construction site officer should direct the workers to evacuate by following the instructions of Police or relevant authorities as appropriate. Induction Training should be provided to any staff before working on site. The responsible officer of the construction site should ensure all construction staff are familiar with the evacuation routes and /or location of the 							
		protective gears (if available).							
Hazard to	Life (Opera	tional Phase)				-			
5.16.14	H2	 FEHD should keep effective communication with Police or relevant authorities to ensure a proper emergency response in case of a gas release incident. 	Entire project site / Operation stage / Whole operation stage	Project Proponent (FEHD)			~		EIAO-TM
Water Qu	ality Impact	(Construction Phase)							
6.8.1	W1	 <u>Construction Site Runoff</u> The following measures are recommended to be implemented: Surface run-off from construction sites should be discharged into storm drains via adequately designed sand/silt removal facilities such as sand traps, silt traps and sedimentation basins. 	Active works areas / throughout the construction period / upon completion of all construction activities	Contractor		✓			EIAO-TM, WQOs ProPECC PN 1/94 Construction Site Drainage, WDO

EIA*	EM&A	Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation	Impleme n Staç		entati ge**	on	Relevant	and
Ref.	Log Ref.		of Completion of Measures	Agent	Des	С	0	Dec	Guidelines	unu
		Channels or earth bunds or sand bag barriers should be provided on site to properly direct stormwater to such silt removal facilities. Perimeter channels at site boundaries should be provided on site boundaries where necessary to intercept storm run-off from outside the site so that it will not wash across the site. Catchpits and perimeter channels should be constructed in advance of site formation works and earthworks.								
		 Silt removal facilities, channels and manholes should be maintained and the deposited silt and grit should be removed regularly, at the onset of and after each rainstorm to ensure that these facilities are functioning properly at all times. 								
		 Construction works should be programmed to minimize soil excavation works in rainy seasons (April to September). If excavation in soil cannot be avoided in these months or at any time of year when rainstorms are likely, for the purpose of preventing soil erosion, temporary exposed slope surfaces should be covered e.g. by tarpaulin, and temporary access roads should be protected by crushed stone or gravel, as excavation proceeds. Intercepting channels should be provided (e.g. along the crest / edge of excavation) to prevent storm runoff from washing across exposed soil surfaces. Arrangements should always be in place in such a way that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm. 								
		 Earthworks final surfaces should be well compacted and the subsequent permanent work or surface protection should be carried out immediately after the final surfaces are formed to prevent erosion caused by rainstorms. Appropriate drainage like intercepting channels should be 								

EIA* Ref.	EM&A	EM&A Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation	Implen St		entati ge ^{**}	on	Relevant Legislation and
Ref.	Log Ref.		of Completion of Measures	Agent	Des	С	0	Dec	Guidelines
		provided where necessary.							
		 Construction materials (e.g. aggregates, sand and fill material) on sites should be covered with tarpaulin or similar fabric during rainstorms. 							
		 Manholes (including newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris from getting into the drainage system, and to prevent storm run-off from getting into foul sewers. Discharge of surface run-off into foul sewers must always be prevented in order not to unduly overload the foul sewerage system. 							
6.8.2	W2	 General Construction Activities Good site practices should be adopted to remove rubbish and litter from construction sites so as to prevent the rubbish and litter from spreading from the site area. It is recommended to clean the construction sites on a regular basis. 	Active works areas / throughout the construction period / upon completion of all construction activities	Contractor		×			EIAO-TM, WQOs, ProPECC PN 1/94 Construction Site Drainage , WDO
6.8.3	W3	Site Effluent There is a need to apply to EPD for a discharge licence for discharge of effluent from the construction site under the WPCO. The discharge quality must meet the requirements specified in the discharge licence. All the runoff and wastewater generated from the works areas should be treated so that it satisfies all the standards listed in the TM-DSS. The beneficial uses of the treated effluent for other on-site activities such as dust suppression, wheel washing and general cleaning etc., can minimise water consumption and reduce the effluent discharge volume. If monitoring of the treated effluent quality from the sites is required during the construction phase of the Project, the monitoring should be carried	Active works areas / throughout the construction period / upon completion of all construction activities	Contractor		×			EIAO-TM, WQOS, ProPECC PN 1/94 Construction Site Drainage , WDO

EIA* Ref	EM&A	A Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation	Impleme Sta		entati ge**	on	Relevant
Ref.	Log Ref.		of Completion of Measures	Agent	Des	С	ο	Dec	Guidelines
		out in accordance with the relevant WPCO licence which is under the ambit of regional office (RO) of EPD.							
6.8.4 - 6.8.6	W4	 <u>Accidental Spillage of Chemicals</u> Contractor must register as a chemical waste producer if chemical wastes would be produced from the construction activities. The <i>Waste Disposal Ordinance (Cap 354)</i> (WDO) and its subsidiary regulations in particular the <i>Waste Disposal (Chemical Waste)</i> (General) Regulation, should be observed and complied with for control of chemical wastes. Any service shop and maintenance facilities should be located on hard standings within a bunded area, and sumps and oil interceptors should be provided. Maintenance of vehicles and equipment involving activities with potential for leakage and spillage should only be undertaken within the areas appropriately equipped to control these discharges. Disposal of chemical wastes should be carried out in compliance with the Waste Disposal Ordinance. <i>The Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes</i> published under the WDO details the requirements to deal with chemical wastes. Suitable containers should be used to hold the chemical wastes to avoid leakage or spillage during storage, handling and transport; Chemical waste containers should be suitably labelled, to notify and warn the personnel who are handling the wastes, to avoid accidents; and 	Active works areas / throughout the construction period / upon completion of all construction activities	Contractor					EIAO-TM, WQOs, ProPECC PN 1/94 Construction Site Drainage , WDO

EIA* Ref	EM&A	A Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation	Implei S		entati ge ^{**}	on	Relevant Legislation and
Ref.	Log Ref.		of Completion of Measures	Agent	Des	С	ο	Dec	Guidelines
		on site and adequate space should be allocated to the storage area.							
6.8.7- 6.8.8	W5	Sewage Arising from Workforces The construction workforce on site will generate sewage. It is recommended to provide sufficient portable toilets in the works areas. Contractual desludging service should be deployed to clean the portable toilets on a regular basis. Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the surrounding environment. Regular environmental audit of the construction site will provide an effective control of any malpractices and can encourage continual improvement of environmental performance on site. It is anticipated that sewage generation during the construction phase of the project would not cause water pollution problem after undertaking all required measures.	Active works areas / throughout the construction period / upon completion of all construction activities	Contractor		~			EIAO-TM, WQOs, ProPECC PN 1/94 Construction Site Drainage , WDO
Water Qu	ality Impact	(Operational Phase)							
6.8.9 to 6.8.10	W6	Following the current practice of the existing Lai Chi Yuen Cemetery, sanitary facilities such as portable toilets should be provided for the visitors and staff during operation of the Project. Sewage generated from the sanitary facilities should be collected and disposed of to a sewage treatment works for proper treatment by contractual desludging service employed by FEHD for handling sewage from the existing sanitary facilities. Best Management Practices (BMPs) to reduce storm water and non-point source pollution have been proposed for the Project as follows:	Lai Chi Yuen Cemetery Extended Areas / throughout the operation of the Cemetery Extended Areas / upon decommissioning of the Cemetery Extended Areas	Operator (FEHD)	•		×		EIAO-TM, WQOs, ProPECC PN 1/94 Construction Site Drainage , WDO

EIA*	EM&A	EM&A Environmental Protection Measures*	Location / Duration of Measures / Timing		Implem Sta		entati ge**	on	Relevant Legislation a	and
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		Design Measures								
		• Exposed surface shall be avoided within the Project site to minimize soil erosion. The development site shall be either hard paved or covered by landscaping area where appropriate.								
		• The streams and channelized nullahs near the Project site should be retained to maintain the original flow path. The drainage system should be designed to avoid flooding.								
		 Evergreen trees species, which in general generate relatively smaller amount of fallen leaves, should be selected where possible. 								
		Devices/ Facilities to Control Pollution								
		 Screening facilities such as standard gully grating and trash grille, with spacing which is capable of screening off large substances such as fallen leaves and rubbish should be provided at the inlet of drainage system. 								
		 Road gullies with standard design and silt traps and oil interceptors should be incorporated during the detailed design to remove particles present in stormwater runoff, where appropriate. 								
		Administrative Measures								
		 Good management measures such as regular cleaning and sweeping of road surface/ open areas are suggested. The open area cleaning should also be carried out prior to occurrence rainstorm. 								
		 Manholes, as well as stormwater gullies, ditches provided at the Project site should be regularly inspected and cleaned (e.g. monthly). Additional 								

EIA* Ref	EM&A	EM&A Log Ref. Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation	lmple า ริ		entati Ige**	on	Relevant
Ref.	Log Ref.		of Completion of Measures	Agent	Des	С	ο	Dec	Guidelines
		inspection and cleansing should be carried out before forecast heavy rainfall.							
Waste Mar	nagement (Construction Phase)							
7.6.1 to 7.6.2	WM1	 <u>Good Site Practices</u> Appropriate waste handling, transportation and disposal methods for all waste arising generated during the construction works for the Project should be implemented Adverse impacts from waste management are not anticipated, provided that good site practices are strictly followed. Recommendations for good site practices during the construction activities include: The contractor shall prepare a Waste Management Plan (WMP) in accordance with the requirements set out in the ETWB TC(W) 19/2005, Waste Management on Construction Site, for the Engineer's Representative approval. Nomination of approved personnel, such as a site manager, to be responsible for good site practices, and making arrangements for collection of all wastes generated at the site and effective disposal to an appropriate facility. Training of site personnel in proper waste management and chemical waste handling procedures. Provision of sufficient waste reception/ disposal points, of a suitable vermin-proof design that minimizes windblown litter. Appropriate measures to minimize windblown litter and dust during transportation of waste by either 	Active works areas / throughout the construction period / upon completion of all construction activities	Contractor					ETWB TC(W) 19/2005, TC(W) 6/2010, WDO, Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes

EIA*	EM&A	Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation	Imple		entati ge ^{**}	on	Relevant
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		covering trucks or by transporting wastes in enclosed containers.							
		Regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors.							
		• A recording system for the amount of wastes generated, recycled and disposed (including the disposal sites) should be proposed.							
7.6.3	WM2	 <u>Waste Reduction Measures</u> Good management and control of construction site activities/ processes can minimise the generation of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices. Recommendations to achieve waste reduction include: Prior to disposal of C&D waste, wood, steel and other materials should be separated for reuse, recycling to minimize the quality of waste to be disposed of at landfill site. Minimize use of wood and reuse non-timber formwork to reduce C&D waste As far as practicable, segregate and store different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal. Encourage collection of aluminum cans, plastic bottles and packaging material and office paper. 	Active works areas / throughout the construction period / upon completion of all construction activities	Contractor		×			ETWB TC(W) 19/2005, TC(W) 6/2010, WDO, Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes
7.6.4 – 7.6.7	WM3	<u>C&D Materials</u> With good site management, it can reduce over- ordering of C&D materials such as concrete and mortars. Alternatives such as still frameworks and	Active works areas / throughout the construction period / upon completion of all construction activities	Contractor		~			ETWB TC(W) 19/2005, TC(W) 6/2010, WDO, Code of Practice on the Packaging,

EIA*	EM&A	Environmental Protection Measures*	Location / Duration of Measures / Timing I	Implementation	In	Implementation Stage**			Relevant
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		 plastic fencing can be considered to increase the chances for reuse. In order to minimize the potential impacts resulting from collection and transportation of C&D materials for off-site disposal, the excavated materials comprising fill materials should be reused on-site as backfilling materials or for landscaping as far as practicable to avoid disposal off-site. C&D waste, such as wood, plastic, steels and other metals should be reused or recycled and, as a last resort, disposal of to the Outlying Islands Transfer Facilities - Mui Wo Station. A suitable area should be designated within the site for temporary stockpiling of C&D materials and to facilitate the sorting process. In order to monitor the disposal of C&D materials at the designated public fill reception facility and landfill and to control fly-tipping, a trip ticket system should be included, with reference to Development Bureau TC(W) 6/2010 for details. The inert C&D materials to be disposed of at public fill reception facilities shall be materials only consists of brick, concrete, cement plaster, soil and inert building debris. The materials shall be free from plastics, chemical waste, industrial metals and other materials that are considered unsuitable at the facility. 							Labelling and Storage of Chemical Wastes
7.6.8	WM4	General Refuse General refuse should be stored in covered bins or compaction units separate from C&D materials. A reputable waste collector should be employed by the Contractor to remove general refuse from the site regularly, separately from C&D materials. An enclosed and covered area is preferred to reduce the occurrence of "wind blown" light materials. In	Active works areas / throughout the construction period / upon completion of all construction activities	Contractor		✓			ETWB TC(W) 19/2005, TC(W) 6/2010, WDO, Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes

EIA*	EM&A	&A Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation	Implem Sta		entati ge ^{**}	on	Relevant
Ref.	Log Ref.		of Completion of Measures	Agent	Des	С	0	Dec	Guidelines
		 addition, a sufficient number of covered bins shall be provided on site for containment of general refuse to prevent visual impacts and nuisance to the sensitive surrounding. The Contractor should carry out an education programme for workers in avoiding, reducing, reusing and recycling of materials generation. Posters and leaflets advising on the use of the bins should also be provided in the site as reminders. 							
7.6.10	WM5	<u>Chemical Waste</u> For disposal of chemical wastes produced at the construction site, the Contractor is required for register with the EPD as a Chemical Waste Producer and to follow the requirements stated in the <i>Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes</i> . Good quality containers compatible with the chemical wastes should be used. Appropriate labels should be securely attached on each chemical waste container indicating the chemical characteristics of the chemical waste, such as explosives, flammable, oxidizing, irritant, toxic, harmful, corrosive, etc. The Contractor shall also use a licensed waste collector engaged to transport and dispose of the chemical wastes to the Chemical Waste Treatment Centre at Tsing Yi (CWTY) or other licensed facility, in accordance with the <i>Waste Disposal (Chemical Waste) (General) Regulation.</i>	Active works areas / throughout the construction period / upon completion of all construction activities	Contractor		~			ETWB TC(W) 19/2005, TC(W) 6/2010, WDO, Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes

EIA*	EM&A	Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation	Implementation Stage ^{**}			on	Relevant Legislation and	
Ref.	Log Ref.		of Completion of Measures	Agent	Des	С	ο	Dec	Guidelines	
Waste Ma	anagement (Operational Phase)								
7.6.11 to 7.6.13	WM6	Ash and non-combustible ResiduesThe ash and non-combustible residues generated from the joss paper burning should be collected and stored in a properly covered refuse containers to avoid dust emission, and final disposed of at landfill site.General RefuseTo promote recycling of waste paper, aluminum cans and plastic bottles by the visitors, it is recommended to place clearly labeled recycling bins (such as those available from EPD) at convenient locations within the area of new niches or Lai Chi Yuen Cemetery. The recyclable waste materials should then be collected by reliable waste recycling agents on a regular basis.The general refuse (other than those segregated recyclable wastes) should be separated from any chemical wastes and stored in cover waste skips. FEHD should remove general refuse from the site, separately from chemical wastes, on daily basis to minimize odour, pest and litter impacts. Burning of refuse must be strictly prohibited.	Lai Chi Yuen Cemetery Extended Areas / throughout the operation of the Cemetery Extended Areas / upon decommissioning of the Cemetery Extended Areas	Operator (FEHD)					ETWB TC(W) 19/2005, TC(W) 6/2010, WDO, Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes	
Ecologica	al Impact (Co	onstruction Phase)	·	•		•	·		L	
8.7.2	E1	In order to avoid woodland of higher ecological value and minimize the loss of woodland / plantation, the currently proposed option has confined the new niches to be built within the existing Lai Chi Yuen Cemetery and only minimal area (about 7.5m ²) outside the cemetery boundary is required for the	Active works areas / throughout the construction period / upon completion of all construction activities	Project proponent (FEHD / ArchSD) & Contractor	~				DEVB TCW No. 7/2015, EIAO-TM	

EIA*	EM&A	Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation	Implem Sta		entati ge**	on	Relevant Legislation and
Ref.	Log Ref.		of Completion of Measures	Agent	Des	С	0	Dec	Guidelines
		proposed barrier-free site access, which is indispensable for the development.							
8.7.3 to 8.7.4	E2	Habitat loss could be minimized in the first instance by retaining existing vegetation wherever possible, particularly mature and semi-mature trees present within the works areas.	Active works areas / throughout the construction period / upon completion of all construction activities	ctive works areas / proughout the ponstruction period / pon completion of all onstruction activities Project proponent (FEHD / ArchSD) & Contractor		~			DEVB TCW No. 7/2015, EIAO-TM
		 Any trees retained should be adequately protected during the construction phase to promote their health and longevity. 							
		 Areas which would be temporarily affected by construction activities should be reinstated after completing the construction works. 	by ter to to an						
		 Hoarding or fencing should be erected around the works areas during the construction phase to restrict access to natural habitats adjacent to works areas by site workers to reduce human disturbance. 							
		 Provision of compensatory native tree and shrub planting. 							
8.7.5 to 8.7.6	E3	An individual of <i>Aquilaria sinensis</i> located within the project site would be subject to direct impacts. As such, prior to the commencement of the construction works, a vegetation survey should be conducted by a qualified ecologist / botanist within the project site boundary to:	Active works areas / throughout the construction period / upon completion of all construction activities	Contractor		~			DEVB TCW No. 7/2015, EIAO-TM
		 Ascertain the presence of, as well as update the conditions, number and locations of the flora species of conservation importance identified. 							
		• Determine the number and location of the affected individual of flora species of conservation importance and evaluate the suitability and / or practicality of the transplantation.							

EIA*	EM&A Log Ref.	Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation Agent	Implementatio Stage ^{**}		on	Relevant Legislation a	and	
Ref.			of Completion of Measures		Des	С	0	Dec	Guidelines	
		A Transplantation Proposal should be prepared by a qualified ecologist / botanist with detailed findings of the vegetation survey (i.e. number and locations of the affected individuals, assessment of the suitability and / or practicality of the transplantation) and locations of receptor site(s), transplantation methodology, implementation programme of transplantation, post-transplantation monitoring and maintenance programme. The proposal should be submitted to and approved by AFCD prior to commencement of any works (including ground investigation). The approved transplantation works should be carried out before the commencement of construction works and should be supervised by a qualified botanist / horticulturist / Certified Arborist with relevant experience in transplanting flora species of conservation importance.								
8.7.8 to 8.7.12	E4	 Construction dust should be suppressed to avoid and minimize the dust covering leaves of plants that would affect their photosynthesis, and thus their health and growth: Regular watering, to reduce dust emissions from exposed site surfaces and unpaved roads. Proper storage of construction materials. Tarpaulin covering of all dusty vehicle loads transported to, from and between site locations. Noise impact during construction phase should be avoided and minimized to reduce the disturbance to the habitats adjacent to the works areas: Machines and plant (e.g. trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum. 	Active works areas / throughout the construction period / upon completion of all construction activities	Contractor		×			EIAO-TM	

EIA*	EM&A	Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation Agent	Implementation Stage ^{**}				Relevant Legislation	and
Ref.	Log Ref.		of Completion of Measures		Des	С	ο	Dec	Guidelines	unu
		 Machines and plants known to emit strong directional noise should, wherever possible, be orientated so that the noise is directed away from the nearby habitats. 								
		• Material stockpiles and other structures should be effectively utilized, wherever practicable, in screening noise from on-site construction activities.								
		With reference to ETWB TCW No. 5/2005 on "Protection of natural streams/ rivers from adverse impacts arising from construction works" and good site practices, the following good site practices/water control measures should be adopted to minimize any pollution entering the watercourse nearby:								
		• General refuse and construction wastes should be collected and disposed of in a timely and appropriate manner.								
		Drainage arrangements should include sediment traps to collect and control construction run-off.								
		All works and storage area should be restricted to the site boundary.								
		Covering of any exposed soil or other loose materials with tarpaulins to prevent erosion.								
		• Exposed soil to be covered as quickly as possible following formation works, then seeded and covered with a biodegradable geotextile blanket for erosion control purposes.								
		• A temporary sewage treatment system or portable chemical toilets should be designed and installed to collect wastewater and prevent it from entering nearby habitats.								
		• The proposed works site inside or in the proximity of nearby habitats should be temporarily isolated,								

EIA*	EIA*	EM&A	Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation Agent	Implementation Stage [™]				Relevant Legislation	and
F	Ref.	Log Ref.		of Completion of Measures		Des	С	0	Dec	Guidelines	unu
			such as by placing of sandbags or silt curtains with a lead edge at the bottom and properly supported props, to prevent adverse impacts on these areas. Other protective measures should also be taken to ensure that no pollution or siltation occurs in the water gathering grounds of the works site.								
			 Construction debris and spoil should be covered up and/or properly disposed of as soon as possible to avoid being washed into nearby habitats by rain. 								
			 Contractors should adhere to a strict "clean site" policy, with all construction waste transported to predetermined sites for safe disposal. Under no circumstances should there be any disposal of waste oil or other materials on site. 								
			 Vehicles and other plant should be carefully maintained and properly used to minimise the chance for accidental spillage. 								
			Prior to the commencement of any works, the appointed Contractor / Construction Manager should conduct a formal briefing to the workforce to reinforce the message that the works are being conducted within Lantau South Country Park adjacent to environmentally sensitive areas. Workers should also be informed about the locations of any identified rare/ protected plant species adjacent to the project site, concepts of site cleanliness and appropriate waste management procedures, including waste reduction, reuse and recycling.								
			The workforce should be reminded of the need for environmental diligence throughout the duration of works, and in particular to avoid littering, improper disposal of construction waste, avoid unnecessarily damage to vegetation or cause noise or visual disturbance during the works.								

EIA*	EM&A	Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation Agent	Impleme Staç		nentation tage ^{**}		Relevant
Ref.	Log Ref.		of Completion of Measures		Des	С	0	Dec	Guidelines
Ecologica	al Impact (O	perational Phase)	-						
8.7.13	E5	During operational phase, adequate litter bins, a joss paper burner of proper function and fire-fighting gears should be provided. Regular patrol shall be conducted at the open niche area during the Ching Ming Festival and Chung Yeung Festival to ensure no uncontrolled burning occurs.	Lai Chi Yuen Cemetery Extended Areas / throughout the operation of the Cemetery Extended Areas / upon decommissioning of the Cemetery Extended Areas	Operator (FEHD)	V		V		EIAO-TM
Landscap	be and Visua	I Impact (Construction Phase)			•				
Table 9.3	LV1	CM1 Preservation of Existing Vegetation All the existing trees to be retained within the site and not to be affected by the Project shall be carefully protected during construction accordance with DEVB TCW No. 7/2015 - Tree Preservation and the latest Guidelines on Tree Preservation during Development issued by GLTM Section of DevB. Any existing vegetation on existing man-made slope and natural terrain not to be affected by the Project shall be carefully preserved. CM2 Compensatory Tree Planting Any trees to be felled under the Project shall be compensated in accordance with DEVB TCW No. 7/2015 - Tree Preservation. Native species will be proposed. CM3 Control of Night-time Lighting Glare Any lighting provision of the construction works at night shall be carefully control to prevent light overspill to the nearby VSRs and into the sky.	Active works areas / throughout the construction period / upon completion of all construction activities	Project proponent (FEHD / ArchSD) & Contractor		✓			EIAO-TM, DEVB TCW No. 7/2015

EIA*	EM&A	Environmental Protection Measures*	Location / Duration of Measures / Timing		Implementation Stage ^{**}			on	Relevant Legislation	and
Ret.	Log Ref.		of Completion of Measures	Agent	Des	С	ο	Dec	Guidelines	unu
		CM4 Erection of Screen Hoarding in Visually Unobtrusive Colour								
		Screen hoarding in visually unobtrusive colour, which is compatible with the surrounding settings, shall be erected during construction to minimize the potential landscape and visual impacts due to the construction works and activities.								
		CM5 Management of Construction Activities and Facilities								
		The facilities and activities at works sites and areas, which include site office, temporary storage areas, temporary works etc., shall be carefully managed and controlled on the height, deposition and arrangement to minimize any potential adverse landscape and visual impacts.								
		CM6 Reinstatement of Temporarily Disturbed Landscape Areas								
		All hard and soft landscape areas disturbed temporarily during construction due to temporary excavations, temporary works sites and works areas shall be reinstated to equal or better quality, to the satisfaction of the relevant Government Departments.								
Landscap	e and Visua	l Impact (Operational Phase)			r	1		T	I	
Table 9.4	LV2	OM1AestheticallypleasingdesignofAboveground StructuresThe aboveground structures of the Project including proposed elevated platform, structural columns, niches and ancillary facilities in the regard of layouts, forms, materials and finishes shall be sensitively	Lai Chi Yuen Cemetery Extended Areas / throughout the operation of the Cemetery Extended Areas / upon decommissioning of	Project proponent (FEHD / ArchSD)	~		~		EIAO-TM	

EIA*	EM&A	Environmental Protection Measures*	Location / Duration of Measures / Timing	Implementation Agent	In	nplem Sta	entati ge**	Relevant Legislation	and	
Ref.	Log Ref.		of Completion of Measures		Des	С	о	Dec	Guidelines	
		designed so as to blend in the structures to the adjacent landscape and visual context.OM2Amenity Tree and Shrub PlantingAmenity tree and shrub planting shall be provided at the edge of the platform to provide green transition between the proposed extension and the existing natural terrain.OM3Screen Planting to soften the Structural Columns of the elevated platformShade Tolerant species will be selected carefully. Screen planting on slope and vertical screen planting in the form of climbers on wire mesh are proposed in front of the structural columns of the elevated	the Cemetery Extended Areas							
		platform to minimize the potential adverse visual impact.								

Notes:

* All recommendations and requirements resulted during the course of EIA Process, including ACE and/or accepted public comment to the proposed project.
 ** Des = Design; C = Construction; O = Operation; Dec = Decommissioning

12. CONCLUSIONS

12.1 Introduction

- 12.1.1 This EIA Report has provided an assessment of the potential environmental impacts associated with the construction and operation of the Project, based on the engineering design information available at this stage. The assessment has been conducted, in accordance with the EIA Study Brief (No. ESB –288/2015) under the EIAO for the Project, covering the following environmental issues:
 - Air Quality Impact
 - Noise Impact
 - Hazard to Life
 - Water Quality Impact
 - Waste Management Implications
 - Ecological Impact
 - Landscape and Visual Impacts
- 12.1.2 The findings of this EIA study have determined the likely nature and extent of environmental impacts predicted to arise from the construction and operation of the Project. During the EIA process, environmental control measures have been identified and incorporated into the planning and design of the Project, to achieve compliance with environmental legislation and standards during both the construction and operation phases. The Implementation Schedule listing the recommended mitigation measures is presented in **Section 11**. A summary of key assessment assumptions and limitation of methodologies are presented in **Appendix 12.1**.
- 12.1.3 Overall, the EIA study for the Lai Chi Yuen Cemetery extension works has predicted that the Project, with the implementation of the mitigation measures, would be environmentally acceptable with no unacceptable residual impacts on the population and environmentally sensitive resources. The sections below summarise the environmental outcomes/benefits that have accrued from the environmental considerations and analysis during the EIA process and the implementation of environmental control measures of the Project.

12.2 Summary of Environmental Outcomes

Estimated Populations and Environmentally Sensitive Areas Protected from Various Environmental Impacts

12.2.1 The Project is located adjacent to the existing Lai Chi Yuen Cemetery in Mui Wo, inside Lantau South Country Park. It is a rural area with scarce population. Environmentally sensitive areas in the vicinity of the Project site include Lai Chi Yuen Tsuen, scattered village houses at the northwest of the Project site, Ngau Koo Wan Hill Court and Lantau South Country Park. These sensitive areas have been protected through the avoidance or minimization of environmental impacts from the construction and operation of the Project. Adverse air quality and noise impacts on sensitive receivers within the assessment area would not be anticipated. Risk associated with existing hazardous facilities in the vicinity (i.e. Silvermine Bay Water Treatment Works) would be within As Low As Reasonably Practicable (ALARP) Region for the societal risk where within "Acceptable" level for individual risk. Potential ecological, landscape and visual impacts associated with the Project have been minimized with environmentally friendly design (e.g. adoption of elevated platform, minimize the scale of the proposed barrier-free site access).

Environmental Designs Recommended, Environmental Friendly Option Considered and Incorporated in the Preferred Option

- 12.2.2 Environmental considerations were taken into account in the selection of preferred option, design and construction method of the Project as detailed in **Section 2**.
- 12.2.3 Elevated platform design within the existing Lai Chi Yuen Cemetery boundary is adopted to accommodate the proposed niches and ancillary facilities in order to minimize the Project footprint

and hence disturbance to surrounding environment. Furthermore, the scale of the proposed barrierfree site access, which is indispensable for the development, has been minimized to 7.5m². With this design, the scale of the construction works would be limited and hence the environmental impacts during the construction phase e.g. fugitive dust emissions, noise from the use of powered mechanical equipment (PME), waste generation and disturbance to wildlife, would be minimized.

12.2.4 During operational phase, Best Available Technology (BAT) would be adopted for the proposed joss paper burner to minimize potential air quality impact from joss paper burning activities. The aboveground structures of the Project including proposed elevated platform, structural columns, niches and ancillary facilities would be designed to blend in the structures to the adjacent landscape and visual context. Amenity tree and shrub planting would be provided at the edge of the platform to provide green transition between the proposed extension and the existing natural terrain. Screen planting (with climber) would be provided in front of the structural columns of the elevated platform to minimize the potential visual impact.

Key Environmental Problems Avoided and Compensation Area Included

- 12.2.5 With the consideration of various alternative options in site selection and design, the Project has avoided or minimized the following environmental problems:
 - Avoidance of waterbodies / water courses loss;
 - Avoidance of areas of archaeological interest;
 - Minimization of loss of ecological habitats;
 - Minimization of loss of trees;
 - Minimization of generation of excavated material; and
 - Minimize the number of environmental sensitive receivers to be affected.
- 12.2.6 Owing to the limited site area, 6 trees will be compensated at the proposed elevated platform and 24 trees will be compensated within the boundary of the existing cemetery.

Environmental Benefits of Environmental Protection Measures Recommended

12.2.7 Environmental benefits of environmental protection measures recommended in this EIA Report are summarised below.

Air Quality

Construction Phase

12.2.8 Potential air quality impacts from the construction works would be related to dust emission from site formation, erection of retaining walls and construction of proposed new niches and the ancillary facilities including a joss paper burner and planters. With the implementation of dust suppression measures specified in the Air Pollution Control (Construction Dust) Regulation and good site practices, no adverse air quality impact would be anticipated during construction phase.

Operational Phase

12.2.9 Potential air quality impact arising from the joss paper burning activities has been assessed. With the incorporation of flue gas treatment system and the implementation of the good operational practices and administrative measures as well as good maintenance practices for the proposed joss paper burner, no adverse air quality impact would be expected during operation of the Project.

Noise

Construction Phase

12.2.10 This assessment has predicted the construction noise impacts of the Project during normal daytime working. The predicted unmitigated noise levels at representative NSRs would range from 58 to 75 dB(A), complying with the construction noise criteria of 75dB(A). No mitigation measure is therefore recommended.

Operational Phase

12.2.11 The fixed plant noise sources associated with the operation of the Project include two water pumps and the proposed joss paper burner. The assessment results indicated that the operational noise levels at the representative NSRs would comply with the fixed plant noise criteria. Therefore, no mitigation measure is recommended.

Hazard to Life

Construction Phase

12.2.12 The risk increase due to construction of the proposed Project is assessed. The societal risk level is in the ALARP Region. Risk mitigation measures and a number of good practices that can effectively reduce the risk to construction workers are recommended.

Operation Phase

12.2.13 The risk increase due to operation of the proposed Project is assessed. The societal risk level is in the ALARP Region. A Cost-Benefit Analysis (CBA) is carried out and it is found out that there is no cost-effective risk mitigation measure during operation phase. The Potential Loss of Life (PLL) contribution by the proposed Project to the overall risk of Silvermine Bay Water Treatment Works (SMBWTW) is minimal. The CBA demonstrates that proposed Project is compliant with the ALARP principle. Nonetheless, good practice for operator is recommended to minimize the impact in case of chlorine accident.

Water Quality

Construction Phase

12.2.14 The key issue from the construction activities of the Project would be the potential for release of wastewater from surface works areas and open cut excavation. Minimization of water quality deterioration could be achieved through implementing adequate mitigation measures, such as control of site run-off of different general construction activities.

Operational Phase

12.2.15 The potential source of water quality impact during operation of the new niches would be the sewage generated from staff and visitors as well as runoff from the Project. It is anticipated that the water quality impact associated with the operational phase would be minimal and acceptable, provided that the recommended mitigation measures and best management practices are properly implemented.

Waste Management

12.2.16 Waste management implications associated with the construction and operation of the Project have been identified and assessed. In view of the nature and small scale of the Project, insignificant amount of waste would be generated. With implementation of the recommended good waste management practices, no unacceptable environmental impacts would be anticipated during construction and operation of the Project.

Ecology

- 12.2.17 Direct loss of habitats due to the construction of the Project would be minimized to approximately 0.0232ha through the elevated platform design. An individual of *Aquilaria sinensis* with conservation interest located within the project site would be affected by the construction work. With the adoption of the recommended measures (e.g. transplantation), the potential impact would be minimized.
- 12.2.18 Indirect impacts during the construction phase would comprise human disturbance, construction dust and noise, and construction site runoff. With proper implementation of good site practices, no unacceptable ecological impact would be anticipated. The level of disturbance during the operation phase would be comparable to the existing condition. No unacceptable impact would therefore be expected.

Landscape and Visual

- 12.2.19 With the proposed mitigation measures, which include the preservation of existing trees, compensatory planting, control of night-time lighting glare, erection of screen hoarding in visually unobtrusive colour, management of construction activities and facilities, reinstatement of temporarily disturbed landscape area, it was predicted that there would be slight residual impact during construction.
- 12.2.20 During operation, with the implementation of mitigation measures, which include aesthetically pleasing design of above ground structures, amenity tree and shrub planting and screen planting to soften the structural columns of the elevated platform, it was predicted that the residual impact on the visitors to Lai Chi Yuen Cemetery would remain slight in day 1 and year 10 of the operation.

12.3 Summary of Environmental Impacts

12.3.1 A summary of environmental impacts for the environmental issues assessed in this EIA is presented in **Appendix 12.2**.

12.4 Documentation of Public Concerns

12.4.1 Lai Chi Yuen Cemetery site is one of the 12 batch one sites that were announced by the Government on 6 July 2010 when it launched the first public consultation on review of columbarium policy. The Project is supported by Islands District Council, the Lantau Area Committee and the Mui Wo Rural Committee. No major concerns from public was received during the course of the EIA study.