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Environmental and Ecological Assessment

Peter Scott Field Studies Centre Demolition and Rebuild

May 2019




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A PETER SCOTT FIELD STUDIES CENTRE

A.1 Introduction

A 21st Century Nature Classroom – A New PSFSC

A.1.1 The Peter Scott Field Studies Centre (PSFSC) was built in 1989 and after almost 30 years is nearing the end of its operational life – as the building fabric deteriorates, maintenance costs increase. ***Figure A1-1*** shows images of the current PSFSC. The building's ecological footprint is high and its energy efficiency is low by today's standards and it simply cannot meet the functional requirements expected for the "21st Century Nature Classroom".

A.1.2 The new PSFSC is being planned with the needs of the Mai Po Community in mind – from design concept through to construction and then to its future operation. The Mai Po Community includes stakeholders and neighbours in the village and various schools, community groups, youth groups and volunteers, wetland managers, researchers, academics, teachers and the many supporters of wetlands and nature habitats who support the work of WWF. The community is committed to "education for sustainable development" and the protection of biodiversity, focused on the role of Mai Po and the Wetlands of Inner Deep Bay.

A.1.3 A needs-based design process sought to provide an efficient and sustainable design, with retention of existing green areas, in a single two-storey structure built to current standards. Fire and safety codes, the requirements for the foundation following ground investigations, and deficiencies in the current building in terms of stairways, energy efficiency, universal accessibility and ceiling heights, pointed to the current design.

A.1.4 WWF will therefore demolish the old Peter Scott building and construct a new building that will provide for the needs of the Mai Po community with modern facilities to better serve stakeholders that access MPNR.

A.1.5 Redevelopment of PSFSC is not a Designated Project (DP) under the Environmental Impact Assessment Ordinance (EIAO).

Location

A.1.6 The existing PSFSC is located 120m east of the Project Site in an area zoned "Government, Institution or Community" ("GIC") on the Mai Po and Fairview Park OZP No. S/YL-MP/6 and surrounded by an area zoned "Conservation Area" ("CA"). The location of PSFSC is shown on ***Figure A1-2***.

Design

A.1.7 After a final review of the concept design options the current design was decided upon, as shown in ***Figures A1-2*** and ***A1-3***. This design requires complete demolition of the existing building structure, but allows the new PSFSC to fully meet WWF's expectations for the "21st Century Nature Classroom" well into the future.

A.1.8 The new PSFSC concept provides for varied needs of the groups that make up the Mai Po community. This includes ground floor reception, educational learning areas and workshop multipurpose rooms with refreshment and toilet facilities. The upper floor

provides for the Mai Po WWF offices, training centre facilities and adjoining accommodation. The rooftop provides a green eco garden area and solar Photovoltaic (PV) array. For best site utilisation the design retains the trees and green areas encircling the site. The new building will aim to achieve a Platinum rating in the BEAM Plus green building assessment, meaning that it will have exemplary energy efficiency and a low ecological footprint.

A.1.9 To mitigate the waste impacts from demolition of the existing building – which was a key concern – selective demolition will be adopted. This is expected to result in close to zero net waste disposal from the demolition of PSFSC – see ***Section A.5*** for details.

Sequence of Works

A.1.10 Based on the Preferred Design, described above, the following sequence of works is envisaged for the demolition and rebuild of PSFSC:

- Remove all Tier 1, Tier 2 and Tier 3 components (see ***Table A5-1*** for explanation).
- Erect bamboo scaffold and dust screen around PSFSC building.
- Erect temporary refuse chute and skip for debris collection.
- Break up roof slab by hydraulic breaker and store all concrete debris in skip prior to transport off-site to crushing plant at Fill Bank in Tseung Kwan O Area 137.
- Break up 1/F concrete wall, then 1/F slab by hydraulic breakers and store all concrete debris in skip prior to transport off-site crushing plant at the Fill Bank.
- Break up G/F wall, on-grade slab and footing by hydraulic hammer and store all concrete debris in skip prior to transport off-site to crushing plant at the Fill Bank.
- Submit Form BA14 for the completion of demolition work and apply consent for construction of foundation works and superstructure for the new building.
- Install sheet pile into ground by pressing along designated alignment and toe level.
- Proceed with the excavation to the designed excavation level upon completion of the installation of the sheet pile.
- Construction of R.C. footing:
  - lay blinding layer at excavation level
  - erect timber formwork shutter to the footing
  - rebar fixing work to the footing with starter bars for columns and walls
  - concreting to footing
  - backfill footing with soil
- Construct new soakaway system for new Sewage Treatment Plant (see ***Section A.4*** for details)
- Construction of Superstructure:
  - Rebar fixing to vertical elements between G/F and 1/F, including RC walls and columns
  - Timber formwork erection to walls and columns at G/F, and timber formwork and falsework for 1/F slab and beams
  - Concreting to RC columns and walls up to 1/F beam soffit
  - Rebar fixing to 1/F slab and beams
  - Concreting to 1/F slabs and beams and allow it cure with fresh water

- Repeat procedure above for the construction of 1/F ~ R/F slab.
- Remove asphalt from forecourt and store all in skip prior to transport off-site to asphalt plant in Sheung Shui, or to Fill Bank in Tuen Mun Area 38.
- Remove sub-base from forecourt and store all in skip prior to transport off-site to crushing plant at the Fill Bank in Tseung Kwan O Area 137.
- Install new plant and equipment, including a Greywater Treatment System (GWTS) and a Sewage Treatment Plant (STP).

A.1.11 The full programme for works at PSFSC, including the above, is shown in ***Figure A1-5***.

Environmental Impact

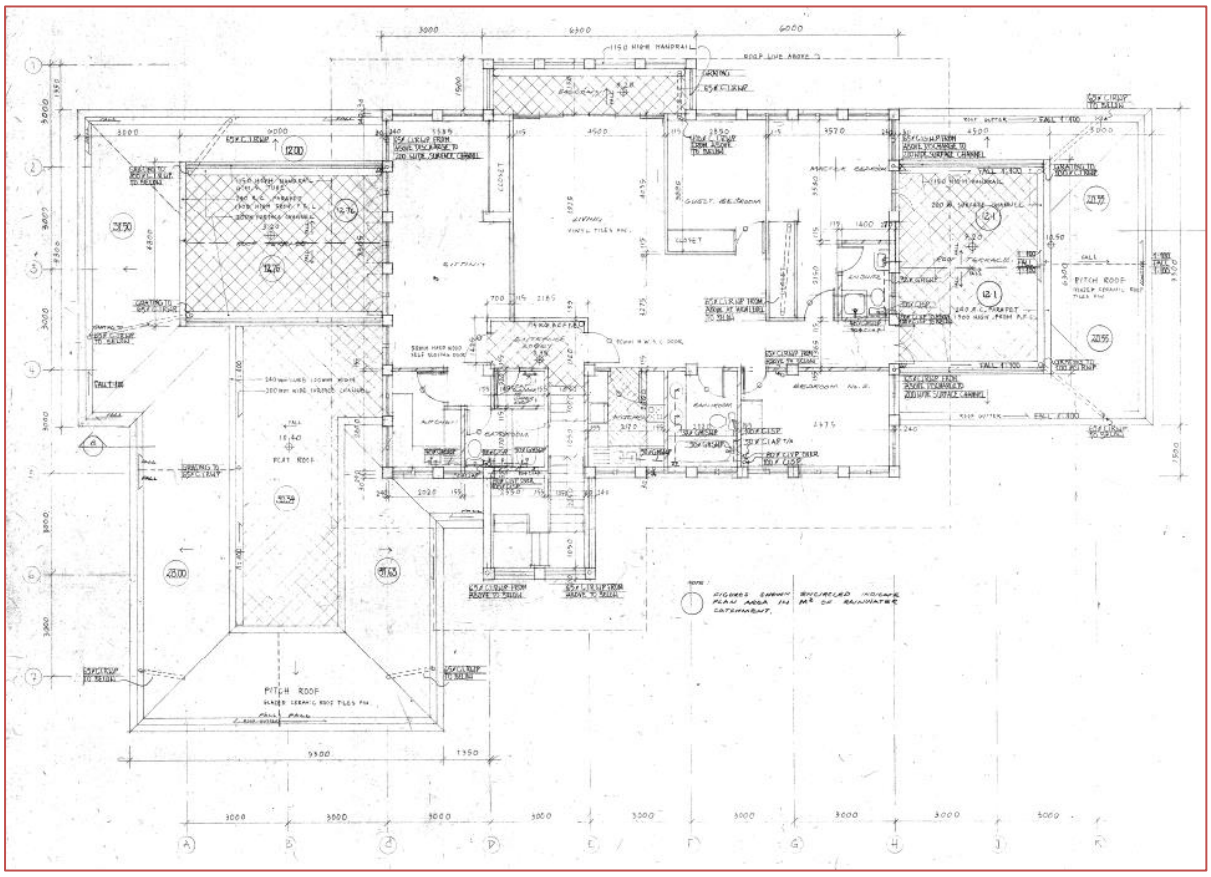
A.1.12 Based on the above sequence of works, the key environmental impacts are as follows:

- **Air Quality.** Fugitive dust primarily from the demolition works but also from rebuild activities and from vehicles accessing the site. Operation stage air quality impacts are not anticipated.
- **Noise.** Noise primarily from the demolition works but also from rebuild activities and from vehicles accessing the site. Operation stage noise impacts are not anticipated.
- **Water Quality/Sewage Treatment.** During the operation of the new PSFSC, there will be more wastewater generated than from the existing building due to the provision of additional facilities and the fact that there will be more visitors to MPNR in the future. There will be greywater (from bathroom sinks and showers) and sewage (from toilets and wastewater from kitchen sinks and floor drains). The existing septic tank and soakaway system will be replaced by a new GWTS and STP.
- **Solid Waste.** Demolition of the existing PSFSC building will generate demolition waste. Small quantities of construction waste will also be generated during rebuild. During demolition and construction stages, general refuse will be generated by workers. During the operation stage, general refuse will be generated from individual resident at PSFSC, from staff and also from visitors who pass through PSFSC before and after visiting MPNR and there will be sludge generated from the operation of the new STP.
- **Ecology.** Although PSFSC is located entirely within a fully developed site zoned G/IC, it is completely encircled by a CA zone and is also within the Ramsar Site and the Wetland Conservation Area. As such it is important to identify any ecological impacts due to the demolition and rebuild of PSFSC. Operation stage ecological impacts are not anticipated.

A.1.13 These impacts will be assessed in detail in the following sections, which will also identify appropriate mitigation measures and the need for Environmental Monitoring and Audit (EM&A) during demolition and construction stages.

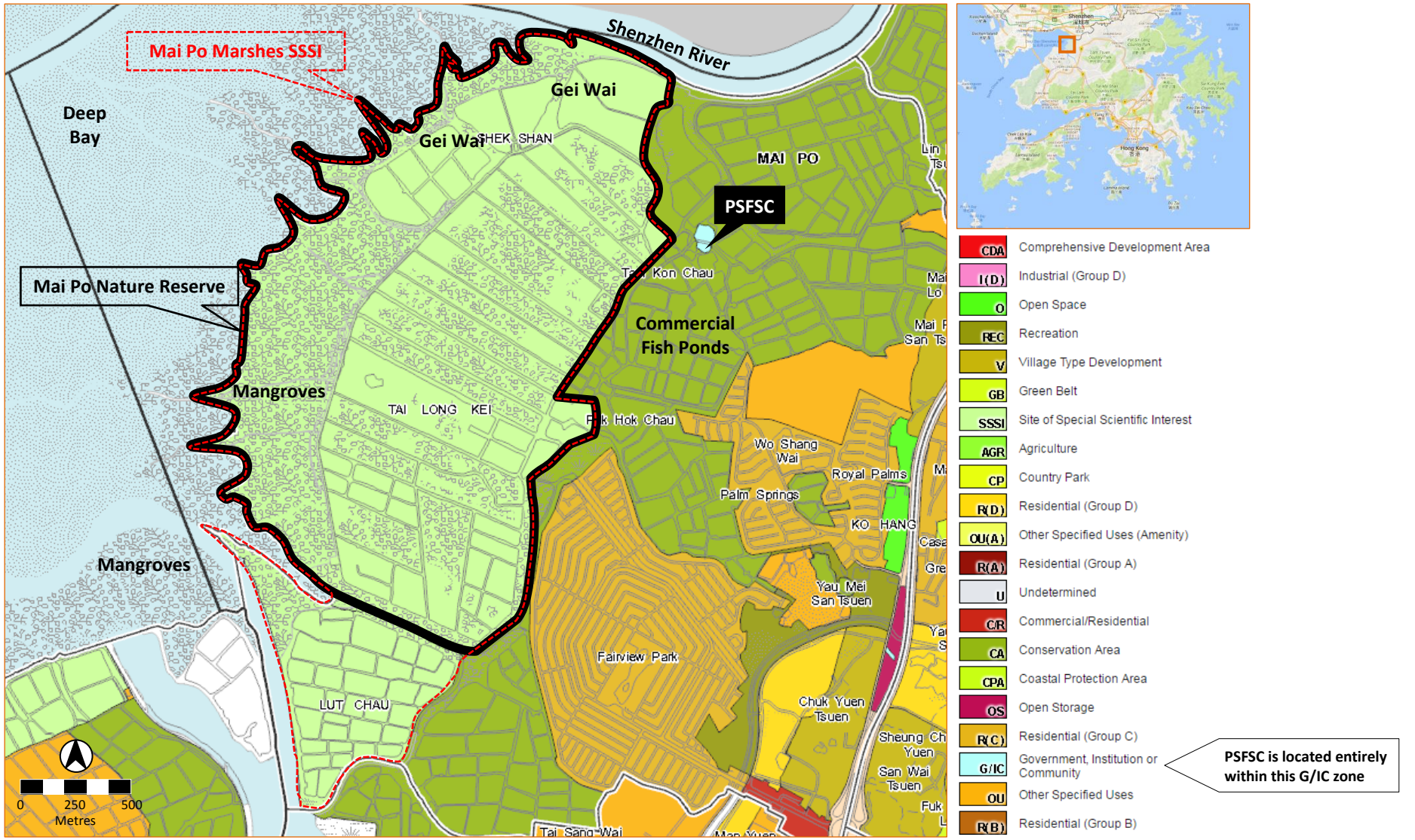
A.1.14 The demolition and rebuild of PSFSC is considered to be a concurrent project for the purpose of the EIA Study, the results of the key assessments provided in this Appendix will be form part of the cumulative impacts assessed in the EIA Report relating to the construction of bird hides and footpath on MPNR from April 2020.

Figure A1-1 Existing PSFSC



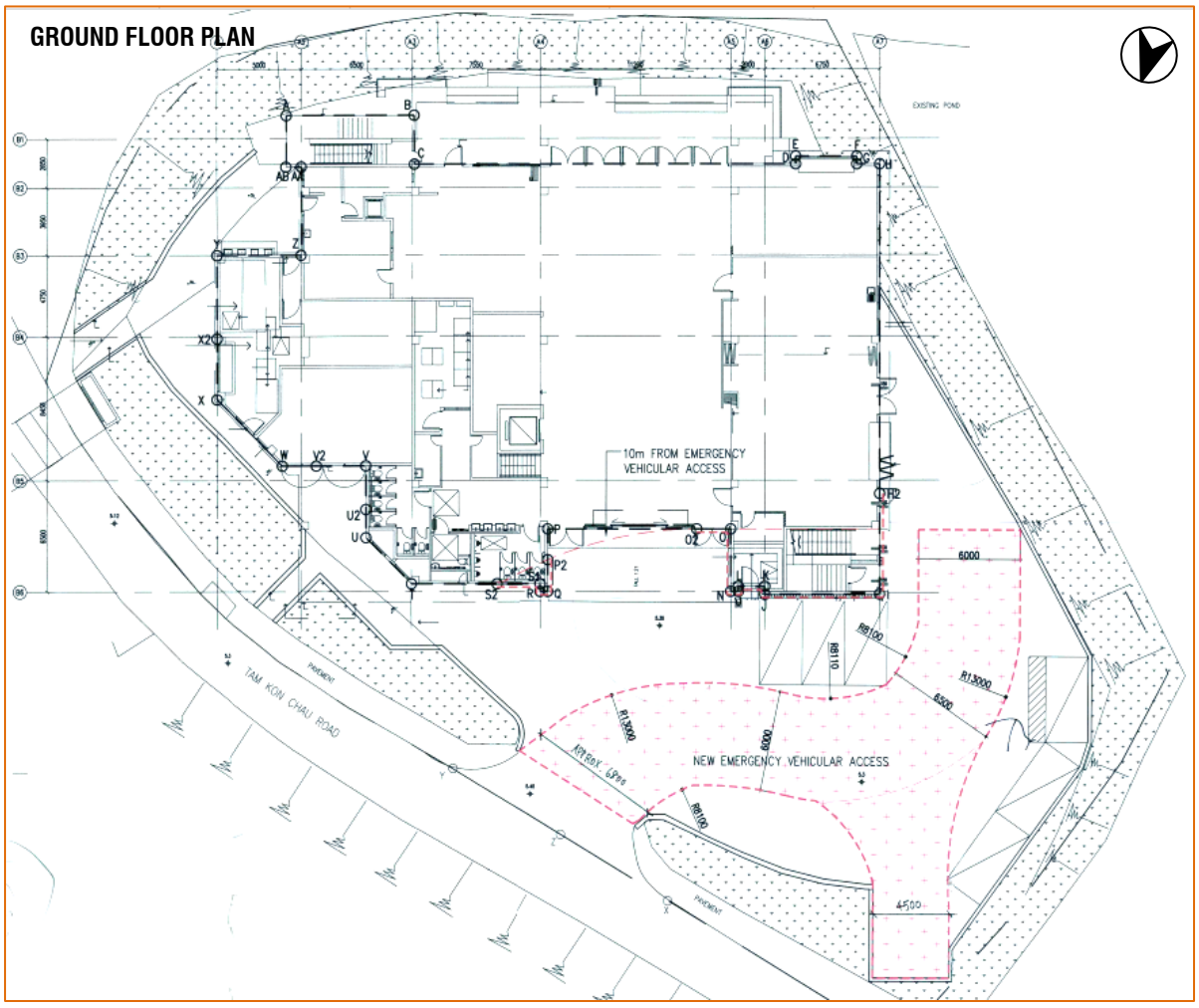
Source: Scan of original PSFSC layout by Hackett and Griffiths Architects, Dwg. No. P071/B/01, dated February 1989.

Figure A1-2 Location of PSFSC and its Environs



Source: Extract from the approved Mai Po and Fairview Park OZP No. S/YL-MP/6, from PlanD Statutory Planning Portal 2.

Figure A1-3 Current Design of PSFSC – Plan



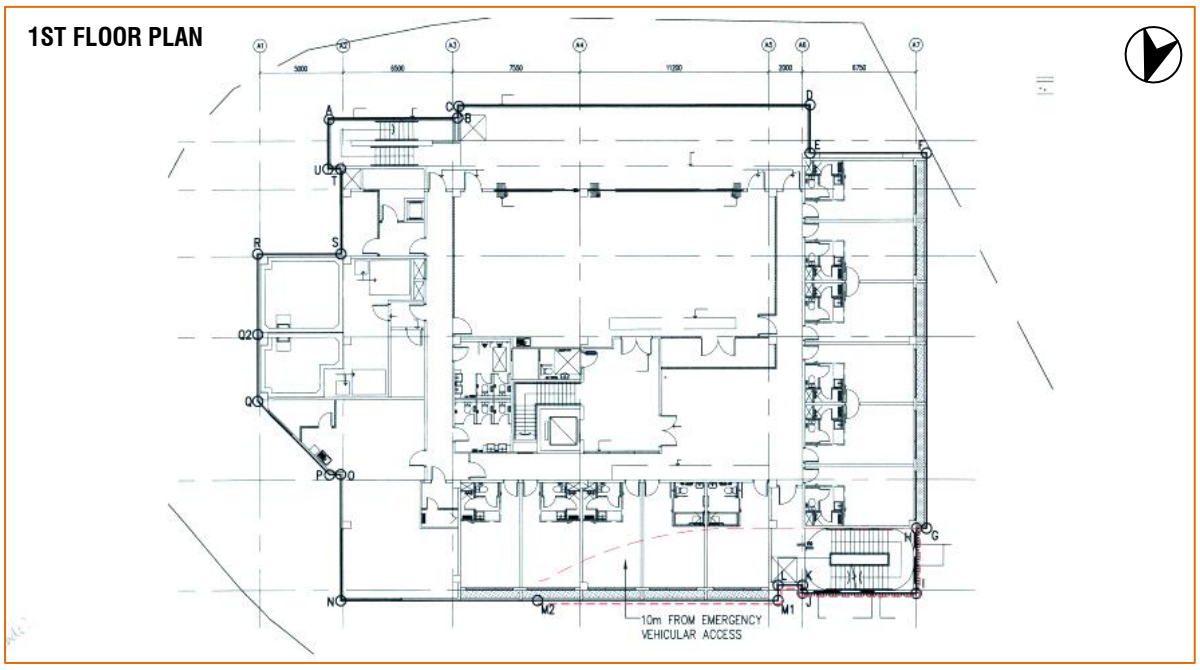


Figure A1-4 Current Design of PSFSC – Elevations

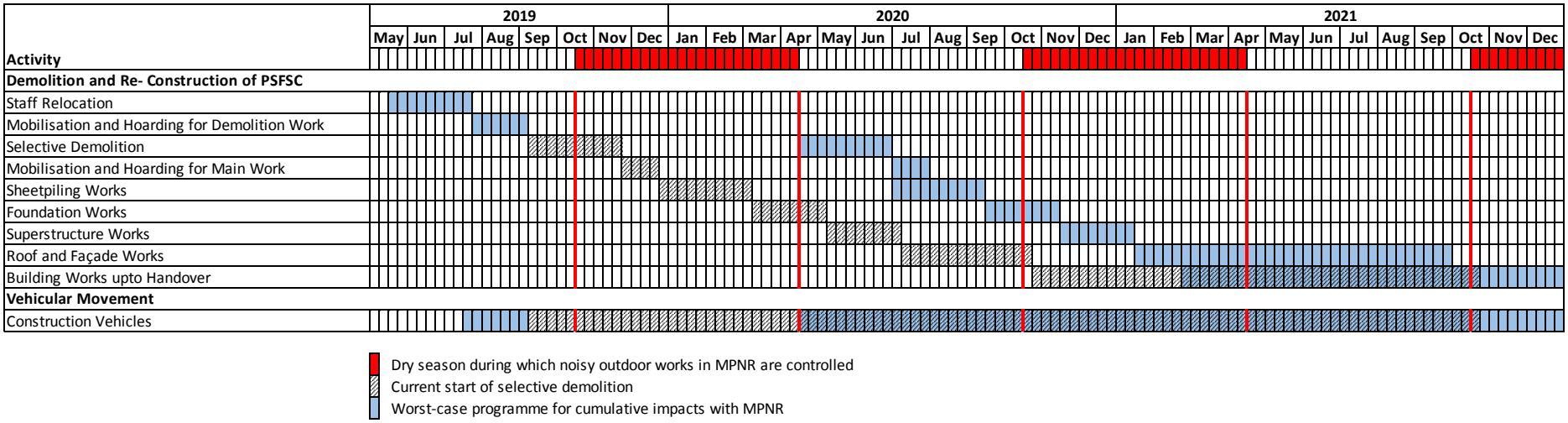
North

East

South

West

Figure A1-5 Programme for Works at PSFSC



A.2 Air Quality Assessment

Introduction

A.2.1 This air quality assessment has been carried out to identify, qualify and quantify the potential dust impacts arising from the demolition and rebuild of the PSFSC. There will be no operational air quality impacts from PSFSC and so these are not considered in this assessment.

A.2.2 Although PSFSC is not a DP, the assessment methodology generally follows that required under the EIAO Technical Memorandum (EIAO-TM) and the assessment has been carried out at a similar level of detail as it would be for a DP under the EIAO. The Study Area for air quality assessment extends 500m from the PSFSC Site and also includes dust emission sources from the MPNR Project Site.

Legislation, Standards and Guidelines

Air Pollution Control Ordinance

A.2.3 The principal legislation for the management of air quality in Hong Kong is the Air Pollution Control Ordinance (APCO). The legislation provides a framework for establishing the Air Quality Objectives (AQOs) and for the control of air pollution from stationary sources and motor vehicles. AQOs specifying the limits for seven pollutants and the maximum number of exceedances allowed over a specified period of time are set out under APCO.

A.2.4 The AQOs for seven pollutants, comprising Sulphur Dioxide (SO_2), Respirable Suspended Particulates (RSP or PM_{10}), Fine Suspended Particulates (FSP or $PM_{2.5}$), Nitrogen Dioxide (NO_2), Ozone (O_3), Carbon Monoxide (CO) and Lead (Pb), are shown in ***Table A2-1*** below.

Table A2-1 Hong Kong Air Quality Objectives

Pollutant	Averaging Time	Concentration Limit [i] ($\mu g/m^3$)	Number of Exceedances Allowed
Sulphur Dioxide (SO_2)	10-minute	500	3
	24-hour	125	3
Respirable Suspended Particulates (RSP, PM_{10}) [ii]	24-hour	100	9
	Annual	50	Not applicable
Fine Suspended Particulates (FSP, $PM_{2.5}$) [iii]	24-hour	75	9
	Annual	35	Not applicable
Nitrogen Dioxide (NO_2)	1-hour	200	18
	Annual	40	Not applicable
Ozone (O_3)	8-hour	160	9
Carbon Monoxide (CO)	1-hour	30,000	0
	8-hour	10,000	0
Lead (Pb)	Annual	0.5	Not applicable

Notes:

i. All measurements of the concentration of gaseous air pollutants, i.e. SO_2, NO_2, O_3 and CO, are to be adjusted to a reference temperature of 293Kelvin and a reference pressure of 101.325 kilopascal.

ii. RSP are suspended particles in air with a nominal aerodynamic diameter of 10µm or less.

iii. FAP are suspended particles in air with a nominal aerodynamic diameter of 2.5µm or less.

Air Pollution Control (Construction Dust) Regulation

A.2.5 Construction dust is controlled by the Air Pollution Control (Construction Dust) Regulation which is enacted under the Section 43 of the APCO. The Air Pollution Control (Construction Dust) Regulation defines notifiable works and regulatory works as follows:

- Notifiable Works:
  - Site formation
  - Reclamation
  - Demolition of a building
  - Work carried out in any part of a tunnel that is within 100m of any exit to the open air
  - Construction of the foundation of a building
  - Construction of the superstructure of a building
  - Road construction work
- Regulatory Works:
  - Renovation carried out on the outer surface of the external wall or the upper surface of the roof of a building
  - Road opening or resurfacing work
  - Slope stabilization work
  - Any work involving stockpiling of dusty materials, loading, unloading or transfer of dusty materials, transfer of dusty materials using belt conveyor system, use of vehicles, pneumatic or power-driven drilling, cutting and polishing, debris handling, excavation or earth moving, concrete production, site clearance, or blasting

A.2.6 This Regulation stipulates that for any notifiable works, notice shall be given to EPD before the proposed notifiable work commences to be carried out. For both notifiable and regulatory works, the contractor responsible for the construction site shall ensure that the work is carried out in accordance with the Schedule which provides the control requirement of construction dust.

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

A.2.7 This Regulation requires Non-road Mobile Machinery (NRMM), other than those exempted, 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, container terminals and back up facilities, restricted areas of the airport, designated waste disposal facilities and specified processes.

Air Pollution Control (Furnaces, Ovens and Chimneys) (Installation and Alteration) Regulations

A.2.8 Enacted under Section 43 of the APCO, the Air Pollution Control (Furnaces, Ovens and Chimneys) (Installation and Alteration) Regulations stipulate that a prior approval from EPD will be required if the total fuel consumption capacity of any fuel-burning equipment or its chimney on premises to be installed or altered exceeds (a) 25 litres (L) of conventional liquid fuel per hour; or (b) 30 kilograms (kg) of conventional solid fuel per hour; or (c) 1,150 megajoules (MJ) of any gaseous fuel per hour.

Hong Kong Planning Standards and Guidelines (HKPSG)

A.2.9 Buffer distances required between different types of roads and open space uses are recommended Table 3.1 of Chapter 9 "Environment" of *Hong Kong Planning Standards and Guidelines* (HKPSG). The relevant buffer distances for each road type listed in HKPSG are summarised in ***Table A2-2*** for ease of reference.

Table A2-2 HKPSG Buffer Distances

Pollution Source	Type of Road	Buffer Distance	Permitted Uses
Road and Highway	Trunk Road and Primary Distributor	>20m	Active and passive recreation use
		3 – 20m	Passive recreational use
		<3m	Amenity areas
	District Distributor	>10m	Active and passive recreational use
		<10m	Passive recreational uses
	Local Distributor	>5m	Active and passive recreational use
		<5m	Passive recreational use
	Under Flyovers	-	Passive recreational use

Source: Adapted from Table 3.1 of Chapter 9 Environment of HKPSG.

A.2.10 The nearest road to PSFSC is Tam Kon Chau Road, a local access road. Tam Kon Chau Road is not listed in *The Annual Traffic Census 2017*, published by the Transport Department in August 2018, as it only a single track access road. The nearest road type listed in the above table is the New Territories Circular Road/San Tin Highway, which is a Trunk Road that is about 1.4km from PSFSC.

Identification of Emission Sources

Demolition Stage

A.2.11 The existing PSFSC building is planned to be demolished before 15 October 2019, or failing that in April 2020. During this period, fugitive dust impacts will potentially arise from:

- Break up of roof slab by hydraulic breaker, break up G/F wall and transport all concrete debris to refuse collection skip.
- Break up of G/F wall, on-grade slab and footing by hydraulic hammer and removed all concrete debris to refuse collection skip.
- Installation of sheet pile into ground by pressing along the designated alignment and toe level or vibratory hammer if required.

Construction Stage

A.2.12 Following demolition, the new PSFSC building will be constructed through 2020 and 2021. During this period, fugitive dust impacts will potentially arise from:

- Installation of sheet pile into ground by pressing along designated alignment and toe level.
- Excavation to the designed excavation level upon completion of the installation of the sheet pile.
- Construction of reinforced concrete footing.

- Construction of superstructure.
- Removal of asphalt from forecourt and store in skip.
- Removal of sub-base from forecourt and store in skip.
- From April 2020, works within the MPNR including construction of new Tower Hides (i.e. TH2 and TH3), construction of new footpath boardwalks and vehicle movement.

Background Air Quality

A.2.13 According to the *Guidelines on Assessing the 'TOTAL' Air Quality Impacts* issued by EPD, Pollutants in the Atmosphere and their Transport over Hong Kong (PATH) is a territory-wide air quality model developed by EPD to estimate air pollutants concentration over the whole Pearl River Delta region including Hong Kong. The latest version of the PATH model is PATH-2016. The background concentrations for 1-hour RSP for discrete receivers for year 2019 have been extracted from PATH-2016 in Grids (27, 50), (27, 51), (27, 52) and (28, 52), which covers the Study Area for air quality assessment.

Assumptions Using PATH-2016 Data

A.2.14 With reference to EPD's *Guidelines on the Estimation of PM2.5 for Air Quality Assessment in Hong Kong*[Ref.1], FSP concentrations could be estimated using RSP data with the following equations:

[FSP-annual] = 0.71 × [RSP-annual]
and
[FSP-daily] = 0.75 × [RSP-daily]

A.2.15 In addition, Section 2.8 of "*Guidelines on Choice of Models and Model Parameters*" published by EPD in September 2016 suggests adding 26.5μg/m^3 to the 10th highest daily RSP concentration and 15.6μg/m^3 to the annual RSP concentration. Hence the adjustment of daily RSP and FSP are as follows:

- Daily RSP concentration: add 26.5μg/m^3
- Annual RSP concentration: add 15.6μg/m^3
- Daily FSP concentration: add 26.5μg/m^3× 0.75 = 19.875 μg/m^3
- Annual FSP concentration: add 15.6μg/m^3×0.71=11.076 μg/m^3

A.2.16 The pollutant background concentrations calculated based on the 1-hour RSP concentrations extracted from PATH-2016 are summarised in ***Table A2-3***.

1. Guidelines on Choice of Models and Model Parameters, EPD, HKSAR

Table A2-3 Background Concentrations of RSP and FSP in 2019

Pollutant	Averaging Time	AQO (μg/m³)	Data	Background Concentrations (μg/m³)			
				from PATH-2016 Grid (27, 50)	from PATH-2016 Grid (27, 51)	from PATH-2016 Grid (27, 52)	from PATH-2016 Grid (28, 52)
RSP	24-hour	100 (9)	Maximum	126.7	125.5	125.0	126.4
			10th Maximum	81.2	81.4	83.6	84.1
			No. of Exceedance	2	2	4	3
	Annual	50	Average	34.4	34.4	35.5	35.8
FSP	24-hour	75 (9)	Maximum	95	94.1	93.7	94.8
			10th Maximum	60.9	61	62.7	63.1
			No. of Exceedance	2	2	4	3
	Annual	35	Average	24.5	24.4	25.2	25.4

Notes:

1. Number inside the brackets are annual frequency of exceedances as compared with the AQO criteria.
2. With reference to "*Guidelines on Choice of Models and Model Parameters*" published by EPD in September 2016, the daily and annual RSP and FSP concentrations have been adjusted as follows:
   - Daily RSP concentration: add 26.5 μg/m³
   - Annual RSP concentration: add 15.6 μg/m³
   - Daily FSP concentration: add 26.5 μg/m³ × 0.75 = 19.875 μg/m³
   - Annual FSP concentration: add 15.6 μg/m³ × 0.71 = 11.076 μg/m³

Representative Air Sensitive Receivers

A.2.17 Within the Study Area, five representative Air Sensitive Receivers (ASRs) have been identified in accordance with the guidelines for air quality assessment provided in Annex 12 of the EIAO-TM. ASR 1 to ASR 4 are all two storey village houses without rooftop access. ASR2 is a container converted into a dwelling. ASR 5 represents a two storey village house and the adjacent AFCD Nature Warden Office. All ASRs are in proximity to Kam Ton Chau Road. Details of these ASRs are shown in ***Table A2-4*** and locations are shown in ***Figure A2-1***.

Table A2-4 Representative ASRs

ASR ID	Description	Use	PATH 2016 Grid	Distance from Site[1] (m)	Assessment Height (mAG)
ASR 1	Village House, Tam Kon Chau Road	Residential	(28, 52)	48	1.5, 4.5, 9.5
ASR 2	Occupied Container, Tam Kon Chau Road	Residential	(27, 52)	13	1.5, 4.5, 9.5
ASR 3	Village House, Boundary Road	Residential	(27, 52)	208	1.5, 4.5, 9.5
ASR 4	Village House, Off Tam Kon Chau Road	Residential	(27, 52)	102	1.5, 4.5, 9.5
ASR 5	Village House / AFCD Nature Warden Office	Residential / Office	(27, 52)	231	1.5, 4.5, 9.5

Notes:

1. Distances are measured between ASRs and the nearest boundary of the PSFSC Site.
2. mAG represents meters above ground.

Assessment Methodology

A.2.18 Dust emission rates are estimated in accordance with emission factors developed by the United States Environmental Protection Agency (USEPA) in *Compilation of Air Pollution Emission Factors (AP-42), 5th Edition*. Emissions from demolition and rebuild activities mentioned in ***paragraphs A2.11 and A2.12*** are estimated assuming that emissions from the active construction area are mainly contributed from heavy construction works and wind erosion. Heavy construction and wind erosion emission factors were estimated in accordance with the Section 13.2.3 of AP42 of USEPA.

A.2.19 As a conservative approach, it is assumed that 100% of the active construction area is used for both demolition and rebuild works. As emission factors for demolition are the same as those for construction under the above assumptions, and these two stages will be carried out consecutively, the worst case assumption is that demolition/rebuild at PSFSC is carried out concurrently with construction works of the Project in MPRN. As such, one set of assessment is presented in this study. The relevant emission factors adopted are listed in ***Table A2-5***. The locations of each dust emission source are shown on ***Figure A2-2***.

Table A2-5 Emission Factors for Dusty Construction Activities

Activity	Emission Rate	References and Remarks
Heavy Construction Activities	E = 2.69 Mg/hectare/month of activity	Section 13.2.3, AP-42, USEPA Assume 100% active area
Wind Erosion	E = 0.85 Mg/hectare/year	Table 11.9.4, Section 11.9, AP-42, USEPA Assume 100% active area
Vehicle Movement on Paved Road[Note 2]	E (in g/VKT) = $k\ (sL)^{0.91}\ (W)^{1.02}$	Equation 1, Section 13.2.1, AP-42, USEPA
Vehicle Movement on Unpaved Road[Note 2]	$E = k\ (s/12)^{a}(W/3)^{b}$	Section 13.2.2, AP-42, USEPA

Notes:

1. k is the particle size multiplier.
2. Emission rates adopted for emission sources within MPNR Project Site.

Air Dispersion Model

A.2.20 The Gaussian dispersion model "AERMOD" was used to estimate pollutant concentrations at ASRs. The model was originally developed by the USEPA and is adopted for evaluating industrial chimney releases (point sources) as well as area and volume sources.

A.2.21 AERMET is a meteorological pre-processor developed by USEPA for organising available meteorological data into a format suitable for use by AERMOD. Three stages are involved in AERMET for processing the meteorological data; the first stage extracts meteorological data and processes the data with quality assessment checks; the second stage merges all data available for 24-hour periods and stores these data in a single file; and the third stage reads the merged meteorological data and estimates the necessary boundary layer parameters for use by AERMOD.

Meteorological Conditions

A.2.22 Meteorological data modelled using the Weather Research and Forecasting (WRF) Model, which is part of PATH-2016, in Grids (27, 52), and (28, 52) at the lowest level were adopted for the air quality modelling assessment. Some adjustments have been made based on the following assumptions:

1. The data of the first 8 hours of Year 2010 (i.e., hours 01 to 07 on 1 January 2010) were not provided in WRF data file. Therefore, the data of the first 8 hours were assumed to be the same as those data from hours 01 to 07 on 1 January 2011. The temperatures, wind speeds, wind directions, cloud covers, relative humidity, mean sea level pressure and mixing height extracted from WRF were converted into format that is suitable for on-site data input in AERMET.
2. Hours 01 to 23 in WRF raw meteorological data were assumed as hours 01 to 23 in the final meteorological data file. Hour 00 of WRF is assumed as Hour 24 of the previous day in final meteorological date file.
3. The wind speed extracted from raw WRF meteorological data which are less than 1m/s are adjusted to be 1m/s.
4. Cloud cover extracted from raw WRF meteorological data have original values ranges between 0 to 1, which are converted to unit of tenths with reference to the USEPA AERMET User's guide, and the definition of CD144 format as mentioned in the PCRAMMET User's Guide to classify the amount of cloud cover measured in tens of percent was adopted, e.g.:
    1) 0 = clear or less than 10%
    2) 4= 40% – 49%
    3) ''-'' = overcast of 100%
5. Surface roughness was determined based on an inverse-distance weighted geometric mean for a default upwind distance of 1km relative to the Site.
6. Bowen ratio should be based on a simple unweighted geometric mean (i.e., no direction or distance dependency) for a representative domain, with a default domain defined by a 10km by 10km region centred on the measurement site.
7. Albedo should be based on a simple unweighted arithmetic mean (i.e. no direction or distance dependency) for the same representative domain as defined for Bowen ratio, with a default domain defined by a 10km by 10km region centred on the measurement site.
8. The anemometer height of the meteorological data file is set at 9m above ground as 9m is the centre of first of 26 vertical levels of WRF data, with reference to Section 4.3.1 of *EPD's Final Report of the Territory-wide Air Quality Modelling System Study*.
9. The base elevation of the anemometer adopted in the AERMOD model was assumed to be same as the mPD level of the site which is approximately 3.5mPD as shown on the survey map provided by the Survey and Mapping Office.

A.2.23 Surface and upper air levels meteorological data should be required and inputted into AERMET. The lowest level of WRF meteorological data at PATH Grids (27, 52) and (28, 52) were converted to the recognised format and are adopted as the on-site data in AERMET model.

A.2.24 The output from AERMET consists of two parts; a file with extension ".sfc" is the surface air data; and a file with extension ".pfl" is the upper air data. Data including wind speed, wind direction and temperature in the surface air data from the output file in ".sfc" format were replaced by the original WRF data.

Particle Size Distribution

A.2.25 Particle size distribution adopted for demolition and rebuild activities are general same. ***Table A2-6*** presents details of the particle size distribution adopted in the input of AERMOD files.

Table A2-6 Particle Size Distribution for Demolition and Construction Emission

Types of Emission	Particle Size Distribution			Reference	Applied to Emission Sources
Heavy Construction	**Mean Particle Size (µm)**	**RSP %age**	**FSP %age**	Category 3 "Mechanically Generated Aggregate, Unprocessed Ores", Page B.2-13, Appendix B.2 Generalized Particle Size Distributions, AP-42, USEPA (Version 1/95)	Construction and Demolition works within the Site of PSFSC.
	0.5	8%	27%		
	1.5	14%	47%		
	2.25	8%	27%		
	2.75	6%			
	3.5	14%			
	4.5	10%			
	5.5	8%			
	8	33%			
		100%	**100%**		
Paved Road	**Mean Particle Size (µm)**	**RSP %age**	**FSP %age**	Table 13.2.1-1 and page 13.2.1-12 of Section 13.2.1.3 of AP-42, USEPA	Paved roads within the Project Site of Mai Po Nature Reserve Infrastructure Upgrade Project
	1.25	24.2%	100%		
	6.25	75.8%			
		100%	**100%**		
Unpaved Road	**Mean Particle Size (µm)**	**RSP %age**	**FSP %age**	Table 13.2.1-1 and page 13.2.1-12 of Section 13.2.1.3 of AP-42, USEPA	Unpaved roads within the Project Site of Mai Po Nature Reserve Infrastructure Upgrade Project
	1.25	76.6%	100%		
	6.25	23.4%			
		100%	**100%**		

Assessment Results

A.2.26 Cumulative pollutant concentrations at ASRs are estimated by summing the results estimated by the air modelling and the background concentrations extracted from PATH-2016. The predicted cumulative impacts of the 10th highest daily and annual average RSP and FSP are shown in ***Table A2-7***, below.

Table A2-7 Predicted Cumulative Pollutant Concentrations at Representative ASRs

ASR ID	Description	Height (mPD)	RSP Concentration (µg/m³)		FSP Concentration (µg/m³)	
			10th Max 24-hr	Annual	10th Max 24-hr	Annual
ASR 1	Village House, Kam Ton Chau Road	5.9	85.7	37.2	63.8	25.9
		8.9	85.5	37.1	63.6	25.9
		13.9	85.4	36.7	63.2	25.7
ASR 2	Occupied Container, Tam Kon Chau Road	5	88.0	40.3	63.6	26.8
		8	86.4	38.9	63.0	26.3
		13	83.9	36.9	62.9	25.7
ASR 3	Village House, Boundary Road	5	84.5	36.7	63.1	25.6
		8	83.9	36.5	62.9	25.5
		13	83.9	36.2	62.9	25.4
ASR 4	Village House, Off Tam Kon Chau Road	5.1	84.2	37.1	63.0	25.7
		8.1	84.1	36.9	63.0	25.7
		13.1	84.0	36.6	62.9	25.5
ASR 5	Village House / AFCD Nature Warden Office	4.8	84.2	36.8	63.0	25.7
		7.8	84.2	36.8	63.0	25.6
		12.8	84.1	36.5	62.8	25.5

A.2.27 The cumulative impacts of the 10th highest daily RSP at the ASRs ranges from 83.9µg/m³ to 88 µg/m³, while annual average RSP ranges from 36.2µg/m³ to 40.3µg/m³. The 10th highest daily FSP at the ASRs ranges from 62.8 µg/m³ to 63.8µg/m³, while annual average FSP ranges from 25.4 µg/m³ to 26.8 µg/m³. The predicted results indicate that cumulative RSP and FSP impacts at all representative ASRs are in compliance with their corresponding AQO limits, and therefore no adverse air quality impact is anticipated during the demolition and construction stages of the PSFSC.

A.2.28 Contour plots of the 10th highest daily, annual average of RSP and FSP concentration at the worst hit levels are shown in ***Figures A2-3 to A2-10*** at levels of 1.5m and 5m above ground. These contour plots reveal that pollutant concentrations at all representative ASRs are in compliance with the AQOs and no exceedances have been identified.

A.2.29 Furthermore, these contour plots also show the generally low level of RSP and FSP concentrations in the area outside the PSFSC boundary, which is zoned CA and therefore of conservation value. This is discussed further in ***Section A.6*** on ecology.

Mitigation Measures

A.2.30 The *Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation* will be applied to ensure that Non-road Mobile Machinery (NRMM), other than those exempted, complies with the prescribed emission standards.

A.2.31 Fugitive dust generation during demolition and construction stages can be controlled with the implementation of mitigation measures that are recommended in the *Air Pollution Control (Construction Dust) Regulation*, such that significant fugitive dust impact is not anticipated.

A.2.32 Good practice and mitigation measures to be implemented during the demolition and construction stages are as follows:

- Regular watering to reduce dust emissions from exposed site surfaces and unpaved roads, particularly during dry weather.
- Frequent watering for particularly dusty areas and areas close to ASRs.
- Cement, pulverized fuel ash or any other dusty materials collected by fabric filters or other air pollution control system or equipment shall be disposed of in totally enclosed containers.
- Open stockpiles shall be avoided or covered. Where possible, prevent placing dusty material storage piles near 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 shall be applied to aggregate fines.
- Tarpaulin covering of all dusty vehicle loads transported to and from the Site.
- Use of water sprinklers at the loading area where dust generation is likely during the loading process of loose material, particularly in dry weather.
- Imposition of speed controls for vehicles within the Site.
- Where possible, routing of vehicles and positioning of construction plant should be at the maximum possible distance from off-site ASRs.
- Every stock of more than 20 bags of cement or dry PFA should be covered entirely by impervious sheeting or placed in an area sheltered on the top and the 3 sides.

Summary and Conclusions

A.2.33 A quantitative assessment of air quality impacts was carried out for the demolition and construction stages of PSFSC, as well as other rebuild activities within the Project Site of the Mai Po Nature Reserve Infrastructure Upgrade Project from April 2020. Cumulative impact results show these do not exceed of AQOs for RSP and FSP at the representative ASR. With the implementation of the recommended mitigation measures and good site practice, adverse air quality impacts during the demolition and construction stages are not anticipated. As such, further air quality mitigation measures during the construction stage are not necessary.

A.2.34 There will be no sources of air pollution arising from PSFSC during the operation stage. As such mitigation measures are not required during the operation stage.

A.2.35 Overall, therefore, no adverse air quality impact is anticipated during the demolition or construction stages of PSFSC.

Figure A2-1 Location of Representative ASRs

Figure A2-2 Dust Emission Sources Within the PSFSC Site

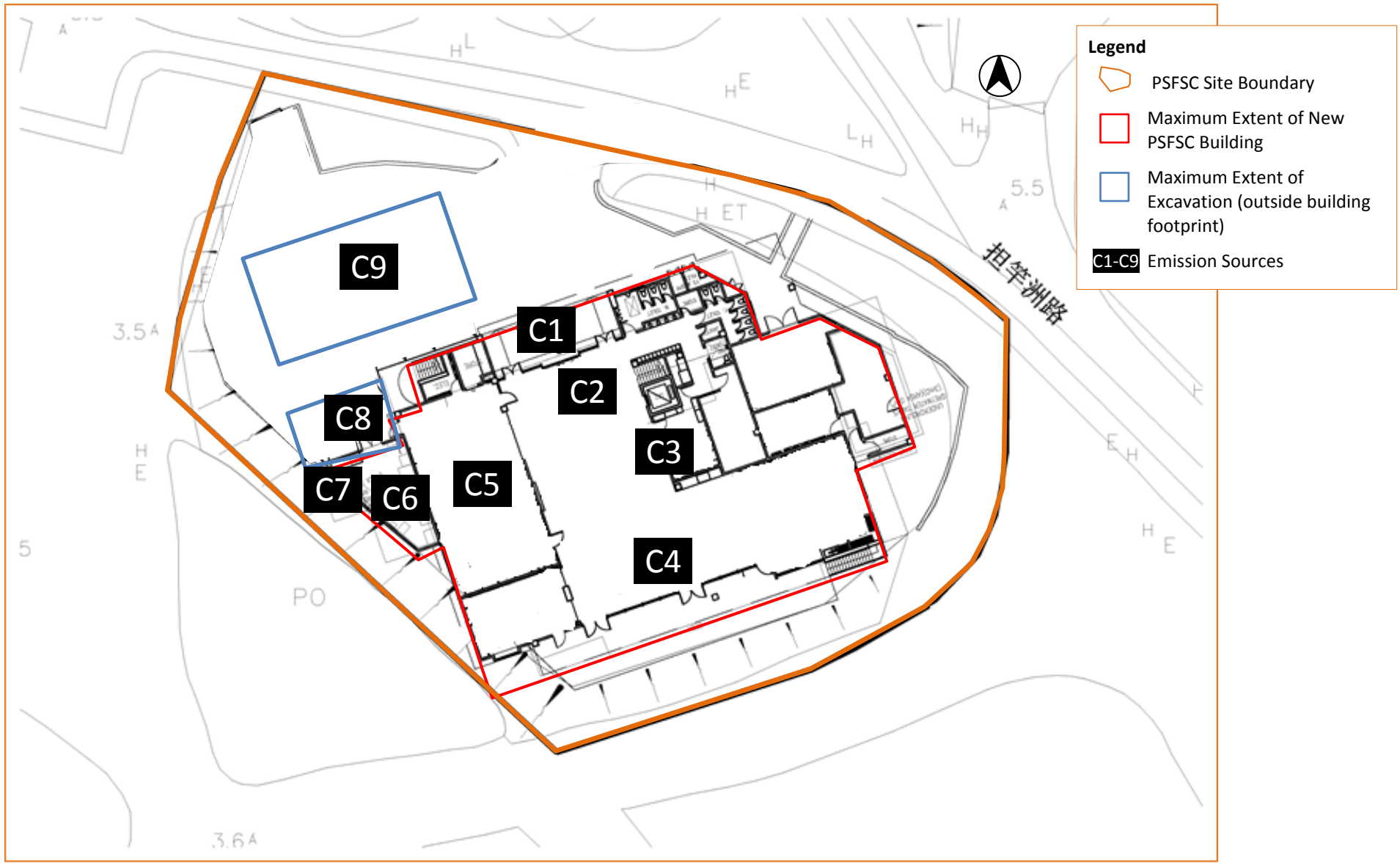
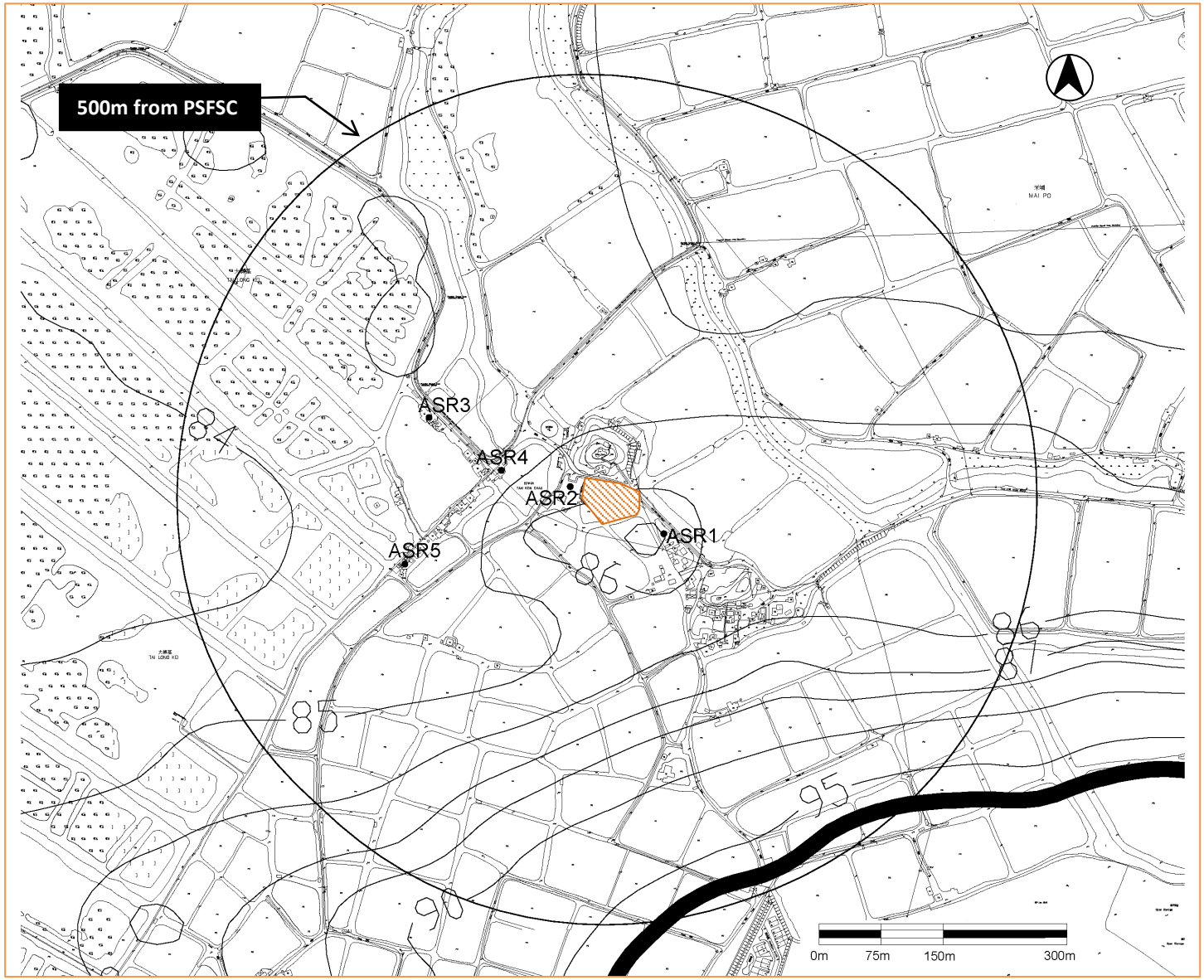


Figure A2-3 Contour Plots of the Highest Daily RSP at 1.5m Above Ground

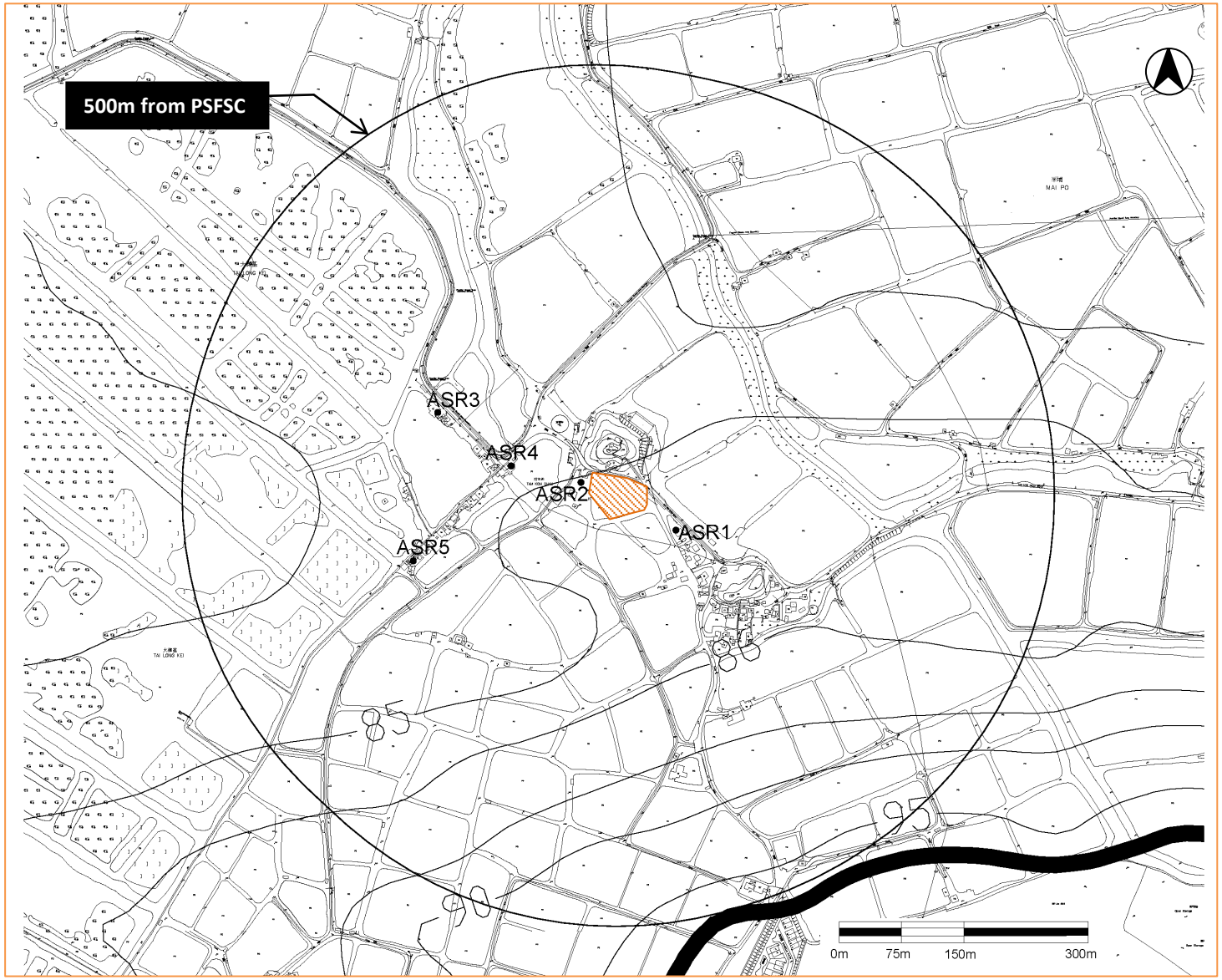


Legend

PSFSC Site

ASR 1 Air Sensitive Receiver (ASR)

Figure A2-4 Contour Plots of the Highest Daily RSP at 5m Above Ground

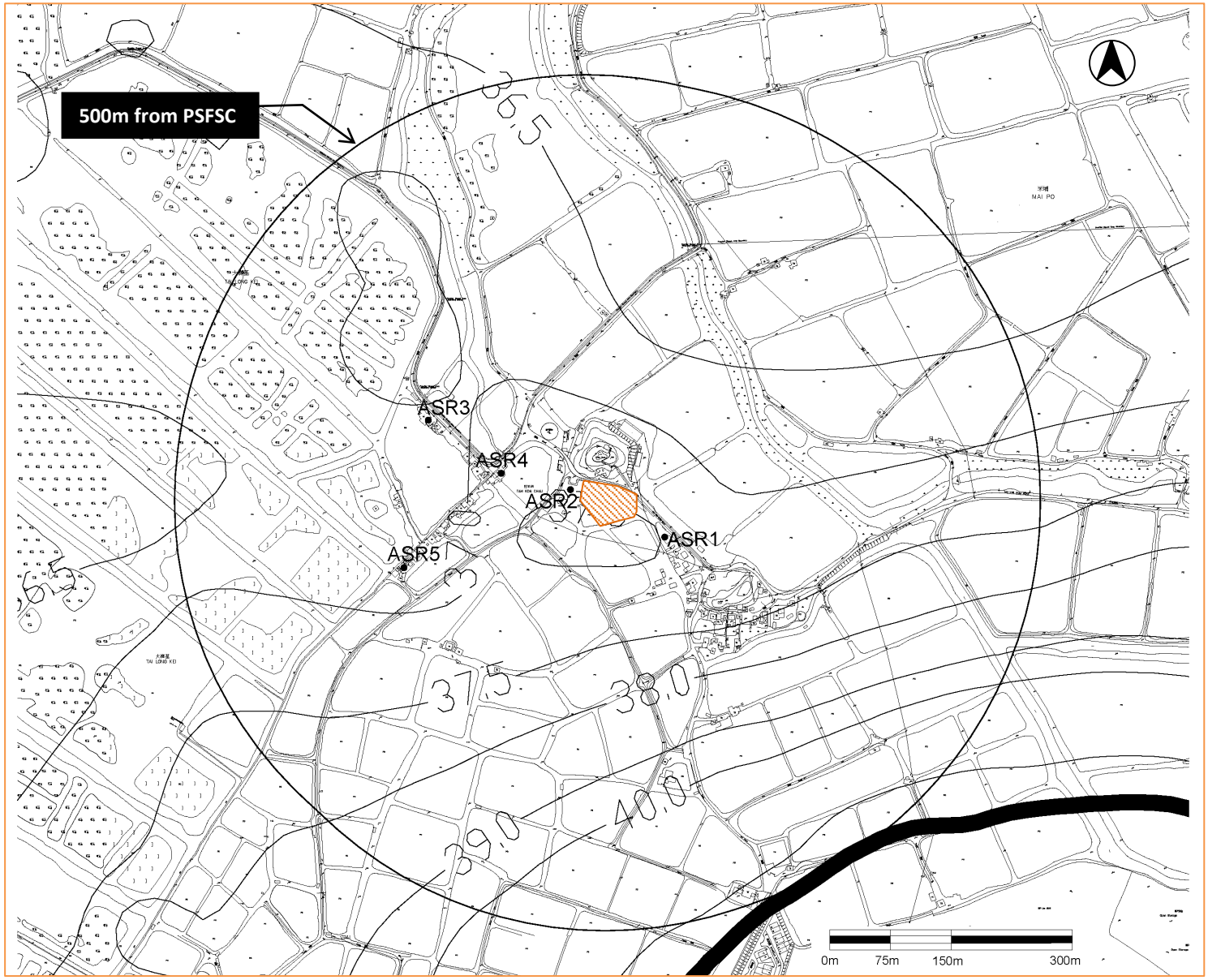


Legend

PSFSC Site

ASR 1 Air Sensitive Receiver (ASR)

Figure A2-5 Contour Plots of the Annual Average RSP at 1.5m Above Ground

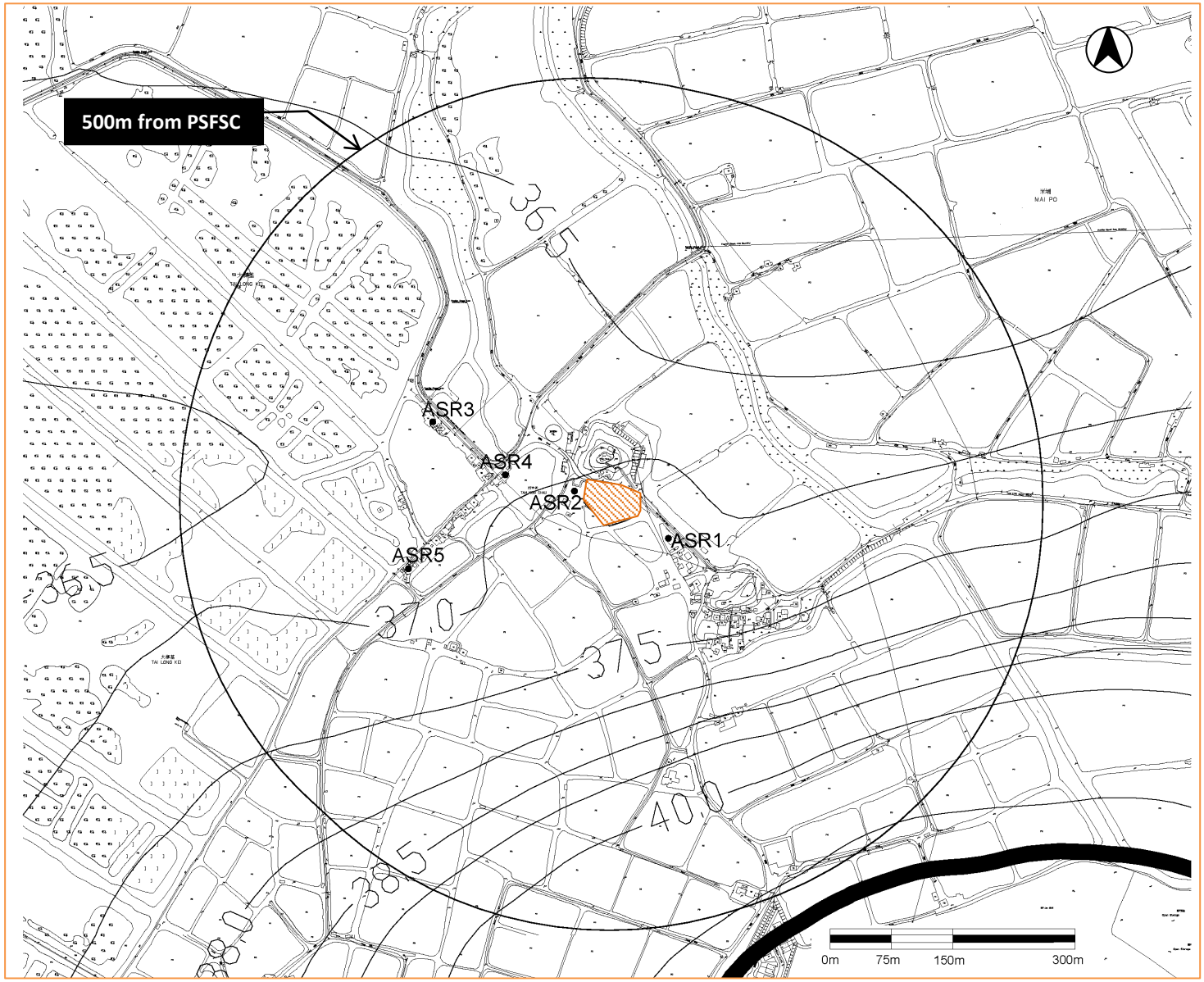


Legend

PSFSC Site

ASR 1 Air Sensitive Receiver (ASR)

Figure A2-6 Contour Plots of the Annual Average RSP at 5m Above Ground

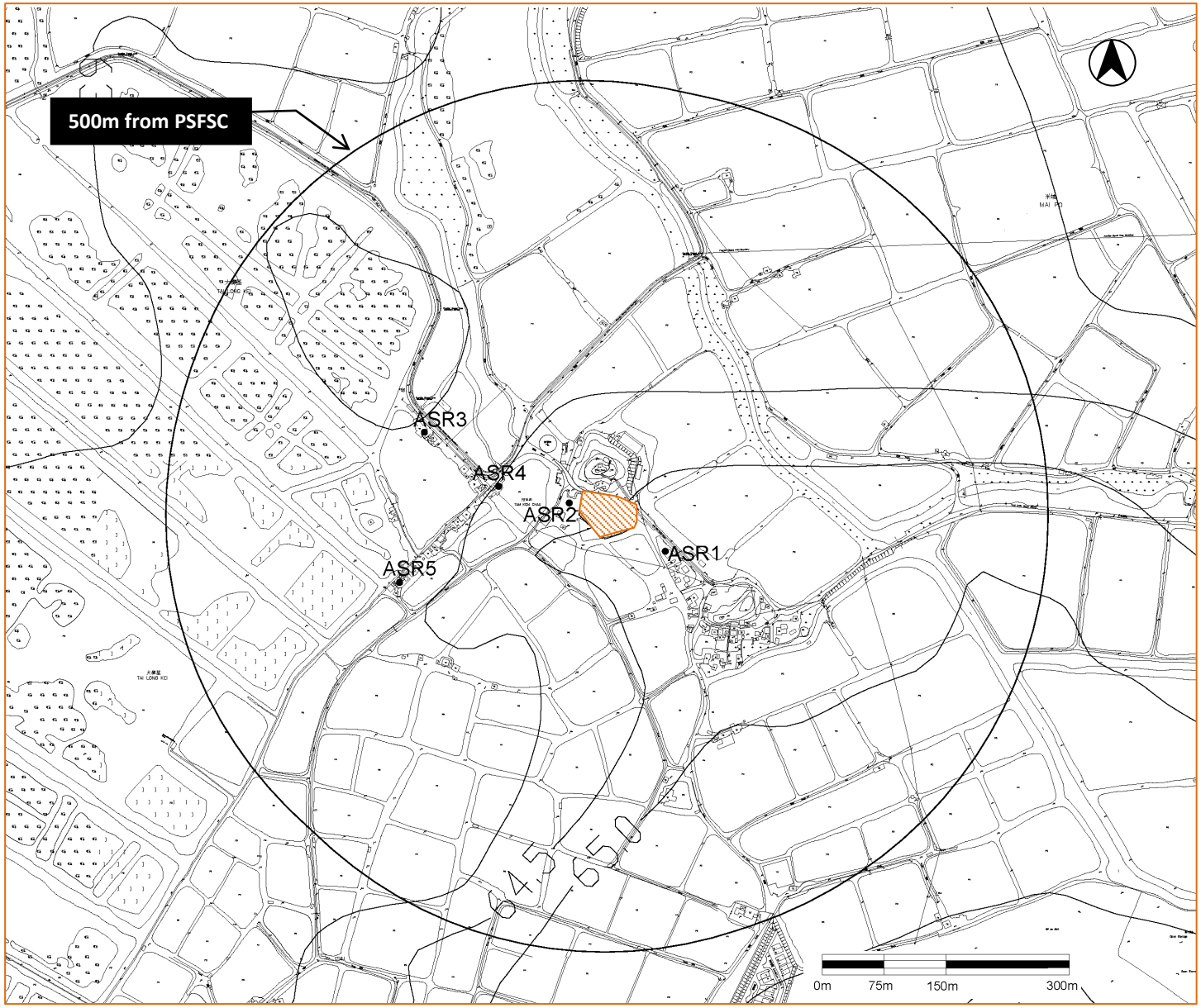


Legend

PSFSC Site

ASR 1 Air Sensitive Receiver (ASR)

Figure A2-7 Contour Plots of the Highest Daily FSP at 1.5m Above Ground

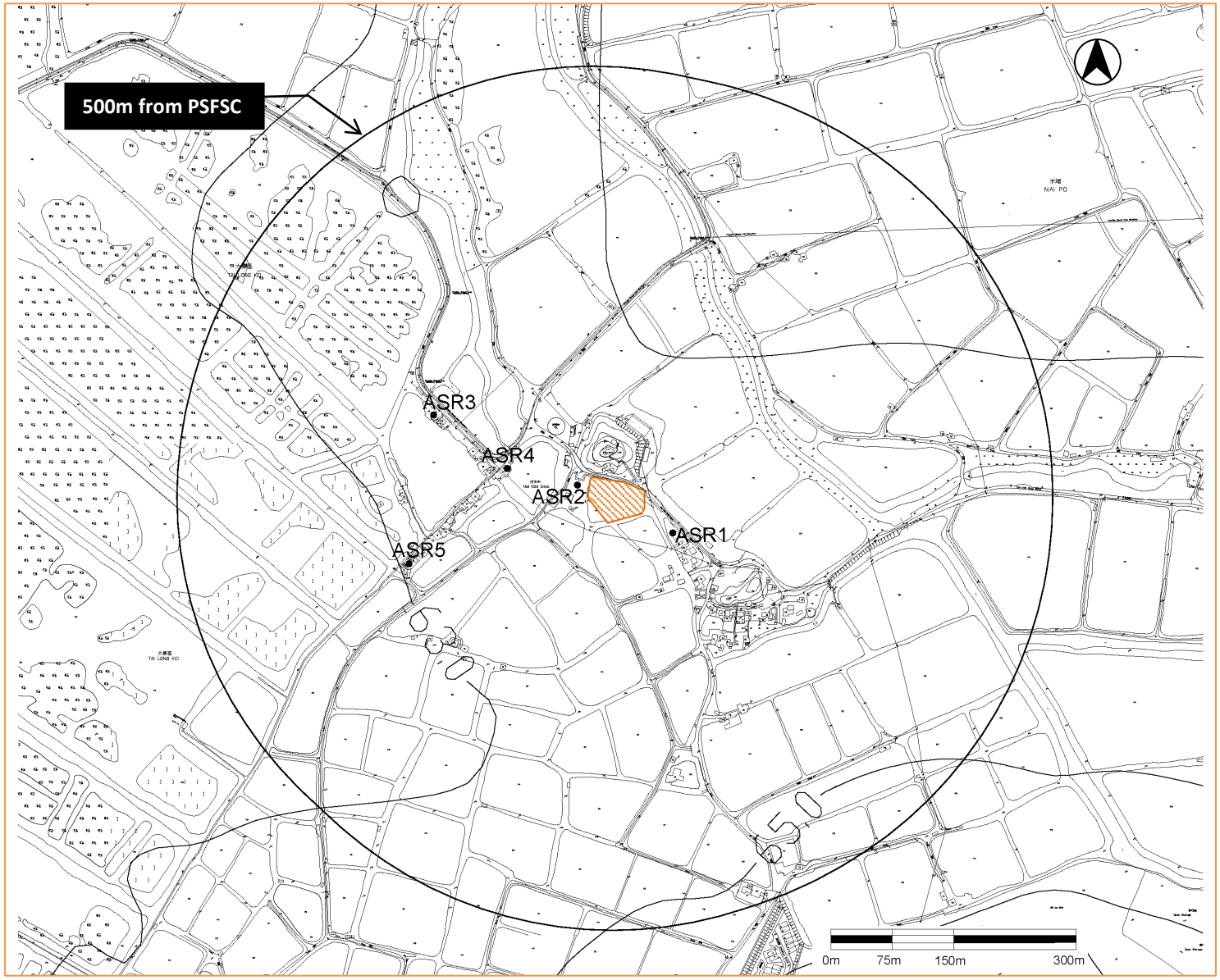


Legend

PSFSC Site

ASR 1 Air Sensitive Receiver (ASR)

Figure A2-8 Contour Plots of the Highest Daily FSP at 5m Above Ground



Legend

PSFSC Site

ASR 1 Air Sensitive Receiver (ASR)

Figure A2-9 Contour Plots of the Annual Average FSP at 1.5m Above Ground

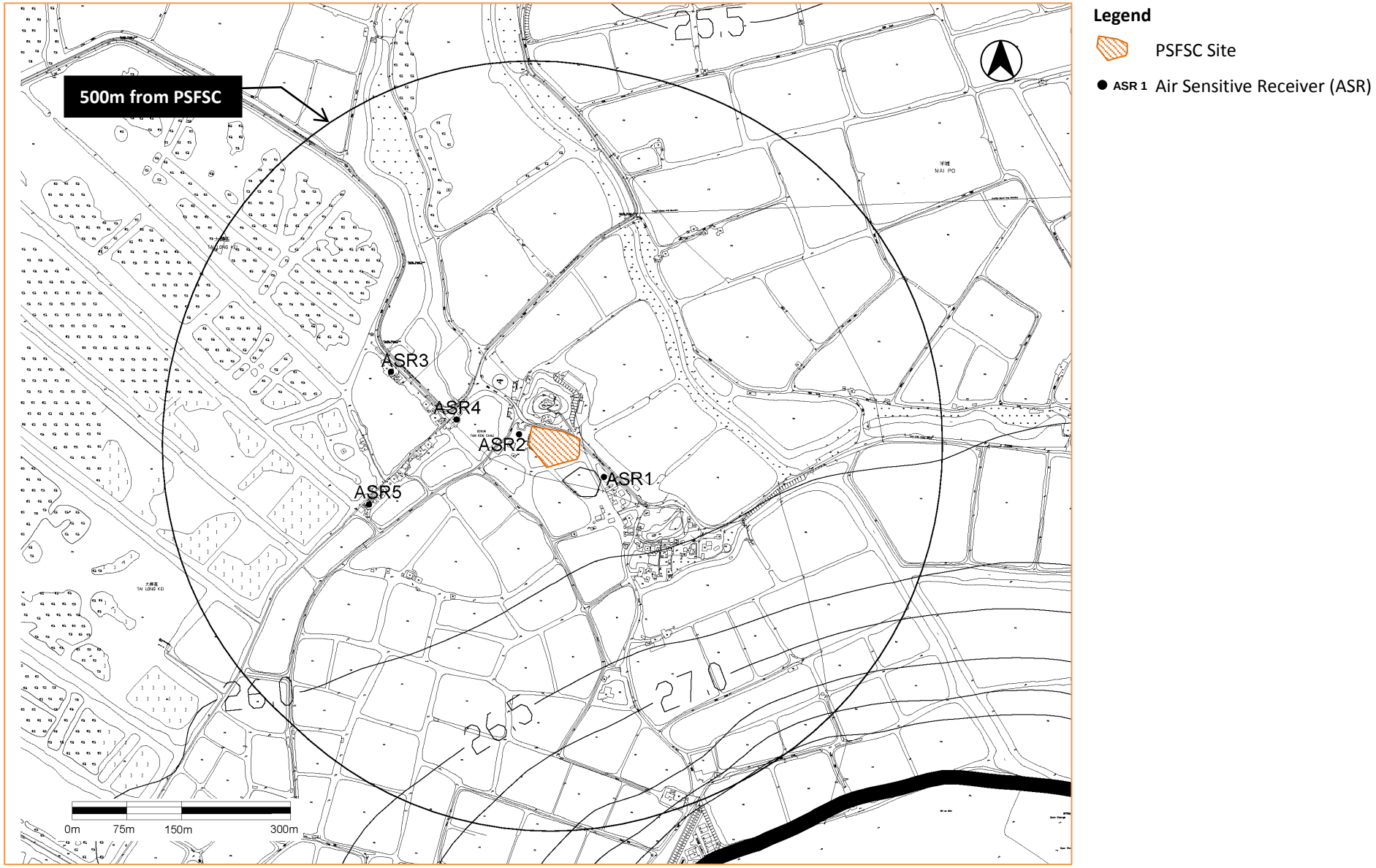
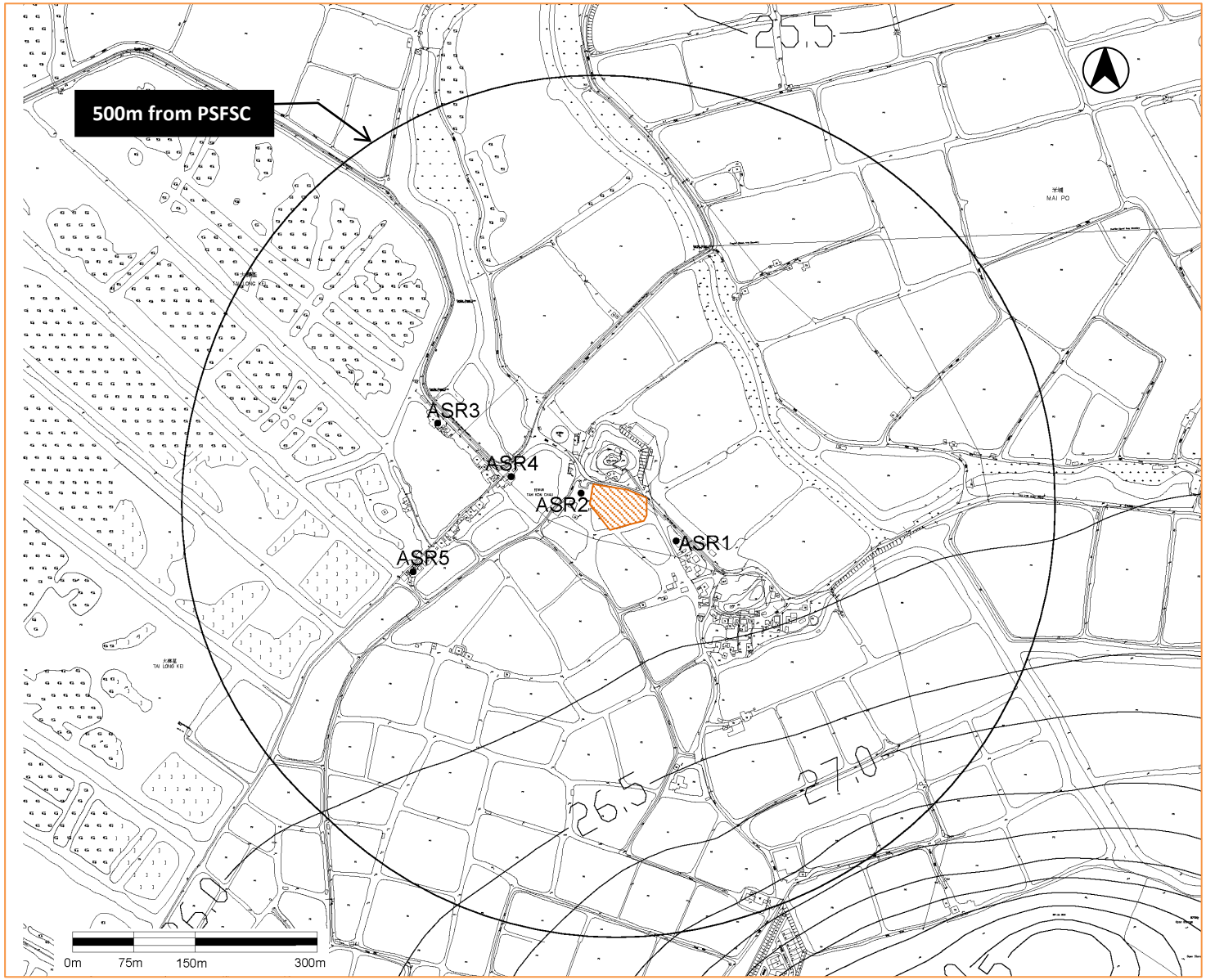


Figure A2-10 Contour Plots of the Annual Average FSP at 5m Above Ground



Legend

PSFSC Site

ASR 1 Air Sensitive Receiver (ASR)

A.3 Noise Assessment

Introduction

A.3.1 This noise assessment has been carried out to identify, qualify and quantify the potential noise impacts arising from the demolition and rebuild of the PSFSC. There will be no operational noise impacts from PSFSC and so these are not considered in this assessment.

A.3.2 Although PSFSC is not a DP, the assessment methodology follows the EIAO-TM and the assessment has been carried out to a level of detail as it would be for a DP under the EIAO. The Study Area for noise assessment extends to 300m from the PSFSC site boundary.

Legislation, Standards and Guidelines

Construction Noise

A.3.3 The main piece of legislation controlling environmental noise impact is the *Noise Control Ordinance* (NCO). The NCO enables regulations and Technical Memoranda (TM) to be enacted, which introduce detailed control criterion, measurement procedures and other technical matters.

General Construction Activities During Non-restricted Hours

A.3.4 For general construction works other than percussive piling, the TM does not provide control over Non-restricted Hours from 0700 to 1900 on any day not being a Sunday or a General Holiday. However, these Non-restricted Hours are subject to noise limits set out in Table 1B of Annex 5 of the EIAO-TM for Designated Projects. The relevant noise standards are summarised in ***Table A3-1***.

Table A3-1 Noise Standards for Daytime Construction Activities

Uses	0700 to 1900 on Any Day Not Being a Sunday or General Holiday Leq(30 mins) dB(A)	1900 to 0700 or Any Time on Sundays or General Holidays
All domestic premises including temporary housing accommodation	75	The criteria laid down in the relevant technical memoranda under the NCO for designated areas and construction works other than percussive piling may be used for planning purposes. A Construction Noise Permit (CNP) shall be required for carrying out of the construction work during these periods
Hotel and hostels	75	
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	70 65 (during examinations)	

Notes:

1. The above standards apply to uses which rely on opened windows for ventilation.
2. The above standards should be viewed as the maximum permissible noise levels assessed at 1m from the external façade.

General Construction Activities During Restricted Hours

A.3.5 Noise impacts arising from general construction activities (excluding percussive piling) conducted during the Restricted Hours from 1900 to 0700 hours on any day and anytime on Sunday or General holiday are governed by the NCO.

A.3.6 Carrying out of any general construction activities involving the use of any Powered Mechanical Equipment ("PME") during Restricted Hours requires a Construction Noise Permit (CNP) from the Authority under the NCO. The noise criteria and the assessment procedures for issuing a CNP are specified in *Technical Memorandum on Noise from Construction Work Other Than Percussive Piling* (GW-TM) under the NCO.

A.3.7 The use of Specified PME ("SPME") and/or the carrying out of Prescribed Construction Work ("PCW") within a Designated Area ("DA") under the NCO during the restricted hours are also prohibited without a CNP. The relevant technical details can be found in *Technical Memorandum on Noise from Construction Work in Designated* Areas (DA-TM) under NCO. Designated Areas, in which the control of SPME and PCW shall apply, are established through the *Noise Control (Construction Work Designated Areas) Notice* made under Section 8A(1) of the NCO. According to the latest Designated Areas defined under the NCO [Plan No.: EPD/AN/NT-01 by the Environment Bureau], the PSFSC Site is not within Designated Areas, however, prior to construction, the Contractor has the responsibility to check the latest status and coverage of the Designated Areas.

A.3.8 For PSFSC, work will not be carried out during Restricted Hours. Furthermore, during the Non-restricted Hours, WWF will limit working time from 0800 to 1730.

Percussive Piling

A.3.9 Percussive piling is only permitted when the Authority has granted a CNP. The *Technical Memorandum on Noise from Percussive Piling* (PP-TM) under the NCO sets out the permitted hours of operation of percussive piling and Acceptable Noise Level ("ANL") requirements, which are dependent on the levels that exceed the Acceptable Noise Level ("ANL").

A.3.10 For PSFSC, percussive piling will not be carried out.

Assessment Area

A.3.11 The Assessment Area includes all areas within 300m (the 300m envelope) from the PSFSC Site boundary as shown in ***Figure A3-1***. Although the assessment area can reach 300m from the work sites, the first-tier Noise Sensitive Receivers (NSRs) are chosen as representative NSRs in planning the works in order to minimise the impact and the implementation of necessary mitigation measures. Other NSRs further away from these first-tier NSRs are expected to be less affected by comparison.

Noise Sensitive Receivers

A.3.12 Within the 300m Assessment Area, five representative NSRs have been identified in accordance with the guidelines for noise assessment provided in Annex 13 of the EIAO-TM. With the exception of NSR2, these NSRs are two storey village houses without rooftop access houses. NSR2 is a container converted into a dwelling. All NSRs are in proximity to Kam Ton Road. Details of these representative NSRs are shown in ***Table A3-4*** and locations are shown in ***Figure A-1***.

Table A3-2 Noise Sensitive Receivers

NSR ID	Description	Use	Distance from Site[1] (m)	No. Floors
NSR 1	Village House, Tam Kon Chau Road	Residential	48	G/F, 1/F
NSR 2	Occupied Container, Tam Kon Chau Road	Residential	13	G/F
NSR 3	Village House, Boundary Road	Residential	208	G/F, 1/F
NSR 4	Village House, Off Tam Kon Chau Road	Residential	102	G/F, 1/F
NSR 5	Village House, near AFCD Nature Warden Office	Residential	231	G/F, 1/F

Note: 1. Distances are measured between NSR and the nearest boundary of the PSFSC Site.

Baseline Conditions

A.3.13 A prevailing background noise survey has been conducted on 28 June 2017 during the day time period at the PSFSC Site. The measured background noise level is summarised in ***Table A3-3*** and the location of the measurement is shown in ***Figure A3-1***.

Table A3-3 Measured Background Noise Levels

Location	Description	Noise Level Leq(30min), dB(A)
On-Site Monitoring Locations		
MP1	On-site	54

Note: Measurements were conducted in free-field condition.

Identification of Noise Sources

A.3.14 Noise impacts arising from demolition and rebuild of the PSFSC are mainly due to the use of PME. The major works are demolition of the existing PSFSC and its rebuild.

A.3.15 Note that work during Restricted Hours will not be required. Also percussive piling will not be required.

A.3.16 The types and quantities of PME to be involved are limited. An inventory of the PME used in the demolition and rebuild work for PSFSC has been confirmed by the Project Engineer.

Assessment Methodology

A.3.17 As discussed above, the noise assessment is focused to the potential noise impact arising from the demolition and rebuild of the PSFSC.

A.3.18 The assessment of construction noise impact was carried out quantitatively based on the guidelines given in GW-TM issued under the NCO where appropriate. Sound Power Levels (SWLs) of PME make reference to Table 3 of the TM and the *Sound Power Levels of Other Commonly Used PME* available in EPD's website[Ref.#2].

A.3.19 A positive 3dB(A) correction was applied to the predicted noise level to account for the façade effect at each assessment point.

2. http://www.epd.gov.hk/epd/sites/default/files/epd/english/application_for_licences/guidance/files/OtherSWLe.pdf

Assessment Results

A.3.20 The noise impact arising from the demolition and rebuild works at PSFSC at the representative NSRs has been predicted to range from 52 to 85dB(A).

A.3.21 The works at PSFSC will be carried out during weekday daytime, however, since the NCO does not provide control over weekday daytime construction activities (other than for percussive piling, which will not be carried out), the above noise levels would not be in breach of the NCO.

A.3.22 Having said that, the Project Proponent acknowledges that the works at PSFSC are close to NSR 1 and NSR 2 in particular and that the PSFSC Site is surrounded by an ecologically sensitive area zoned CA. If the EIAO-TM construction noise criteria of 75dB(A) for residential uses was applied, then the predicted noise levels of NSR 1 and NSR 2 would not comply, as shown in in ***Table A3-4***.

Table A3-4 Predicted Noise Impact at Representative NSRs – Unmitigated

NSR ID	Noise Criteria, dB(A)	Predicted Construction Noise Level Leq(30 min), dB(A)
NSR 1	75	64 – **79**
NSR 2	75	70 – **85**
NSR 3	75	53 – 69
NSR 4	75	58 – 74
NSR 5	75	52 – 70

Note: Bold indicates exceedance of EIAO-TM noise criteria.

A.3.23 To generate the noise contours of the PSFSC and its vicinity, the Project Site has been overlain by a grid and the predicted highest construction impact noise level (in terms of Leq) during each construction stage at each grid intersection is used as the value for producing the contour. The noise contour showing the unmitigated noise impacts of the construction stages is plotted in ***Figure A3-2***.

A.3.24 As the Project Proponent wishes to minimise the disturbance to local residents and to wildlife from the works at PSFSC, the EIAO-TM criteria shall be adopted. On this basis, mitigation measures will be required to reduce noise levels at NSR 1 and NSR 2 to 75dB(A) or below.

Mitigation Measures

Quality Powered Mechanical Equipment

A.3.25 Quality Powered Mechanical Equipment (QPME) items are construction equipment that are new, notably quieter, more environmentally friendly and efficient. In order to mitigate construction noise levels at NSRs, quiet PME items including handheld breaker, generator, excavator and mobile crane are selected from the QPME system listed under webpages of EPD as mitigation measures. SWLs of these QPME items are adopted for the assessment of mitigated scenario. It is considered to be too restrictive to specify QPME items of designated types or models for the Contractor to use in construction works. The contractors shall have the flexibility to select groups of PME that would have the noise impacts not worse than those predicted in this assessment.

A.3.26 An inventory of the PME used for this mitigated scenario has been confirmed by the Project Engineer.

Noise Barrier

A.3.27 Given the predicted noise levels that exceed the EIAO-TM noise criteria at NSRs 1 and 2 even with the use of QPME, it is proposed to install noise barrier along part of the perimeter of the PSFSC site to mitigate noise levels. The location of the proposed noise barrier is shown in ***Figure A3-3***.

A.3.28 According to EPD[Ref.#3] a typical construction noise barrier can achieve a noise reduction of 5 – 10 dB(A). A noise barrier such as the *SilentUP Retractable Noise Barrier*[Ref.#4] or similar can offer even greater noise reduction – up to 26dB(A) according to the manufacturer. A 10 dB(A) noise reduction from a typical construction noise barrier is adopted for the noise barrier for the section of noise barrier adjacent to NSRs 1 and 2.

A.3.29 For the proposed use of QPME and noise barrier, the mitigated noise impact at the NSRs from the demolition and rebuild works at PSFSC has been predicted and the results are summarised in ***Table A3-5***.

Table A3-5 Predicted Noise Impact at Representative NSR – Mitigated

NSR ID	Noise Criteria, dB(A)	Predicted Construction Noise Level Leq(30 min), dB(A)
NSR 1	75	54 – 66
NSR 2	75	60 – 72
NSR 3	75	53 – 66
NSR 4	75	58 – 70
NSR 5	75	52 – 69

Note: Bold indicates exceedance of EIAO-TM noise criteria (no exceedance).

A.3.30 The results show that with the proposed QPME and noise barrier in place, the construction noise impact at all NSRs will comply with the EIAO-TM criteria. The noise contour showing the mitigated noise impacts of the construction stages is plotted in ***Figure A3-4***.

A.3.31 Furthermore, these contour plots also show the generally low level of noise in the area outside the PSFSC boundary, which is zoned CA and therefore of conservation value. This is discussed further in ***Section A.6*** on ecology.

Additional Mitigation Measures

A.3.32 Although the assessment had demonstrated that there will be no adverse impact to NSR 1 with the proposed noise barrier, given the proximity of PSFSC to MPNR, the Contractor should adopt good working practices in order to further minimise construction noise impact to the surrounding wildlife, such as:

- The Contractor shall adopt the *Code of Practice on Good Management Practice to Prevent Violation of the NCO* (for Construction Industry) published by EPD.
- To further reduce noise from demolition, the Demolition Contractor shall consider the use of a moveable noise enclosure for top-down selective demolition, which can achieve a noise reduction of 26dB(A), according to EPD[Ref.#5].

3. See http://www.epd.gov.hk/epd/misc/construction_noise/contents/157-construction-noise-barrier.htm#.Wi-9jFXXaUk
4. See http://www.wal.hk/downloads/SilentUP-Catalogue.pdf.
5. See http://www.epd.gov.hk/epd/misc/construction_noise/contents/158-construction-noise-enclosure.htm#.Wi_DOVXXaUk.

- Upon the advice of the ET's ecologist, the Demolition Contractor and/or Construction Contractor shall also consider installing a noise barrier between the Site and any Ecological Sensitive Receivers (ESRs) identified in proximity to PSFSC.
- Before commencing any work, the Contractor shall submit to the Project Engineer for approval the method of working, equipment and noise mitigation measures intended to be used at the site.
- Unused equipment should be turned off. PME should be kept to a minimum and the parallel use of noisy equipment/machinery should be avoided.
- Regular (off-site) maintenance of all plant and equipment.

Conclusion

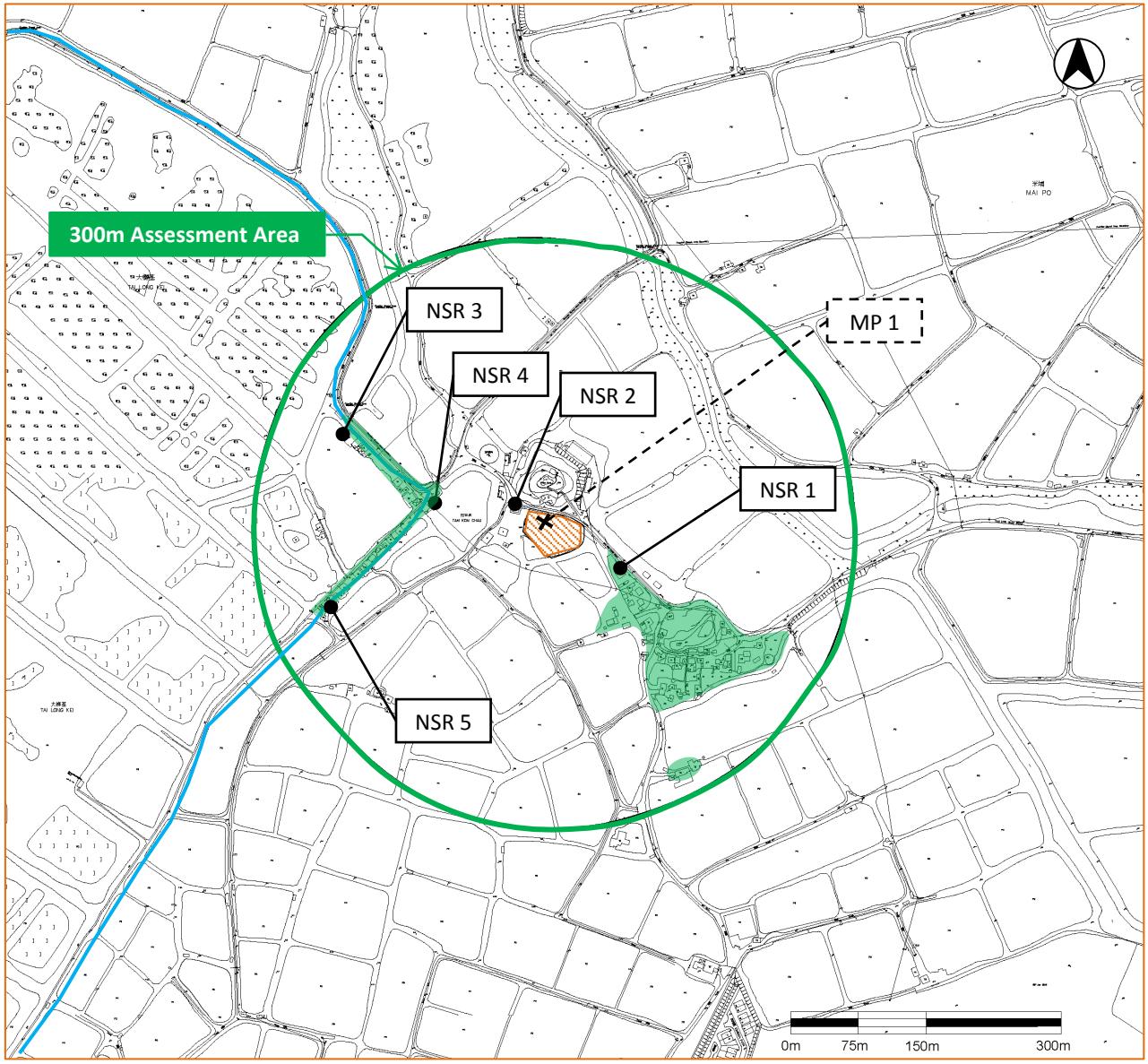
A.3.33 A quantitative assessment of noise impacts was carried out for the demolition and rebuild of PSFSC. Results show noise levels that do not exceed the EIAO-TM noise criteria at the representative NSRs with the installation of the proposed construction noise barrier.

A.3.34 With the implementation of good site practice, adverse noise impacts during the demolition and construction stages are not anticipated. As such, further noise mitigation measures during the construction stage are not necessary.

A.3.35 There will be no sources of noise arising from PSFSC during the operation stage. As such mitigation measures are not required during the operation stage.

A.3.36 Overall, therefore, no adverse noise impact is anticipated during the demolition or rebuild of PSFSC.

Figure A3-1 Location of Representative NSRs



Legend:

- PSFSC Site
- MPNR Boundary
- Residential Areas
- Representative NSRs
- Background Noise Measurement Location

Figure A3-2 Noise Contour during Construction stage at PSFSC – Unmitigated Scenario

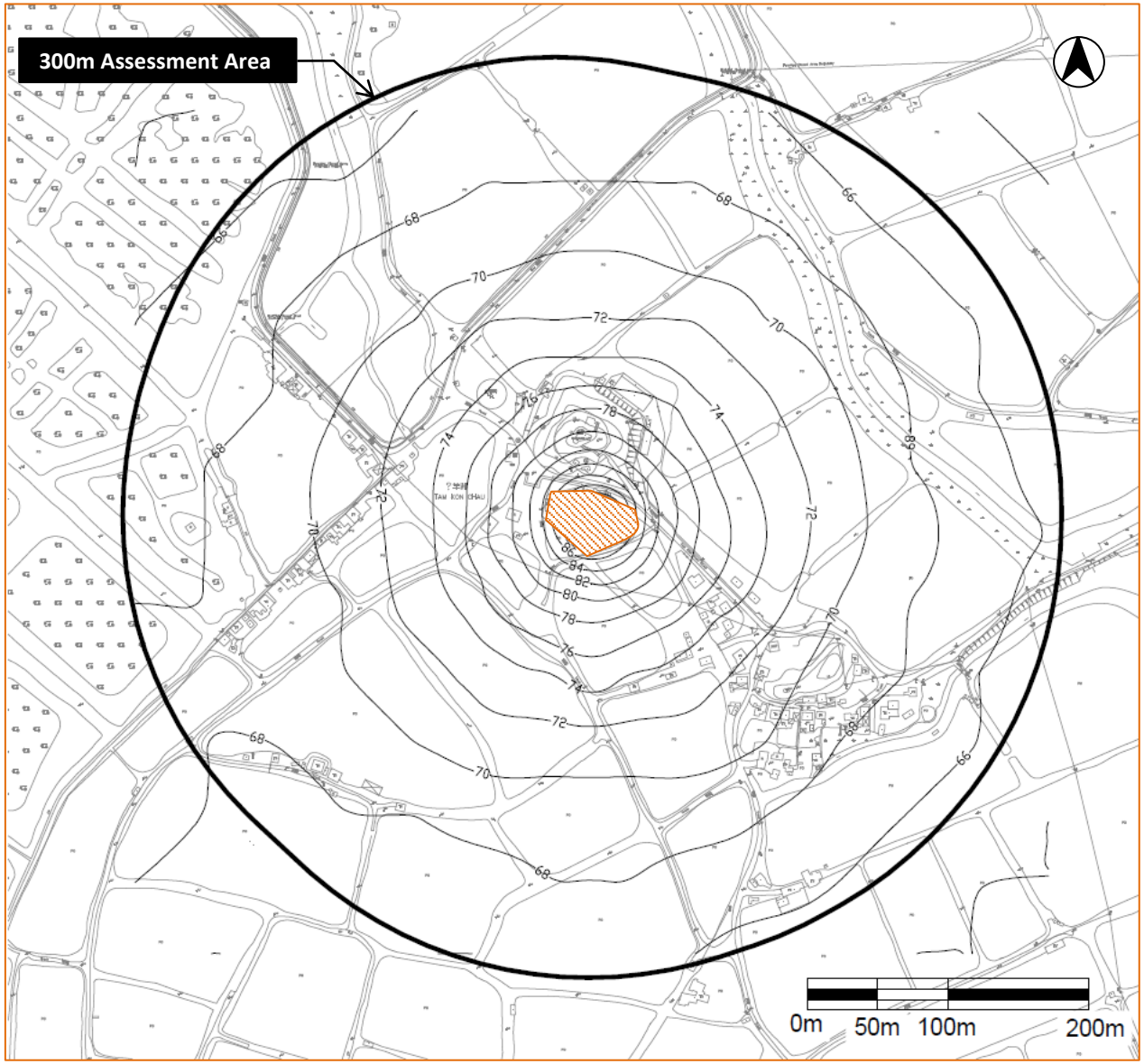


Figure A3-3 Noise Mitigation at PSFSC

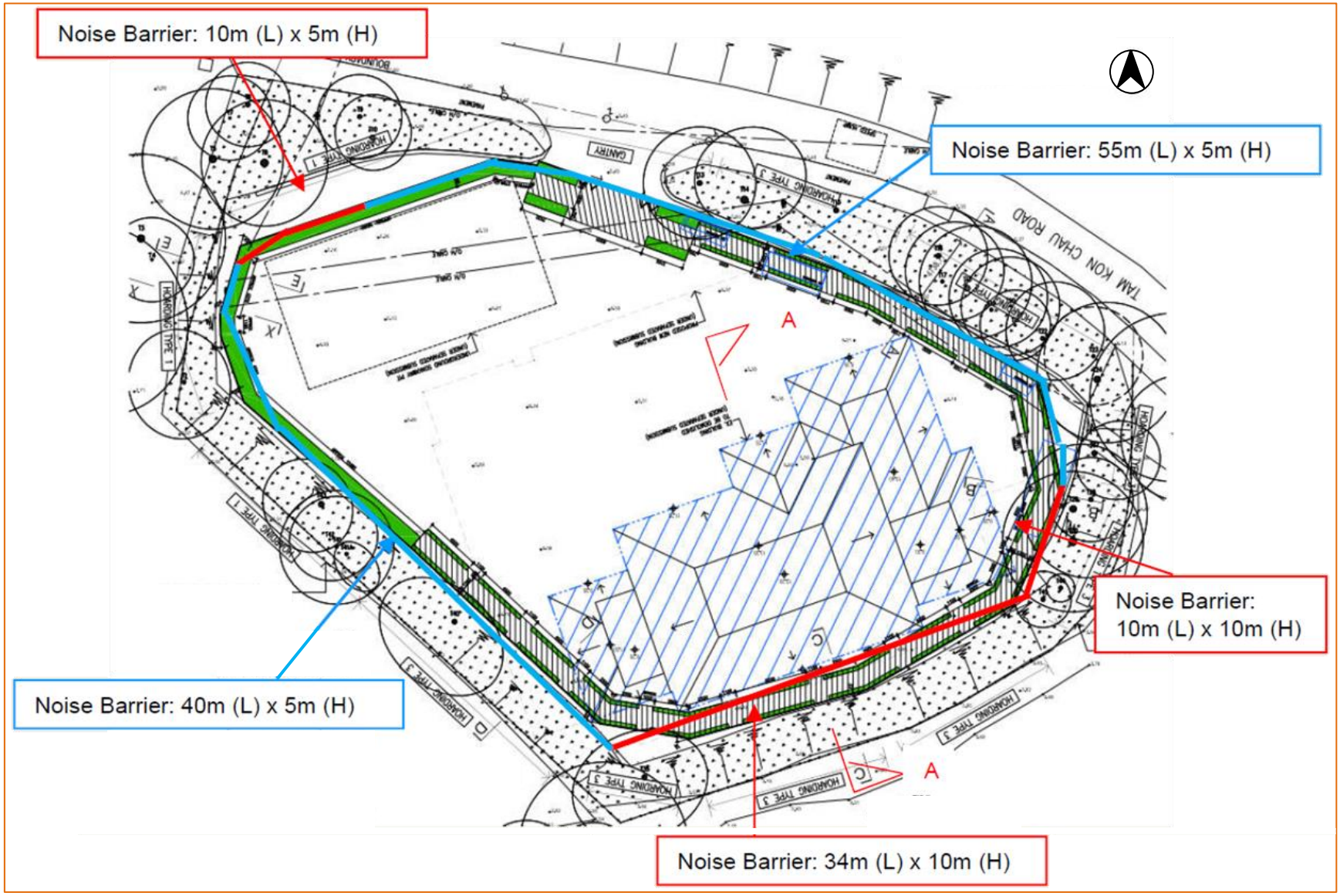
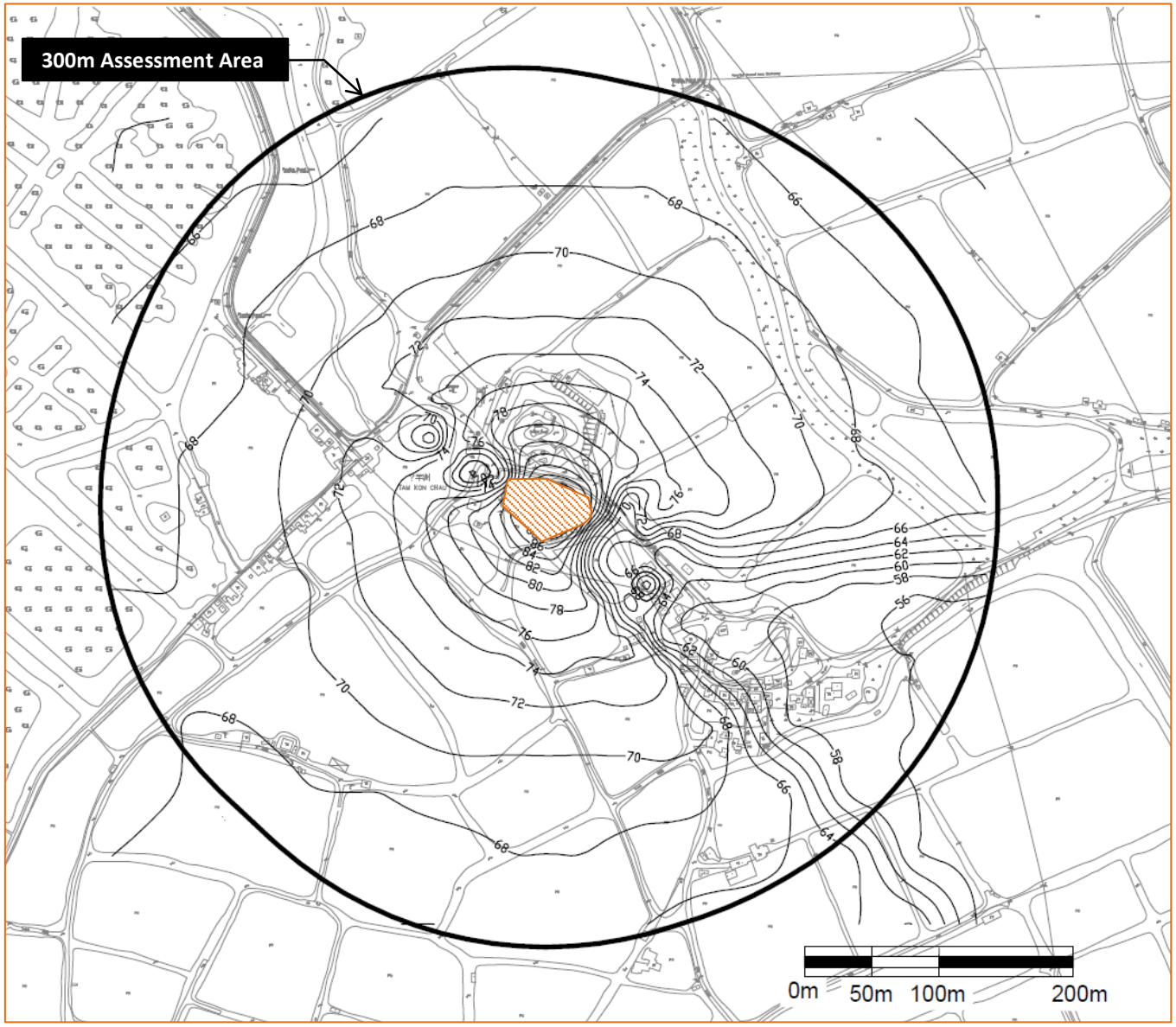


Figure A3-4 Noise Contour during Construction stage at PSFSC – Mitigated Scenario



A.4 Water Quality / Sewage Treatment

Introduction

A.4.1 This water quality and sewage treatment assessment has been carried out to identify, qualify and quantify the potential water quality impacts arising from the demolition, rebuild and operation of the PSFSC.

A.4.2 Although this is not a DP, the assessment methodology generally follows that required under the EIAO-TM and the assessment has been carried out at a similar level of detail as it would be for a DP under the EIAO.

Legislation, Standards and Guidelines

Water Pollution Control Ordinance

A.4.3 The Water Pollution Control Ordinance (WPCO) (Cap. 358) enacted in 1980 is the principal legislation controlling water quality in Hong Kong. Under the WPCO, Hong Kong waters are classified into 10 Water Control Zones (WCZ). The Project Site is situated within the catchment area of the Deep Bay WCZ.

A.4.4 Water Quality Objectives (WQOs) are specified for each WCZ. The WQOs for any particular waters, as defined in the WPCO, shall be the quality, which should be achieved and maintained in order to promote conservation and best use of those waters in the public interest. The WQOs designated for Deep Bay WCZ are listed in ***Table A4-1***.

Table A4-1 Key Water Quality Objectives for Inland Waters in Deep Bay WCZ

Parameter	WQOs
pH range	6.0 – 9.0
Maximum 5-Day Biochemical Oxygen Demand, mg/L	5
Maximum Chemical Oxygen Demand, mg/L	30
Maximum Annual Median Suspended Solids, mg/L	20
Minimum Dissolved Oxygen, mg/L	4
Unionised Ammonia (annual mean), mg/L	0.021
E. coli (median), count/100 mL	1000

Notes: Refers to Key WQOs for river monitoring stations in the Northwestern New Territories, *River Water Quality in Hong Kong in 2014* published by EPD and Statement of WQOs (Deep Bay Control Zone), Schedule of Cap 358R.

Environmental Impact Assessment Ordinance

A.4.5 Annex 6 and 14 of the EIAO-TM outline the criteria and guidelines for evaluating and assessing water quality impact.

Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters

A.4.6 The *Technical Memorandum (TM) for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* issued under section 21 of the WPCO sets the limits that make effluents acceptable into foul sewers, storm water drains, inland and coastal waters. These limits control the physical, chemical and microbial quality of effluents.

A.4.7 At present, there is no direct discharge of effluent from PSFSC into Deep Bay. Instead, effluent from the existing septic tank that serves the PSFSC soaks away into the ground (details of the current arrangement are given below). According to the TM, discharge into groundwater follows the same standards as discharge to inland waters. The beneficial use of inland water (or groundwater) is the only criteria that determines the standard adopted for discharge, and the use is classified into Groups A to D as follows:

A. Abstraction for potable water supply
B. Irrigation
C. Pond fish culture
D. General amenity and secondary contact recreation

A.4.8 According to the TM, "Group C waters are those running through areas where there are large numbers of fish ponds, mostly in the Yuen Long area" and so this is the appropriate standard to adopt for PSFSC, as shown in ***Table A4-2***.

Table A4-2 Standards for Effluent Discharged into Group C Inland Waters

Determinand	Flow Rate (m^3/day)			
	≤200	>200 and ≤400	>400 and ≤600	>600 and ≤800
pH (pH units)	6-9	6-9	6-9	6-9
Temperature (°C)	30	30	30	30
Colour (lovibond units) (25mm cell length)	1	1	1	1
Suspended solids	20	10	10	5
BOD	20	15	10	5
COD	80	60	40	20
Oil & Grease	1	1	1	1
Boron	10	5	4	2
Barium	1	1	1	0.5
Iron	0.5	0.4	0.3	0.2
Mercury	0.001	0.001	0.001	0.001
Cadmium	0.001	0.001	0.001	0.001
Silver	0.1	0.1	0.1	0.1
Copper	0.1	0.1	0.05	0.05
Selenium	0.1	0.1	0.05	0.05
Lead	0.2	0.2	0.2	0.1
Nickel	0.2	0.2	0.2	0.1
Other toxic metals individually	0.5	0.4	0.3	0.2
Total toxic metals	0.5	0.4	0.3	0.2
Cyanide	0.05	0.05	0.05	0.01
Phenols	0.1	0.1	0.1	0.1
Sulphide	0.2	0.2	0.2	0.1
Fluoride	10	7	5	4
Surfactants (total)	15	15	15	15
Sulphate	800	600	400	200
Chloride	1,000	1,000	1,000	1,000
Total phosphorus	10	10	8	8
Ammonia nitrogen	2	2	2	1
Nitrate + nitrite nitrogen	30	30	20	20
Surfactants (total)	2	2	2	1
E. coli (count/100 ml)	1,000	1,000	1,000	1,000

Note: All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated.

Construction Site Drainage, ProPECC PN1/94

A.4.9 Under ProPECC Practice Note PN1/94 Construction Site Drainage (ProPECC PN1/94), various guidelines for the handling and disposal of construction site discharges are included. The guidelines include the use of sediment traps, wheel washing facilities for vehicles leaving the Site, adequate maintenance of drainage systems to prevent flooding and overflow, sewage collection and treatment, and comprehensive waste management (collection, handling, transportation, and disposal) procedures.

Town Planning Board Note 12C

A.4.10 TPB PG-No. 12C (Revised May 2014) are *Town Planning Board (TPB) Guidelines For Application for Developments Within Deep Bay Area Under Section 16 of the Town Planning Ordinance*. While these are primarily aimed at new housing and commercial developments on former fishpond or agricultural areas, the intent is still appropriate to consider for the redevelopment of PSFSC, even though this does not require planning approval under Section 16 of the TPO.

A.4.11 TPB PG-No. 12C simply requires that new developments "…should not add to the pollution loading of the Deep Bay Area". Essentially this means that no additional pollution loading shall be allowed above existing levels.

A.4.12 While this is purely a planning consideration, and PSFSC does not require a planning application, WWF understand the reasoning behind the need to protect the Deep Bay Area and so will also follow this requirement.

Deep Bay Guidelines for Drainage, Reclamation and Drainage Works

A.4.13 These Guidelines were prepared back in 1991 to ensure that any necessary dredging, reclamation and drainage works carried out in the Deep Bay Area are executed in such a way that the particular environmental value and sensitivity of the area are fully recognised, respected and adequately taken into account.

A.4.14 Although these Guidelines are out of date and the works for PSFSC do not involve dredging, reclamation or drainage works to be carried out in the Deep Bay Area, these Guidelines have nevertheless been reviewed to ensure that the works for PSFSC have been designed to achieve the intent of the Guidelines.

Potential Impacts – Construction Stage

A.4.15 The demolition and rebuild of PSFSC will not result in the alternation of any water courses, natural streams, ponds, change of water holding/flow regimes, change of catchment types or areas, erosion or sedimentation. There will be no hydrological change due to the demolition and rebuild of PSFSC.

Typical Pollution Sources

A.4.16 For a typical construction site, water quality impacts can arise from the following:

- General construction activities.
- Construction site runoff.
- Construction works near Waterbodies.
- Accidental spillage.
- Sewage effluent from construction workforce.

General Construction Activities

A.4.17 Construction works could have the potential to cause water pollution. Various types of construction activities may generate wastewater. These include general cleaning and polishing, wheel washing, dust suppression and utility installation. These types of wastewater would contain high concentrations of Suspended Solids (SS). Various construction works may also generate debris and rubbish such as packaging, construction materials and refuse. Uncontrolled discharge of site effluents, rubbish and refuse generated from the construction works would lead to deterioration in water quality.

Construction Site Runoff

A.4.18 Surface runoff generated from the construction site may contained increased loads of SS and contaminants. Potential pollution sources of site runoff may include:

- Runoff and erosion of exposed bare soil and earth, drainage channel, earth working area and stockpiles.
- Release of any bentonite slurries, concrete washings and other grouting materials with construction runoff or stormwater.
- Wash water from dust suppression sprays and wheel washing facilities.
- Fuel, oil and lubricants from maintenance of construction vehicles and equipment.

A.4.19 During rainstorms, site runoff would wash away the soil particles on work areas and areas with the topsoil exposed. The construction runoff is generally characterised by high concentrations of SS. Release of uncontrolled site runoff would increase the SS levels, turbidity and cause depletion of dissolved oxygen levels in the nearby water environment. Site runoff may also wash away contaminants and therefore cause off-site water pollution.

A.4.20 Windblown dust would be generated from exposed soil surfaces in the works areas. It is possible that windblown dust would fall directly onto the nearby water bodies when a strong wind occurs. Dispersion of dust within the works areas may increase the SS levels in surface runoff causing a potential impact to the nearby sensitive receivers.

A.4.21 According to the *DSD Stormwater Drainage Manual*, annual rainfall in Hong Kong is around 2,200mm. However, the EPD study *Update on Cumulative Water Quality and Hydrological Effect of Coastal Developments and Upgrading of Assessment Tool (Update Study* suggested that only rainfall events of sufficient intensity and volume would give rise to runoff and that runoff percentage is about 44% for the dry and 82% for the wet season. Therefore, only 1,386mm of 2,200mm annual rainfall would be considered as effective rainfall that would generate runoff (i.e. 1386mm=2200mm×(82%+44%)÷2).

Construction Works near Water Bodies

A.4.22 Pollution of inland waters may occur due to potential release of construction wastes and wastewater from the adjacent works area. Construction wastes and wastewater are generally characterized by high concentration of SS and elevated pH.

Accidental Spillage

A.4.23 The use of chemicals such as 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 runoff into the nearby water environment, increasing hydrocarbon levels.

Sewage Effluent from Construction Workforce

A.4.24 During construction of a project, the workforce on site will generate sewage, which are characterized by high levels of BOD, ammonia and E. coli counts. Based on the *DSD Sewerage Manual*, the sewage production rate for construction workers is estimated at 0.35m^3 per worker per day. Thus, for every 100 construction workers working simultaneously at the construction site, about 35m^3 of sewage would be generated per day. Potential water quality impacts upon the local drainage and fresh water system may arise from these sewage effluents, if uncontrolled.

Assessment – Construction Stage

A.4.25 The Demolition Works Contractor and Construction Works Contractor shall follow good site practice (as discussed in ***Paragraph A4.40***, below) and shall be responsible for the design, construction, operation and maintenance of relevant mitigation measures specified in *ProPECC PN 1/94* for construction site drainage in order to avoid any uncontrolled discharge and potential impacts on the surrounding Conservation Area. Specified good site practice and code of behaviour shall be included in the works contract documents.

A.4.26 Excavation and filling will be required during the foundation; utilities and road works and also for the new soakaway system to take treated sewage effluent from the on-site STP. Properly controlled with sedimentation tanks and drainage systems, stormwater runoff cannot bring along sediment and other pollutants into nearby water bodies.

A.4.27 Particulates as well as effluent, fuels and lubricants from machinery, liquid spillage and the like may be generated on-site during the construction stage. Pollutants can flow into nearby water bodies as non-point source discharge which has to be properly controlled.

A.4.28 The PSFSC Site will be provided with a sufficient number of chemical toilets for use by workers. Sewage collected in these chemical toilets will be treated off-site by the toilet provider.

A.4.29 With the above measures in place – and regularly checked/audited by the Environmental Team (ET) and the Independent Environmental Checker (IEC) – there will be no point or non-point pollution sources due to the demolition and rebuild works for PSFSC. Runoff from works areas will be controlled and, as such, there will be no pollution of the surrounding Conservation Area, fishponds or ecologically sensitive gei wai and, consequently, no pollution of Deep Bay.

A.4.30 Overall, therefore, no adverse water quality impact is anticipated during the demolition or construction stages.

Potential Impacts and Assessment – Operation Stage

Current Situation

A.4.31 There are no existing public sewers in the vicinity of PSFSC and there are no plans to extend the public sewerage system to this area in the near future. When PSFSC was built, it was provided with a septic tank and soakaway system to treat wastewater, including that from toilets. This is common practice in rural areas not connected to public sewerage systems.

A.4.32 It is presumed that the septic tank and soakaway system for PSFSC was constructed in accordance with EPD's *Guidance Notes On Discharges From Village Houses* or its preceding publication. A sketch showing the current septic tank and soakaway system is given in ***Figure A4-1***. Based on WWF's estimates, the current septic tank and soakaway system has an Average Dry Weather Flow (ADWF) of around 8.7m^3/day.

Future Situation

A.4.33 The redevelopment of PSFSC will result in a moderate increase in wastewater generation from toilets serving the expected number of visitors to the PSFSC facilities; en-suite toilets in 11 rooms associated with overnight accommodation serving the same 24 number of guests as now accommodated in six hostel rooms; and more wastewater from a modernised kitchen and refreshment facilities for all visitors. The future wastewater generation from the new PSFSC is therefore greater than the current flow.

A.4.34 It is possible to upgrade the existing septic tank and soakaway system to meet latest standards and accommodate a greater flow, but since there are limitations to the treatment efficiency of a septic tank and soakaway system, this would result in increased discharge of pollutants and may increase pollution loading to Deep Bay, which runs contrary to TPB PG-No. 12C.

Proposed Wastewater Treatment System

A.4.35 To meet the requirements of WPCO, TPB PG-No. 12C and the expectations of stakeholders for WWF to adopt a high standard of wastewater treatment, WWF will construct a new wastewater treatment system at PSFSC that deals with both greywater (with reuse) and sewage and also meets the highest standards for discharge. A schematic of this system, comprising a Greywater Treatment System (GWTS) and a Sewage Treatment Plant (STP) is shown in ***Figure A4-1***.

A.4.36 From this it can be seen that greywater from bathroom sinks and showers will be reclaimed in the GWTS and treated to the standard stipulated in WSD's *Technical Specifications on Grey Water Reuse and Rainwater Harvesting*, which is summarised in ***Table A4-3***, below. This reclaimed water will be used for toilet flushing.

A.4.37 Surplus reclaimed water from the GWTS that is not needed for toilet flushing will feed into the new STP, along with sewage from toilets and wastewater from kitchen sinks and floor drains. Based on EPD's *Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning*, the new STP will require a design capacity of 24m^3/day (including 100% of the GWTS reclaimed water).

A.4.38 The STP will adopt a Membrane Bioreactor (MBR) treatment system to produce a treated sewage effluent that meets the Group A standard for discharge into inland waters, and will be discharged into the ground beneath PSFSC through a new soakaway system (there

are no surface water channels for this treated effluent to be discharged into within the PSFSC Site). WWF will apply for a Discharge Licence under WPCO for this discharge.

Table A4-3 WSD Standards for Reclaimed Water

Parameter	Unit	Recommended Standard
E. coli	cfu /100 ml	Non detectable
Total Residual Chlorine	mg/l	≥ 1 exiting treatment system; ≥ 0.2 at user end
Dissolved Oxygen	mg/l	≥ 2
Total Suspended Solids (TSS)	mg/l	≤ 5
Colour	Hazen unit	≤ 20
Turbidity	NTU	≤ 5
pH		6 - 9
Threshold Odour Number (TON)		≤ 100
5-day Biochemical Oxygen Demand (BOD5)	mg/l	≤ 10
Ammoniacal nitrogen	mg/l as N	≤ 1
Synthetic detergents	mg/l	≤ 5

Source: WSD's *Technical Specifications on Grey Water Reuse and Rainwater Harvesting, 1st Edition*, May 2015.

Notes:

1. Apart from total residual chlorine which has been specified, the water quality standards for all parameters shall be applied at the point-of-use of the system.
2. Where recycled water is treated for immediate usage, the level of total residual chlorine may be lower than the one specified in this table.
3. Immediate usage means the collected greywater is drawn into the treatment process immediate before a particular round of usage and the treated water will be depleted after that round of usage is completed.

A.4.39 It should be noted that the Group A discharge standard is more stringent that the Group C discharge standard required under WPCO, which itself is more stringent that direct discharge into the coastal waters of Deep Bay. By electing to meet the Group A standard, WWF is demonstrating its commitment to achieving the highest standards of environmental protection, above and beyond what is legally required. A comparison between Group A, Group C and Deep Bay WCZ is provided in ***Table A4-4***, below.

A.4.40 ***Table A4-5***, also below, compares the estimated pollution loading from the existing Septic Tank System with flow of around 8.7m^3/day to the estimated pollution loading from the new MBR STP with design capacity of 24m^3/day.

Table A4-4 Comparison Between WPCO Discharge Standards for Group A, Group C and Deep Bay WCZ for ADWF of 24m^3/day

Determinand	Group A Inland Waters	Group C Inland Waters	Deep Bay WCZ
Flow Rate (m^3/day)	>10 and ≦200	≦100	>10 and ≦200
pH (pH units)	6.5-8.5	6-9	6-9
Temperature (°C)	35	30	45
Colour (lovibond units)	1	1	1
Conductivity (µs/cm at 20°C	1000		
Suspended solids	10	20	50
Dissolved Oxygen	≧4		
BOD	10	20	20
COD	50	80	80
Oil & Grease	1	1	20
Boron	2	10	4
Barium	2	1	4
Iron	2	0.5	10
Arsenic	0.05		
Total Chromium	0.05		
Mercury	0.001	0.001	0.001
Cadmium	0.001	0.001	0.001
Silver		0.1	
Copper	0.2	0.1	
Selenium	0.1	0.1	
Lead	0.1	0.2	
Manganese	0.5		
Zinc	1		
Nickel		0.2	
Other toxic metals individually	0.1	0.5	0.5
Total Toxic metals	0.3	0.5	1
Cyanide	0.05	0.05	0.1
Phenols	0.1	0.1	0.5
Hydrogen Sulphide	0.05		
Sulphide	0.2	0.2	5
Fluoride	1	10	
Sulphate	800	800	
Chloride	800	1000	
Total residual chlorine			1
Total phosphorus	1	10	10
Ammonia nitrogen	1	2	
Nitrate + nitrite nitrogen	15	30	
Total nitrogen			100
Surfactants (total)		2	15
E. coli (count/100ml)	<1	1000	1000

Note: All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated.

Source: Technical Memorandum on Standards For Effluents Discharged Into Drainage and Sewerage Systems, Inland and Coastal Waters, Tables 3, 5 and 8.

Table A4-5 Comparison of Pollutant Loading from Existing Septic Tank System and New MBR STP

Effluent Parameter	Existing Septic Tank	New MBR STP	Difference in Loading	Remarks
Flow Rate, m^3/day	**Actual 8.70**	**Design 24.00**		
BOD_5 of Treated Effluent, mg/L	138.00	10.00		See Note 2 for BOD_5 concentration of the existing Septic Tank System. The BOD_5 concentration of MBR effluent is <5mg/L as per Note 3. To meet for Group A discharge standard, this has been set to 10mg/L.
BOD_5 Loading, g/day	**1,200.60**	**240.00**	**– 960.60**	**The BOD_5 loading from the new MBR STP will be less than that of the existing Septic Tank System, therefore TPB Note 12C is achieved.**
COD of Treated Effluent, mg/L	327.00	50.00		See Note 2 for COD concentration of the existing Septic Tank System STS. The COD concentration of MBR effluent is <30mg/L as per Note 3. To meet for Group A discharge standard, this has been set to 50mg/L.
COD Loading, g/day	**2,844.90**	**1,200.00**	**– 1,644.90**	**The COD loading from the new MBR STP will be less than that of the existing Septic Tank System, therefore TPB Note 12C is achieved.**
Suspended Solids (SS) of Treated Effluent, mg/L	49.00	10.00		See Note 2 for SS concentration of the existing Septic Tank System STS. The SS concentration of MBR effluent is <1mg/L as per Note 3. To meet for Group A discharge standard, this has been set to 10mg/L.
SS Loading, g/day	**426.30**	**240.00**	**– 186.30**	**The SS loading from the new MBR Plant will be less than that of the existing Septic Tank System, therefore TPB Note 12C is achieved.**
Total Nitrogen (N) of Treated Effluent, mg/L	45.00	15.00		See Note 2 for Total N concentration of the existing Septic Tank System STS. The Total N concentration of MBR effluent is <6mg/L as per Note 3 To meet for Group A discharge standard, this has been set to15mg/L.
Total N Loading, g/day	**391.50**	**360.00**	**– 31.50**	**The Total N loading from the new MBR Plant will be less than that of the existing Septic Tank System, therefore TPB Note 12C is achieved.**

Effluent Parameter	Existing Septic Tank	New MBR STP	Difference in Loading	Remarks
Flow Rate, m^3/day	**Actual 8.70**	**Design 24.00**		
Total Phosphorus (P) of Treated Effluent, mg/L	20	1.00		See Note 2 for Total P concentration of the existing Septic Tank System. The Total P concentration of MBR effluent is <0.7mg/L as per Note 3. To allow for a more conservative assessment, this has been doubled to 1.4mg/L.
Total P Loading, g/day	**174.00**	**24.00**	**– 150.00**	**The Total P loading from the new MBR Plant will be less than that of the existing Septic Tank System, therefore TPB Note 12C is achieved.**
Faecal Coliform in Treated Effluent (cfu/100mL)	10,000,000.00	40.00		See Note 2 for faecal coliform concentration of the existing Septic Tank System. The faecal coliform concentration of MBR effluent is 10-20cfu/100mL as per Note 3. To allow for a more conservative assessment, this has been doubled to 40cfu/100mL.
Total Faecal Coliform Loading, cfu/day	**870,000,000.00**	**9,600.00**	**– 869,990,400.00**	**The *E.coli* loading from the New MBR Plant will be less than that of the existing Septic Tank System, therefore TPB Note 12C is achieved.** Note that the Group A discharge standard of 1cfu/100ml cannot be achieved by the MBR alone, therefore the STP will be equipped with ultraviolet disinfection to achieve the required <1cfu/100ml.

Notes:

1. STS = Existing Septic Tank System with Soakaway. The new MBR System also uses a (new) soakaway.
2. The mean parameters for the effluent of septic tank/soakaway refers to Table 6-1 of *Design Manual, Onsite Wastewater Treatment and Disposal Syst*ems, USEPA, October 1980, and Total P concentration refers to Section 6.2.4 of the *Design Manual*.
3. The performance parameters for the MBR are from the proposed MBR provider, Dunwell Engineering Co Ltd, but MBR performance from other suppliers will be broadly similar.
4. Section 6.2.4 of the *Design Manual* states "bacterial concentrations in the effluent are not significantly changed since septic tanks cannot be relied upon to remove disease-causing micro-organisms". Thus the faecal coliform concentration for STS will be the same as for raw domestic sewage. Table 3-19 of *Wastewater Engineering, 4th Edition*, Metcalf & Eddy, 2003, gives the typical range of faecal coliform concentration in 100mL of domestic sewage as 10^5 to 10^7, so 10^6 has been adopted.

A.4.41 It can be seen from ***Table A4-5***, the pollution loading from the new MBR STP compared to that of the existing Septic Tank System is significantly lower in terms of BOD, COD, SS, Total N, Total P and Faecal Coliforms – typical measures of organic (sewage) pollutant loading. As such, TPB Note 12C requiring that new developments "... should not add to the pollution loading of the Deep Bay Area" is complied with.

A.4.42 The estimated pollution loading from the new MBR STP in ***Table A4-5*** is based on manufacturer's data and to allow for a conservative assessment, all values have been doubled. Even allowing for this conservative assessment, it can be seen that the new MBR STP will fully comply with TPB PG-No. 12C.

A.4.43 Note that disinfection of the treated sewage effluent from the MBR will be required to further reduce *E.coli* count to meet the Group A Discharge Standard. Ultraviolet (UV) disinfection will be used to achieve the <1cfu per 100mL standard for *E.coli* required by the Group A Discharge Standard.

A.4.44 Overall, with the operation of the new STP, no adverse water quality impact is anticipated during the operation stage of PSFSC.

Mitigation Measures

Construction Stage

A.4.45 The Works Contractor shall follow good site practice and be responsible for the design, construction, operation and maintenance of applicable mitigation measures specified in *ProPECC PN 1/94* for construction site drainage:

- 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 sediment 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 shall be provided where necessary to intercept surface runoff from outside the works areas so that it will not wash across the works areas.
- For the purpose of preventing soil erosion, temporarily exposed slope surfaces shall be covered e.g. by tarpaulin, and temporary access roads shall be protected by crushed stone or gravel.
- Intercepting channels shall be provided (e.g. along the crest/edge of excavation) to prevent storm runoff from washing across exposed soil surfaces. Arrangements shall always be in place to ensure that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm.
- Earthworks final surfaces shall be well compacted and the subsequent permanent work or surface protection shall be carried out immediately after the final surfaces are formed to prevent erosion caused by rainstorms.
- Measures shall be taken to minimise the ingress of rainwater into trenches. If excavation of trenches in wet seasons is necessary, they shall be dug and backfilled in short sections.
- Silt removal facilities, channels and manholes should be maintained and the deposited silt and grit should be removed regularly.

- All vehicles and plant should be cleaned before they leave a construction site to ensure no earth, mud, debris and the like is deposited by them on roads. A wheel washing bay should be provided at every site exit if practicable and wash-water should have sand and silt settled out or removed before discharging into storm drains. The section of construction road between the wheel washing bay and the public road should be paved with backfall to reduce vehicle tracking of soil and to prevent site run-off from entering public road drains.

Operation Stage

A.4.46 No mitigation measures are required during the operation stage as all wastewater will be treated by the on-site STP to Group A standard under WPCO and the requirements of TPB PG-No. 12C will be met. WWF will apply for a Discharge Licence under WPCO for the treated sewage effluent from the STP and regular monitoring of effluent will demonstrate to the satisfaction of the Authority that there is no unacceptable pollution.

Conclusion

A.4.47 During demolition and rebuild, the Works Contractor shall follow good site practice and be responsible for the design, construction, operation and maintenance of applicable mitigation measures specified in ProPECC PN 1/94 for construction site drainage. With these measures in place, it is unlikely than any adverse water quality impacts from the PSFSC Site will be generated during the demolition and construction stages.

A.4.48 The redevelopment of PSFSC will result in a moderate increase in wastewater generation from toilets serving the expected number of visitors to the Peter Scott facilities; en-suite toilets in 11 rooms associated with overnight accommodation serving the same 24 number of guests as now accommodated in six hostel rooms; and more wastewater from a modernised kitchen and refreshment facilities for all visitors. The future wastewater generation from the new PSFSC is therefore greater than the current flow. Rather than upgrade the existing septic tank and soakaway system, WWF will construct a new wastewater treatment system at PSFSC that deals with both greywater (with reuse) and sewage and also meets the highest standards for discharge – that for Group A Inland Waters under WPCO. During operation, therefore, no adverse water quality impact is anticipated.

A.4.49 Overall, therefore, no adverse water quality impact is anticipated during the demolition, construction or operation stages of PSFSC.

Figure A4-1a The Existing Septic Tank and Soakaway System Currently in Operation at PSFSC – Septic Tank Design

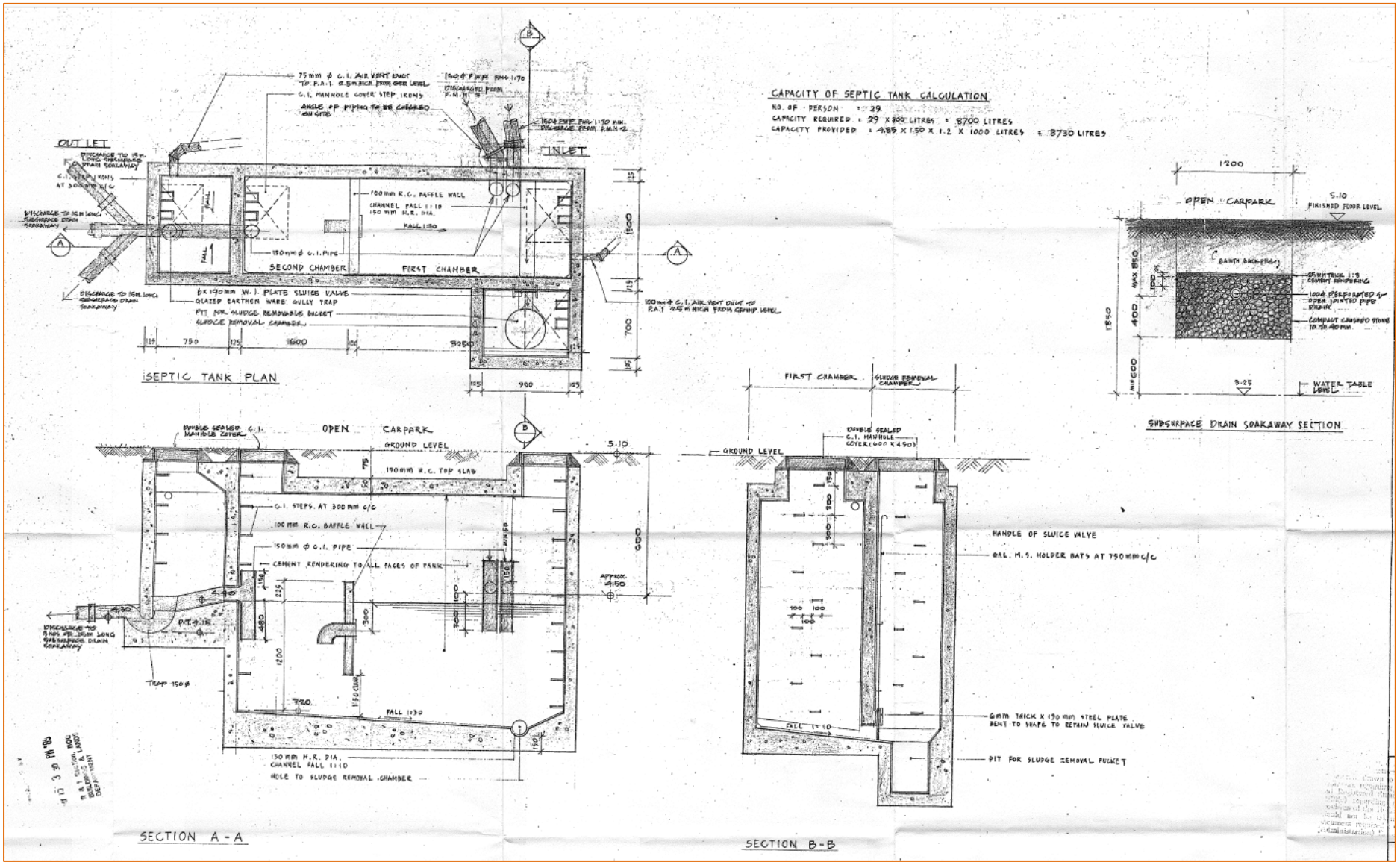
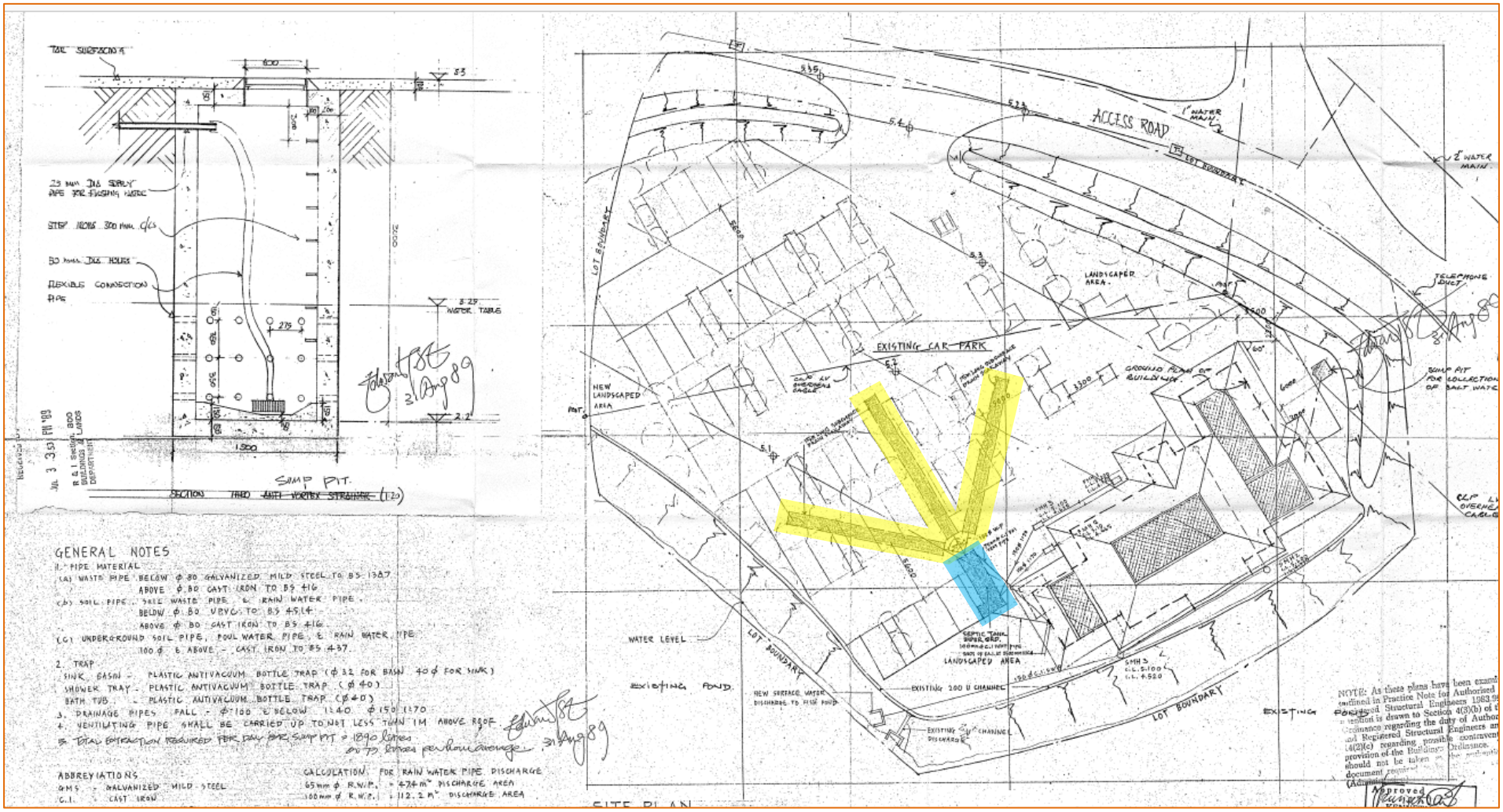
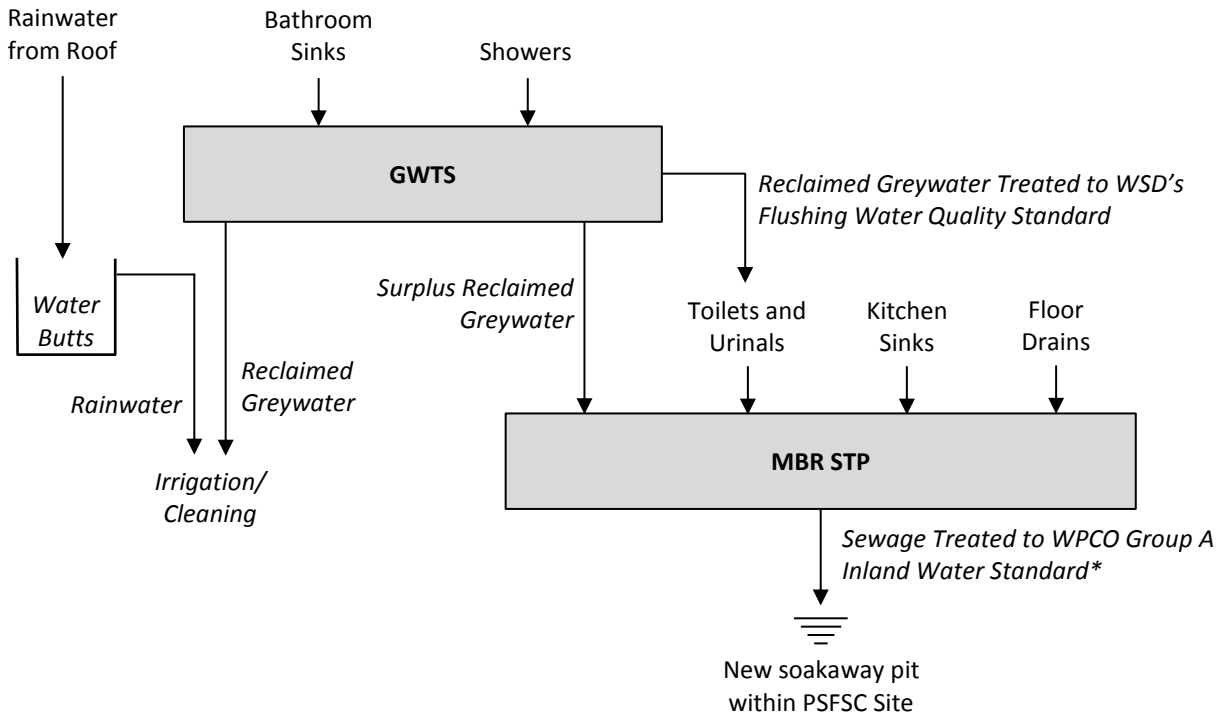


Figure A4-1b The Existing Septic Tank and Soakaway System Currently in Operation at PSFSC – Location of Septic Tank and Soakaway



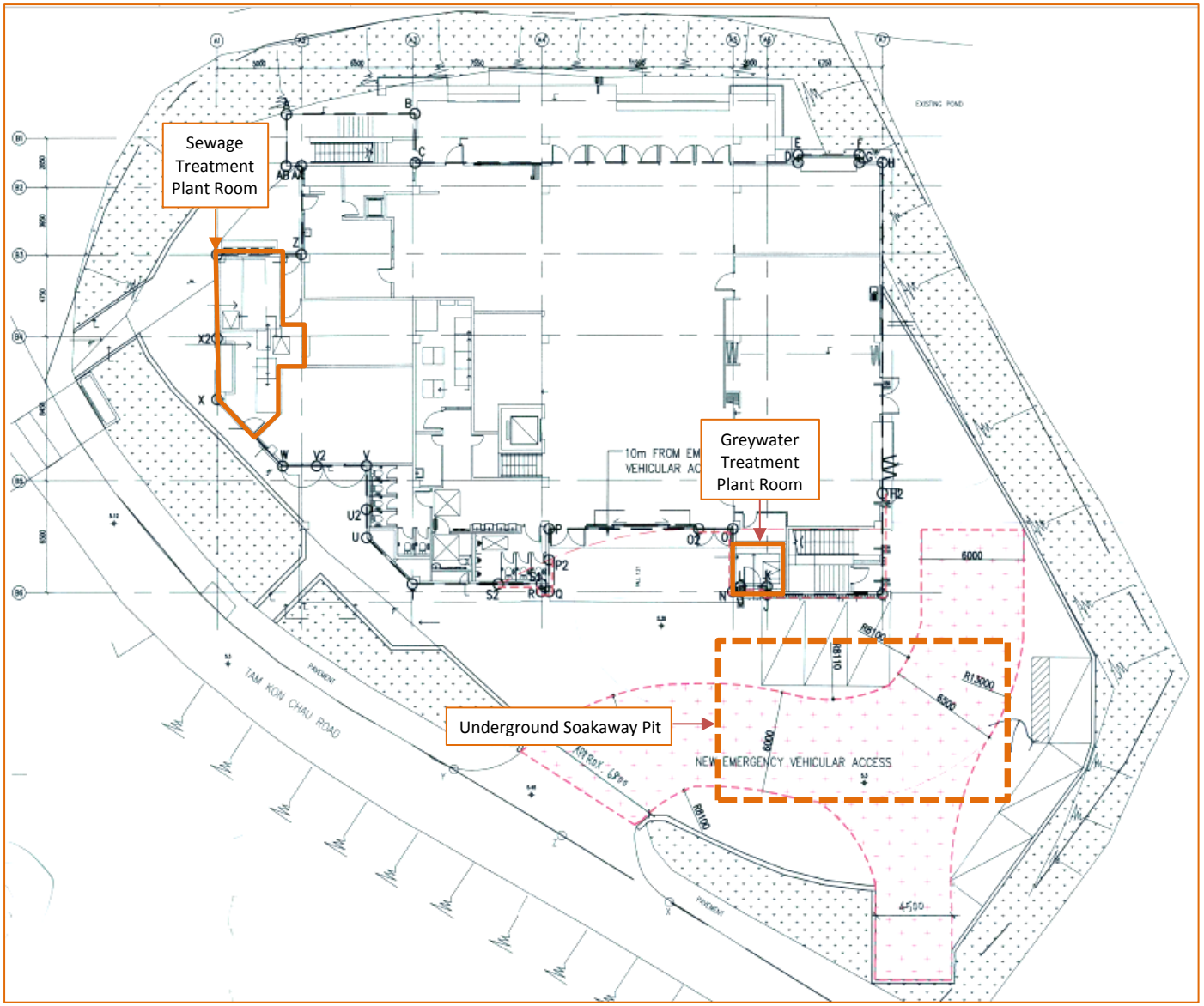
Note: The septic tank is highlighted in blue; and the soakaway is highlighted in yellow.

Figure A4-2 Schematic of Proposed GWTS and STP System



Note: * This is a more stringent standard than Group C and that for discharge to Coastal Waters of Deep Bay – see ***Table A4-4***.

Figure A4-3 Indicative Layout of Proposed GWTS, STP and Associated Soakaway



A.5 Waste Management Implications

Introduction

A.5.1 This waste assessment has been carried out to identify, qualify and quantify the potential waste impacts arising from the demolition, rebuild and operation of the PSFSC.

A.5.2 Although this is not a DP, the assessment methodology generally follows that required under the EIAO-TM and the assessment has been carried out at a similar level of detail as it would be for a DP under the EIAO.

Legislation, Standards and Guidelines

A.5.3 The principle legislation governing waste management in Hong Kong is the Waste Disposal Ordinance (Cap. 354) (WDO), and its subsidiary regulations. The Ordinance, enacted in 1980, generally encompasses all stages of waste management, from place of arising to final disposal point of waste. The Waste Disposal (Chemical Waste) (General) Regulation, enacted under the WDO in 1992, provides controls on all aspects of chemical waste disposal, including storage, collection, transport, treatment and final disposal.

A.5.4 In carrying out the solid waste assessment, reference has been made to the following relevant legislation, documents and guidelines:

- The WDO (Cap. 354) setting out requirements for storage, handling and transportation of all types of wastes, and subsidiary legislation such as the Waste Disposal (Charges for Disposal of Construction Waste) Regulation and the Waste Disposal (Chemical Waste) (General) Regulation
- Environmental, Transport and Works Bureau (ETWB) Technical Circular (Works) No. 19/2005, Environmental Management on Construction Sites
- Environmental, Transport and Works Bureau (ETWB) Technical Circular (Works) No. 22/2003A, Additional Measures to Improve Site Cleanliness and Control Mosquito Breeding on Construction Sites
- Environmental, Transport and Works Bureau (ETWB) Technical Circular (Works) No. 33/2002, Management of Construction & Demolition Material Including Rock
- Development Bureau (DevB) Technical Circular (Works) No. 6/2010, Trip Ticket System for Disposal of Construction & Demolition Materials

Types of Waste

A.5.5 The following types of waste may be generated during the demolition, rebuild and operation of PSFSC:

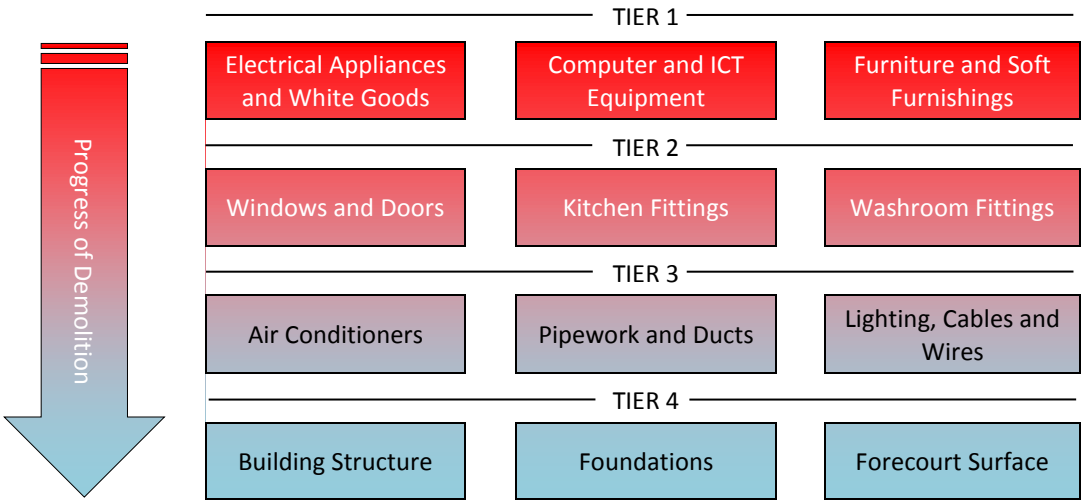
- **Inert C&D Material.** Does not decompose, such as debris, rubble, earth and concrete, and is suitable for land reclamation and site formation. The major source of inert C&D material will be from the demolished building structure.
- **C&D Waste (or Non-inert C&D Material).** Can decompose and generate odour, such as bamboo, timber, vegetation, packaging waste and other organic material, and is therefore unsuitable for land reclamation. The major source of non-inert C&D material will be from the construction stage.

- **General Refuse.** Municipal Solid Waste (MSW) includes paper, packaging, food waste, etc. arising from workers during demolition and construction stages and from employees and visitors during the operation stage.
- **Chemical Waste.** Liquid, semi-solid and solid wastes (e.g. waste lube oil, asbestos, etc.) that are hazardous or polluting and must therefore be managed, treated and disposed of in a controlled manner. Chemical waste may arise in small quantities during demolition and/or during construction.

Demolition Stage

A.5.6 To ensure that the majority of demolition waste from PSFSC is acceptable at public filling areas or for recycling, WWF intends to adopt "selective demolition". ***Table A5-1***, below, illustrates the sequence adopted in selective demolition, taken from *A Guide for Managing and Minimizing Building and Demolition Waste*[Ref.#6] ("*The Guide*"). Reference is also be made to *Guidelines for Selective Demolition and On Site Sorting*[Ref.#7].

Table A5-1 Sequence of Selective Demolition of PSFSC



Source: Adapted from *The Guide*[Ref.#6].

A.5.7 The demolition process is separated into phases in which one type of material is carefully dismantled at one time and salvaged for reuse and recycling. Concise sorting of different material types prevents any cross-contamination of inert or recyclable materials with non-inert materials.

A.5.8 Selective demolition is principally carried out in reverse order to the construction process according to the following procedures:

- Removal of remains and non-fixtures.
- Stripping, comprising internal clearing, removal of doors, windows, roof components, installations for water, air conditioning, electricity, etc., leaving only the building shell (bearing structure) and foundations.
- Demolition of the building structure.

6. *A Guide for Managing and Minimizing Building and Demolition Waste*, C. S. Poon, T.W. Yu and L. H. Ng, Research Centre for Urban Environmental Technology & Management, Department of Civil and Structural Engineering, Hong Kong Polytechnic University, May 2001.
7. *Guidelines for Selective Demolition and On Site Sorting*, Public Fill Committee Civil Engineering and Development Department, July 2004.

A.5.9 **Tier 1 Materials**, such as electrical appliances, white goods; computer and ICT equipment; and furniture and soft furnishings, will be removed first. If in usable condition, these will be put in storage pending reuse in the new PSFSC. Items that are not needed will be sent for recycling/refurbishment, e.g. Waste Electrical and Electronic Equipment (WEEE) will be sent to the WEEE Treatment Facility (WTF) at EcoPark.

A.5.10 **Tier 2 Materials**, such as windows and doors; kitchen fittings; and toilet fittings, will then be removed. Wood and glass from windows and doors and metals from kitchen fittings and washroom fittings will be sent to recyclers. Porcelain will be sent to a Public fill Reception Facilities (PFRF) for reuse/recycling.

A.5.11 **Tier 3 Materials**, such as air conditioners, pipework and ducts, cables and wires, will then be removed/stripped out. Air conditioners will be sent to the WTF, metals will be sent to recyclers and florescent lights will be sent to the Chemical Waste Treatment Centre (CWTC) in Tsing Yi for safe disposal.

A.5.12 **Tier 4 Materials**, from the building structure, foundations and forecourt surface will be the key residual waste sources during the selective demolition stage:

- Inert C&D material from the PSFSC building structure, foundations and forecourt surface (e.g. bricks, concrete, asphalt, etc.).
- C&D Waste from demolition of the PSFSC building (e.g. wood and plastics) and also general refuse generated by site workers.

A.5.13 All Tier 4 C&D material arising from or in connection with the demolition work shall be sorted on-site and be separated into different groups for disposal at landfills, PFRFs, or recycling as appropriate. As a minimum, separation of inert from non-inert materials shall be provided, as research[Ref.#6] indicates that 90% of demolition waste produced could be used for reclamation if waste sorting is performed.

Inert C&D Material

A.5.14 To determine the likely quantity of inert C&D material arising from demolition of the building structure based on Gross Floor Area (GFA), and in the absence of any local GFA-based estimation method, reference has been made to the USEPA's *Characterization of Building-Related Construction and Demolition Debris in the United States*[Ref.#8], which establishes typical demolition generation rates for a number of building types. For non-residential buildings, such as PSFSC, the rate is 888kg/m^2 of GFA. Thus, for 600m^2 of GFA in the existing PSFSC, the estimated quantity of inert C&D material arising from the demolition of the building structure and foundations will be around 533 tonnes.

A.5.15 The land lease for PSFSC is around 2,500m^2. Excluding the 300m^2 footprint of the two-storey PSFSC building leaves 2,200m^2. Of this area, approximately 25% is occupied by landscaped areas/trees around the perimeter, leaving around 1,650m^2 of hardstanding for forecourting. This hardstanding is asphalt, approximately 20cm thick including 10cm of sub-base. The total volume of asphalt to be removed is therefore 1,650m^2 x 0.1m = 165m^3. Assuming a typical density of 1.8tonnes/m^3, this is equivalent to around 297 tonnes of waste asphalt. A similar quantity of sub-base would also be expected.

8. *Characterization of Building-Related Construction and Demolition Debris In the United States*, Report No. EPA530-R-98-010 prepared for USEPA Municipal and Industrial Solid Waste Division, Office of Solid Waste, by Franklin Associates, June 1998.

A.5.16 In total, therefore, 1,127 tonnes of inert C&D material is anticipated to be generated, comprising 830 tonnes of demolition waste and 297 tonnes of sub-base; and also around 297 tonnes of waste asphalt.

A.5.17 The concrete building waste and stone sub-base will be sent to the nearest crushing plant, which is operated by the Civil Engineering and Development Department (CEDD) at the Fill Bank in Tseung Kwan O Area 137, around 45km from PSFSC. At the crushing plant all of the concrete building waste and stone sub-base will be crushed into G200 recycled rockfill, which can then be reused in construction projects.

A.5.18 Subject to agreement with asphalt producers, waste asphalt could be accepted a one of Hong Kong's asphalt plants as a raw material – Recycled Asphalt Pavement (RAP) – that is incorporated into new asphalt production. The nearest plant has newly opened at Man Kam To Road, near Sheung Shui, around 18km from PSFSC. Alternatively, if RAP cannot be used in asphalt production, waste asphalt shall be sent to the nearest Fill Bank, which is in Tuen Mun Area 38, around 27km from PSFSC, for reuse as public fill.

A.5.19 During the subsequent rebuild of PSFSC, an amount of G200 recycled rockfill equivalent to the amount of inert C&D material (estimated at 830 tonnes, above) will be sourced from the crushing plant at the Fill Bank in Tseung Kwan O Area 137. Asphalt containing RAP will also be used for the new forecourt area. This will enable close to zero net waste generation from the demolition of PSFSC to be achieved.

A.5.20 Given the above, no adverse waste impact from the handling, transportation or disposal of inert C&D material during the demolition stage is anticipated.

C&D Waste

A.5.21 With selective demolition approach, there will be very little C&D waste generated during the demolition stage that requires disposal. Materials such as glass window panes, doors, etc., will have been removed and sent for recycling.

A.5.22 Given the above, no adverse waste impact from the handling, transportation or disposal of C&D waste during the demolition stage is anticipated.

General Refuse

A.5.23 General refuse from demolition workers is similar to domestic waste and includes packaging and organic material. There are no means to estimate the numbers of workers who will be engaged on the demolition works as this will depend on the selective demolition method used and on which contractor carries out the work. However, given that selective demolition is more labour-intensive than traditional mechanised demolition, the number of workers involved in the demolition is expected to greater than would be typically expected. An average of 50 workers per day over the 6 months (26 weeks) of demolition has therefore been assumed.

A.5.24 Each demolition worker will generate general refuse, which is similar to domestic waste. Plate 2.7 of EPD's *Monitoring of Solid Waste in Hong Kong – Waste Statistics for 2017*[Ref.#9] (*"Waste Statistics for 2017"*) identifies that the per capita domestic waste disposal rate in 2017 was 0.87kg/person/day. Although the per worker generation rate of general refuse will be less than this, to be conservative the per capita domestic waste

9. *Monitoring of Solid Waste in Hong Kong – Waste Statistics for 2017*, EPD, December 2018 (revised January 2019).

disposal rate in 2017 has been adopted for general refuse generation by demolition workers. On this basis:

General Refuse/day = No. workers/day x per capita generation rate
= 50 workers x 0.87kg/worker/day
= 43.5kg/day
Total General Refuse = General refuse/day x duration of demolition contract
= 44kg/day x (6 days/week x 26 weeks)
= 6,786kg
≈ 7 tonnes

A.5.25 An estimated 7 tonnes of general refuse may be generated throughout the 6 months demolition stage, equivalent to around 1.1 tonnes per month on average.

A.5.26 On-site sorting should be carried out, with recyclable materials, such as metal, paper and plastic, given to local recyclers for off-site recycling. Based on the 32% recovery rate for MSW achieved in Hong Kong in 2017, as shown on Plate 3.2 in *Waste Statistics for 2017*, this could be around 2.2 tonnes. Landfill disposal of the remaining 68%, or 4.8 tonnes, should be adopted as the last resort. The nearest disposal facility for general waste is the Northwest New Territories (NWNT) Transfer Station in Yuen Long, which is around 18km from PSFSC.

A.5.27 The estimated 1.1 tonnes per month of general refuse arising is insignificant when compared to the 333,000 of MSW that was disposed of at Hong Kong's landfills each month in 2017 (derived from Plate 2.8 in *Waste Statistics for 2017*). Nevertheless, to minimise waste generation mitigation measures proposed below should be implemented.

A.5.28 Given the above, and with the recommended mitigation measures in place, no adverse waste impact from the handling, transportation or disposal of general refuse during the demolition stage is anticipated.

Chemical Waste

A.5.29 PSFSC was built in 1989 and so Asbestos-Containing Material (ACM) could potentially have been used in its construction. Asbestos is a chemical waste and is also controlled under APCO. In January 2017 WWF arranged for MateriaLab Consultants Ltd to prepare an Asbestos Investigation Report (AIR)[Ref.#10] to identify the presence of ACM in PSFSC. The AIR concluded that there was no ACM present in PSFSC.

A.5.30 Other sources of chemical waste that typically arise during the demolition works on other projects include spent lubricants, waste batteries, etc. from vehicles, plant and equipment that are maintained on site. WWF will mandate in all contract documents that there shall be no maintenance or repair of vehicles, plant or equipment on site. On this basis, therefore, no chemical waste is anticipated to arise during the demolition stage.

10. *Asbestos Survey for Upgrading Mai Po Nature Reserve Infrastructure at Mai Po, San Tin, Yuen Long, New Territories* (Ref. 0116/16/ED/0234) prepared on behalf of WWF by MateriaLab Consultants Ltd, February 2017.

Construction Stage

A.5.31 To ensure that the majority of construction waste from PSFSC is acceptable at public filling areas or for recycling, all waste materials arising from or in connection with the rebuild work shall be sorted on-site and be separated into different groups for disposal at landfills, PFRFs, or recycling as appropriate. As a minimum, separation of inert from non-inert materials shall be provided, as research[Ref.#6] indicates that 90% of construction waste produced could be used for reclamation if waste sorting is performed.

Inert C&D Material

A.5.32 Section 3.2 of *The Guide* provides a "waste index" for building waste generation in Hong Kong based on the GFA of three different building types:

Private Housing Projects	$0.250m^3/m^2$ GFA
Government Housing Projects	$0.174m^3/m^2$ GFA
Commercial Office Projects	$0.200m^3/m^2$ GFA

A.5.33 To provide a conservative estimate of building waste from the rebuild of the PSFSC, the "waste index" for commercial office projects is the most appropriate index to use. However, in addition to inert C&D material, this "waste index" also includes C&D waste and *The Guide* does not identify what proportion of building waste is inert C&D material and what proportion is C&D waste.

A.5.34 However, Plate 2.12 of *Waste Statistics for 2016* identifies that in 2015, 94% of construction waste was either reused on-site or off-site or was sent to public fill reception facilities, meaning it must be inert C&D material. The proportion of inert C&D material in the "waste index" can therefore be estimated by applying the Hong Kong-wide proportion of inert C&D material in construction waste, i.e. 94%, to the "waste index" as follows:

$$\text{Waste Index}_{\text{INERT C\&D MATERIAL}} = 0.94 \times \text{"waste index" for commercial office projects}$$
$$= 0.94 \times 0.200m^3/m^2 \text{ GFA}$$
$$= 0.188m^3/m^2 \text{ GFA}$$

A.5.35 The inert C&D material component of building waste from rebuild of the PSFSC, which will have a GFA of about $1,209m^2$, can therefore be estimated as follows:

$$\text{Building Waste} = \text{Waste Index}_{\text{INERT C\&D MATERIAL}} \times \text{GFA}$$
$$= 0.188m^3/m^2 \text{ GFA} \times 1,209m^2$$
$$= 227m^3$$

A.5.36 Assuming a typical density of $1.8\text{tonnes}/m^3$, this is equivalent to around 409 tonnes generated throughout the entire 22 months construction period, equivalent to around 18.6 tonnes per month on average.

A.5.37 Inert C&D material, comprising mainly concrete building waste, will be sent to the nearest crushing plant, which is operated by CEDD at the Fill Bank in Tseung Kwan O Area 137, around 45km from PSFSC. At the crushing plant all of the concrete building waste and stone sub-base will be crushed into G200 recycled rockfill.

A.5.38 Given the above, no adverse waste impact from the handling, transportation or disposal of inert C&D material during the construction stage is anticipated.

C&D Waste

A.5.39 For building work, C&D waste, such as timber formwork, packaging waste, vegetation from site clearance and other wastes, is included in the "waste index" provided in *The Guide*, together with inert C&D material.

A.5.40 However, Plate 2.12 of *Waste Statistics for 2017* identifies that in 2016, 7% of construction waste was disposed of in landfills, meaning it must be C&D waste. The proportion of C&D waste in the "waste index" can therefore be estimated by applying the Hong Kong-wide proportion of C&D waste in construction waste, i.e. 7%, to the "waste index" as follows:

$$\text{Waste Index}_{\text{C\&D WASTE}} = 0.07 \times \text{"waste index"}$$
$$= 0.07 \times 0.200 m^3/m^2 \text{ GFA}$$
$$= 0.01 m^3/m^2 \text{ GFA}$$

A.5.41 The C&D waste component in building waste can therefore be estimated as follows:

$$\text{Building Waste} = \text{Waste Index}_{\text{C\&D WASTE}} \times \text{GFA}$$
$$= 0.01 m^3/m^2 \text{ GFA} \times 1{,}209 m^2$$
$$= 12 m^3$$

A.5.42 Assuming a typical density of 1.8tonnes/m^3, this is equivalent to around 22 tonnes generated throughout the entire 22 months construction period, equivalent to around 1 tonne per month on average.

A.5.43 On-site sorting should be carried out for the C&D waste generated from the rebuild works. Recyclable materials, such as metal, paper products, timber and plastic, should be collected by local recyclers for off-site recycling. Plate 3.2 in *Waste Statistics for 2017* identified that 32% of MSW was recovered in 2017. Assuming a similar recovery rate for C&D waste, this could be around 7 tonnes. Landfill disposal of the remaining 68%, or 15 tonnes, should be adopted as the last resort. The nearest disposal facility is the North New Territories (NENT) Landfill, which is around 22km from PSFSC.

A.5.44 The estimated 1 tonne per month of C&D waste is insignificant compared to the average of 119,567 tonnes per month of C&D Waste that was sent to landfills in 2017 (derived from Plate 2.12 in *Waste Statistics for 2017*).

A.5.45 Given the above, no adverse waste impact from the handling, transportation or disposal of C&D waste during the construction stage is anticipated.

General Refuse

A.5.46 General refuse from construction workers is similar to domestic waste and includes packaging and organic material. There are no means to estimate the numbers of workers who will be engaged on the rebuild works, as this will depend on the construction methods used and on which contractor carries out the work. However, based on industry experience, we estimate for a site of this size there would be around 100 workers per day over the 22 months (1.83 years) of construction.

A.5.47 Each construction worker will generate general refuse, which is similar to domestic waste. Plate 2.7 of *Waste Statistics for 2017* identifies that the per capita domestic waste disposal rate in 2017 was 0.87kg/person/day. Although the per worker generation rate of general refuse will be less than this, to be conservative the per capita domestic

waste disposal rate in 2017 has been adopted for general refuse generation by construction workers. On this basis:

General Refuse/day = No. workers/day x per capita generation rate
= 100 workers x 0.87kg/worker/day
= 87kg/day

Total General Refuse = General Refuse/day x duration of construction contract
= 87kg/day x (6 days/week x 52 weeks/year x 1.83 years)
=49,673kg
≈ 50 tonnes

A.5.48 An estimated 50 tonnes of general refuse may be generated throughout the 22 months construction stage, equivalent to around 2.3 tonnes per month on average.

A.5.49 On-site sorting should be carried out, with recyclable materials, such as metal, paper and plastic, given to local recyclers for off-site recycling. Based on the 32% recovery rate for MSW achieved in Hong Kong in 2017, as shown on Plate 3.2 in *Waste Statistics for 2017*, this could be around 16 tonnes. Landfill disposal of the remaining 68%, or 34 tonnes, should be adopted as the last resort. The nearest disposal facility for general waste is the NWNT Transfer Station in Yuen Long, which is around 18km from PSFSC.

A.5.50 The estimated 2.3 tonnes per month of general refuse arising is insignificant when compared to the 333,000 tonnes of MSW that was disposed of at Hong Kong's landfills each month in 2017 (derived from Plate 2.8 in *Waste Statistics for 2017*). Nevertheless, to minimise waste generation mitigation measures proposed below should be implemented.

A.5.51 Given the above, and with the recommended mitigation measures in place, no adverse waste impact from the handling, transportation or disposal of general refuse during the construction stage is anticipated.

Chemical Waste

A.5.52 Chemical waste that typically arises during construction on other projects includes spent lubricants, waste batteries, etc. from vehicles, plant and equipment that are maintained on site. WWF will mandate in all contract documents that there shall be no maintenance or repair of vehicles, plant or equipment on site. On this basis, therefore, no chemical waste is anticipated to arise during the construction stage.

Operation Stage

Inert C&D Material, C&D Waste and Chemical Waste

A.5.53 None of these waste types are anticipated to be generated during operation of PSFSC.

General Refuse

A.5.54 No waste bins are provided within MPNR and so visitors currently deposit any waste at PSFSC, although WWF minimises waste generation from refreshments offered with reusable tableware and cutlery and by encouraging bring your own bottle for use with water stations. This situation will continue when the new PSFSC becomes operational.

A.5.55 In addition to waste from visitors, a smaller quantity of waste is generated by WWF staff and by individuals resident at PSFSC for short-term training courses. According to WWF's records, the general refuse arising from the operation of PSFSC in 2018 was between 5kg and 7kg per day, which is less than 0.09kg per person per day.

A.5.56 To estimate the quantity of general refuse likely to arise from the operation of the new PSFSC, first the existing waste generation rate on a per visitor basis is determined:

General Refuse	= average of 6kg per day in 2018 (from WWF records)
	= 2,190kg in 2018 (incl. staff and visitors)
No. Past Visitors	= 24,100 visitors in 2018
Refuse per Visitor	= 0.09 kg per visitor on average in 2018

A.5.57 Note that this 0.09kg per visitor is very low and suggests that most visitors do not leave any waste at PSFSC – this likely a result of with WWF's policy to encourage visitors to bring their own reusable water bottles and food containers, rather than single-use containers, and WWF's provision of free drinking water for visitors.

A.5.58 WWF estimates that visitor numbers will increase 32,800 per year within three years after the Mai Po Nature Reserve Infrastructure Upgrade Project is completed. Although each visitor will spend less time on average in MPNR, all visitors will still pass through PSFSC:

No. Future Visitors	= 32,800 visitors per year
Refuse per Visitor	= 0.09 kg per visitor per year on average (based on 2018 rate)
Predicted Refuse	= 2,981kg per year
	= 248kg per month
	= 8kg per day

A.5.59 The above calculation inflates the current waste generation by around 36% in line with predicted increases in visitor numbers. However, since current waste generation per visitor also includes waste from staff and individuals resident at PSFSC for short-term training courses, this 8kg per day is likely to be an over-estimation and therefore a conservative figure.

A.5.60 With the expanded kitchen and café in the new PSFSC, there be more general refuse and kitchen waste (food waste). However, the food waste from the kitchen and café will be composted on-site for use in a future "Eco-garden", and so will not enter the waste stream directly. The 8kg per day is therefore still considered to be a conservative figure.

A.5.61 On-site segregation of general waste shall be carried out, with recyclable materials, such as metal, paper and plastic, given to local recyclers for off-site recycling. Based on the 32% recovery rate for MSW achieved in Hong Kong in 2017, as shown on Plate 3.2 in *Waste Statistics for 2017*, this could be around 79kg per month. Landfill disposal of the remaining 68%, or 169kg per month, should be adopted as the last resort. The nearest disposal facility for general waste is the NWNT Transfer Station in Yuen Long, which is around 18km from PSFSC.

A.5.62 Since domestic waste will be collected on a regular basis by the Food and Environmental Health Department (FEHD) or their agent, or by registered waste collectors, and since domestic waste will be disposed at a landfill managed by EPD, no adverse waste impacts from handling, transportation or disposal are anticipated.

A.5.63 The estimated 248kg per month of general refuse arising is insignificant when compared to the 333,000 tonnes of MSW that was disposed of at Hong Kong's landfills each month

in 2017 (derived from Plate 2.8 in *Waste Statistics for 2017*). Nevertheless, to minimise waste generation mitigation measures proposed below should be implemented.

A.5.64 Given the above, and with the recommended mitigation measures in place, no adverse waste impact from the handling, transportation or disposal of general refuse during the operation stage is anticipated.

Sludge from STP

A.5.65 The new MBR STP will generate a small amount of sludge, estimated at less than 10kg per month. This will be collected by a licenced sludge contractor and treated at the Sludge Treatment Facility at Nim Wan, also known as T-Park, where is will be burned to generate electricity.

Mitigation Measures

Demolition and Construction Stages

A.5.66 Waste management shall be controlled through contractual requirements as well as through statutory requirements, including:

- Environmental, Transport and Works Bureau (ETWB) Technical Circular (Works) No. 19/2005, Environmental Management on Construction Sites
- ETWB Technical Circular (Works) No. 33/2002, Management of Construction and Demolition Material Including Rock
- Development Bureau (DevB) Technical Circular (Works) No. 6/2010, Trip Ticket System for Disposal of Construction & Demolition Materials

A.5.67 According to *ETWB TC(W) No. 19/2005*, the Waste Management Plan (WMP) becomes part of the Environmental Management Plan that should be developed by the contractor and to be submitted to Architect/Engineer for approval before the commencement of any demolition or rebuild works. The objectives of the WMP will be to identify any potential environmental impacts from the generation of waste at the Site; to recommend appropriate waste handling, collection, sorting, disposal and recycling measures in accordance with requirements of the current regulations; and to categorise and permit segregation of C&D material (i.e. inert C&D materials, C&D waste, etc. for off-site reuse, recycling, treatment and/or disposal as recommended in this Appendix.

A.5.68 The contractors shall adopt good housekeeping practices with reference to the WMP such as waste segregation prior to disposal. Besides the provision of stockpiling and segregating areas at site, effective collection of site wastes is required to prevent waste materials being blown around by wind, flushed or leached into nearby waters, or creating odour nuisance or pest and vermin problems. Waste storage areas shall be well maintained and cleaned regularly.

A.5.69 Mitigation measures listed in *Practice Note for Registered Contractors No. 17 Control of Environmental Nuisance from Construction Sites* shall be adopted. C&D material shall be delivered to the appropriate designated outlets by dump trucks fitted with covered box type dump bed and such dump trunks shall comply with the particular specification listed in *Part B of Annex 2 to Appendix C of ETWB TC(W) No. 19/2005* to minimise potential nuisance during transportation of waste. Refuse pending removal shall be stored in receptacles provided with close fitting covers to avoid waste materials be flushed or leached under inclement weather conditions, such as heavy rainfall.

A.5.70 A trip-ticket system shall be established in accordance with *DevB TC(W) No. 6/2010* and the *Waste Disposal (Charges for Disposal of Construction Waste) Regulation* to monitor the disposal waste at PFRFs and landfills, and to control fly-tipping.

A.5.71 General refuse shall be stored in enclosed bins or compaction units separate from C&D material. A reputable waste collector shall be employed by the demolition contractor to remove general refuse from the Site, separately from C&D materials. An enclosed and covered area shall be provided to reduce the occurrence of "wind-blown" materials.

Operation Stage

A.5.72 WWF have long-established internal policies to manage waste arising from their operations, and these will continue to be followed. WWF also supports government's initiatives to reduce waste at source. WWF staff working at PSFSC will follow EPD's "green office" guidelines[Ref.#11] for minimising office waste. Individuals resident at PSFSC for short-term training courses will follow EPD's "green home" guidelines[Ref.#12].

A.5.73 In order to minimise the amount of waste generated by visitors at PSFSC, WWF will continue to encourage visitors to bring their own reusable water bottles and food containers, rather than single-use containers, and to provide free drinking water for visitors at PSFSC. Visitors will also be encouraged to take their waste home with them.

A.5.74 As no waste receptacles are provided within MPNR, any general refuse that visitors wish to dispose of will be disposed of at PSFSC. To enable as much of this waste to be recycled as possible, 3-colour bins for metals, plastics and paper will be placed at prominent locations within PSFSC to enable segregation-at-source of recyclables. Receptacles for organic waste will be provided for food waste and a smaller number of general refuse bins will be provided for non-recyclable waste.

Summary

A.5.75 To ensure that the majority of demolition waste from PSFSC is acceptable at public filling areas or for recycling, WWF intends to adopt "selective demolition" – this has already been included as contractual requirement in the demolition contract.

A.5.76 Based on the above assessments, ***Table A5-2***, below, summarises the generation of waste during the demolition, construction and operation stages and identifies the appropriate management options for treatment and disposal of each waste type.

A.5.77 According to *CEDD Technical Circular No. 03/2015 Management of Construction and Demolition Materials*, if a project generates more than 50,000m^3 of C&D material then a Construction and Demolition Material Management Plan (C&DMMP) is required. As shown in ***Table A5-2***, below, the PSFSC will result in the generation of approx. 1,536 tonnes (around 853m^3) of C&D material. As such, a C&DMMP will not be required.

A.5.78 Overall, provided that the mitigation measures recommended above are followed, there should be no adverse waste impact from the handling, transportation or disposal of inert C&D material, C&D waste or general refuse during the demolition, rebuild or operation of PSFSC. A summary of waste arising at each stage of the PSFSC project is provided below:

11. Hong Kong Waste Reduction Website: https://www.wastereduction.gov.hk/en/workplace/tips_green_office.htm
12. Hong Kong Waste Reduction Website: https://www.wastereduction.gov.hk/en/household/tips_daily_wisdom.htm

Demolition Stage

A.5.79 It is intended that inert C&D material comprising concrete building waste and stone sub-base will be sent to the crushing plant operated by CEDD at the Fill Bank in Tseung Kwan O Area 137, which will produce G200 recycled rockfill. Asphalt stripped from the forecourt is will be sent to the new asphalt plant in Sheung Shui, if possible.

A.5.80 Because of selective demolition, there will be a negligible quantity of C&D waste generated.

A.5.81 There will be no chemical waste generated as there no asbestos was identified in PSFSC and as WWF will mandate in all demolition contract documents that there shall be no maintenance or repair of vehicles, plant or equipment on site. There will be no sludge generated during the demolition stage.

A.5.82 General refuse will be generated by workers during the demolition. On-site segregation of general waste shall be carried out, with recyclable materials, such as metal, paper and plastic, given to local recyclers for off-site recycling. Residual general refuse will be sent to landfill for disposal

Construction Stage

A.5.83 In terms of inert C&D material, during the rebuild of PSFSC, an amount of G200 recycled rockfill equivalent to the amount of inert C&D material sent to the Fill Bank in Tseung Kwan O Area 137 during the demolitions stage will be used, if possible. Asphalt from the new asphalt plant in Sheung Shui containing RAP will be used for the new forecourt, if possible. Together, these two initiatives should enable close to zero net waste generation from the demolition of PSFSC to be achieved.

A.5.84 A small quantity of C&D waste will be generated during the construction stage, some of which will can be recycled off-site and some of which will need to be disposed of at landfill.

A.5.85 There will be no chemical waste generated as WWF will mandate in all construction contract documents that there shall be no maintenance or repair of vehicles, plant or equipment on site. There will be no sludge generated during the construction stage.

A.5.86 General refuse will be generated by workers during construction stages. On-site segregation of general waste shall be carried out, with recyclable materials, such as metal, paper and plastic, given to local recyclers for off-site recycling. Residual general refuse will be sent to landfill for disposal.

Operation Stage

A.5.87 There will be no Inert C&D material, C&D waste or chemical waste generated during the operation stage.

A.5.88 General refuse will be generated by staff and visitors to MPNR who pass through PSFSC. On-site segregation of general waste shall be carried out, with recyclable materials, such as metal, paper and plastic, given to local recyclers for off-site recycling. Residual general refuse will be sent to landfill for disposal.

A.5.89 The new MBR STP will generate a small amount of sludge, which will be collected by a licenced sludge contractor and treated at a the Sludge Treatment Facility at Nim Wan, also known as T-Park, where is will be burned to generate electricity.

Table A5-2 Summary of Waste Generation and Management Options

Waste Type	Estimated Quantity Generated				Management Options			
	Stage				Treatment		Disposal	
	Demolition	Construction	Operation	Total	Approach	Quantity	Approach	Quantity
Total Quantity (tonnes) Excl. Operation Stage								
Inert C&D Material	1,127	409		**1,536**	Concrete building waste and stone sub-base to crushing plant at Fill Bank in Tseung Kwan O Area 137 for recycling, waste asphalt recycled as RAP	1,536 (incl. 297 tonnes of asphalt)	If use as RAP not possible, waste asphalt to Fill Bank in Tuen Mun Area 38 for reuse	297
C&D Waste	0	22		**22**	Segregation + off-site recycling by local recyclers	7	Disposal at NENT Landfill	15
General Refuse (excl. Operation)	7	50		**57**	Segregation + off-site recycling by local recyclers	18	Residual to NWNT RTS > Landfill	39
Chemical Waste	0	0		**0**	N/A	0	N/A	0
Total	**1,134**	**481**		**1,615**		**1,561**		**351**
Monthly Generation Rate (kg/month) Incl. Operation Stage								
Inert C&D Material	187,833	18,591	0	**206,424**	Concrete building waste and stone sub-base to crushing plant at Fill Bank in Tseung Kwan O Area 137 for recycling, waste asphalt recycled as RAP	206,424 (incl. 49,500 kg/month of asphalt during demolition)	If use as RAP not possible, waste asphalt to Fill Bank in Tuen Mun Area 38 for reuse	49,500
C&D Waste	0	1,000	0	**1,000**	Segregation + off-site recycling by local recyclers	320	Disposal at NENT Landfill	680
General Refuse	1,167	2,273	248	**3,688**	Segregation + off-site recycling by local recyclers	1,180	Residual to NWNT RTS > Landfill	2,508
Chemical Waste	0	0	0	**0**	N/A	0	N/A	0
Sludge from STP	0	0	10	**10**	Incineration at T-Park	10	N/A	0
Total per Month	**189,000 (6 months)**	**21,864 (22 months)**	**258**	**up to 211,112**		**up to 207,934**		**up to 52,688**

A.6 Ecological Assessment

Introduction

A.6.1 This ecological assessment has been carried out to identify, qualify and quantify the potential ecological impacts arising from the demolition and rebuild of PSFSC. There will be no operational ecological impacts from PSFSC and so these are not considered in this assessment, which relates only to the construction stage.

A.6.2 Although PSFSC is not a DP, the assessment methodology generally follows that required under the EIAO-TM and the assessment has been carried out at a similar level of detail as it would be for a DP under the EIAO. The Study Area for ecological assessment includes the PSFSC Site and extends to 500m from the PSFSC site boundary.

Legislation, Standards and Guidelines

General

A.6.3 Relevant legislation and associated guidelines related to ecological assessment include:

- Hong Kong Planning Standards and Guidelines (HKPSG) Chapter 10 "Conservation".
- Town Planning Ordinance (Cap. 131) and Environmental Impact Assessment Ordinance (Cap. 499) and subsidiary legislation and guidelines.
- Forests and Countryside Ordinance (Cap. 96) and its subsidiary legislation, the Forestry Regulation (Cap. 96A).
- Wild Animals Protection Ordinance (Cap. 170).
- Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586) and its subsidiary legislation.

A.6.4 International conventions and guidelines that are relevant to this study include:

- **International Union for Conservation of Nature (IUCN).** The IUCN maintains, through its Species Survival Commission, a “Red List” of globally threatened species of wild plants and animals (see http://www.iucnredlist.org/).
- **United Nations Convention on Biological Diversity (CBD).** This Convention requires parties to regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use. It also requires parties to promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings. The People’s Republic of China ratified the Convention on Biological Diversity on 5th January 1993. The convention came into force in Hong Kong during 2011. In the CBD Strategic Plan for Biodiversity 2011-2020, the Aichi Biodiversity Target 1 calls for people’s awareness of the value of biodiversity and the steps they can take to conserve and use it sustainably by 2020, at the latest.
- **Convention on Wetlands of International Importance (Ramsar Convention).** This Convention relates to the protection and wise use of wetland ecosystems for the protection of biological diversity and sustainable development. The Convention requires signatories to designate at least one wetland site for

inclusion in a list of Wetlands of International Importance (Ramsar sites); Mai Po Inner Deep Bay Ramsar Site is designated under this convention and supports internationally important numbers of several bird species.

Guidelines for Developments in the Deep Bay Area

A.6.5 Town Planning Board Guideline No. 12C (TPB PG-No.12C, revised in May 2014) sets out the Wetland Conservation Area (WCA) and Wetland Buffer Area (WBA) in the Deep Bay area to protect the wetlands of high ecological value in and around the Ramsar Site. Under the Guideline, any development is required to demonstrate conformity to the "No-Net-Loss in Wetland" principle. According to the guideline, the 'no-net-loss' can refer to both loss in "area" and "function". No decline in wetland or ecological functions served by the existing fishponds', especially as a source to provide abundant and accessible food and roosting grounds to ardeids and other species, should occur. Consideration will only be given to the developments that could be demonstrated not to cause any loss in the ecological functions of existing ponds.

Field Survey and Assessment Methodology

General

A.6.6 The duration of the survey period and the detailed methodology of the ecological assessment followed the requirements and/or recommendations provided in the technical guidelines of ecological assessment in Annexes 8 and 16 of the EIAO-TM, and the EIAO Guidance Notes (GN 6/2010, GN 7/2010 and GN 10/2010).

A.6.7 Surveys between November 2016 and December 2017 were conducted to provide project-specific data and the ecological information concerning the area around PSFSC, where the Project Proponent will be undertaking demolition and rebuilding works. These surveys included an update to the habitat map for the site and surveys of flora, mammals (bat roosts), birds, herpetofauna (amphibians and reptiles), odonates (dragonflies and damselflies) and butterflies. Details of the survey methodologies are presented in the following sections, survey periods and frequencies for all surveys are detailed in ***Table A6-1***, below.

Habitat/Species Evaluation and Assessment

A.6.8 Habitats within the Study Area and species of conservation interest identified during the ecological field surveys are evaluated according to the guidelines set out in Tables 2 and 3 of Annex 8 of EIAO-TM.

A.6.9 The potential ecological impacts arising from the demolition and rebuild of PSFSC will be identified and assessed following the criteria and relevant guidelines set out in Annexes 8 and 16 of TM-EIAO. The ecological assessment will include the identification and quantification of any direct/indirect, on-site/off-site, primary, secondary or cumulative ecological impacts on habitats or wildlife; evaluation of identified impacts caused by the demolition and rebuild, such as habitat loss, disturbance, etc.

A.6.10 Recommended mitigation measures in the order of avoidance, minimisation and compensation will be provided in the assessment. The assessment will also conclude whether the mitigation measures proposed would bring any secondary impacts and, if positive, the impacts could be controlled to within acceptable bounds. The acceptability of the overall residual ecological impacts will be determined. In addition to the potential adverse impacts, any ecological benefits will also be elaborated in the assessment.

Table A6-1 Schedule of Ecological Survey (November 2016 – December 2017)

Flora / Fauna Group		Duration of WWF Data Reviewed (within MPNR)	Frequency of Supplementary Survey														Remarks
			2016		2017												
			N	D	J	F	M	A	M	J	J	A	S	O	N	D	
Habitat and Flora		Nil					1		1			1			1		PS + SA
Non-flying Mammals		2016 (Infra-red camera trap data and small mammal trap data)	Nil														
Bats	Transect survey	2015-2016 (bat detector data)	Nil														
	Bat roosts	Nil			1	1	1	1	1	1	1	1	1	1	1	1	PS + SA
Birds	Transect survey	2011-2016, 2017 (2 times/month)			1	1	1	1	1	1	1	1	1	1	1	1	SA
	Cormorant roosts	Nil	1	1	1	1	1										PS
	Dry-season cormorant flight lines	Nil	1	1	1	1	1										PS
Herpetofauna		2016						1	1	1	1	1	1	1			PS + SA
Odonates (incl. Four-spot Midget)		2016						1	1	1	1	1	1	1			PS
Butterflies		2016					1	1	1	1	1	1	1	1	1		PS + SA

Notes:

1. PS = Project Site, SA = Study Area (excluding the Project Site).
2. Shaded months indicate the wet season.

Ecological Baseline Conditions

Habitat and Vegetation

A.6.11 As PSFSC is located less than 150m to the east of MPNR, the 500m Study Area overlaps with MPNR. A habitat map of the Study Area is provided in ***Figure A6-1***. Seven habitat types were identified, comprising brackish gei wai, rain-fed pond, commercial fishpond, brackish marsh, natural watercourse, wooded areas and developed areas..

A.6.12 PSFSC is wholly located within existing developed area. It is a hard-surfaced area with limited vegetation present along the fringes of the Site. Planted and self-sown trees including *Macaranga tanarius* var. *tomentosa*, *Ficus subpisocarpa, Melia azedarach, Celtis sinensis* and *Ficus microcarpa* are found on the slope surrounding the Site and roadside area where PSFSC abuts the Tam Kon Chau Road. Ruderal herbs and grasses including *Bidens alba*, *Chloris barbata* and *Panicum maximum*, as well as shrubby species including *Lantana camara* and *Ligustrum sinense*, are the dominant species in the understorey.

Mammals

A.6.13 Only two mammal species, the Short-nosed Fruit bat and Leopard Cat, were identified within the Study Area, but neither of these occurred within the PSFSC Site itself.

A.6.14 A single bat was observed roosting underneath the bird sighting noticeboard in the forecourt of PSFSC in December 2017. In addition, a Chinese Fan Palm *Livistona chinensis* adjacent to Pond 182 and Pak Hok Chau Public Toilet was identified as a roosting site of Short-nosed Fruit Bat. Up to 14 individuals were found on this single tree during the surveys. Juveniles were also observed among the bat roost, strongly indicating a maternity roost. The Short-nosed Fruit Bat is listed as Near Threatened in China (Jiang *et al.* 2016) and is protected locally under Cap.170. However, the species is considered very common in Hong Kong, and is very widely distributed in urban and countryside areas throughout Hong Kong (AFCD 2017).

A.6.15 Scats of Leopard Cat were found on Tam Kon Chau Road next to Pond 184A. The species is listed as Vulnerable in China (Jiang *et al.* 2016) and is considered uncommon in Hong Kong (AFCD 2017). It is also listed in the Appendix II of CITES, and is locally protected under Cap.170 and Cap.586.

A.6.16 Prior to the demolition of PSFSC, additional bat surveys are being conducted in and around PSFSC to update the previous ecological observations in 2017, discussed in ***paragraph A.6.8***, above. In 2019 so far, bat surveys on 18 and 24 April and 3 and 7 May did not record any bats emerging from the PSFSC. External checks made of the building during daytime revealed several potential roost entrances, however, no bats were observed emerging at dusk from these points. Low numbers of bats (Pipistrelle sp.) were recorded emerging from the roost in the noticeboard (no more than three individuals). Several bats were recorded foraging around the PSFSC building and forecourt shortly after sunset, though there was no evidence of these emerging from the building itself. These appeared to arrive from the east.

A.6.17 Mammal species recorded within the Study Area are presented in ***Table A6-2***, below.

Table A6-2 Mammal Species Recorded at PSFSC

Species	Conservation and Protection Status[Note 1]	PSFSC	Study Area Excl. PSFSC	
		Developed	Developed	Wooded
Short-nosed Fruit Bat *Cynopterus sphinx*	RLCV(NT); Cap.170	-		✓
Leopard Cat *Prionailurus bengalensis*	RLCV(VU); CITES(II); Cap.170; Cap.586	-	✓	

Notes:
1. Conservation and protection status refers to Fellowes *et al*. (2002), Red List of China's Vertebrates (Jiang *et al.* 2016), IUCN (2017), China State Major Protection Status, CITES (2017), Cap. 170 and Cap. 586.
   a. Conservation status by Red List of China's Vertebrates (RLCV) (Jiang *et al.* 2016): NT = Near Threatened; VU = Vulnerable.
   b. Protection status by CITES (2017): II = Listed in CITES Appendix II.
   c. Cap. 170 = Wild Animal Protection Ordinance.
   d. Cap. 586 = Protection of Endangered Species of Animals and Plants Ordinance.

Birds

A.6.18 A total of 97 bird species were recorded in the 500m Study Area of PSFSC during the survey period for the Project, including one species pair (Japanese and Manchurian Bush Warbler *Horornis diphone* and *H. borealis*, the identification criteria of which are not fully resolved; three established feral species (Eurasian Collared Dove, Azure-winged Magpie and Common Myna); and one non-established feral species, Great Myna *Acridotheres grandis*. Unsurprisingly, the highest number of species (77) were recorded in MPNR brackish gei wai; 61 species were recorded from commercial fish ponds; and 31 species were noted from the wooded areas around the PSFSC.

A.6.19 Only 25 bird species were recorded from developed area habitat around the PSFSC, of which 19 were noted within the PSFSC. All of the latter were common and widespread landbird species with the exception of White-breasted Waterhen (which is a common and widespread waterbird) and White-shouldered Starling, which is categorised as being of Local Conservation Concern in Hong Kong as a breeding species.

A.6.20 Tam Kon Chau egretry used to be located on banyan tress at Tam Kon Chau, close to PSFSC. It supported 26 nests of Chinese Pond Heron in the 2007 breeding season and 23 nests of the same species in 2008, but has been abandoned since 2009, probably due to increased human activities underneath the trees, i.e. the presence of the container dwelling identified as ASR 2 and NSR 2.

A.6.21 It was noted during the bird surveys in April 2016 that the PSFSC is not being used as a roost or breeding site for avifauna. A pair of White-shouldered Starlings appears to be nesting on the electricity supply pylon outside the PSFSC site boundary. Surveys found that a non-breeding roost of egrets is using the group of trees next to the PSFSC forecourt. During April 2019, some 74-84 Little Egrets, 25 to 33 Chinese Pond Herons, 6 Great Egrets and 1 Cattle Egret were observed recorded flying to a night roost in the trees adjacent to the PSFSC forecourt.

A.6.22 Bird species recorded within the Study Area are presented in ***Table A6-3***.

Table A6-3 Bird Species Recorded at PSFSC

Species	Conservation and Protection Status[Note 1]	PSFSC	Study Area Excl. PSFSC			
		Developed	Developed	Wooded	Commercial Fish Pond	Brackish Gei Wai
Eurasian Wigeon *Anas penelope*	RC					✓
Northern Shoveler *Anas clypeata*	RC					✓
Northern Pintail *Anas acuta*	RC					✓
Garganey *Anas querquedula*	-					✓
Eurasian Teal *Anas crecca*	RC					✓
Tufted Duck *Aythya fuligula*	LC					✓
Little Grebe *Tachybaptus ruficollis*	LC				✓	✓
Eurasian Spoonbill *Platalea leucorodia*	LC; RLCV(NT); CITES(II); CSMPS(II); Cap.586					✓
Black-faced Spoonbill *Platalea minor*	PGC; RLCV(EN); IUCN(EN); CSMPS(II)					✓
Yellow Bittern *Ixobrychus sinensis*	(LC)					✓
Black-crowned Night Heron *Nycticorax*	(LC)				✓	✓
Striated Heron *Butorides striata*	(LC)					✓
Chinese Pond Heron *Ardeola bacchus*	PRC (RC)				✓	✓
Eastern Cattle Egret *Bubulcus coromandus*	(LC)				✓	✓
Grey Heron *Ardea cinerea*	PRC				✓	✓
Purple Heron *Ardea purpurea*	RC				✓	✓
Great Egret *Ardea alba*	PRC (RC)				✓	✓
Intermediate Egret *Egretta intermedia*	RC				✓	✓
Little Egret *Egretta garzetta*	PRC (RC)				✓	✓
Great Cormorant *Phalacrocorax carbo*	PRC				✓	✓
Western Osprey *Pandion haliaetus*	RC; RLCV(NT); CITES(II); CSMPS(II); Cap.586					✓
Greater Spotted Eagle *Clanga*	GC; RLCV(EN); IUCN(VU); CITES(II); CSMPS(II); Cap.586					✓

Species	Conservation and Protection Status[Note 1]	PSFSC	Study Area Excl. PSFSC			
		Developed	Developed	Wooded	Commercial Fish Pond	Brackish Gei Wai
Besra *Accipiter virgatus*	-					✓
Eastern Marsh Harrier *Circus spilonotus*	LC; RLCV(NT); CITES(II); CSMPS(II); Cap.586					✓
Black Kite *Milvus migrans*	(RC); CITES(II); CSMPS(II); Cap.586			✓		✓
Eastern Buzzard *Buteo japonicus*	CSMPS(II); CITES(II); Cap.586					✓
White-breasted Waterhen *Amaurornis phoenicurus*	-	✓	✓	✓	✓	✓
Common Moorhen *Gallinula chloropus*	-					✓
Eurasian Coot *Fulica atra*	RC					✓
Black-winged Stilt *Himantopus*	RC				✓	✓
Pied Avocet *Recurvirostra avosetta*	RC					✓
Pacific Golden Plover *Pluvialis fulva*	LC				✓	
Little Ringed Plover *Charadrius dubius*	(LC)				✓	
Common Snipe *Gallinago*	-				✓	
Eurasian Curlew *Numenius arquata*	RC; RLCV(NT); IUCN(NT)					✓
Common Redshank *Tringa totanus*	RC					✓
Marsh Sandpiper *Tringa stagnatilis*	RC				✓	✓
Common Greenshank *Tringa nebularia*	RC					✓
Wood Sandpiper *Tringa glareola*	LC				✓	
Common Sandpiper *Actitis hypoleucos*	-					✓
Whiskered Tern *Chlidonias hybrida*	-				✓	
Oriental Turtle Dove *Streptopelia orientalis*	-			✓		
Eurasian Collared Dove *Streptopelia decaocto*	-	✓	✓	✓	✓	✓
Red Turtle Dove *Streptopelia tranquebarica*	-				✓	
Spotted Dove *Spilopelia chinensis*	-	✓	✓	✓	✓	✓

Species	Conservation and Protection Status[Note 1]	PSFSC	Study Area Excl. PSFSC			
		Developed	Developed	Wooded	Commercial Fish Pond	Brackish Gei Wai
Greater Coucal *Centropus sinensis*	CSMPS(II)		✓	✓	✓	✓
Asian Koel *Eudynamys scolopaceus*	-			✓	✓	✓
Indian Cuckoo *Cuculus micropterus*	-					✓
White-throated Kingfisher *Halcyon smyrnensis*	(LC)				✓	✓
Common Kingfisher *Alcedo atthis*	-				✓	✓
Pied Kingfisher *Ceryle rudis*	(LC)				✓	✓
Blue-tailed Bee-eater *Merops philippinus*	-		✓		✓	
Black-winged Cuckooshrike *Coracina melaschistos*	-				✓	
Scarlet Minivet *Pericrocotus speciosus*	-			✓		
Long-tailed Shrike *Lanius schach*	-				✓	✓
Black-naped Oriole *Oriolus chinensis*	LC			✓	✓	
Black Drongo *Dicrurus macrocercus*	-			✓	✓	✓
Azure-winged Magpie *Cyanopica cyanus*	-	✓	✓	✓	✓	✓
Red-billed Blue Magpie *Urocissa erythrorhyncha*	-					✓
Eurasian Magpie *Pica*	-	✓	✓	✓	✓	✓
Collared Crow *Corvus torquatus*	LC; RLCV(NT); IUCN(NT)				✓	✓
Cinereous Tit *Parus cinereus*	-	✓	✓	✓	✓	✓
Red-whiskered Bulbul *Pycnonotus jocosus*	-	✓	✓	✓	✓	✓
Chinese Bulbul *Pycnonotus sinensis*	-	✓	✓	✓	✓	✓
Barn Swallow *Hirundo rustica*	-	✓	✓		✓	✓
Mountain Tailorbird *Phyllergates cuculatus*	-			✓		
Japanese/Manchurian Bush Warbler *Horornis diphone/borealis*	-		✓	✓		✓
Dusky Warbler *Phylloscopus fuscatus*	-		✓		✓	✓

Species	Conservation and Protection Status[Note 1]	PSFSC	Study Area Excl. PSFSC			
		Developed	Developed	Wooded	Commercial Fish Pond	Brackish Gei Wai
Pallas's Leaf Warbler *Phylloscopus proregulus*	-			✓		✓
Yellow-browed Warbler *Phylloscopus inornatus*	-	✓	✓	✓	✓	✓
Black-browed Reed Warbler *Acrocephalus bistrigiceps*	-				✓	✓
Yellow-bellied Prinia *Prinia flaviventris*	-		✓		✓	✓
Plain Prinia *Prinia inornata*	-	✓	✓	✓	✓	✓
Common Tailorbird *Orthotomus sutorius*	-			✓		✓
Masked Laughingthrush *Garrulax perspicillatus*	-	✓	✓	✓	✓	✓
Japanese White-eye *Zosterops japonicus*	-			✓	✓	✓
Crested Myna *Acridotheres cristatellus*	-	✓	✓	✓	✓	✓
Common Myna *Acridotheres tristis*	-					✓
Red-billed Starling *Spodiopsar sericeus*	GC			✓	✓	✓
White-cheeked Starling *Spodiopsar cineraceus*	PRC				✓	✓
Black-collared Starling *Gracupica nigricollis*	-	✓	✓		✓	✓
White-shouldered Starling *Sturnia sinensis*	(LC)	✓	✓		✓	✓
Common Starling *Sturnus vulgaris*	LC				✓	
Grey-backed Thrush *Turdus hortulorum*	-			✓		
Chinese Blackbird *Turdus mandarinus*	-			✓	✓	✓
Oriental Magpie Robin *Copsychus saularis*	-	✓	✓	✓	✓	✓
Asian Brown Flycatcher *Muscicapa latirostris*	-			✓		
Red-throated Flycatcher *Ficedula albicilla*	-				✓	
Daurian Redstart *Phoenicurus auroreus*	-			✓	✓	✓
Stejneger's Stonechat *Saxicola stejnegeri*	-				✓	
Eurasian Tree Sparrow *Passer montanus*	-	✓	✓		✓	✓
White-rumped Munia *Lonchura striata*	-			✓		

Species	Conservation and Protection Status[Note 1]	PSFSC	Study Area Excl. PSFSC			
		Developed	Developed	Wooded	Commercial Fish Pond	Brackish Gei Wai
Scaly-breasted Munia *Lonchura punctulata*	-		✓		✓	✓
Eastern Yellow Wagtail *Motacilla tschutschensis*	-				✓	
White Wagtail *Motacilla alba*	-	✓	✓		✓	✓
Chinese Grosbeak *Eophona migratoria*	LC	✓	✓		✓	
Great Myna *Acridotheres grandis*	-					✓

Notes:

1. Conservation and protection status refers to Fellowes *et al*. (2002), Red List of China's Vertebrates (Jiang *et al.* 2016), IUCN (2017), China State Major Protection Status, CITES (2017), Cap. 170 and Cap. 586.
   a. Conservation status by Fellowes *et al.* (2002): LC = Local Concern; PRC = Potential Regional Concern; RC = Regional Concern; PGC = Potential Global Concern; GC = Global Concern. Letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.
   b. Conservation status by Red List of China's Vertebrates (RLCV) (Jiang *et al.* 2016): NT = Near Threatened; VU = Vulnerable; EN = Endangered; CR = Critically Endangered.
   c. Conservation status by IUCN (2017): NT = Near Threatened; VU = Vulnerable; EN = Endangered.
   d. Protection status by China State Major Protection Status (CSMPS): I = Class I Protected Species in China; II = Class II Protected Species in China.
   e. Protection status by CITES (2017): II = Listed in CITES Appendix II; III = Listed in CITES Appendix III.
   f. All wild birds in Hong Kong are protected under Cap. 170. Wild Animal Protection Ordinance.
   g. Cap. 586 = Protection of Endangered Species of Animals and Plants Ordinance.

Herpetofauna

A.6.23 A total of four amphibian species were recorded in the Study Area, with none being of conservation importance. In view of the low diversity and abundance of amphibians recorded, it is apparent that neither the brackish nor the frequently-disturbed wetland habitats in the Study Area favour amphibians. The PSFSC site, which is entirely man-made habitat, also supported very few amphibian species.

A.6.24 A total of six reptile species of were recorded in the Study Area. Within the PSFSC site, only one species, Bowring's Gecko, was recorded. All of the recorded species are common and widespread in the context of Hong Kong, with two being of conservation importance, namely Chinese Cobra and Indo-Chinese Rat Snake.

A.6.25 Shed skin from a Chinese Cobra was found on the access road outside of the AFCD Mai Po Warden Post. Chinese Cobra is considered to be of Potential Global Concern (Fellowes *et al.* 2002) and is listed as Vulnerable in both China and Global contexts (Jiang *et al*. 2016, IUCN 2017). The species is listed in the Appendix II of CITES, and is locally protected under Cap.586. In Hong Kong, the species is fairly common and widespread (Karsen *et al.* 1998).

A.6.26 An Indo-Chinese Rat Snake was noted crossing the Tam Kon Chau Road between Ponds 183 and 185 during the night-time. The species is considered to be of Potential Regional

Concern (Fellowes *et al.* 2002) and is listed as Vulnerable in China (Jiang *et al*. 2016), though it is fairly common and widespread in open habitats across Hong Kong (Karsen *et al.* 1998).

A.6.27 Road-killed individuals of Bamboo Snake and Checkered Keelback, plus some amphibian specimens that could not be identified, were noted on Tam Kon Chau Road during the surveys. These records indicate that some mortality of wild animals, including but not necessarily limited to reptiles and amphibians, has been caused by collision with vehicle under the current traffic flow.

A.6.28 Herpetofauna species recorded within the Study Area are presented in ***Table A6-4***.

Table A6-4 Herpertofauna Species Recorded at PSFSC

Species	Conservation and Protection Status[Note 1]	PSFSC	Study Area Excl. PSFSC		
		Developed	Developed	Commercial Fish Pond	Brackish Gei Wai
Amphibians					
Asian Common Toad *Duttaphrynus melanostictus*	-	✓	✓	✓	✓
Brown Tree Frog *Polypedates megacephalus*	-	✓		✓	✓
Günther's Frog *Hylarana guentheri*	-		✓	✓	✓
Paddy Frog *Fejervarya limnocharis*	-		✓	✓	✓
Reptiles					
Long-tailed Skink *Eutropis longicaudata*	-		✓		✓
Bowring's Gecko *Hemidactylus bowringii*	-	✓	✓	✓	✓
Indo-Chinese Rat Snake *Ptyas korros*	PRC; RLCV(VU)		✓		
Chinese Cobra *Naja atra*	PRC; RLCV(VU); IUCN(VU); CITES(II); Cap.586		✓		
Checkered Keelback *Xenochrophis flavipunctatus*	-		✓	✓	
Bamboo Snake *Cryptelytrops albolabris*	-		✓		
Red-eared Slider *Trachemys scripta*	-			✓	

Notes:

1. Conservation and protection status refers to Fellowes *et al*. (2002), Red List of China's Vertebrates (Jiang *et al.* 2016), IUCN (2017), China State Major Protection Status, CITES (2017), Cap. 170 and Cap. 586.
   a. Conservation status by Fellowes *et al.* (2002): PRC = Potential Regional Concern.
   b. Conservation status by Red List of China's Vertebrates (RLCV) (Jiang *et al.* 2016): VU = Vulnerable.
   c. Conservation status by IUCN (2017): VU = Vulnerable.
   d. Protection status by CITES (2017): II = Listed in CITES Appendix II.
   e. Cap. 586 = Protection of Endangered Species of Animals and Plants Ordinance.

Butterflies

A.6.29 A total of 56 species of butterflies were recorded from the PSFSC site and the Study Area. Most of them are common in Hong Kong and widespread across the territory (AFCD 2017). None of the species recorded is of particular conservation importance, except Forget-me-not and Small Cabbage White.

A.6.30 Forget-me-not was recorded in the wooded area in the Study Area. The species is considered Very Rare in Hong Kong and is listed as a Species of Conservation Concern (AFCD 2017). However, since 2012, the population of Forget-me-not has increased significantly, with many sightings made across the territory (AEC pers. obs., AFCD 2012).

A.6.31 Small Cabbage White was also recorded in the wooded area. The species is considered Rare in Hong Kong (AFCD 2017); albeit it is a globally-invasive pest of vegetable crops.

A.6.32 Butterfly species recorded within the Study Area are presented in ***Table A6-5***, below:

Table A6-5 Butterfly Species Recorded at PSFSC

Species	Conservation and Protection Status[Note 1]	Status in Hong Kong[Note 2]	PSFSC	Study Area Excl. PSFSC				
			Developed	Developed	Wooded	Commercial Fishpond	Brackish Gei Wai	Rain-fed Pond
Bush Hopper *Ampittia dioscorides*	-	Uncommon					✓	
Formosan Swift *Borbo cinnara*	-	Common			✓	✓	✓	
Chinese Dart *Potanthus confucius*	-	Uncommon					✓	
Greenish Palm Dart *Telicota ancilla*	-	Uncommon					✓	
Chestnut Angle *Odontoptilum angulatum*	-	Common					✓	
Purple Sapphire *Heliophorus epicles*	-	Common			✓	✓	✓	
Common Hedge Blue *Acytolepis puspa*	-	Common				✓	✓	
Forget-me-not *Catochrysops strabo*	-	Very Rare#			✓			
Tailed Cupid *Everes lacturnus*	-	Common					✓	
Long-tailed Blue *Lampides boeticus*	-	Common		✓		✓	✓	
Transparent 6-line Blue *Nacaduba kurava*	-	Common			✓		✓	
Pale Grass Blue *Pseudozizeeria maha*	-	Very Common	✓	✓	✓	✓	✓	
Silver Streak Blue *Iraota timoleon*	-	Uncommon			✓			
Plum Judy *Abisara echerius*	-	Very Common			✓			
Large Faun *Faunis eumeus*	-	Common			✓		✓	
Tawny Rajah *Charaxes bernardus*	-	Common			✓			

Species	Conservation and Protection Status[Note 1]	Status in Hong Kong[Note 2]	PSFSC	Study Area Excl. PSFSC				
			Developed	Developed	Wooded	Commercial Fishpond	Brackish Gei Wai	Rain-fed Pond
Plain Tiger *Danaus chrysippus*	-	Uncommon	✓		✓			
Common Tiger *Danaus genutia*	-	Common			✓	✓	✓	
Common Indian Crow *Euploea core*	-	Common				✓	✓	
Blue-spotted Crow *Euploea midamus*	-	Very Common			✓	✓	✓	
Glassy Tiger *Parantica aglea*	-	Common		✓			✓	
Blue Tiger *Tirumala limniace*	-	Common					✓	
Angled Castor *Ariadne*	-	Common				✓	✓	
Common Sergeant *Athyma perius*	-	Uncommon			✓			
Rustic *Cupha erymanthis*	-	Very Common			✓			
Common Mapwing *Cyrestis thyodamas*	-	Common			✓			
Red-ring Skirt *Hestina assimilis*	-	Common			✓	✓		
Great Egg-fly *Hypolimnas bolina*	-	Common	✓		✓		✓	
Grey Pansy *Junonia atlites*	-	Common					✓	
Common Sailer *Neptis hylas*	-	Very Common		✓		✓	✓	✓
Five-dot Sergeant *Parathyma sulpitia*	-	Common					✓	
Short-banded Sailer *Phaedyma columella*	-	Common					✓	✓
Common Palmfly *Elymnias hypermnestra*	-	Common						✓
Dark-brand Bush Brown *Mycalesis mineus*	-	Very Common	✓				✓	
South China Bush Brown *Mycalesis zonata*	-	Common					✓	
Common Five-ring *Ypthima baldus*	-	Common				✓	✓	
Straight Five-ring *Ypthima lisandra*	-	Common					✓	
Common Mime *Chilasa clytia*	-	Common				✓	✓	
Tailed Jay *Graphium agamemnon*	-	Common			✓		✓	
Common Jay *Graphium doson*	-	Common					✓	
Common Bluebottle *Graphium sarpedon*	-	Very Common			✓		✓	
Chinese Peacock *Papilio bianor*	-	Common					✓	

Species	Conservation and Protection Status[Note 1]	Status in Hong Kong[Note 2]	PSFSC	Study Area Excl. PSFSC				
			Developed	Developed	Wooded	Commercial Fishpond	Brackish Gei Wai	Rain-fed Pond
Lime Butterfly *Papilio demoleus*	-	Common					✓	
Red Helen *Papilio helenus*	-	Very Common				✓	✓	
Great Mormon *Papilio memnon*	-	Very Common	✓		✓	✓	✓	
Paris Peacock *Papilio paris*	-	Very Common		✓		✓	✓	
Common Mormon *Papilio polytes*	-	Very Common	✓	✓	✓	✓	✓	
Spangle *Papilio protenor*	-	Very Common				✓	✓	
Lemon Emigrant *Catopsilia pomona*	-	Common				✓	✓	
Mottled Emigrant *Catopsilia pyranthe*	-	Very Common	✓			✓		
Three-spot Grass Yellow *Eurema blanda*	-	Common					✓	
Common Grass Yellow *Eurema hecabe*	-	Very Common	✓	✓			✓	
Red-base Jezebel *Delias pasithoe*	-	Very Common	✓			✓	✓	
Great Orange Tip *Hebomoia glaucippe*	-	Common				✓	✓	
Indian Cabbage White *Pieris canidia*	-	Very Common		✓	✓	✓	✓	
Small Cabbage White *Pieris rapae*	-	Rare			✓			

Notes:

1. Conservation and protection status refers to Fellowes *et al*. (2002), Red List of China's Vertebrates (Jiang *et al.* 2016), IUCN (2017), China State Major Protection Status, CITES (2017), Cap. 170 and Cap. 586.
2. Status in Hong Kong follows AFCD (2017); # denotes Species of Conservation Concern listed by AFCD.

Dragonflies

A.6.33 A total of 17 dragonfly species were recorded from the PSFSC site and the Study Area. All of the recorded species are either abundant or common in Hong Kong (AFCD 2017). None of the species recorded is of particular conservation importance, except Scarlet Basker.

A.6.34 Scarlet Basker was recorded in a brackish *gei wai* (GW no. 6) near the existing footpath. It is considered to be of Local Concern (Fellowes *et al.* 2002) but is common in Hong Kong (AFCD 2017).

A.6.35 Dragonfly species recorded within the PSFSC site and its 500m Study Area are presented in ***Table A6-6.***

Table A6-6 Dragonfly Species Recorded at PSFSC

Species	Conservation and Protection Status[Note 1]	Status in Hong Kong[Note 2]	PSFSC	500m SA[3]			
			Developed	Wooded	Commercial Fishpond	Brackish Gei Wai	Rain-fed Pond
Orange-tailed Sprite *Ceriagrion auranticum*	-	Abundant			✓	✓	✓
Common Bluetail *Ischnura senegalensis*	-	Abundant			✓	✓	
Pale-spotted Emperor *Anax guttatus*	-	Common				✓	✓
Common Flangetail *Ictinogomphus pertinax*	-	Common			✓	✓	✓
Blue Dasher *Brachydiplax chalybea*	-	Common			✓	✓	
Asian Amberwing *Brachythemis contaminata*	-	Abundant			✓	✓	✓
Crimson Darter *Crocothemis servilia*	-	Abundant				✓	
Russet Percher *Neurothemis fulvia*	-	Common					✓
Pied Percher *Neurothemis tullia*	-	Common				✓	
Common Blue Skimmer *Orthetrum glaucum*	-	Abundant				✓	✓
Common Red Skimmer *Orthetrum pruinosum*	-	Abundant				✓	✓
Green Skimmer *Orthetrum sabina*	-	Abundant	✓		✓	✓	✓
Wandering Glider *Pantala flavescens*	-	Abundant	✓	✓	✓	✓	✓
Variegated Flutterer *Rhyothemis variegata*	-	Common	✓			✓	✓
Saddlebag Glider *Tramea virginia*	-	Abundant	✓		✓	✓	✓
Crimson Dropwing *Trithemis aurora*	-	Abundant				✓	✓
Scarlet Basker *Urothemis signata*	LC	Common				✓	

Notes:

1. Conservation and protection status refers to Fellowes *et al*. (2002), Red List of China's Vertebrates (Jiang *et al.* 2016), IUCN (2017), China State Major Protection Status, CITES (2017), Cap. 170 and Cap. 586.
   a. Conservation status by Fellowes *et al.* (2002): LC = Local Concern.
2. Status in Hong Kong follows AFCD (2017).

Ecological Evaluation of Habitats and Species

A.6.36 An evaluation of the habitats identified in the Study Area and species of conservation importance recorded during the surveys is provided below, with reference to the guidance of Tables 2 and 3 of Annex 8 of EIAO-TM. The distribution areas of each habitat within the Study Area around PSFSC shown on ***Figure A6-1***.

MPNR Brackish Gei Wai and Rain-fed Ponds

A.6.37 MPNR Brackish gei wai and rain-fed ponds contain a complex mosaic of wetland microhabitats, including former gei wai (brackish shrimp ponds), rain-fed ponds, reedbed and mangroves, together with non-wetland areas including vegetated islands and bunds, bare islands and bunds and wooded areas, all of which are actively managed for wildlife. Ecological evaluation MPNR Brackish Gei Wai and Rain-fed Ponds of Fish Ponds is given in ***Table A6-7***.

Table A6-7 Ecological Evaluation of MPNR Brackish Gei Wai and Rain-fed Ponds

Criteria	MPNR Brackish Gei Wai and Rain-fed Pond
Naturalness	Originally a modified habitat mosaic but actively managed to enhance its natural features.
Diversity	High diversity of fauna, especially birds, moderate diversity of flora.
Rarity	Actively managed wetlands are few in Hong Kong and MPNR is much the largest, thus rendering it unique in a Hong Kong context and rare in a regional context.
Re-creatability	Potentially re-creatable, especially if baseline conditions include existing coastal wetland habitats such as fish ponds, though some habitats such as mangroves would take some time to reach maturity and resource inputs would be high.
Fragmentation	Not fragmented.
Ecological linkage	Strong ecological linkages to other habitats in the Ramsar Site.
Potential value	Despite its high existing value, ongoing active management has the potential to increase value incrementally.
Nursery/breeding ground	Significant breeding ground, especially for wetland birds and some aquatic invertebrates and fish.
Age	Actively managed as a nature reserve for just over 30 years.
Abundance/richness of wildlife	Bird diversity and abundance are high to very high especially during migration and winter seasons. Other faunal groups are also more abundant and diverse than in most Deep Bay wetland areas.
Ecological value	**Very High Ecological Value.**

Commercial Fish Ponds

A.6.38 Fish ponds are the dominant habitat in the Study Area outside PSFSC. Most of these ponds, are actively maintained for the cultivation of fish species. Management includes periodic stocking and rearing and harvesting of fish, management of water quality and adjustment of pond profiles. Where fish harvesting is accomplished by draining down ponds, large waterbirds (including egrets and spoonbills) are frequently attracted into fish ponds. Bund vegetation is regularly managed and is mostly maintained with very low vegetation. The dominant plant species are common grasses and ruderal herbs. Some trees are also present, especially fruit trees. In order to enable vehicular access, some fish pond bunds have been strengthened by import of fill material, limiting the colonisation of vegetation. Assessment of the ecological value of these active fish ponds (and indeed abandoned ponds) includes an evaluation of the bunds, which are an integral part of the pond structure and thus are a key element of wetland function.

A.6.39 Management of the active fish ponds requires a significant amount of human and vehicular activity around the ponds. This leads to the disturbance of large waterbirds

and other disturbance-sensitive wildlife. Fish pond operators are often resident on site, so some degree of disturbance is present throughout the day (albeit at significantly lower levels overnight). Dogs are often present, creating an additional source of disturbance to wildlife. Man-made structures and utility services around the fish ponds further increase the levels of disturbance, whilst many ponds in the Study Area are wired in order to deter large waterbirds, in particular Great Cormorants, from feeding on fish stocks. Conversely, Management Agreements (MAs) supported by the Environment and Conservation Fund, whereby fish pond operators receive a subsidy if they follow a pond management protocol intended to increase the attractiveness of ponds to foraging waterbirds, have covered some ponds in the Study Area since 2012. However, there is no published information on where these MA protocols are in effect.

A.6.40 Several of the former fish ponds in the Study Area, notably in the area to the south of Pak Hok Chau, have been abandoned. Some of these ponds have open water areas, but most have been at least partially overgrown with reeds, while the bunds are well-vegetated with trees, shrubs and grasses. Compared to the active fish ponds, the abandoned ponds receive considerably less human disturbance, increasing their value to disturbance-sensitive species. Thus, these ponds support a somewhat different wetland bird community to the active fish ponds with larger numbers of cryptic species including bitterns and rails, while the bunds are often used by roosting and loafing ardeids. Conversely, these ponds lack the drain-down period of actively managed ponds and the fish stocks are expected to be lower than in commercial ponds. Ecological evaluation of Fish Ponds is given in ***Table A6-8***.

Table A6-8 Ecological Evaluation of Commercial Fish Ponds

Criteria	Active Fish Pond	Abandoned Fish Pond
Naturalness	Man-made habitat with high levels of human activity.	Man-made habitat but now with low levels of human disturbance.
Diversity	Low habitat and vegetation diversity but moderate diversity of fauna, especially birds.	Diversity of vegetation and microhabitats higher than in managed ponds, similar overall faunal diversity but species composition differs.
Rarity	Fish ponds are a common habitat in the Deep Bay area, but are becoming less common throughout Hong Kong. Active fish ponds at Lut Chau are important for Collared Crow (globally Near-threatened).	Fish ponds are a common habitat in the Deep Bay area, but are becoming less common throughout Hong Kong. Blocks of contiguous abandoned fish ponds with such low levels of human disturbance as those to the south of Pak Hok Chau are unusual.
Re-creatability	Easily re-creatable.	Easily re-creatable.
Fragmentation	Not fragmented.	Not fragmented.
Ecological linkage	Ponds show strong ecological linkage to nearby wetland habitats, including abandoned ponds and intertidal rivers.	Ponds show strong ecological linkage to nearby fish ponds and other wetland habitats.

Criteria	Active Fish Pond	Abandoned Fish Pond
Potential value	Value could be increased by more ecologically-friendly management methods. The MAs may be effective in this respect. However, value may also decrease if fisheries management becomes more intensive.	Value could be increased by more ecologically-friendly management methods. However, value may also decrease if fisheries management is resumed and becomes intensive.
Nursery/breeding ground	No significant nursery or breeding grounds, but used by foraging egrets from Mai Po Village and Mai Po Lung Village egretries.	No significant nursery or breeding grounds known but doubtless supports breeding wetland-dependent fauna including disturbance-sensitive species.
Age	Not known but moderately old.	Not known but moderately old.
Abundance/richness of wildlife	Some waterbird species, notably ardeids, are routinely present in moderate numbers and may be abundant during pond-drain down. Low abundance and diversity of other fauna (dragonflies and amphibians).	Abundance generally of waterbirds typically lower than in active ponds but this is partly a function of species using this habitat being more solitary than those which favour active ponds; other faunal groups, such as amphibians, generally more abundant and diverse than in managed ponds.
Ecological value	In their current state these ponds attract moderate numbers and diversity of wetland species, although some wetland birds are present in good numbers and the ecological linkages are good; these active ponds are therefore considered currently to be of moderate to high importance. However, given their scale and location and their ecological linkages to MPNR, there is considerable potential to improve these ponds by MAs and similar means and taking this potential value into account these ponds are considered to be of **High Ecological Value.**	These abandoned ponds support smaller numbers of birds of conservation importance than active ponds. However, taking into account their value for other wetland fauna, the fact that they support a different suite of wetland birds to active ponds, the relatively large area and its freedom from disturbance, these ponds are considered to be of **High Ecological Value.**

Brackish Marshes and Natural Watercourses

A.6.41 Brackish marsh is present in the Study Area in association with natural watercourses that discharge into the Shenzhen River to the north of Tam Kon Chau. Natural watercourse and brackish marsh habitats are intimately linked in this Study Area, hence are evaluated here as an ecological unit. The watercourse channels are intertidal, at least at spring tides; hence the linked marsh areas are periodically inundated with brackish water, a feature which has an important influence on the marsh floral and faunal communities.

A.6.42 Fauna present include moderate numbers and diversity of bird species, including small numbers of ardeids, rails and wetland-dependent or associated passerines, such as Oriental Reed, Black-browed Reed and Dusky Warblers. Ecological evaluation of Brackish Marshes and Natural Watercourses is given in ***Table A6-9***.

Table A6-9 Ecological Evaluation of Brackish Marshes and Natural Watercourses

Criteria	Brackish Marshes and Natural Watercourses
Naturalness	Natural habitat with few recent anthropogenic influences.
Diversity	Low diversity of microhabitat types but reasonably high faunal diversity, especially birds and invertebrates.
Rarity	Habitat is relatively rare in Hong Kong, and many areas are threatened by anthropogenic activities and succession. Most species using this habitat are not rare but some are habitat specialists, notably Bent-winged Firefly.
Re-creatability	Could be re-created at a suitable location by restoring channelised watercourse and adjacent habitats.
Fragmentation	Not fragmented.
Ecological linkage	Ecologically linked to mudflats and mangrove and fish pond areas, but upstream linkages are blocked by channelised watercourse and urban development.
Potential value	Could be enhanced by conservation management and reduction in pollution load to watercourses.
Nursery/breeding ground	No significant nursery or breeding grounds.
Age	Not known.
Abundance/richness of wildlife	High abundance and diversity of wetland birds and some invertebrate groups.
Ecological value	Considered to be of **High Ecological Value**.

Wooded Area

A.6.43 One small area of secondary woodland are present in the Study Area, immediately to the north of PSFSC and around Tam Kon Chau Police Post. This area is dominated by naturally regenerated native tree species, in particular *Ficus microcarpa*. The wooded area to the north of PSFSC supported an egretry utilised by Chinese Pond Herons from 2000. The number of nests peaked at 47 in 2004, but the egretry was last used in 2008 (HKBWS data). This wood also supports a colony of Azure-winged Magpies, a colonial nesting species. Whilst this species is largely restricted to the Deep Bay area in Hong Kong, the population is not considered to be of natural origin or of conservation significance. A pair of Chinese Blackbirds, which is a rare breeding species in Hong Kong, has bred around the PSFSC since at least 2007 (Welch 2016), and bred in this wood in 2017 (this study). A *Livistona chinensis* tree in this wood is utilised as a roost site by Short-nosed Fruit Bat (ibid). Ecological evaluation of Wooded Areas is given in ***Table A6-10***.

Table A6-10 Ecological Evaluation of Wooded Areas

Criteria	Wooded Area
Naturalness	Naturally regenerated but some anthropogenic influences and planted / exotic species present.
Diversity	Low diversity of woody flora and resident fauna due to small size but visited by a relatively high diversity of migratory birds on a casual basis.
Rarity	Disturbed secondary woodland is a common habitat in Hong Kong.
Re-creatability	Can be re-created in suitable locations, although trees would take a long time to reach maturity.

Criteria	Wooded Area
Fragmentation	Internally fragmented by buildings; fragmented from other woodland habitats by wetland areas.
Ecological linkage	Utilised as roosting sites by birds foraging in adjacent wetland areas; wooded area north of PSFSC was formerly utilised by breeding Chinese Pond Herons.
Potential value	Value will increase naturally over time as trees mature; areas around PSFSC could be increased if brought under conservation management.
Nursery/breeding ground	Wooded area north of PSFSC formerly used by breeding Chinese Pond Herons, currently used by breeding Azure-winged Magpies and Chinese Blackbird and roosting Short-nosed Fruit Bats.
Age	Uncertain but many trees are large.
Abundance/richness of wildlife	Low abundance but moderate diversity of fauna, notably birds.
Ecological value	Most trees are native but small areas and disturbance compromises the habitat value to some extent, thus assessed as of **Moderate Ecological Value**.

Developed Areas

A.6.44 The central part of the Study Area includes a developed area of small groups of domestic structures and farm structures along Tam Kok Chau Road. The environs of domestic structures around Tam Kon Chau Road are well vegetated with ornamental trees and shrubs and fruit trees which attract a moderate number and diversity of mostly common and widespread bird and butterfly species, but include nesting White-shouldered Starlings which breed in nestboxes and electrical installations and appear to be largely dependent on man-made breeding sites in Hong Kong (Carey *et al.* 2001); whilst some structures may be utilised by roosting bats. Ecological evaluation of Developed Areas is given in ***Table A6-11***.

Table A6-11 Ecological Evaluation of Developed Areas

Criteria	Developed Area
Naturalness	An artificial, man-made habitat.
Diversity	A low to moderate diversity of vegetation managed for cultivation and ornamental purposes around houses.
Rarity	A common habitat in Hong Kong.
Re-creatability	Easily re-creatable.
Fragmentation	Most developed areas in the Study Area are rather fragmented and do not pose a significant barrier to faunal movement.
Ecological linkage	No significant ecological linkages.
Potential value	Little scope for an increase in ecological value.
Nursery/breeding ground	Some structures are used by breeding White-shouldered Starlings and perhaps by bats.
Age	Most areas occupied by structures have been developed for many years, with little recent change in the areas and extent of development. However, there has been an increase in the area occupied by on-farm structures in recent years, especially to the south of Tam Kon Chau Road.

Criteria	Developed Area
Abundance/richness of wildlife	Moderate abundance and diversity of bird and butterfly species associated with domestic and farm structures; most species are habitat-generalists but the locally distributed White-shouldered Starling appears to be largely dependent upon anthropogenic breeding sites in Hong Kong.
Ecological value	In general, developed areas are considered to be of **Low Ecological Value**, however the domestic structures and their environs at Tam Kon Chau Road are considered to be of **Low to Moderate Ecological Value** in view of their importance to breeding White-shouldered Starlings**.**

Ecological Assessment of the PSFSC Demolition and Rebuild

A.6.45 The potential direct and indirect ecological impacts arising from the demolition and rebuild of PSFSC are assessed in this section in accordance with Annexes 8 and 16 of the EIAO-TM.

Evaluation of Direct Impacts

A.6.46 Direct loss of developed and wooded areas is NOT anticipated.

A.6.47 The anthropogenic and highly disturbed nature of the developed area means that direct impacts are of no ecological significance and are not considered further in the following sections. The wooded area covered by the footprint of the PSFSC is very small (less than 0.03ha); loss of this area is not considered to be of significance due to its small size and limited ecological function.

A.6.48 Although all of the bird and bat species recorded within and near PSFSC are common and widespread in Hong Kong, and are highly adapted to frequent human disturbance, care should still be taken to maintain the wooded area as species are protected under WAPO.

Evaluation of Indirect Impacts

A.6.49 Indirect impacts from the PSFSC demolition and rebuild are considered negligible on the residential area of the study area.

A.6.50 The assessment of air quality during demolition and rebuild of PSFSC showed generally low concentrations of RSP and FSP off-site during the works, meaning that there are unlikely to be any ecological impacts caused by dust emissions from PSFSC.

A.6.51 The noisiest works are selective demolition and sheetpiling works and, as shown on Figure A3-3, appropriate noise mitigation will be provided .The modelling of noise during the demolition and construction stages of PSFSC show low levels of noise off-site during the works, meaning that there are unlikely to be any ecological impacts caused by noise from the PSFSC project site.

Impacts on Birds Utilising Adjacent Wetland Habitats (Brackish Gei Wai, Rain-fed Ponds and Commercial Fishponds)

A.6.52 There is no expected impact on waterbirds using the gei wai, due to their distance from PSFSC. Whilst the PSFSC itself and its immediate environs comprise developed areas and woodland, the Study Area is largely comprised of wetland habitats, largely commercial fish ponds but also including the southeastern parts of MPNR Gei Wai 3 to 7, together with a very small area of rain-fed Pond 8.

A.6.53 The brackish gei wai are utilised by a high diversity and abundance of waterbirds, including disturbance-sensitive large ardeids and Black-faced Spoonbills. However, there is no expected impact on waterbirds using the gei wai, due to their distance from PSFSC – around 120m to the nearest point on Gei Wai 3, which is already disturbed by the residents of the adjacent houses; and 204m to the nearest point used by large numbers of waterbirds during drain-down (in Gei Wai 4). This 204m distance is beyond the maximum 200m distance at which it is predicted that there may be some disturbance impacts on the most sensitive species of large waterbirds. Furthermore, there is no line of sight from the PSFSC (due to screening by trees and, to aa lesser extent, by buildings), so the only potential disturbance impact would be that of noise which would be much attenuated due to distance.

A.6.54 The other wetland habitats adjacent to or within 200m of PSFSC comprised only of commercial fishponds, which are either abandoned or frequently managed for aquaculture. Either way, these fishponds are of much less significance to wintering waterbirds than the brackish gei wai in the MPNR, as shown on ***Table A6-12***. Any impacts to this small number of birds will be of low significance.

Table A6-12 Numbers of Waterbirds Utilising Ponds within 200m of PSFSC from January to December 2017

Name	Scientific Name	Conservation and Protection Status[1]	Mean	Max
Little Grebe	*Tachybaptus ruficollis*	LC	0.08	1
Black-crowned Night Heron	*Nycticorax nycticorax*	(LC)	1	11
Chinese Pond Heron	*Ardeola bacchus*	PRC (RC)	1.17	7
Grey Heron	*Ardea cinerea*	PRC	0.25	1
Great Egret	*Ardea alba*	PRC (RC)	0.67	2
Little Egret	*Egretta garzetta*	PRC (RC)	7.08	76
Great Cormorant	*Phalacrocorax carbo*	PRC	1.08	8
Black Kite	*Milvus migrans*	(RC); CITES(II); CSMPS(II); Cap.586	0.08	1
White-breasted Waterhen	*Amaurornis phoenicurus*	-	1.08	3
White-throated Kingfisher	*Halcyon smyrnensis*	(LC)	0.17	1
Common Kingfisher	*Alcedo atthis*	-	0.08	1
Pied Kingfisher	*Ceryle rudis*	(LC)	0.08	1
Little Grebe	*Tachybaptus ruficollis*	LC	0.08	1
Number of Species of Conservation Importance and/or Wetland-dependent Birds				**12**

Note:

1. Conservation and protection status refers to Fellowes *et al*. (2002), Red List of China's Vertebrates (Jiang *et al.* 2016), IUCN (2017), China State Major Protection Status, CITES (2017), Cap. 170 and Cap. 586.
   a. Conservation status by Fellowes *et al.* (2002): LC = Local Concern; PRC = Potential Regional Concern; RC = Regional Concern; PGC = Potential Global Concern; GC = Global Concern. Letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.
   b. Conservation status by Red List of China's Vertebrates (RLCV) (Jiang *et al.* 2016): NT = Near Threatened; VU = Vulnerable; EN = Endangered; CR = Critically Endangered.
   c. Conservation status by IUCN (2017): NT = Near Threatened; VU = Vulnerable; EN = Endangered.
   d. Protection status by China State Major Protection Status (CSMPS): I = Class I Protected Species in China; II = Class II Protected Species in China.
   e. Protection status by CITES (2017): II = Listed in CITES Appendix II; III = Listed in CITES Appendix III.
   f. All wild birds in Hong Kong are protected under Cap. 170. Wild Animal Protection Ordinance.
   g. Cap. 586 = Protection of Endangered Species of Animals and Plants Ordinance.

Evaluation of Impacts on Other Non-bird Fauna and Species of Conservation Importance

A.6.55 Much of the Study Area is of relatively low ecological significance to non-bird fauna, as indicated by the low non-bird faunal diversity and frequent human disturbance (mainly fishpond management).

A.6.56 Whilst a number of species of conservation importance were recorded in the 500m Study Area, these species occur at a low density in the area, with some of them being locally common and widespread in Hong Kong. Given these circumstances, together with the fact that the proposed demolition and rebuild at PSFSC site will be small scale, the impacts to non-bird fauna will be of low significance. As a result, specific mitigation measures are not considered necessary.

Evaluation of Impacts on Nesting/Roosting Bats and Birds Within the Study Area

A.6.57 Based on the ongoing update surveys that started in April 2019, there do not appear to be any bat or bird roosts in the PSFSC building itself. Bat surveys on 18th and 24th April and the 3rd and 7th May did not record any bats emerging from the PSFSC. External checks made of building during daytime on all dates revealed several potential roost entrances. However, no bats were observed emerging at dusk from these points. Low numbers of bats (Pipistrelle sp.) were recorded emerging from the roost in the noticeboard (no more than three individuals). Surveys also revealed that a non-breeding roost of egrets is using the group of trees next to the PSFSC forecourt. A pair of White-shouldered Starlings appears to be using the electricity supply pylon in front of the PSFSC; this is outside the project site boundary.

Recommended Mitigation Strategies

A.6.58 All wild birds and bats, including their nests and eggs, are protected under the Wild Animals Protection Ordinance (Cap. 170). In particular, bats are vulnerable to mortality at roosts, especially if the roosts are being utilised by nursing females.

Birds Utilising Adjacent Wetland Habitats (Brackish Gei Wai, Rain-fed Ponds and Commercial Fishponds)

A.6.59 Egrets were observed flying to a night roost in the trees adjacent to the PSFSC. There will, however, be no works at the PSFSC site in the period 1730 to 0800 and therefore mitigation strategies are not required.

A.6.60 Impacts on birds due to demolition and rebuild activities will be low.

Roosting/Nesting Bats and Birds

A.6.61 Low numbers of bats (*Pipistrelle sp.*) were recorded emerging from the roost in the noticeboard (no more than three individuals). Several bats were recorded foraging around the PSFSC building and forecourt shortly after sunset, though there was no evidence of these emerging from the building itself. These appeared to arrive from the east. A review should be carried out by the qualified ecologist, in consultation with AFCD, to determine the most appropriate course of action, i.e. translocation, or development of an exclusion strategy for the noticeboard.

A.6.62 A pair of White-shouldered Starlings appears to be using the electricity supply pylon in front of the PSFSC; this is outside the project site boundary, with no immediate mitigation measures necessary. This should be kept in view by a qualified ecologist as a common and widespread breeding species in the Deep Bay Area.

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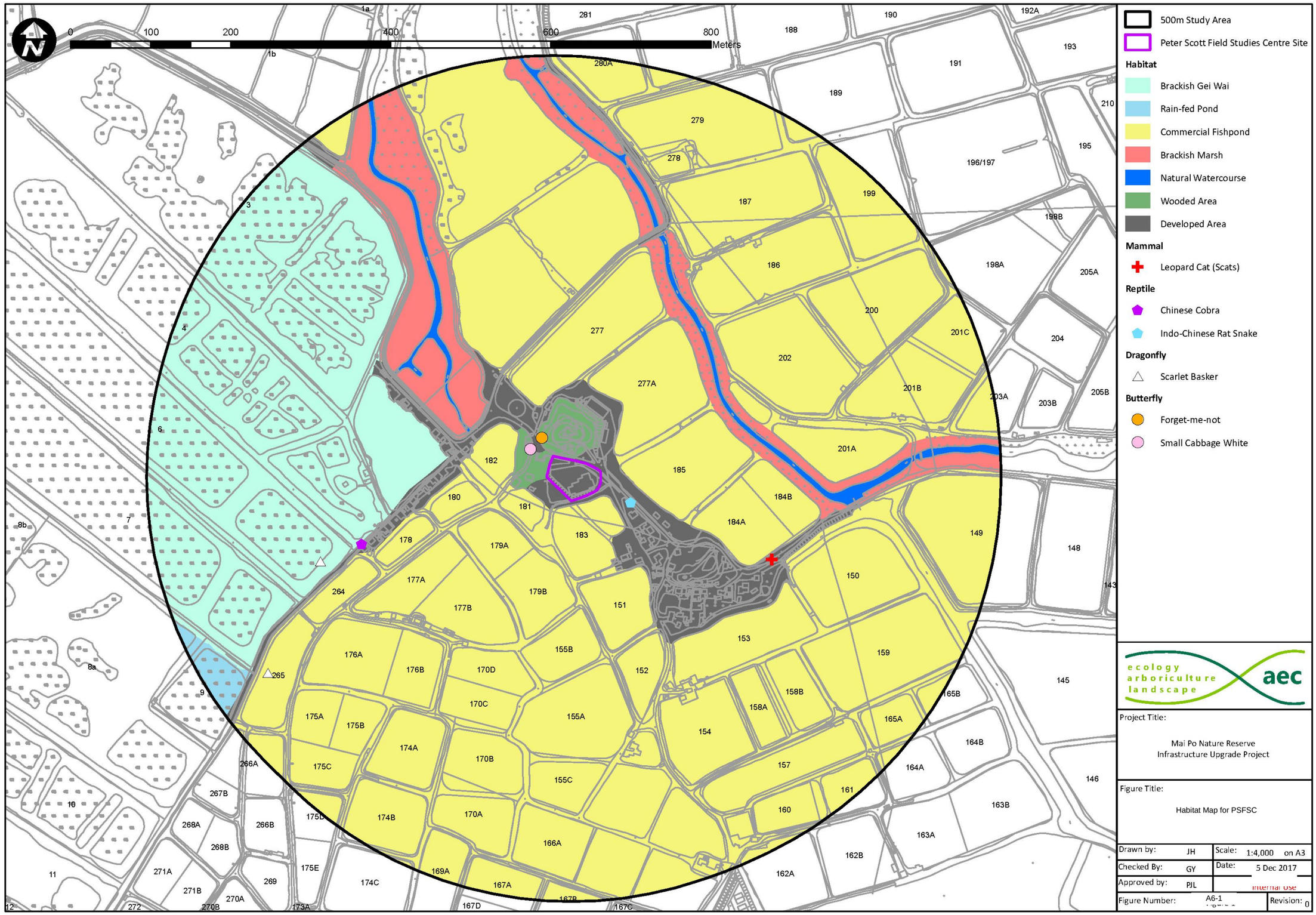
0
100
200
400
600
800
Meters
500m Study Area
Peter Scott Field Studies Centre Site
Habitat
Brackish Gei Wai
Rain-fed Pond
Commercial Fishpond
Brackish Marsh
Natural Watercourse
Wooded Area
Developed Area
Mammal
Leopard Cat (Scats)
Reptile
Chinese Cobra
Indo-Chinese Rat Snake
Dragonfly
Scarlet Basker
Butterfly
Forget-me-not
Small Cabbage White
ecology arboriculture landscape aec
Project Title:
Mai Po Nature Reserve
Infrastructure Upgrade Project
Figure Title:
Habitat Map for PSFSC
Drawn by: JH
Scale: 1:4,000 on A3
Checked By: GY
Date: 5 Dec 2017
Approved by: PJL
Internal Use
Figure Number: A6-1
Revision: 0

A.7 Environmental Monitoring and Audit

General Approach

A.7.1 WWF has engaged an Environmental Team (ET) and an Independent Environmental Checker (IEC) to carry out Environmental Monitoring and Audit (EM&A) of the construction within MPNR during the construction stage.

A.7.2 For PSFSC, which is not a DP, it is recommended that non-statutory EM&A is carried out during the demolition and construction stages as follows. The Implementation Schedule for PSFSC provided in ***Annex A*** shall be followed.

Air Quality

A.7.3 Dust will be the key air pollutant of concern during the demolition and construction stages. Although the dust levels at the ASRs are predicted to comply with the AQO limits for RSP and FSP, the proximity of ASR 1 and ASR 2 – just 48m and 13m, respectively, from the PSFSC Site boundary – may give cause for concern.

A.7.4 The major dust sources from work at PSFSC will be the demolition of the existing building and removal of the asphalt forecourt and sub-base; and construction works such as excavation, piling, materials handling, spoil removal, backfilling and wind erosion. As these activities will generate dust, rather than of small size particulates, monitoring of 24-hour RSP and 24-hour FSP levels are not proposed. Instead, 1-hour Total Suspended Particulates (TSP) is recommended to be monitored as the most appropriate parameter for construction dust.

Mitigation Measures

A.7.5 Mitigation measures to prevent dust impacts have been recommended in ***paragraphs A.2.30 to A.2.32***. All the recommended mitigation measures are detailed in the implementation schedule in ***Annex A***. Appropriate parties have been identified to be responsible for the design and implementation of these mitigation measures.

Monitoring Parameters and Equipment

A.7.6 1-hour TSP shall be monitored using a direct reading dust meter. The instrument shall be calibrated regularly following the requirements specified by the equipment manufacturer. It is not considered necessary to log wind speed or wind direction.

Monitoring Locations

A.7.7 Monitoring shall be carried out at ASR 1 and ASR 2, which are described in ***Table A2-2***. The locations of ASR 1 and ASR 2 are shown in ***Figure A2-1***. ASRs 3, 4 and 5 are considered too distant from PSFSC to be affected by dust.

Baseline Monitoring Frequency and Duration

A.7.8 Baseline monitoring should be carried out to determine the ambient 1-hour TSP levels at ASR 1 and ASR2 prior to the commencement of demolition works. Before commencing the baseline monitoring, the ET should inform the IEC of the monitoring programme such that the IEC can conduct on-site audit to ensure accuracy of the baseline monitoring results.

A.7.9 Baseline monitoring shall be carried out for a period of 5 consecutive weekdays. On each day, 3 sets of 1-hour TSP readings shall be taken. General meteorological conditions (wind speed, direction and precipitation) and notes regarding any significant adjacent dust producing sources should also be recorded on each day of monitoring.

A.7.10 In case the baseline monitoring cannot be carried out at ASR 1 and/or ASR 2 during the baseline monitoring period, the ET Leader shall carry out the monitoring at an alternative location that can effectively represent the baseline conditions at ASR 1 and/or ASR 2. The alternative baseline monitoring location shall be agreed with the IEC prior to commencement of baseline monitoring.

A.7.11 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with the IEC to agree on an appropriate set of data to be used as a baseline reference.

Impact Monitoring Frequency and Duration

A.7.12 When demolition or external rebuild work is ongoing at PSFSC, i.e. up to completion of roof and façade works, impact monitoring shall be carried out at ASR 1 and ASR2 once every two weeks. On each day, 3 sets of 1-hour TSP readings shall be taken. General meteorological conditions (wind speed, direction and precipitation) and notes regarding any significant adjacent dust producing sources should also be recorded on each day of monitoring.

A.7.13 Readings should be taken while typical demolition or rebuild works are being carried out at PSFSC, not during work breaks or times of inactivity.

Event and Action Plan

A.7.14 The baseline monitoring results shall form the basis for determining the air quality criteria for impact monitoring. The ET shall compare the impact monitoring results with the Action and Limit levels shown in ***Table A7-1***.

Table A7-1 Action and Limit Levels for Impact Monitoring of Dust

Parameter	Action Level	Limit Level
1-hour TSP	• For BL < 384μg/m^3, AL = (BL x 1.3 + LL) ÷ 2 • For BL > 384μg/m^3, AL = LL	500μg/m^3

Note: BL = Baseline Level | AL = Action Level | LL = Limit Level

A.7.15 The Event and Action Plan prescribes procedures and actions associated with the outcome of the comparison of air quality monitoring data recorded and the agreed A/L levels. In the cases where exceedances of these A/L levels occurs, the ET, the IEC, the ER and the Contractor should strictly observe the relevant actions of the respective Event and Action Plan given in ***Table A7-2***.

Table A7-2 Event and Action Plan for Dust Monitoring

Event	Action			
	ET	IEC	ER	Contractor
Action Level				
Exceedance for one sample	1. Repeat measurement to confirm findings 2. If exceedance is confirmed, inform the Contractor, IEC and ER 3. Identify source(s), investigate the causes of exceedance and propose remedial measures 4. Increase monitoring frequency	1. Check monitoring data submitted by the ET 2. Check Contractor's working method and 3. Discuss with ET, ER and Contractor on possible remedial measures 4. Review and advise the ET and ER on the effectiveness of the proposed remedial measures	1. Confirm receipt of notification of exceedance in writing.	1. Identify source(s), investigate the causes of exceedance and propose remedial measures 2. Implement remedial measures 3. Amend working methods agreed with the ER as appropriate
Exceedance for two or more consecutive samples	1. Repeat measurements to confirm findings 2. If exceedance is confirmed, inform Contractor, IEC and ER 3. Identify source(s), investigate the causes of exceedance and propose remedial measures 4. Increase monitoring frequency to daily 5. Advise the Contractor and ER on the effectiveness of the proposed remedial measures 6. Discuss with IEC and Contractor on remedial actions required 7. If exceedance continues, arrange meeting with Contractor, IEC and ER to discuss the remedial measures to be taken 8. If exceedance stops, cease additional monitoring	1. Check monitoring data submitted by the ET 2. Check Contractor's working method and 3. Discuss with ET, ER and Contractor on possible remedial measures 4. Review and advise the ET and ER on the effectiveness of the proposed remedial measures 5. Supervise Implementation of remedial measures	1. Confirm receipt of notification of exceedance in writing 2. In consultation with the ET and IEC agree with the Contractor on the remedial measures to be implemented and 3. Supervise implementation of remedial measures	1. Identify source(s) and investigate the causes of exceedance 2. Submit proposals for remedial measures to the ER, ET and IEC within three working days of notification for agreement 3. Implement the agreed proposals 4. Amend proposal as appropriate

Event	Action			
	ET	IEC	ER	Contractor
Limit Level				
Exceedance for one sample	1. Repeat measurement to confirm findings 2. If exceedance is confirmed, inform the Contractor, IEC and ER 3. Identify source(s), investigate the causes of exceedance and propose remedial 4. Increase monitoring frequency to daily 5. Discuss with the ER, IEC and Contractor on the remedial measures and assess effectiveness	1. Check monitoring data submitted by the ET 2. Check Contractor's working method 3. Discuss with the ET, ER and Contractor on possible remedial measures 4. Review and advise the ET and ER on the effectiveness of the proposed remedial measures 5. Supervise implementation of remedial measures	1. Confirm receipt of notification of exceedance in writing 2. Review and agree on the remedial measures proposed by the Contractor 3. Ensure remedial measures properly implemented	1. Identify source(s) and investigate the causes of exceedance 2. Take immediate action to avoid further exceedance 3. Submit proposals for remedial measures to ER, ET and IEC within three working days of notification for agreement 4. Implement the agreed proposals 5. Amend proposal if appropriate
Exceedance for two or more consecutive samples	1. Repeat measurement to confirm findings 2. If exceedance is confirmed, inform IEC, ER and Contractor 3. Identify source(s), investigate the causes of exceedance and propose remedial measures 4. Increase monitoring frequency to daily 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented 6. Arrange meeting with IEC and ER to discuss the remedial actions to be taken 7. Assess effectiveness of Contractor's remedial actions and keep IEC and ER informed of results 8. If exceedance stops, cease additional monitoring	1. Check monitoring data submitted by the ET 2. Discuss amongst ER, ET, and Contractor on the potential remedial actions 3. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly 4. Supervise the implementation of remedial measures	1. Confirm receipt of notification of exceedance in writing 2. In consultation with the ET and IEC, agree with the Contractor on the remedial measures to be implemented 3. Supervise the implementation of remedial measures 4. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated	1. Identify source(s) and investigate the causes of exceedance 2. Take immediate action to avoid further exceedance 3. Submit proposals for remedial measures to the ER, IEC and ET within three working days of notification for agreement 4. Implement the agreed proposals 5. Revise and resubmit proposals if problem still not under control 6. Stop the relevant portion of works as determined by the ER until the exceedance is abated

Audit Requirements

A.7.16 Regular inspection and audit of the PSFSC Site shall be conducted during demolition and external rebuild works (i.e. up to completion of roof and façade works) to ensure the recommended air quality mitigation measures are properly implemented. The ET shall carry out inspections every two weeks and the IEC shall carry out audits jointly with the ET on a monthly basis.

A.7.17 Inspection findings shall be logged in a site monitoring report with any discrepancies or concerns regarding the implementation and effectiveness of mitigation measures highlighted.

Noise

A.7.18 Noise will be of concern during the demolition and construction stage. Although mitigated noise levels at the NSRs are predicted to comply with the 75dB(A) criteria specified in Table 1B of Annex 5 of the EIAO-TM, the proximity of NSR 1 and NSR 2 – just 48m and 13m, respectively, from the PSFSC Site boundary – may give cause for concern.

A.7.19 The major noise sources from work at PSFSC will be the use of PME for the demolition of the existing building and removal of the asphalt forecourt and sub-base; and for rebuild works such as excavation, piling, structural work, materials handling, backfilling and vehicular movement.

Mitigation Measures

A.7.20 Mitigation measures to prevent nose impacts have been recommended in ***paragraphs A.3.24 to A.3.31***. All the recommended mitigation measures are detailed in the implementation schedule in ***Annex A***. Appropriate parties have been identified to be responsible for the design and implementation of these mitigation measures.

Monitoring Parameters and Equipment

A.7.21 Noise from demolition and rebuild activities should be measured in terms of the A-weighted equivalent continuous sound pressure level (Leq). Leq (30 min) should be used as the monitoring parameter for the time period between 0700 and 1900 hours on normal weekdays, which is when demolition and rebuild will be carried out.

A.7.22 Supplementary information for data auditing and statistical results such as L10 and L90 should also be obtained for reference.

A.7.23 As referred to the requirements of the Technical Memorandum (TM) issued under the NCO, sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications should be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement the accuracy of the sound level meter should be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the difference between calibration levels obtained before and after the noise measurement is less than 1.0 dB.

A.7.24 Noise measurements should not be made in the presence of fog, rain, wind with a steady speed exceeding 5m/s or wind with gusts exceeding 10m/s. The wind speed should be checked with a portable wind speed meter capable of measuring wind speeds in m/s.

Monitoring Locations

A.7.25 Monitoring shall be carried out at NSR 1 and NSR 2, which are described in ***Table A3-2***. The locations of NSR 1 and NSR 2 are shown in ***Figure A3-1***. NSRs 3, 4 and 5 are considered too distant from PSFSC to be affected by noise.

Impact Monitoring Frequency and Duration

A.7.26 Baseline monitoring should be carried out to determine the ambient noise levels at NSR 1 and NSR 2 prior to the commencement of demolition works. Before commencing the baseline monitoring, the ET should inform the IEC of the monitoring programme such that the IEC can conduct on-site audit to ensure accuracy of the baseline monitoring results.

A.7.27 Baseline monitoring shall be carried out for a period of 5 consecutive weekdays. On each day, 1 set of 30 minute Leq, L10 and L90 readings shall be taken between 0700 and 1900. General meteorological conditions (wind speed, direction and precipitation) and notes regarding any significant adjacent noise sources should also be recorded each day.

A.7.28 In case the baseline monitoring cannot be carried out at NSR 1 and/or NSR 2 during the baseline monitoring period, the ET Leader shall carry out the monitoring at an alternative location that can effectively represent the baseline conditions at NSR 1 and/or NSR 2. The alternative baseline monitoring location shall be agreed with the IEC prior to commencement of baseline monitoring.

A.7.29 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with the IEC to agree on an appropriate set of data to be used as a baseline reference.

Impact Monitoring Frequency and Duration

A.7.30 When demolition or external rebuild work is ongoing at PSFSC (i.e. up to completion of roof and façade works) impact monitoring shall be carried out once every two weeks. On each day, 1 set of 30 minute Leq, L10 and L90 readings shall be taken between 0700 and 1900. General meteorological conditions (wind speed, direction and precipitation) and notes regarding any significant adjacent noise sources should also be recorded on each day of monitoring.

A.7.31 Readings should be taken while typical demolition or rebuild works are being carried out at PSFSC, not during work breaks or times of inactivity.

Event and Action Plan

A.7.32 The Action and Limit levels for demolition and construction noise are shown in ***Table A7-3***. The ET shall compare the impact monitoring results with these Action and Limit levels.

Table A7-3 Action and Limit Levels for Impact Monitoring of Noise

Parameter	Action Level	Limit Level
Leq(30 minutes)	When one documented complaint is received	75dB(A)

Note: NSR 1 is a village house and NSR 2 is an occupied container, and so 75dB(A) criteria stipulated in the EIAO-TM for residential premises is adopted. There are no hotels, hostels or educational institutions in the vicinity of PSFSC.

A.7.33 To account for cases in which ambient noise levels, as identified by baseline monitoring, approach or exceed the stipulated Limit Levels prior to the commencement of demolition and rebuild, a Maximum Acceptable Impact Level, which incorporates the baseline noise levels and the identified noise Limit Level, may be defined by the ET and agreed with the IEC. The amended level will be greater than 75dB(A) and will represent the maximum acceptable noise level at NSR 1 and/or NSR 2. Correction factors for the effects of acoustic screening and/or architectural features of NSR 1 and/or NSR 2 may also be applied as specified in the *Technical Memorandum on Noise from Construction Work other than Percussive Piling (TM-GW)*.

A.7.34 The Event and Action Plan prescribes procedures and actions associated with the outcome of the comparison of noise monitoring data recorded and the agreed A/L levels. In the cases where exceedances of these A/L levels occurs, the ET, the IEC, the ER and the Contractor should strictly observe the relevant actions of the respective Event and Action Plan given in ***Table A7-4***.

Audit Requirements

A.7.35 Regular inspection and audit of the PSFSC Site shall be conducted during demolition and external rebuild works (i.e. up to completion of roof and façade works) to ensure that the recommended noise mitigation measures are properly implemented. The ET shall carry out inspections every two weeks and the IEC shall carry out audits jointly with the ET on a monthly basis.

A.7.36 Inspection findings shall be logged in a site monitoring report with any discrepancies or concerns regarding the implementation and effectiveness of mitigation measures highlighted.

Table A7-4 Event and Action Plan for Noise Monitoring

Event	Action			
	ET	IEC	ER	Contractor
Action Level				
Exceedance for one reading	1. Investigate the complaint and propose remedial measures 2. Discuss with the ER and Contractor on the remedial measures required 3. Increase monitoring frequency to check mitigation effectiveness.	1. Review the investigation results submitted by the Contractor 2. Review and advise the ET and ER on the effectiveness of the remedial measures proposed by the Contractor	1. Notify the Contractor, ET, IEC and Confirm receipt of notification of complaint in writing 2. Review and agree on the remedial measures proposed by the Contractor 3. Supervise implementation of remedial measures	1. Investigate the complaint and propose remedial measures 2. Report the results of investigation to the IEC, ET and ER 3. Submit noise mitigation proposals to the ER, IEC and ET for agreement within three working days of notification 4. Implement noise mitigation proposals
Limit Level				
Exceedance for one reading	1. Repeat measurement to confirm exceedance 2. If exceedance is confirmed, notify the Contractor, IEC and ER 3. Identify source and investigate the causes of exceedance 4. Increase monitoring frequency 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented 6. Arrange meeting with the IEC and ER to discuss the remedial measures to be taken 7. Review the effectiveness of Contractor's remedial measures and keep IEC, EPD and ER informed of the results 8. If exceedance stops, cease additional monitoring	1. Check monitoring data submitted by the ET 2. Check the Contractor's working method 3. Discuss with the ER, ET and Contractor on the potential remedial measures 4. Review and advise the ET and ER on the effectiveness of the remedial measures proposed by the Contractor.	1. Confirm receipt of notification of exceedance in writing 2. In consultation with the ET and IEC, agree with the Contractor on the remedial measures to be implemented 3. Supervise the implementation of remedial measures 4. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated	1. Identify source and investigate the causes of exceedance 2. Take immediate action to avoid further exceedance 3. Submit proposals for remedial measures to the ER, IEC and ET within three working days of notification for agreement 4. Implement the agreed proposals 5. Revise and resubmit proposals if problem still not under control 6. Stop the relevant portion of works as determined by the ER until the exceedance is abated

Water Quality

A.7.37 The demolition and rebuild works at PSFSC are not anticipated to result in any unacceptable water quality impacts.

Mitigation Measures

A.7.38 Mitigation measures to minimise waste during the demolition and construction stages have been recommended in ***paragraph A.4.45***. All the recommended mitigation measures are detailed in the implementation schedule in ***Annex A***. Appropriate parties have been identified to be responsible for the design and implementation of these mitigation measures.

A.7.39 No mitigation measures are required during the operation stage as all wastewater will be treated by the on-site STP to Group A standard under WPCO. WWF will apply for a Discharge Licence under WPCO for the treated sewage effluent from the STP and regular monitoring of effluent will demonstrate to the satisfaction of the Authority that there is no unacceptable pollution. Such monitoring is carried out under WPCO and does not form part of the non-statutory EM&A programme for PSFSC.

Audit Requirements

A.7.40 Regular inspection and audit of the PSFSC Site shall be conducted during demolition and external rebuild works (i.e. up to completion of roof and façade works) to ensure that the recommended water quality mitigation measures are properly implemented. The ET shall carry out inspections every two weeks and the IEC shall carry out audits jointly with the ET on a monthly basis.

A.7.41 Inspection findings shall be logged in a site monitoring report with any discrepancies or concerns regarding the implementation and effectiveness of mitigation measures highlighted.

Waste Management

A.7.42 In any project that involves demolition, the handling of demolition waste is of concern, more so than the generation of construction-related waste.

Mitigation Measures

A.7.43 Mitigation measures to minimise waste during the demolition and construction stages have been recommended in ***paragraphs A.5.66 to A.5.74***. All the recommended mitigation measures are detailed in the implementation schedule in ***Annex A***. Appropriate parties have been identified to be responsible for the design and implementation of these mitigation measures.

Audit During Demolition

A.7.44 Regular inspection and audit of the PSFSC Site shall be conducted during demolition. The ET shall carry out inspections once every week and the IEC shall carry out audits jointly with the ET once every two weeks, paying particular attention to:

- The implementation of the Demolition Contractor's *Selective Demolition Plan* – this is a contractual obligation:

  - **Stage 1.** Removal of any remaining:
    - Electrical Appliances and White Goods
    - Computer and ICT Equipment
    - Furniture and Soft Furnishings

    These materials shall be sent for recycling/refurbishment, e.g. Waste Electrical and Electronic Equipment (WEEE) will be sent to the WEEE Treatment Facility (WTF) at EcoPark.
  - **Stage 2.** Dismantling and removal of:
    - Windows and Doors
    - Kitchen Fittings
    - Washroom Fittings

    Wood and glass from windows and doors and metals from kitchen fittings and washroom fittings shall be sent to recyclers. Porcelain will be sent to the closest Public fill Reception Facility (PFRF).
  - **Stage 3.** Disconnection and removal of:
    - Air Conditioners
    - Pipework and Ducts
    - Lighting, Cables and Wires

    Air-conditioners shall be sent to the WTF, metals will be sent to recyclers and florescent lights will be sent to the Chemical Waste Treatment Centre (CWTC) in Tsing Yi for safe disposal.
  - **Stage 4.** Demolition and removal of:
    - Building Superstructure
    - Building Substructure
    - Building Foundations

    Concrete waste shall be sent to the nearest crushing plant, which is operated by the Civil Engineering and Development Department (CEDD) at the Fill Bank in Tseung Kwan O Area 137. At the crushing plant all of the concrete building waste will be crushed into G200 recycled rockfill, which can then be reused in construction projects.

- The Demolition Contractor's records, to be submitted monthly, relating to the quantities and types of material removed during selective demolition:
  - The off-site destination of all such materials (e.g. to local recyclers, WTF, PFRFs, etc.)
  - The quantities of waste reused, recycled, treated or disposed of (including trip tickets) at each off-site destination
- The Demolition Contractor's and Construction Contractor's documents, including licenses, permits, disposal and recycling records, shall be regularly inspected to ensure they comply with legislation and contract requirements.
- Review of the Demolition Contractor's and Construction Contractor's Waste Management Plans (WMPs) prepared in accordance with *ETWB TC(W) No. 19/2005* to be submitted to the Engineer for approval before the commencement of any demolition work.
- Implementation of mitigation measures listed in *Practice Note for Registered Contractors No. 17 Control of Environmental Nuisance from Construction Sites* and compliance with the particular specification listed in *Part B of Annex 2 to Appendix C of ETWB TC(W) No. 19/2005* in relation to the use of dump trucks.

- Implementation of a trip-ticket system in accordance with *DevB TC(W) No. 6/2010 and the Waste Disposal (Charges for Disposal of Construction Waste) Regulation* and the Demolition Contractor's regular submission of chits.
- Provision of suitable enclosed bins or compaction units (separate from C&D Material) in an enclosed and covered area to be used for the temporary storage of general refuse prior to its removal from Site by a reputable waste contractor.

A.7.45 Inspection findings shall be logged in a site monitoring report with any discrepancies or concerns regarding the implementation and effectiveness of mitigation measures highlighted.

Audit During Construction

A.7.46 Regular inspection and audit of the PSFSC Site shall be conducted during external rebuild works (i.e. up to completion of roof and façade works) to ensure that the recommended waste management mitigation measures are properly implemented. The ET shall carry out inspections every two weeks and the IEC shall carry out audits jointly with the ET on a monthly basis.

A.7.47 Inspection findings shall be logged in a site monitoring report with any discrepancies or concerns regarding the implementation and effectiveness of mitigation measures highlighted.

Ecology

Mitigation Measures

A.7.48 Mitigation measures to minimise ecological impacts have been recommended in ***paragraphs A.6.58 to A.6.62***. All the recommended mitigation measures are detailed in the implementation schedule in ***Annex A***. Appropriate parties have been identified to be responsible for the design and implementation of these mitigation measures.

Audit Requirements

A.7.49 Prior to the commencement of demolition works, the area within and in proximity to the works area (including trees, buildings and other structures) should be checked by an ecologist for the presence of any nests or roosts of birds, bats or other fauna.

A.7.50 Regular inspection and audit of the PSFSC Site shall be conducted during demolition and external rebuild works (i.e. up to completion of roof and façade works) to ensure that the recommended ecological mitigation measures are properly implemented. The ET shall carry out inspections every two weeks and the IEC shall carry out audits jointly with the ET on a monthly basis.

A.7.51 Inspection findings shall be logged in a site monitoring report with any discrepancies or concerns regarding the implementation and effectiveness of mitigation measures highlighted.

A.8 Conclusions

A.8.1 The overall conclusion of this assessment is that in terms of air quality, noise, water quality/sewage treatment, waste and ecology, there will be no adverse environmental impacts arising from the demolition, rebuild and operation of PSFSC. A summary of each assessment is provided as follows:

Air Quality

A.8.2 A quantitative assessment of air quality impacts was carried out for the demolition and construction stages of PSFSC. Cumulative impact results show no exceedance of AQOs for RSP and FSP at the representative ASRs. With the implementation of the recommended mitigation measures and good site practice, adverse air quality impacts during the demolition and construction stages are not anticipated. As such, further air quality mitigation measures during the construction stage are not necessary. Nevertheless, adopting the precautionary principle, EM&A of dust at the two closest ASRs will be carried out.

A.8.3 There will be no sources of air pollution arising from PSFSC during the operation stage. As such mitigation measures are not required during the operation stage.

A.8.4 Overall, therefore, no adverse air quality impact is anticipated during the demolition, construction or operation stages of PSFSC.

Noise

A.8.5 A quantitative assessment of noise impacts was carried out for the demolition and rebuild of PSFSC. Results show no exceedance of the EIAO-TM noise criteria at the representative NSRs with the installation of the proposed construction noise barrier. With the implementation of good site practice, adverse noise impacts during the demolition and construction stages are not anticipated. As such, further noise mitigation measures during the construction stage are not necessary. Nevertheless, adopting the precautionary principle, EM&A of noise at the two closest NSRs will be carried out.

A.8.6 There will be no sources of noise arising from PSFSC during the operation stage. As such mitigation measures are not required during the operation stage.

A.8.7 Overall, therefore, no adverse noise impact is anticipated during the demolition, construction or operation stages of PSFSC.

Water Quality / Sewage Treatment

A.8.8 During demolition and rebuild, the Works Contractor shall follow good site practice and be responsible for the design, construction, operation and maintenance of applicable mitigation measures specified in ProPECC PN 1/94 for construction site drainage. With these measures in place, it is unlikely than any adverse water quality impacts from the PSFSC Site will be generated during the demolition and construction stages.

A.8.9 The redevelopment of PSFSC will result in an increase in wastewater generation from more public toilets to serve more visitors to MPNR, from more en-suite toilets associated with expanded overnight accommodation of course attendees, and more kitchen wastewater from an expanded kitchen. The future wastewater generation from the new PSFSC will therefore be significantly greater than the current flow. Rather than

upgrade the existing septic tank and soakaway system, WWF will construct a new wastewater treatment system at PSFSC that deals with both greywater (with reuse) and sewage and also meets the highest standards for discharge – that for Group A Inland Waters under WPCO. During operation, therefore, no adverse water quality impact is anticipated.

A.8.10 Overall, therefore, no adverse water quality impact is anticipated during the demolition, construction or operation stages of PSFSC.

Waste Management

A.8.11 To ensure that the majority of demolition waste from PSFSC is acceptable at public filling areas or for recycling, WWF intends to adopt "selective demolition", which will avoid the generation of a significant quantity of demolition waste.

A.8.12 By making use of the crushing plant operated by CEDD at the Fill Bank in Tseung Kwan O Area 137, all of the comprising concrete building waste and stone sub-base arising during demolition and rebuild can be recycled into G200 recycled rockfill. Asphalt from the forecourt can be used as RAP in the production of new asphalt. Using G200 recycled rockfill from the crushing plant and asphalt made from RAP in the rebuild of the PSFSC will enable close to zero net waste generation from the demolition and rebuild of PSFSC to be achieved.

A.8.13 Because of selective demolition, there will be a negligible quantity of C&D waste generated. A small quantity of C&D waste will be generated during the construction stage, some of which will can be recycled off-site and some of which will need to be disposed of at landfill.

A.8.14 General refuse, which is similar to MSW, will be generated by workers during the demolition and construction stages, and during the operation stage by staff and visitors to MPNR who pass through PSFSC. On-site segregation of general waste shall be carried out, with recyclable materials, such as metal, paper and plastic, given to local recyclers for off-site recycling. Residual general refuse will be sent to landfill for disposal.

A.8.15 No chemical waste is anticipated to arise during the demolition or construction stages. There will be no chemical waste generated during the operation stage, although a small quantity of sludge from the MBR STP will be generated, which will be treated at T-Park.

A.8.16 Overall, therefore, provided that recommended mitigation measures are followed, there should be no adverse waste impact from the handling, transportation or disposal of inert C&D material, C&D waste or general refuse during the demolition, rebuild or operation of PSFSC.

Ecology

A.8.17 The current ecological conditions and potential ecological impacts of the demolition and rebuild of PSFSC have been assessed. Based on this review, measures to avoid and minimise ecological impacts have been recommended. With these measures in place it is considered that all significant ecological impacts will be addressed and residual impacts will be acceptable.

ANNEX A

Implementation Schedule for PSFSC

App A Ref.	EM&A Log	Environmental Protection Measures	Location/Duration of Measures and Timing of Completion of Measures	Implementation Agent	Implementation Stage*				Relevant Legislation and Guidelines
					D	M	C	O	
Air Quality									
A.2.7	A.1	Use of approved Non-road Mobile Machinery (NRMM) for all site works areas.	PSFSC works area during demolition and construction period	Demolition and Construction Contractors		✓	✓		Air Pollution Control (NRMM) (Emission) Regulation
A.2.32	A.4	1. Regular watering to reduce dust emissions from exposed site surfaces and unpaved roads, particularly during dry weather. 2. Frequent watering for particularly dusty areas and areas close to ASRs. 3. Cement, pulverized fuel ash or any other dusty materials collected by fabric filters or other air pollution control system or equipment shall be disposed of in totally enclosed containers. 4. Open stockpiles shall be avoided or covered Where possible, prevent placing dusty material storage piles near ASRs. 5. 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 shall be applied to aggregate fines. 6. Tarpaulin covering of all dusty vehicle loads transported to and from the Site. 7. Use of water sprinklers at the loading area where dust generation is likely during the loading process of loose material, particularly in dry weather. 8. Imposition of speed controls for vehicles in the Site. 9. Where possible, routing of vehicles and positioning of construction plant should be at the maximum possible distance from off-site ASRs. 10. Every stock of more than 20 bags of cement or dry PFA should be covered entirely by impervious sheeting or placed in an area sheltered on the top and the 3 sides.	PSFSC works area during demolition and construction period	Demolition and Construction Contractors		✓	✓		Air Pollution Control (Construction Dust) Regulation

App A Ref.	EM&A Log	Environmental Protection Measures	Location/Duration of Measures and Timing of Completion of Measures	Implementation Agent	Implementation Stage*				Relevant Legislation and Guidelines
					D	M	C	O	
Noise									
A.3.8	N.1	Prohibition of works during Restricted Hours.	PSFSC works area during demolition and construction period	Demolition and Construction Contractors		✓	✓		NCO
A.3.10	N.2	Prohibition of percussive piling.	PSFSC works area during construction period	Construction Contractor			✓		NCO Technical Memorandum on Noise from Percussive Piling
A.3.32	N.5	1. Adopt the *Code of Practice on Good Management Practice to Prevent Violation of the NCO (for Construction Industry)*. 2. To further reduce noise from demolition, the Demolition Contractor shall consider the use of a moveable noise enclosure for top-down selective demolition. 3. Upon the advice of the ET's ecologist, the Contractor shall also consider installing a noise barrier between the Site and any ESRs identified in proximity to PSFSC 4. Before commencing any work, submit to the Project Engineer for approval the method of working, equipment and noise mitigation measures intended to be used at the site. 5. Unused equipment should be turned off PME should be kept to a minimum and the parallel use of noisy equipment / machinery should be avoided. 6. Regular maintenance (off-site) of all plant and equipment.	PSFSC works area during demolition period	Demolition and Construction Contractors		✓	✓		Code of Practice on Good Management Practice to Prevent Violation of the NCO (for Construction Industry)

App A Ref.	EM&A Log	Environmental Protection Measures	Location/Duration of Measures and Timing of Completion of Measures	Implementation Agent	Implementation Stage*				Relevant Legislation and Guidelines
					D	M	C	O	
Water Quality / Sewage Treatment									
A.4.36 and Table A4-3	WQ.11	GWTS to reclaim greywater to flushing water standard.	Within PSFSC Building	Engineer Construction Contractor WWF	✓		✓	✓	WSD Technical Specifications on Grey Water Reuse and Rainwater Harvesting
A.4.38, A.4.39 and Table A4-4	WQ.12	MBR STP to treat sewage to meet Group A standard for discharge into inland waters.	Within PSFSC Building	Engineer Construction Contractor WWF	✓		✓	✓	WPCO Technical Memorandum on Standards for Effluents Discharged Into Drainage and Sewerage Systems, Inland and Coastal Waters – Group A Inland Waters
A.4.40 and Table A4-5	WQ.13	Treated sewage effluent from the MBR STP shall not exceed the estimated pollutant loadings from the existing septic tank system: • BOD_5 138 mg/L • COD 327 mg/L • SS 49 mg/L • Total N 45 mg/L • Total P 20 mg/L • Total Faecal Coliform 10M cfu/100mL **Note:** Pollutant loading will need to be significantly lower than shown above to meet WPCO discharge standard for Group A Inland Waters. This requirement is under the purview of WPCO, not EIAO.	Discharge pipe from MBR STP leading to soakaway	Engineer Construction Contractor WWF	✓		✓	✓	TPB PG-No. 12C (Revised May 2014)) Guidelines For Application for Developments Within Deep Bay Area Under Section 16 of the Town Planning Ordinance

App A Ref.	EM&A Log	Environmental Protection Measures	Location/Duration of Measures and Timing of Completion of Measures	Implementation Agent	Implementation Stage*				Relevant Legislation and Guidelines
					D	M	C	O	
A.4.45	WQ.14	1. 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 sediment basins. 2. Channels or earth bunds or sand bag barriers should be provided on site to properly direct stormwater to such silt removal facilities. 3. Perimeter channels at site boundaries shall be provided where necessary to intercept surface runoff from outside the works areas so that it will not wash across the works areas. 4. For the purpose of preventing soil erosion, temporarily exposed slope surfaces shall be covered e.g. by tarpaulin, and temporary access roads shall be protected by crushed stone or gravel. 5. Intercepting channels shall be provided (e.g. along the crest/edge of excavation) to prevent storm runoff from washing across exposed soil surfaces. Arrangements shall always be in place to ensure that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm. 6. Earthworks final surfaces shall be well compacted and the subsequent permanent work or surface protection shall be carried out immediately after the final surfaces are formed to prevent erosion caused by rainstorms. 7. Measures shall be taken to minimise the ingress of rainwater into trenches. If excavation of trenches in wet seasons is necessary, they shall be dug and backfilled in short sections. 8. Silt removal facilities, channels and manholes should be maintained and the deposited silt and grit should be removed regularly. 9. All vehicles and plant should be cleaned before they leave a construction site to ensure no earth, mud, debris and the like is deposited by them on roads. A wheel washing bay should be provided at every site exit if	PSFSC works area during demolition and construction periods	Demolition and Construction Contractors		✓	✓		ProPECC PN 1/94 Construction Site Drainage

App A Ref.	EM&A Log	Environmental Protection Measures	Location/Duration of Measures and Timing of Completion of Measures	Implementation Agent	Implementation Stage*				Relevant Legislation and Guidelines
					D	M	C	O	
		practicable and wash-water should have sand and silt settled out or removed before discharging into storm drains. The section of construction road between the wheel washing bay and the public road should be paved with backfall to reduce vehicle tracking of soil and to prevent site run-off from entering public road drains.							
Waste Management									
A.5.9 to A.5.13	WM.1	Selective demolition of PSFSC to be included in demolition contract documents as follows: 1. Tier 1 Materials, such as electrical appliances, white goods; computer and ICT equipment; and furniture and soft furnishings, will be removed first. If in usable condition, these will be put in storage pending reuse in the new PSFSC. Items that are not needed will be sent for recycling/refurbishment, e.g. Waste Electrical and Electronic Equipment (WEEE) will be sent to the WEEE Treatment Facility (WTF) at EcoPark. 2. Tier 2 Materials, such as windows and doors; kitchen fittings; and toilet fittings, will then be removed. Wood and glass from windows and doors and metals from kitchen fittings and washroom fittings will be sent to recyclers. Porcelain will be sent to a Public fill Reception Facilities (PFRF) for reuse/recycling. 3. Tier 3 Materials, such as air conditioners, pipework and ducts, cables and wires, will then be removed/stripped out. Air conditioners will be sent to the WTF, metals will be sent to recyclers and florescent lights will be sent to the Chemical Waste Treatment Centre (CWTC) in Tsing Yi for safe disposal. 4. Tier 4 Materials, from the building structure, foundations and forecourt surface will be shall be sorted on-site and be separated into different groups for disposal at landfills, PFRFs, or recycling as appropriate.	PSFSC works area during demolition period	Engineer Demolition Contractor	✓	✓			N/A

App A Ref.	EM&A Log	Environmental Protection Measures	Location/Duration of Measures and Timing of Completion of Measures	Implementation Agent	Implementation Stage*				Relevant Legislation and Guidelines
					D	M	C	O	
A.5.65	WM.2	Sludge from the MBR STP shall be collected by a licenced sludge contractor and treated at T-Park.	MRR STP	WWF				✓	N/A
A.5.67	WM.3	Preparation of a WMP to manage waste on site.	PSFSC works area during demolition and construction period	Demolition Contractor and Construction Contractor		✓	✓		ETWB TC(W) No. 19/2005, Environmental Management on Construction Sites
A.5.68	WM.4	Waste storage areas should be well maintained and cleaned regularly.	PSFSC works area during demolition and construction period	Demolition Contractor and Construction Contractor		✓	✓		N/A
A.5.69	WM.5	Store refuse pending removal in receptacles provided with close fitting covers and remove and properly dispose of refuse daily.	PSFSC works area during demolition and construction period	Demolition Contractor and Construction Contractor		✓	✓		PNRC No. 17 Control of Environmental Nuisance from Construction Sites
A.5.69	WM.6	Dump trucks shall be fitted with covered box type dump bed and such dump trunks shall comply with the particular specification listed in Part B of Annex 2 to Appendix C of ETWB TC(W) No. 19/2005.	PSFSC works area during demolition and construction period	Demolition Contractor and Construction Contractor		✓	✓		Part B of Annex 2 to Appendix C of ETWB TC(W) No. 19/2005
A.5.70	WM.7	Establishment of a Trip Ticket System to monitor the disposal of public fill and solid wastes at public filling facilities and landfills, and to control fly-tipping.	PSFSC works area during demolition and construction period	Demolition Contractor and Construction Contractor		✓	✓		DevB TC(W) No. 6/2010 and Waste Disposal (Charges for Disposal of Construction Waste) Regulation
A.5.71	WM.8	General refuse should be stored in enclosed bins or compaction units separate from C&D material. A reputable waste collector should be employed by the construction contractor to remove general refuse from the Site, separately from C&D materials.	PSFSC works area during demolition and construction period	Demolition Contractor and Construction Contractor		✓	✓		N/A

App A Ref.	EM&A Log	Environmental Protection Measures	Location/Duration of Measures and Timing of Completion of Measures	Implementation Agent	Implementation Stage*				Relevant Legislation and Guidelines
					D	M	C	O	
Table A5.2	WM.10	Inert C&D Material: Concrete building waste to crushing plant at Tseung Kwan O Area 137 for recycling into G200 recycled rockfill.	PSFSC works area during demolition and construction period	Demolition Contractor and Construction Contractor		✓	✓		N/A
Table A5.2	WM.11	Inert C&D Material: Waste asphalt to be recycled as RAP at a nearby Asphalt Plant. If not possible then send to Fill Bank in Tuen Mun Area 38 for reuse.	PSFSC works area during demolition period	Demolition Contractor		✓			N/A
Table A5.2	WM.12	C&D Waste (non-inert): Segregation + off-site recycling by local recyclers / residual waste to NENT Landfill.	PSFSC works area during demolition and construction period	Demolition Contractor and Construction Contractor		✓	✓		N/A
Table A5.2	WM.14	General Refuse: Segregation + off-site recycling by local recyclers / residual waste to NWNT RTS.	PSFSC works area during demolition and construction period	Demolition Contractor and Construction Contractor		✓	✓		N/A
A.5.74	WM.15	3-colour bins for metals, plastics and paper will be placed at prominent locations within PSFSC to enable segregation-at-source of recyclables. Receptacles for organic waste will be provided for food waste and a smaller number of general refuse bins will be provided for non-recyclable waste.	PSFSC during operation period	WWF				✓	N/A
Ecology									
A.6.59	E.4	Egrets were observed flying to a night roost in the trees adjacent to the PSFSC. To avoid disturbance, no works will be permitted in the period 1730 to 0800.	PSFSC works area and the immediate environment	ET / IEC	✓	✓			Wild Animals Protection Ordinance
A.6.61	E.9	A review should be carried out by the qualified ecologist, in consultation with AFCD, to determine the most appropriate course of action, i.e. translocation, or development of an exclusion strategy for the noticeboard	PSFSC works area before demolition and site clearance	ET / IEC		✓			Wild Animals Protection Ordinance