

# West Rail

## Operational EM&A Manual

(Revised May 2020)

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## INTRODUCTION

### 1.1 Purpose of the Operational EM&A

- 1.1.1 The purpose of Environmental Monitoring and Audit (EM&A) for the operation of West Rail Phase 1 – West Kowloon to Tuen Mun Centre is to ensure compliance with the Environmental Impact Assessment (EIA) study recommendations and the environmental legislation by undertaking systematic procedures for monitoring, auditing and minimising of the environmental impacts associated with the operational activities.
- 1.1.2 The quality, safety and environmental issues are inter-related and thus an integrated management system for these aspects is established for the West Rail operations. To define the management responsibilities for the implementation and maintenance of the management system that meets the requirement of ISO9001 “Quality Management System”, ISO14001 “Environmental Management System” and BS8800 “Occupational Health and Safety Management System”, a Management System Manual is established.
- 1.1.3 The Management System Manual contains the structure of the divisional management system and outlines the core processes in which the system is implemented. It also identifies the management’s commitment to and responsibility for the implementation of the management system that meet the requirements of ISO9001, ISO14001, BS8800 and other standards as deemed necessary.
- 1.1.4 Fifteen generic procedures applied to all activities for West Rail operations which incorporate the environmental control measures and monitoring are further developed to supplement the Management System Manual and are listed as below,

**Table 1 Management Procedure List – Generic**

<b>Procedure No.</b>	<b>Title</b>
WRD/MP/01	Management Review
WRD/MP/02	Procedure / Instruction Implementation
WRD/MP/03	Purchasing of Materials / Equipment & Services
WRD/MP/04	Contract Review
WRD/MP/05	Document and Data Control
WRD/MP/06	Training
WRD/MP/07	Internal Audit
WRD/MP/08	Inspection, Measuring and Test Equipment (IM & TE)
WRD/MP/09	Design Control and Servicing
WRD/MP/10	Complaint Handling
WRD/MP/11	Safety Management Procedure
WRD/MP/12	Environmental Management Procedure

<b>Procedure No.</b>	<b>Title</b>
WRD/MP/13	Project Management
WRD/MP/14	HKRI Inspection of Temporary Works
WRD/MP/15	Reporting of Notifiable Occurrences to HKRI

Note: WRD/MP/16 – WRD/MP/20 reserved for future uses.

- 1.1.5 In addition to the Generic Procedures, a series of process procedures are developed by Rolling Stock Department, Infrastructure and Buildings Department, Operations Department, Business Analysis Section, Public Affairs Section and Personnel and Administration Section for incorporation of the operational and environmental control for its sectional/departmental activities. A list of the management procedures for individual department is shown as below.

**Table 2 Management Procedure List – Business Analysis Section**

<b>Procedure No.</b>	<b>Title</b>
WRD/MP/21	Business Planning and Budgeting
WRD/MP/22	Monthly and Quarterly Performance Report

Note: WRD/MP/23 – WRD/MP/25 reserved for future uses.

**Table 3 Management Procedure List - Rolling Stock Department**

<b>Procedure No.</b>	<b>Title</b>
WRD/MP/26	Pat Heung Depot Maintenance and Repair
WRD/MP/27	Tuen Mun Depot Maintenance and Repair
WRD/MP/28	EMU and LRV Workshop Maintenance and Repair
WRD/MP/29	Maintenance and Repair of Plant Equipment & Auxiliary Vehicles
WRD/MP/30	Rolling Stock Design and Technical Support
WRD/MP/31	Store
WRD/MP/32	Maintenance and Repair of KCRC Buses
WRD/MP/33	Maintenance and Repair of KCRC Road Vehicles

Note: WRD/MP/34 – WRD/MP/40 reserved for future uses.

**Table 4 Management Procedure List - Infrastructure & Buildings Department**

<b>Procedure No.</b>	<b>Title</b>
WRD/MP/41	Signal and Communications (S&C) Maintenance
WRD/MP/42	S&C Software Maintenance and Support
WRD/MP/43	S&C Systems Technical Support
WRD/MP/44	Workshop (Signal & communications Maintenance) and Repair
WRD/MP/45	Workshop (Plant & Calibration) Maintenance and Repair
WRD/MP/46	Automatic Fare Collection (AFC) Maintenance
WRD/MP/47	AFC Workshop Maintenance and Repair
WRD/MP/48	AFC System Maintenance and Support

<b>Procedure No.</b>	<b>Title</b>
WRD/MP/49	P-Way Monitoring
WRD/MP/50	P-Way Maintenance
WRD/MP/51	P-Way Standard & Control
WRD/MP/52	Tunnel & Landscape Maintenance
WRD/MP/53	Viaduct & Light Rail Works Maintenance
WRD/MP/54	Survey
WRD/MP/55	Operation of Civil Engineering Fault Report Centre and Emergency Recovery Team
WRD/MP/56	Light Rail Power Control
WRD/MP/57	Traction & Tunnel Ventilation System Control
WRD/MP/58	Overhead Line Maintenance
WRD/MP/59	High Voltage Maintenance
WRD/MP/60	Building Services
WRD/MP/61	Building Maintenance
WRD/MP/62	Railway Protection
WRD/MP/63	Drawing Office

Note: WRD/MP/64 – WRD/MP/70 reserved for future uses.

**Table 5 Management Procedure List - Operations Department**

<b>Procedure No.</b>	<b>Title</b>
WRD/MP/71	Crew Management
WRD/MP/72	Traffic Management
WRD/MP/73	Operations Control Centre (OCC) Operations
WRD/MP/74	Train Operations Planning
WRD/MP/75	Operations Control Centre (OCC) /Depot Control Centre (DCC) Operations
WRD/MP/76	Train Crew Management
WRD/MP/77	Station Operations
WRD/MP/78	Ticket Inspection
WRD/MP/79	Prosecution
WRD/MP/80	Fare Handling
WRD/MP/81	Customer Services Centre (CSC) Operation
WRD/MP/82	Market Research
WRD/MP/83	Transport Planning
WRD/MP/84	Market Development
WRD/MP/85	Bus Traffic Operations
WRD/MP/86	Bus Traffic Administration

Note: WRD/MP/87 – WRD/MP/95 reserved for future uses.

**Table 6 Management Procedure List – Personnel and Administration Section**

<b>Procedure No.</b>	<b>Title</b>
WRD/MP/96	General Administration Services
WRD/MP/97	Identity Card System
WRD/MP/98	Catering and Cleaning Services Management
WRD/MP/99	Security Services
WRD/MP/100	Recreation Services
WRD/MP/101	Public Liability Claims
WRD/MP/102	Claims Against Third Party
WRD/MP/103	Issue of Uniform
WRD/MP/104	Office Renovation
WRD/CP/01	Recruitment
WRD/CP/02	Induction, Probation, Staff Movement and Exit Interviews
WRD/CP/03	Performance Management System & the Annual Review System
WRD/CP/04	Benefits Administration
WRD/CP/05	Pfile and HR Computer System Data

**Table 7 Management Procedure List – Public Affairs Section**

<b>Procedure No.</b>	<b>Title</b>
WRD/CP/07	Passenger Liaison Group Meeting Process
WRD/CP/08	Complaint Handling for East Rail and Light Rail

1.1.6 Instructions are also developed to elaborate the implementation of Management Procedures above and to provide a documented guidance on tasks in order to comply with the statutory requirements or standard with regard to the environmental aspect.

1.1.7 This Operational EM&A Manual contains the required environmental control measures and describes how these controls are implemented in accordance to the relevant Management Procedures and Instructions of the Integrated Management System.

## **1.2 Background of the Project**

### *Overview*

1.2.1 West Rail Phase I is a 30.5-km domestic passenger railway linking Sham Shui Po in West Kowloon with Tuen Mun. There are nine stations: two in Sham Shui Po (Nam Cheong & Mei Foo stations), one in Tsuen Wan (Tuen Wan West station), four in Yuen Long (Kam Sheung Road, Yuen Long, Long Ping and Tin Shui Wai stations), and two in Tuen Mun (Siu Hong and Tuen Mun stations) that it interchanges with MTR Tung Chung line at Nam Cheong; MTR Tsuen Wan line at

Mei Foo; and KCR's Light Rail at Yuen Long, Tin Shui Wai, Siu Hong, and Tuen Mun. There are also a Pat Heung Maintenance Centre (PMC) and a headquarters building housing a central operations control center in Kam Tin. An Overview of the West Rail alignment is shown in Figure 1.

### ***Alignment***

- 1.2.2 The route commences in the south at the Phase I terminus at Nam Cheong Station in Sham Shui Po. The alignment parallels the West Kowloon Expressway and runs to the northwest before curving northwards to Mei Foo Station, an enclosed, landscaped station within Lai Chi Kok Park. From Mei Foo the alignment continues through the Ha Kwai Chung tunnel, under a portion of Kwai Fuk Road, and then through the Tsing Tsuen Tunnel before entering the Tsuen Wan West Station, which is situated on the new reclamation in Tsuen Wan Bay. The tracks then continue northwestwards and enter the Tai Lam Tunnel, gradually rising to the north portal.
- 1.2.3 From the north portal, the alignment continues into the Kam Tin Valley where the PMC will provide maintenance and stabling facilities for the entire West Rail fleet. Leaving the PMC, trains will curve slightly to the west and enter the elevated Kam Sheung Road Station.
- 1.2.4 The alignment from Kam Sheung Road Station to Tuen Mun is for the most part on viaduct. After turning to the west at Au Tau, the railway crosses over Route 3 and Castle Peak Road to enter Yuen Long. It continues further westward with elevated stations in Yuen Long and Long Ping. The alignment remains elevated before reaching Tin Shui Wai Station, which will be a key West Rail/Light Rail/bus interchange facility.
- 1.2.5 From Tin Shui Wai, the alignment then turns south, heading for Siu Hong Station, and onward to the Tuen Mun Station terminus, both stations will be built over the Tuen Mun drainage nullah.

### ***Operation***

- 1.2.6 Upon opening in end 2003, West Rail will run seven-car trains at a frequency of 20 trains per direction during the peak hour to meet the forecast daily patronage. As patronage increases, West Rail will be able to operate up to nine cars per train at an hourly frequency of 34 trains in each direction during the peak hour.
- 1.2.7 The most critical time periods for railway noise impact are the hour 0600-0700 and 2300-2400 as these periods fall within the “night-time” period specified under the Noise Control Ordinance and the noise criterion is lower. The train frequency

during the initial opening (and envisaged for the first few years of operation) and for design capacity are planned to be:-

<b>Period</b>	<b>Initial Operation (per hour per direction)</b>	<b>Design Capacity (per hour per direction)</b>
0600-0700	10	20
2300-2400	6	10

1.2.8 The KCRC Pat Heung Maintenance Centre at Pat Heung provides facilities for the maintenance of the WR and its associated rolling stock. The complex contains the Electric Multiple Unit (EMU) Maintenance Building, EMU stabling sidings and two train washing plant. The PMC is designed to accommodate the total number of trains required for West Rail service including the operational spare train-sets.

### **1.3 Summary of the Impacts and Mitigation Measures Specified in the EIA**

#### *Air Quality*

1.3.1 Air quality impact during the operation phase of the WR is not considered to be of concern as limited potential sources have been identified. No adverse residual impacts are anticipated in the EIA.

#### *Operational Noise*

1.3.2 Noise impacts from the operational railway may be a concern, particularly at night (between 2300 and 0700 hours) when the statutory noise criteria are most stringent. In order to achieve the night-time criteria, a package of noise mitigation measures centred around the use of the Multi-plenum system has been proposed by the Corporation on the viaduct section.

1.3.3 The Multi-plenum noise attenuation system comprises three components:

- (a) a plenum beneath the train involving the use of vehicle skirts and under-car absorption;
- (b) a plenum located beneath a walkway on both sides of the track; and
- (c) edge walls with sound absorption.

1.3.4 In addition to the use of the Multi-plenum system, in order to meet the night-time noise criteria, the package of noise mitigation measures requires limitation of train speed at 100kph at a viaduct section between Tin Shui Wai and Siu Hong and the use of noise enclosures at point and crossing. Also, floating slab track is provided for the entire elevated alignment on viaduct.



- 1.3.5 Moreover, noise absorptive panels are installed in the "outboard" area of the open station, i.e. Yuen Long, Long Ping and Tin Shui Wai to effectively create an absorptive environment.
- 1.3.6 The Multi-plenum is effective in controlling airborne noise at source and therefore minimises noise barrier heights and enclosure requirements. Similarly the acoustically optimised structural design of the viaduct and track support system means that structure-borne noise levels will be reduced to a minimum. Full enclosures are only necessary and built at point and crossings to control airborne noise from the crossovers.
- 1.3.7 With the implementation of the recommended mitigation measures, the proposed scheme will comply with the NCO.
- 1.3.8 Upon opening, the PMC will operate 24 hours a day. With the provision of noise barriers at the PMC and along the main track and siding tracks, the noise levels from moving trains and the fixed plant will comply with the Government's noise criteria with virtually no residual noise impact on the surrounding community.
- 1.3.9 Fixed plant structures including ventilation shafts, cooling water pumping stations which are particularly required for the tunnels at the southern and central section of West Rail. Power feeder sub-stations and chillers associated with the stations at the western section may generate noise impact at the noise sensitive receivers nearby. Mitigation measures of mechanical means including acoustic louvers and enclosure structures are the major solution to the potential impact.

#### *Water Quality*

- 1.3.10 Stormwater runoff related impacts from stations and the PMC should be effectively controlled through the design and implementation of appropriate drainage system(s) including silt traps and oil interceptors prior to discharge to stormwater drains. Wastewater generated by the detergent wash plant in the PMC should be collected and transferred to a dedicated on-site treatment plant. The treated effluents and any other wastewater generated from the PMC and stations have to meet the criteria specified in the TM on Standard for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters. Also, discharge licence is required.
- 1.3.11 The public sewerage system for the Pat Heung area is being constructed by Drainage Services Department and the works will be completed in 2008 at the earliest. Therefore, as an interim measure, the effluent discharge from the PMC is pumped to store in two underground tanks which is then tanked away by a licensed collector for disposal. When the foul sewer system become available, the sewage effluent generated from the PMC will discharge to the public sewers.

*Waste Management*

- 1.3.12 General refuse are generated from the passengers, station employees and commercial operators. General refuse generated on-site should be stored in enclosed bins or compaction units separate from chemical wastes. A reputable and licensed waste collector should be employed to remove general refuse and industrial waste from the stations, separately from chemical wastes, on a daily basis to minimize odour, pest and litter impact.
- 1.3.13 Office wastes can be reduced through recycling of paper if volumes are large enough to warrant collection. Participation in a local collection scheme should be considered if one is available.
- 1.3.14 General industrial waste generated on-site should be stored in enclosed bins separate from chemical wastes and it could be collected together with the general refuse. Scrape metal may be sold for recycling.
- 1.3.15 Chemical waste that is produced, as defined by Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation, should be handled and disposed of in accordance with the *Code of Practice on the packaging, Labelling and Storage of Chemical Waste*.

*Hazard*

- 1.3.16 A section of Kwai Tsing Tunnel falls within and in proximity to the 250m of Gin Drinkers Bay Landfill Consultation Zone. Precautionary measures, such as air testing during maintenance that required staff to enter the tunnel and prior to the operation of the day for the initial six months of operation are necessary.
- 1.3.17 A section of WR alignment to the north of Kam Sheung Road station passes within the Consultation Zone of the Au Tau Water Treatment Works. A Hazard Assessment study has been carried out to assess the risks to the population associated with the operation of WR. The assessment identified that levels of individual and societal risk at West Rail due to Au Tau Water Treatment Works comply with the requirements of the Government's Risk Guidelines and there is no mitigation measures need to be considered. However, several recommendations are still made to ensure the risks to the proposed development will be as low as reasonably practicable. Those related to the WR are to locate ventilation intakes for Kam Sheung Road Station at as high a level as reasonably practicable and to establish an emergency plan to provide guidance procedures in the event of a chlorine release.

*Landscape and Visual*

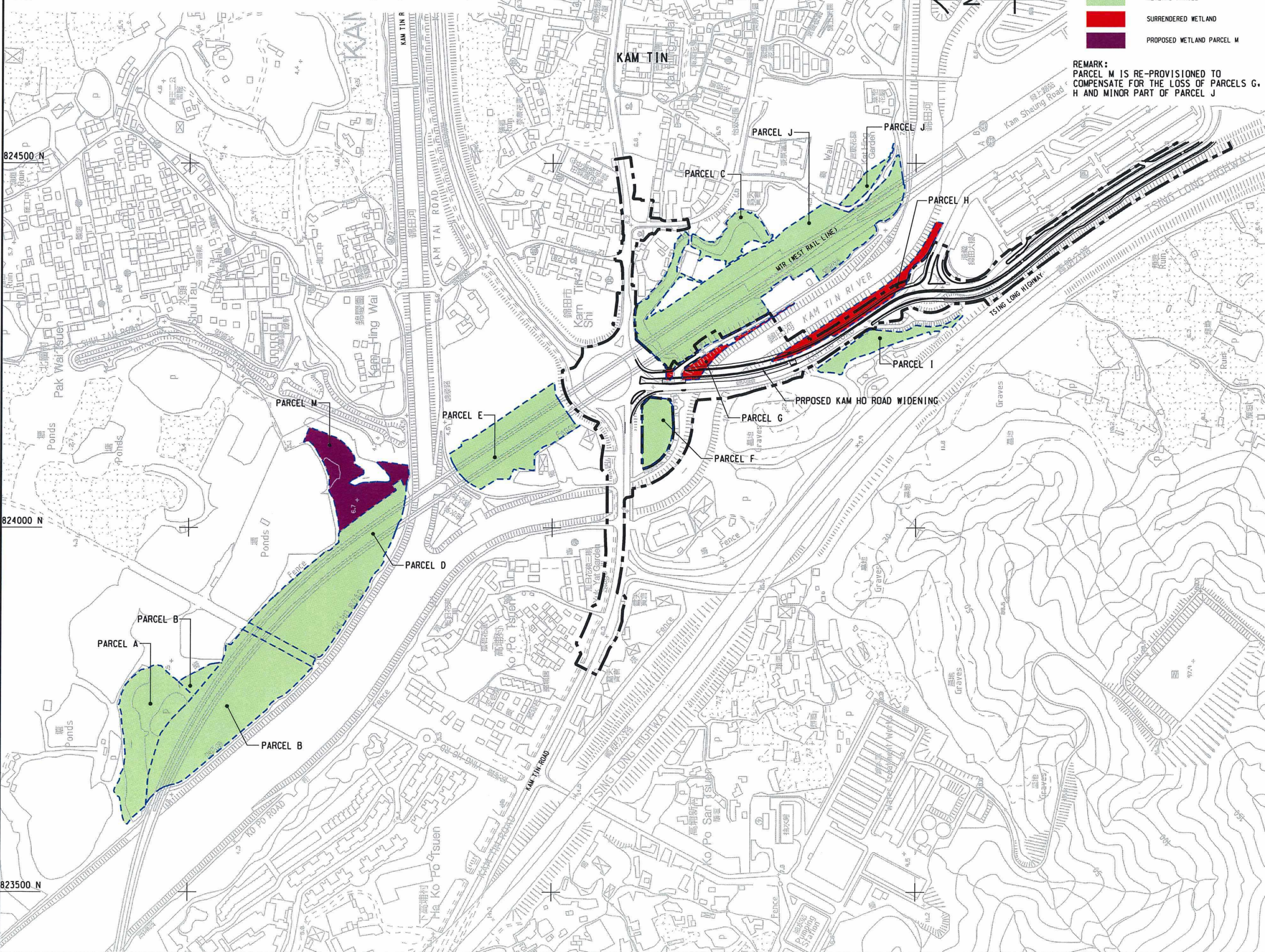
- 1.3.18 During the operation phase, the WR development brings positive visual impacts in the urban section (between Nam Cheung and Tsuen Wan West), in the longer term, by virtue of the screening and landscaping to be placed over the tunnels. Along the at-grade and viaduct sections in the New Territories (Pat Heung to Tuen Mun), some negative visual impacts will be sustained by nearby rural villages, largely as a result of the elevated design. However these impacts will be considerably reduced as an intensive landscape planting has been undertaken in accordance with the Landscape Master Plan.

*Ecological Impacts at Kam Tin and Au Tau areas*

- 1.3.19 A total of 12 hectares of streams (1.8 hectares), fish ponds (10 hectares) and freshwater marsh (0.3 hectare) in the Kam Tin and Pat Heung areas are lost due to the West Rail. These areas provide breeding, foraging and roosting habitats for some rare or protected species, such as egrets, herons, painted snipe and the Narrow-mouthed frog and are considered to be having high ecological value. Re-provisioning of 12 hectares similar habitat is, therefore, recommended to compensate the ecological loss.
- 1.3.20 Two broad areas of land in Kam Tin and Pat Heung which are located at the vicinity of the affected areas are identified for habitat re-provisioning. The range of habitats and ecological functions to be provided in order to compensate the affected habitats on a like-to-like basis have been established in the Habitat Creation and Management Plan (HCMP). They include ponds, seasonal/permanent marsh, grassland and terrestrial habitats.
- 1.3.21 Under Civil Engineering and Development Departments (“CEDD”) project namely CE34/2014 (CE) Site Formation and Infrastructure Works for Development at Kam Tin South, Yuen Long, a section of Kam Ho Road between Kam Tin Road and Tung Wui Road will be improved in order to meet the future traffic demand. The existing single 2-lane Kam Ho Road will be widened to a dual 2-lane carriageway under this project. The existing Kam Ho Road will become part of the proposed north bound Kam Ho Road whereas a new elevated road will be formed under this CEDD project as the south bound of Kam Ho Road is shown in Figure 2
- 1.3.22 Due to the implementation of this CEDD project, the proposed road works would affect a significant portion of Land Parcels G and H, as well as a minor portion of Land Parcel J at the southwest. Though not the whole Land Parcels G and H will be completely lost, the remaining unaffected portion of these two land parcels will have limited ecological function after the construction. In order to provide a better linkage with other wetlands and enhance the wetland characteristic, the whole Land Parcel G (approx. 0.13 ha) and H (approx. 0.44 ha) will be surrendered completely and relevant portion of Land Parcel J (approx. 135m<sup>2</sup>) will also be surrendered. A

ISO A1 594mm x 841mm  
 Approved:  
 Checked:  
 Designer:  
 Project Management Initials:  
 Plot File by: CHENHK 2017/09/29  
 PATH: P:\PROJECTS\60336159\DRAWING\GIS\CHENHK0284.dgn  
 823500 N  
 824500 N  
 824000 N  
 823500 N

The locations of wetland parcels shown on this Figure are approximate locations and for identification purpose only.



**LEGEND:**

- SITE BOUNDARY OF THE ROAD WORKS OF THE PROJECT
- MITIGATION WETLAND
- WETLAND PARCEL
- SURRENDERED WETLAND
- PROPOSED WETLAND PARCEL M

**REMARK:**  
 PARCEL M IS RE-PROVISIONED TO COMPENSATE FOR THE LOSS OF PARCELS G, H AND MINOR PART OF PARCEL J

**AECOM**

**PROJECT**  
 SITE FORMATION AND INFRASTRUCTURAL WORKS FOR THE INITIAL SITES AT KAM TIN SOUTH, YUEN LONG - INVESTIGATION, DESIGN AND CONSTRUCTION

**CLIENT**  
 土木工程拓展署  
 Civil Engineering and Development Department

**CONSULTANT**  
 AECOM Asia Company Ltd.  
 www.aecom.com

**SUB-CONSULTANTS**

**ISSUE/REVISION**

NO.	DATE	DESCRIPTION	CHK.

**STATUS**

**SCALE**                      **DIMENSION UNIT**

比例                              尺寸單位

A1 : 2500                      METRES

**KEY PLAN**  
 索引圖

<b>PROJECT NO.</b> 項目編號	<b>CONTRACT NO.</b> 合約編號
60336159	CE 34/2014 (CE)

**SHEET TITLE**  
 圖紙名稱

HABITAT MAP

**SHEET NUMBER**  
 圖紙編號

FIGURE 2

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new mitigation wetland, named as Land Parcel M (approx. 0.7 ha), will be re-provided by CEDD on a “like-to-like” basis. The location, design rationale and ecological function of Land Parcel M have been detailed in the approved HCMP in 2018.

#### *Archaeological and Cultural Heritage*

1.3.23 All existing archaeological buildings are sufficiently distant from the WR alignment except the Tsui Shing Lau Pagoda which is located some 40 metres to the south of Tin Shui Wai Station. The potential implication associated with the vibration impact arising during the operation has been investigated. Vibration and tilting monitoring has continued after the completion of the civil construction works during the Trial Operations for 3 months between June and August 2003. During the Trial Operations, train has been running generally on the West Rail in accordance with the timetable for normal services. The monitoring results during this period show that the vibration levels and the tilt condition do not exceed the limits due to the train operation. It is concluded that no structural damage to the Pagoda will occur as a result of operation vibration with the use of floating slab on the viaduct.

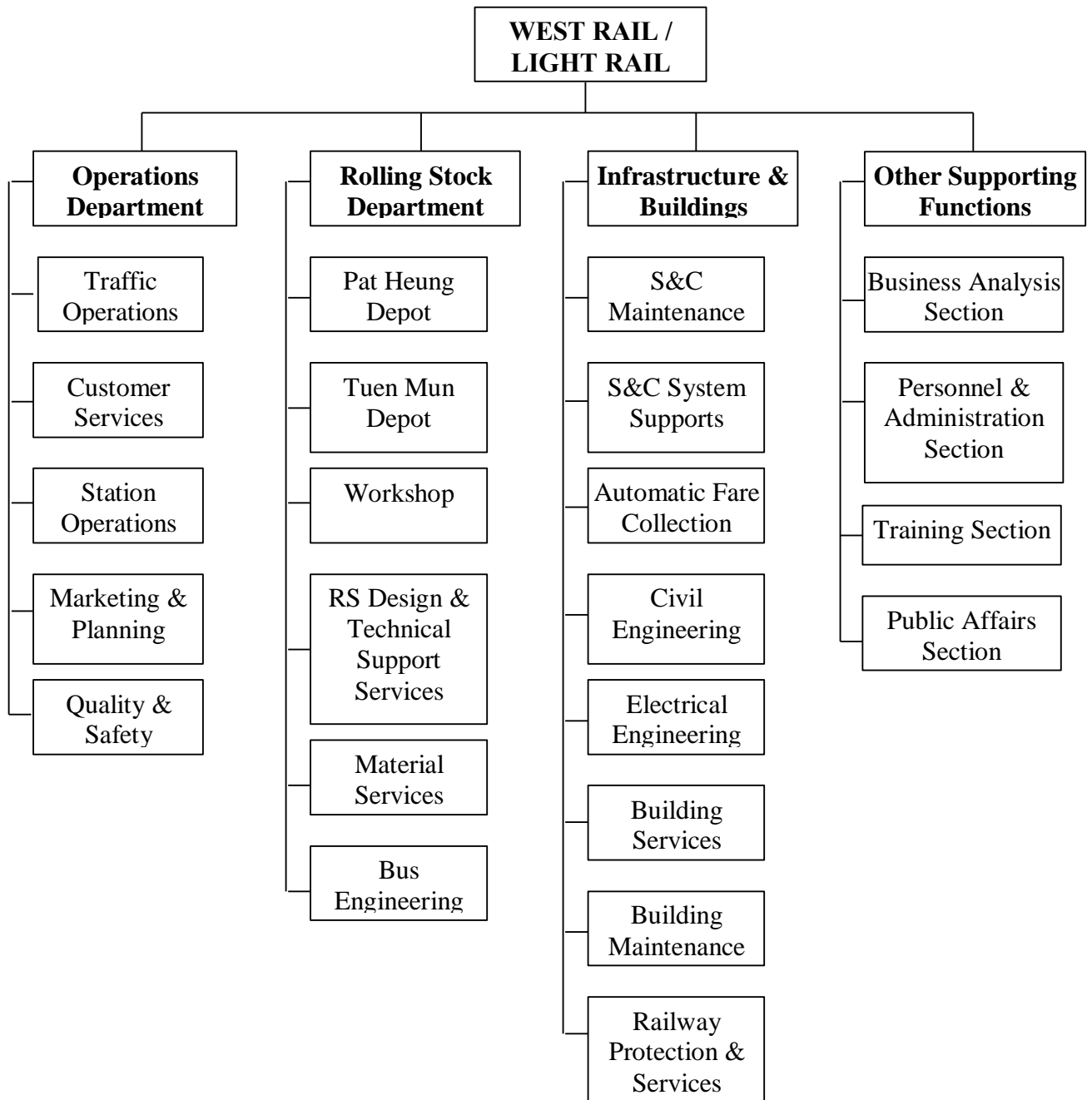
### **1.4 Environmental Monitoring and Audit Requirements**

1.4.1 According to the Environmental Permit No. EP-004/1998 for the West Rail, an EM&A programme shall be performed in accordance with an operational EM&A Manual which shall be approved by the Director of EPD prior to the commissioning.

### **1.5 West Rail Organization**

1.5.1 The project organisation and lines of communication with respect to environmental protection works are shown in Figure 3.

**Figure 3 Organisation**



Remarks:  
 RS denotes Rolling Stock  
 S&C denotes Signalling and Communication

**2. AIR QUALITY**

- 2.1.1 Along the alignment of the WR, the area is predominantly urban with the majority of land uses in the vicinity of the work sites being residential, recreational and institutional. The main sources of pollutants are the traffic on existing roads and highways.
- 2.1.2 Electric trains are employed for West Rail and no operational air quality impacts are anticipated.
- 2.1.3 No EM&A relating to air quality is required for the operational phase.

**3. NOISE**

- 3.1.1 Concerning the noise emitted during the operation phase, noise monitoring is required to verify the noise levels arising from the running trains, fixed plant at stations and the Pat Heung Maintenance Centre. The noise monitoring plan is established and details are presented in Annex A.



#### **4. WATER QUALITY**

- 4.1.1 Connection of sewerage systems to the public sewers are provided in all WR premises except the Kam Sheung Road Station, the WR Building and the Pat Heung Maintenance Centre in Kam Tin. Surface runoff from stations and track sides and sewage generated from the stations are connected to storm drains and public sewers with the installation of oil interceptors wherever necessary.
- 4.1.2 The connection to communal sewerage systems of the Kam Sheung Road Station, the WR Building and the Pat Heung Maintenance Centre will not be available until the Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1 commissions in 2008. Before the commissioning of the Sewerage works, the sewage generated from the buildings are transported into two sewage holding tanks (SHTs) via pre-installed pipelines.
- 4.1.3 As a temporary measure to store the domestic sewage, the SHTs requires regular retrieval in order to maintain the capacities. Licence collectors are employed to provide the service to keep the SHTs in effective working condition. The sewage removed from the tanks is transported to Yuen Long Sewage Treatment Work for disposal.
- 4.1.4 Two types of sewage are generated from the PMC. Domestic sewage is generated from toilets, showers, kitchen and heavy cleaning platform where cleaning to the interior of the train will be carried out. The sewage is discharged to one of the holding tanks. Industrial sewage is generated from bogie washing, machine pits, cleaning bays and train washing facilities. A recycling treatment equipment is provided at the bogie washing pit to recycle the water. The material being washed out from wheels are mainly dirt. The treated effluent is discharged to a holding tank with water quality monitoring device. For the train wash facilities, because detergent is used, a treatment plant is provided in the PMC to treat the effluent to compliance of the local effluent standards. The in-house treatment plant contains filtration units and a “Bioturbo<sup>®</sup>” unit which uses fine air bubble injection to remove suspended particles. Both the two types of sewage, after appropriate treatment is stored in one of the SHTs for subsequent collection.
- 4.1.5 The requirements on implementation and maintenance of the above mitigation measures for protection of water quality are incorporated into the Working Instruction – Workplace Environmental Practices. In addition, requirements on monitoring are stipulated under this instruction to ensure effective implementation. As the collection of the wastewater in the PMC and WRB are being undertaken by the external contractors, the performance of the contractors are controlled under the Management Procedure – Purchasing of Materials/Equipment & Services.

## **5. WASTE MANAGEMENT**

5.1.1 For the operational phase, the following measures should be implemented.

### *General Refuse and Industrial Waste*

5.1.2 The various waste management options can be categorised from an environmental viewpoint. The options considered to be preferable have the least impacts and are more sustainable in the long term, hence, the hierarchy is as follows:

- (a) avoidance and minimisation;
- (b) reuse of materials;
- (c) recovery and recycling; and
- (d) treatment and disposal, as the last option to be considered.

5.1.3 The above hierarchy should be used to evaluate and select waste management options. The aim should be to minimise the amount of waste to be generated and hence reduce the waste handling and disposal costs. For example, by reducing or eliminating over-ordering of construction materials, waste is avoided and costs are reduced both in terms of purchasing materials and in disposing of wastes.

5.1.4 Proper storage will minimise the damage or contamination of waste. Appropriate measures may be implemented for stations and offices which promote the proper disposal of wastes once it is moved. For example having sorting for inert (rubble, sand, stone, etc) and non-inert (wood, organics, etc) wastes would help to ensure that the former are taken to public filling areas, while the latter are properly disposed of at controlled landfills. Since waste brought to public filling areas will not attract a charge, while that taken to landfill may attract some future charge, sorting waste may also help to reduce waste disposal costs, should landfill charging be introduced.

5.1.5 Specifically, it is recommended that:

- (a) wastes should be handled and stored in a manner which ensures that they are held securely without loss or leakage thereby minimising the potential for pollution;
- (b) only reputable waste collectors authorised to collect the specific category of waste concerned should be employed;
- (c) procedures, such as a ticketing system, are develop to facilitate the tracking of loads and to ensure that illegal disposal of wastes does not occur;
- (d) appropriate measures should be employed to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers;

- (e) the necessary waste disposal permits should be obtained from the appropriate authorities, if they are required, in accordance with the *Waste Disposal Ordinance* (Cap 354), *Waste Disposal (Chemical Waste) (General) Regulation* (Cap 354), the *Crown Land Ordinance* (Cap 28) and *Dumping at Sea Ordinance* (1995);
- (f) collection of general refuse should be carried out on a daily basis;
- (g) waste should only be disposed of at licensed sites and the staff should develop procedures to ensure that illegal disposal of wastes does not occur;
- (h) waste storage areas should be well maintained and cleaned regularly;
- (i) records should be maintained of the quantities of wastes generated, recycled and disposed (determined by weighting each load or by another method); and
- (j) for internal innovation, the contractor should adopt selective demolition measures so that reusable material, like wood and metal, can be disposed of at landfills, and inert demolition materials can be reused on site or delivered to public filling areas, public filling points or land formation sites.
- (k) Training and instruction of operation staff should be given to increase awareness and draw attention to waste management issues and the need to minimise waste generation.
- (l) Chemical waste that is produced, as defined by Schedule 1 of *Waste Disposal (Chemical Waste) (General) Regulations*, should be handled and disposed of in accordance with the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes*.

5.1.6 In order to ensure proper implementation of the above measures, appropriate requirements are incorporated into the Management Procedures developed by individual department/section as listed in Tables 2 – 7 to provide guideline in how to handling wastes arising from different departments/processes.

5.3.2 To elaborate further on the implementation of the Environmental Management Procedure, working instructions are also developed. For example, “Handling of Chemicals and Chemical Wastes” provides a documented guideline on use, storage and disposal in order to comply with the relevant statutory or standard requirements for chemical waste handling.

## **6. HAZARD**

### *Landfill Gas*

- 6.1.1 A section of Kwai Tsing Tunnel falls within and in proximity to the 250m of Gin Drinkers Bay Landfill Consultation Zone. Monitoring of landfill gas has been conducted throughout the construction stage of Kwai Tsing Tunnels. The results show steadily nil or trace levels of gases far below the level that could pose a health hazard. Based on the findings, it was considered that the bored tunnels amount nothing to a confined space, and therefore no permanent monitoring of gas was necessary to be installed inside the tunnels. Similarly, early switching of tunnel ventilation fans before traffic starts, as recommended in the EIA report, is considered unnecessary as no hazardous gases are present.
- 6.1.2 However, precautionary measures are deemed necessary at the tunnel sumps and niches. These structures are separated from the main tunnel tubes with covers or doors and could be classified as confined spaces. During maintenance that requires staff to enter these compartments, normal air testing and forced ventilation and safety gear shall be used in full accordance with the Government and the KCRC Confined Space Procedures.
- 6.1.3 In addition, methane concentration shall be checked daily prior to the operation of the day for the main tunnel sections to ensure that methane concentration shall not exceed 10% of the Lower Explosive Limit (LEL). This additional measure can be taken for six months and subject to the approval of the Director of Environmental Protection at the end of this period, it is appropriate to cease regular monitoring activities in future.
- 6.1.4 In the event that hazardous gases are detected above the dangerous level, all maintenance work nearby shall be stopped immediately and all personnel shall be evacuated from the tunnels. Also, the tunnel ventilation system will be operated for at least half an hour before the first passenger train to ensure the methane level is below 10% of LEL, otherwise, train service shall not commence and ventilation shall be maintained throughout the traffic hours.
- 6.1.5 A thorough investigation shall then be carried out in order to identify the source of infiltration and emergency repair shall be arranged to re-seal the tunnel lining to eliminate the hazard. Before sealing works are completed, any work teams entering the affected areas shall carry out Confined Space Procedures. Upon completion of repair, gas monitoring as described in the preceding paragraph shall be resumed for a further 6 months and until consistently acceptable results are obtained. Warnings to maintenance staff regarding the monitoring arrangement and the areas covered are issued both in the Possession Meetings and in the weekly Traffic Notices within such period.

- 6.1.6 Contingency Action Plan is developed to specify all the above requirements and submitted to EPD for the Variation of Environmental Permit (VEP-084/2003). The procedures shall be followed all the time.

*Au Tau Water Treatment Work*

- 6.1.7 Contingency Plan is developed for the West Rail to define the actions to be taken during incidents and emergencies. Part 3 Section A of the West Rail Contingency Plan sets out the procedures to be adopted in case of unidentified gas/substance is detected, including chlorine gas, to ensure the safety of passengers, members of the public, staff and emergency services. The procedures shall be followed all the time.

## **7. VISUAL, LANDSCAPE AND ECOLOGY**

7.1.1 The landscape, visual and ecological mitigation measures listed below shall be implemented along the alignment:

- (a) Soften and screen engineering structures with planting wherever possible;
- (b) Plant embankments and cuttings of both the railway and the new roads with indigenous vegetation;
- (c) Dense screen planting on both sides of the PMC;
- (d) Control of lightings; and
- (e) Wetland in Kam Tin.

7.1.2 Environmental audits shall be conducted to confirm the completion of the above landscaping and wetland works. Any outstanding works shall be recorded and follow-up audits shall be conducted until all the works are completed.

7.1.3 The landscaping and wetland works along the alignment within the West Rail boundary shall be maintained regularly. A Management Procedure on the maintenance of the landscape works for the tunnel and viaduct sections is developed, WRD/MP/52 “Tunnel and Landscape Maintenance”.

7.1.4 The Management Procedure WRD/MP/52 specifies the responsibilities of relevant parties, i.e. to inspect on the conditions of the landscape features, recommend remedial works/maintenance and supervise the works of the term contractors during the execution of the maintenance works. All the procedures shall be followed.

7.1.5 In addition, an ecological specialist consultant has been employed to monitor the wetland and provide recommendations on any improvement works required. The monitoring shall be conducted for at least five years following construction of the wetland to ensure that the wetlands are colonized by key species of wetland plants and animals. Details of the monitoring programme are presented in Annex B.

## **8. ENVIRONMENTAL AUDIT & COMPLAINT HANDLING**

### **8.1 Environmental Audit**

8.1.1 Generic management procedure is developed, Procedure No. WRD/MP/07 “Internal Audit” to ensure a comprehensive internal audit system is carried out to verify the compliance and the effectiveness of the Management System, including the environmental management system established for West Rail operations.

### **8.2 Environmental Complaints**

8.2.1 Complaints shall be referred to the Public Affairs Section and passed on to relevant line manager for carrying out complaint investigation procedures. The involved parties shall undertake the procedures in the Procedure No. WRD/MP/10 “*Complaint Handling*” upon receipt of the complaints.

**9. REPORTING**

**9.1 Operational Audit Report**

9.1.1 Audit Reports for the operational phase shall be prepared in accordance with the format outlined in the Procedure No. WRD/MP/07 "*Internal Audit*".

**9.2 Operational Noise Monitoring Report**

9.2.1 The results of the operation noise monitoring conducted according to the Noise Monitoring Plan described in Chapter 3 shall be presented in the form of a monitoring report which shall be submitted to the EPD for information.

**9.3 Data Keeping**

9.3.1 The site document such as the monitoring field records, laboratory analysis records, site inspection forms, etc. are not required to be included in the EM&A reports. However, the document shall be well kept by relevant departments along with the Document Control System established and utilized in the Corporation. All the relevant information shall be stored clearly and systematically. The information shall be ready for inspection upon request. All the documents and data shall be kept in accordance with the requirements stipulated in Management System Manual.

**END OF TEXT**



## **Annex A**

# **Operational Noise Monitoring Plan**

## 1 INTRODUCTION

### 1.1 Purpose

1.1.1 The Environmental Impact Assessment Report identified that operational airborne noise impacts for West Rail (WR) would be derived from three potential sources:

- Fixed electrical and mechanical plant (including ventilation systems) which are likely to be the dominant sources of noise within the vicinity of railway stations, traction substations and ventilation buildings;
- Maintenance and stabling activities at the depot; and
- Airborne noise from rolling stock on West Rail and train induced vibration in elevated structures re-radiated as noise.

1.1.2 This plan describes the noise monitoring programme throughout the first six months of operations. The operation noise monitoring programme is divided into three parts: namely “Fixed Plant Noise”, “Maintenance Centre Noise” and “WR Train Noise”.

1.1.3 Normally, operational monitoring will be conducted during the peak operation of the fixed plant and train maintenance activities and during the critical 2300 to 0700hrs for the running of trains.

1.1.4 Termination of the operational monitoring will be determined on the following basis and subject to the approval by EPD:

- insignificant environmental impacts of the WR operation and maintenance; and
- trends analysis to demonstrate the reduction of exceedance due to operation and maintenance of the WR and return of ambient environmental conditions in comparison with baseline data, EIA predicted noise levels; and
- no environmental complaints.

### 1.2 Noise Monitoring Equipment

1.2.1 In accordance with *Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites* (TM), sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications will be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement, the accuracy of each sound level meter will 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 calibration level from before and after the noise measurement agree to within 1.0 dB.

1.2.2 Noise measurements shall be made in accordance with international acoustical standards and practices in relation to weather conditions.

### **1.3 Monitoring Parameters**

1.3.1 The appropriate parameter for measuring operational noise impacts shall be the A-weighted equivalent continuous sound pressure level ( $L_{Aeq}$ ) measured in decibels (dB). The two statistical sound levels  $L_{10}$  and  $L_{90}$ ; the levels exceeded for 10 and 90 percent of the time respectively, shall also be recorded during the monitoring for reference. A sample data record sheet is shown in Appendix for reference.

1.3.2 As supplementary information for data auditing, statistical results such as octave band and  $L_{max}$  shall be obtained. Other general information including start and end time of the measurement, weather conditions, train frequency, train speed, type of plant operating or other contributing factors will also be recorded for reference. Moreover, the characteristics of the noise, namely tonality will be assessed for the transformer/rectifier noise.

### **1.4 Monitoring Locations**

1.4.1 The worst affected noise sensitive receivers are identified for the noise monitoring. Details of the proposed noise monitoring locations for various noise sources are presented in the relevant sections below.

1.4.2 If there are difficulties in obtaining access to the proposed noise monitoring locations, alternative monitoring locations may be proposed. The selection of these alternative monitoring locations shall be based on the following criteria:

- at locations close to the noise sources which are likely to have noise impacts; and
- close to the proposed NSRs or other NSRs, such as domestic premises, hotel, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law and performing arts centre.

1.4.3 The monitoring locations shall normally be at a point 1 m from the exterior of the sensitive receiver building façade and at a height approximately 1.2 m above the ground or at the height that replicate in all respects the acoustical environment and/or exposure at the worst affected NSR. If there is a problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurements shall be made. For reference, a correction of +3dB(A) shall be made to the free field measurements. The Monitoring Team shall agree with the KCRC on the monitoring positions and the corrections adopted. Once the positions for the monitoring stations are chosen, the operational monitoring shall be carried out at the same positions.

## **2 LEGISLATIVE REQUIREMENTS**

- 2.1.1 Railway noise is under the control of the Noise Control Ordinance (NCO) and shall comply with the Acceptable Noise Levels (ANLs) of the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (TM). The ANLs are shown in Table 2-1.

**Table 2-1 Acceptable Noise levels (ANLs) under TM**

Time Period	L <sub>eq</sub> (30 min), dB(A)		
	ASR "A"	ASR "B"	ASR "C"
Daytime 0700-1900 hours	60	65	70
Evening 1900-2300 hours	60	65	70
Night-time 2300-0700 hours	50	55	60

- 2.1.2 In addition, the noise levels at 2 m from the transformer bays in the rectifier stations R14 for Tin Shui Wai Phase 4 and R16 in Tin Shui Wai Reserve Zone should be less than 66 dB(A) with reference to Condition 4.1a of the environmental permits issued under the EIA Ordinance for the Light Rail Extensions (EP No. EP-041/2000/A and EP-042/2000/D).

### 3 FIXED PLANT NOISE MONITORING

#### 3.1 Noise Sources

- 3.1.1 The majority of the fixed plant for West Rail are located in the southern section because this section is in tunnel and a number of ventilation facilities are required. The fixed plant in the northern section are associated with the stations. These fixed plant include,

- Ventilation shafts at the northern and southern platform ends of Nam Cheong Station;
- Ventilation shafts at the platform ends of Mei Foo Station;
- Kwai Fong Ancillary Building;
- Ventilation shafts at the platform ends of Tsuen Wan West Station;
- Ventilation and electric substations at the south and north portals of Tai Lam Tunnel;
- Electricity Sub-Station at PMC;
- Rectifier Stations and Sub-Stations in Tin Shui Wai; and
- Chillers and fans associated with the stations, namely Kam Sheung Road, Yuen Long, Long Ping, Tin Shui Wai, Siu Hong and Tuen Mun Stations.

The above fixed plant will operate at any time of the day while the loading will depend on the schedule of the train operations.

#### 3.2 Monitoring Locations

- 3.2.1 All monitoring locations are selected based on the following criteria:
- Having closest distance to the fixed plant operation; and/or

- Having direct line of sight.
- 3.2.2 Representative noise monitoring stations selected for fixed plant noise monitoring are summarized in Table 3-1.
- 3.2.3 According to the EIA report, the monitoring locations for the two rectifier stations and sub-station should be at a distance of 2m from the transformer, with all transformers in the stations operating simultaneously.

**Table 3-1 Summary of Monitoring Stations for Fixed Plant Operation**

Area	Fixed Plant Noise Sources	Drawing No.	Station No.	Monitoring Location <sup>3</sup>	Description	Area Sensitivity Rating	Acceptable Noise Level (dB(A))
Nam Cheong	Ventilation shaft at northern & southern platform ends of Nam Cheong Station	1	1	Fu Cheong Estate	Roof	C	70 <sup>1</sup> /60 <sup>2</sup>
Mei Foo	Ventilation shafts at platform ends of Mei Foo Station	2	2	Mei Foo Sun Chuen Bldg 8	Roof facing NAC station	C	70 <sup>1</sup> /60 <sup>2</sup>
		2	3	Ching Lai Court	Roof facing MEF station	C	70 <sup>1</sup> /60 <sup>2</sup>
Kwai Fong	Kwai Fong Ancillary Building	3	4	Kwai Fong Terrace	Podium facing Kwai Fong Ancillary Building	C	70 <sup>1</sup> /60 <sup>2</sup>
Tsuen Wan	Ventilation shaft at northern & southern platform ends of Tsuen Wan West Station	4	5	Clague Garden Estate	Roof of Jade River Restaurant on podium of Clague Garden Estate facing TWW station	C	70 <sup>1</sup> /60 <sup>2</sup>
	Ventilation at the south portal of the Tai Lam Tunnel	There are two openings at the ventilation building, one facing Kong Nam Industrial Building and another opening facing Tuen Mun Road. The nearest noise sensitive receivers in the vicinity of the ventilation openings are identified as The Panorama behind Kong Nam Industrial Building and Summit Terrace up on the hillside at Chai Wan Kok. Since these NSRs are screened off from the openings either by the industrial building or the viaduct of Tuen Mun Road, no noise impact is anticipated and noise monitoring is not necessary.					
Pat Heung	Ventilation and cooling buildings at the north portal of the Tai Lam Tunnel	5	6	Village house to the south of Cheung Po	Outside Village House facing the ventilation shaft	B	65 <sup>1</sup> /55 <sup>2</sup>
Kam Tin	Ventilation shaft of Kam Sheung Road Station	The noise sensitive receivers in the vicinity of the ventilation facilities at Kam Sheung Road are low-rise village houses. As the ventilation facilities are located on the roof of the station, these NSRs have no direct line of sight on the ventilation facilities. No noise impact is anticipated and noise monitoring is not necessary.					

Area	Fixed Plant Noise Sources	Drawing No.	Station No.	Monitoring Location <sup>3</sup>	Description	Area Sensitivity Rating	Acceptable Noise Level (dB(A))
Yuen Long	Ventilation shaft of Yuen Long Station	7	9	Ying Lung Wai	Village house facing YUL station	C	70 <sup>1</sup> /60 <sup>2</sup>
Long Ping	Ventilation shaft of Long Ping Station	8	11	Fu Loy Garden	Podium facing LOP station	C	70 <sup>1</sup> /60 <sup>2</sup>
Tin Shui Wai	WR Sub-Stations in Tin Shui Wai	9	12	Tin Tsz Estate	Tsz Sam House	B	65 <sup>1</sup> /55 <sup>2</sup>
	Ventilation shaft of Tin Shui Wai Station	9	13	Tin Yiu Estate	Roof facing TIS station	B	65 <sup>1</sup> /55 <sup>2</sup>
	R14 Rectifier Station in Tin Shui Wai	9	14	R14 Rectifier Station	2m from the transformer	B	Less than 66
	R16 Rectifier Station in Tin Shui Wai	10	15	R16 Rectifier Station	2m from the transformer	B	Less than 66
Siu Hong	Ventilation shaft of Siu Hong Station	12	17	Siu Hong Court	Podium facing Siu Hong Station	C	70 <sup>1</sup> /60 <sup>2</sup>
Tuen Mun	Ventilation shaft of Tuen Mun Station	The nearest NSRs to the ventilation shafts of Tuen Mun Station are identified as Ho King Building, Mei Kei Building and Hong Lai Garden. Special design has been incorporated to the vent shafts that openings are facing Tuen Mun River, i.e. facing away from these NSRs. Considering no direct line of sight on the vent shaft at these noise sensitive receivers, noise impact is not anticipated. While Tai Hing Garden is the nearest NSR having direct line of sight on the ventilation facilities, it is over 300m away and noise impact is not anticipated neither. Therefore, noise monitoring is not necessary for Tuen Mun Station.					

Notes : <sup>1</sup>Daytime and Evening; <sup>2</sup>Night-time; <sup>3</sup> All monitoring locations are noise sensitive receivers except the R14 & R16 Rectifier Stations

### **3.3 Monitoring of Fixed Plant Noise**

- 3.3.1 During the WR commissioning period (0700-2300 Monday to Sunday), all fixed plant will be operated with full power for 30 minutes and, monitoring of  $L_{Aeq\ 30min}$  noise levels will be carried out in accordance with the methodology stated in the TM at the proposed monitoring stations. For night time operation (2300-0700), one set of  $L_{Aeq\ 30min}$  noise levels will be monitored at the same location with the fixed plant operation the same as normal operating hours.
- 3.3.2 During the peak loading operation of all transformers in the two rectifier stations and substations in Tin Shui Wai, measurement of  $L_{Aeq\ 30min}$  will be taken in any time within 0700-2300 Monday to Sunday.
- 3.3.3 A 30-minute  $L_{eq}$  background noise monitoring shall also be carried out at the designated location prior to the operation of the corresponding fixed plants. The  $L_{max}$ ,  $L_{10}$  and  $L_{90}$  shall be recorded at the specified interval. There shall not be any operation of fixed plant in the vicinity of the stations during the background noise monitoring. Any Non-West Rail related operation activities in the vicinity of the stations during the background monitoring shall be noted and the source and location shall be recorded.
- 3.3.4 In case of non-compliance with the noise criteria, KCRC will review the operation plan/schedule for the non-compliance and will decide what action is required to overcome the non-compliance. An action plan in the operational EM&A Manual will be followed by all appropriate parties.

## **4 MAINTENANCE CENTRE NOISE MONITORING**

### **4.1 Noise Sources**

- 4.1.1 Pat Heung Maintenance Centre (PMC) provides maintenance and stabling facilities for the entire West Rail fleet. The maintenance activities are carried out inside the enclosed maintenance building and will not pose noise nuisance. However, train washing facilities are located in an open area which may induce noise impact. In addition, the West Rail fleet will be stabled at the sidings to the west of the main lines at the end of daily service. The trains leaving the stabling area in the early morning may also generate noise.
- 4.1.2 The PMC will operate 24 hours a day. Noise emission will be dependent on the activities which occur at any particular time, but also the sensitivity of the period during which they are generated. Therefore, the schedule of the operations at the maintenance centre will be considered to determine the most affected periods for noise monitoring.



## 4.2 Monitoring Locations

4.2.1 All monitoring locations are selected based on the following criteria:

- Having closest distance to the maintenance activities; and/or
- Having closest distance to the stabling area.

4.2.2 Two noise monitoring stations are selected which are close to the PMC and summarized in Table 4-1. Details such as location of the monitoring stations, Area Sensitivity Rating (ASR) and noise criteria are also summarized in the table.

**Table 4-1 Summary of Monitoring Stations for PMC Operation**

Area	Noise Source	Drawing No.	Station No.	Monitoring Location	Description	ASR	Acceptable Noise Level (dB(A))
Kam Tin	PMC	6	7	Village house of Tai Kek facing PMC	Outside Village House	B	65 <sup>1</sup> /55 <sup>2</sup>
		6	8	Village house to the south of Tin Sum Tsuen	Outside Village House	B	65 <sup>1</sup> /55 <sup>2</sup>

Notes : <sup>1</sup>Daytime and Evening; <sup>2</sup>Night-time

## 4.3 Monitoring of PMC Maintenance Noise

4.3.1 The PMC will operate throughout the day, monitoring of  $L_{Aeq\ 30min}$  noise levels will be carried out at the most sensitive period, which will be early morning which falls into the night time period of the NCO, once a week in the first monitoring month and then once a month starting from the second and continuing to the sixth month.

4.3.2 A 30-minute  $L_{eq}$  background noise monitoring shall also be carried out at the designated location prior to the operation of the train maintenance activities. The  $L_{max}$ ,  $L_{10}$  and  $L_{90}$  shall also be recorded at the specified interval. There shall not be any train maintenance activities in the vicinity of the stations during the background noise monitoring. Any Non-West Rail related operation activities in the vicinity of the stations during the background monitoring shall be noted and the source and location shall be recorded.

4.3.3 In case of non-compliance with the noise criteria, KCRC will review the operation plan/schedule for the non-compliance and will decide what action is required to overcome the non-compliance. An Action Plan in the operational EM&A Manual will be followed by all appropriate parties.

## 5 WEST RAIL TRAIN OPERATIONS MONITORING

### 5.1 Noise Sources

5.1.1 The major operational impact of the WR train noise will be on the northern part of the alignment as the railway is open. The multi-plenum system has been applied on the viaduct to reduce the noise impact to the surrounding NSRs.

5.1.2 The Multi-Plenum System consists of the following components:

- track mounted on a soft base plate upon a floating mini slab, to reduce vibration transmission to the viaduct structure;
- a system of sound-absorptively lined cascading plena comprising an under vehicle plenum created with vehicle skirts and under walkway plena on either side of the viaduct – for twin viaducts, an additional central plenum is created with a capped central wall; and
- an edge wall provided with acoustic lining which may be increased in height with the addition of noise barriers to further reduce airborne noise levels.

### 5.2 Monitoring Locations

5.2.1 The noise monitoring locations are selected according to the following criteria:

- (i) Receivers having shortest distance to the railway;
- (ii) Receivers having direct line of sight on the railway;
- (iii) Section of railway where trains traveling at the highest speed; and/or
- (iv) Area Sensitivity Rating with more stringent noise limit.

5.2.2 The proposed train noise monitoring locations are shown in Table 5-1. Information including description of trackform, detailed location of NSRs, Area Sensitivity Rating (ASR) and noise criteria are also summarized in the table.

**Table 5-1 Summary of the proposed NSR location for train noise monitoring**

Railway Section	Drawing No.	Station No.	Monitoring Location	Description	ASR	ANL (dB(A))
Yuen Long	7	10	Sun Yuen Long Centre	Podium	C	70 <sup>1</sup> /60 <sup>2</sup>
Long Ping	8	11	Fu Loy Garden	Roof	C	70 <sup>1</sup> /60 <sup>2</sup>
Tin Shui Wai	9	13	Yiu Fu House/ Yiu Yat House	20/F	B	65 <sup>1</sup> /55 <sup>2</sup>
Tin Shui Wai - Siu Hong	11	16	Yick Yuen Tsuen	Roof of village house facing viaduct <sup>3</sup>	B	65 <sup>1</sup> /55 <sup>2</sup>
Tuen Mun	13	18	Hong Lai Garden	Roof	B	65 <sup>1</sup> /55 <sup>2</sup>

Notes : <sup>1</sup>Daytime and Evening; <sup>2</sup>Night-time

<sup>3</sup>The elevation of the roof is below the viaduct

### 5.3 Monitoring of Railway Noise

- 5.3.1 Commencing from opening of West Rail which is scheduled in the end of 2003, monitoring of  $L_{Aeq\ 30min}$  noise levels will be carried out at the proposed monitoring locations during the critical operation hours, i.e.2300-0700 once a week in the first monitoring month and then once a month starting from the second and continuing to the sixth month. The monitoring frequency and duration will be reviewed after the six-month monitoring based on the criteria established in 1.1.4. It is suggested to continue the monitoring once every 6 months after the sixth month for another 18 months subject to the findings of the review.
- 5.3.2 Background noise monitoring shall also be carried out concurrently with the train noise monitoring. One individual sound level meter will be set at the same location as train noise monitoring. Train events shall be edited out manually during the monitoring period.
- 5.3.3 In case of non-compliance with the noise criteria, KCRC will review the operation plan/schedule for the non-compliance and decide what actions are required to overcome the non-compliance. An Action Plan in the operational EM&A Manual will be followed by all appropriate parties.

## 6 SUMMARY

- 6.1.1 The methodology for operational monitoring of different noise sources is summarized in Table 6-1.

**Table 6-1 Different methods for different types of operation**

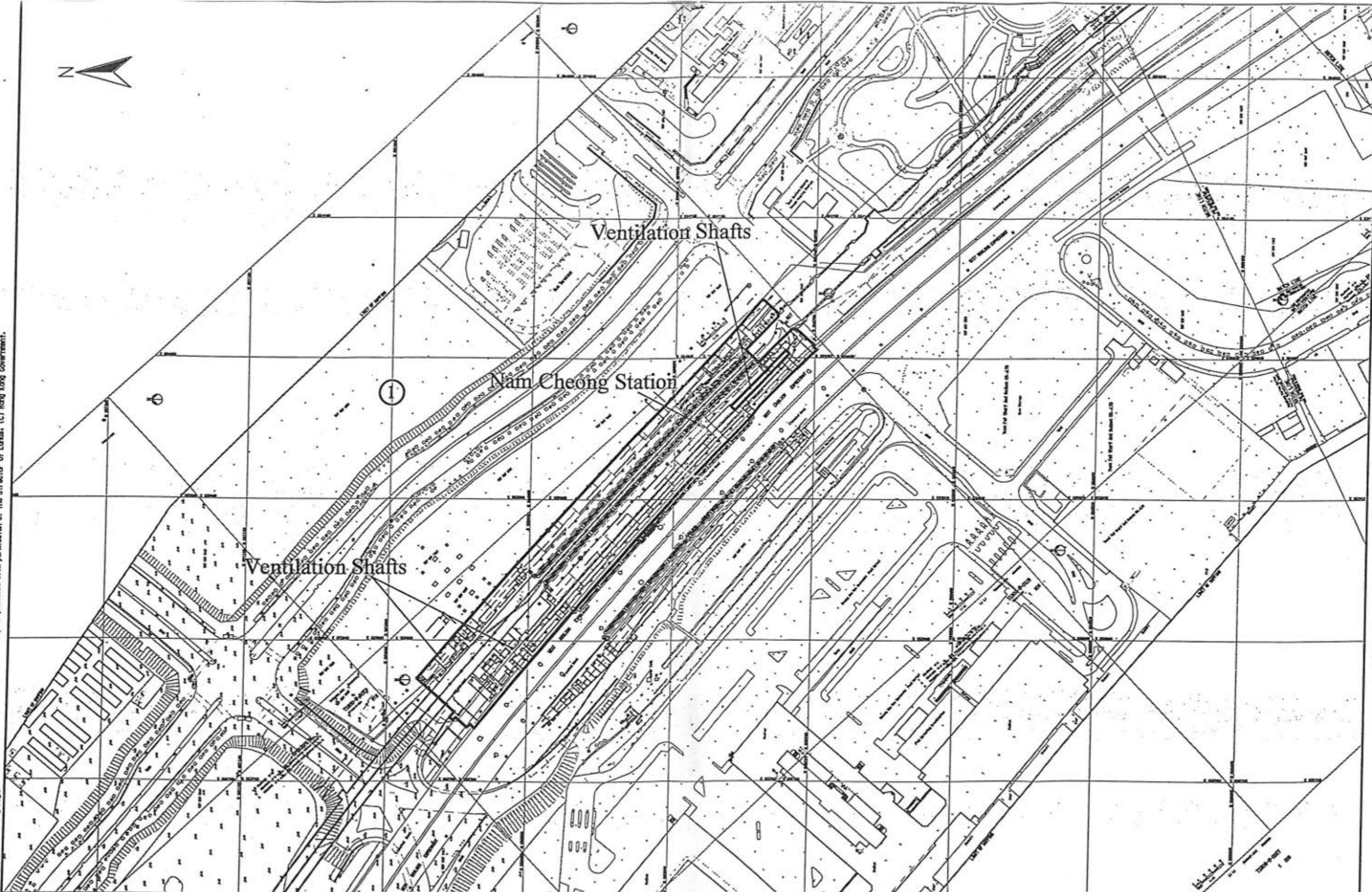
	<b>Operation Phase Monitoring</b>	
<b>Fixed plant noise</b>	$L_{Aeq\ 30min}$	One-off measurement during commissioning
<b>Rectifier Station and Sub-Station</b>	$L_{Aeq\ 30min}$	
<b>Maintenance noise</b>	$L_{Aeq\ 30min}$	Once a week during night time in first monitoring month and once a month during the 2 <sup>nd</sup> to 6 <sup>th</sup> month
<b>Railway noise</b>	$L_{Aeq\ 30min}$	Once a week in first monitoring month and once a month between the 2 <sup>nd</sup> to 6 <sup>th</sup> month during 2300-0700

## 7 REPORTING

- 7.1.1 Monitoring reports will be produced on a monthly basis in accordance with the requirements set out in Guidelines for Development Projects in Hong Kong for EM&A. The certified and verified copies of the report will be submitted to the EPD for their information. The number of copies required by each party will be established through liaison.



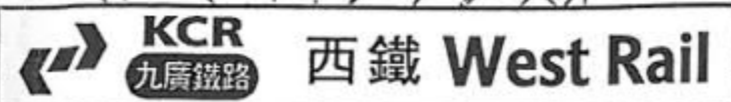
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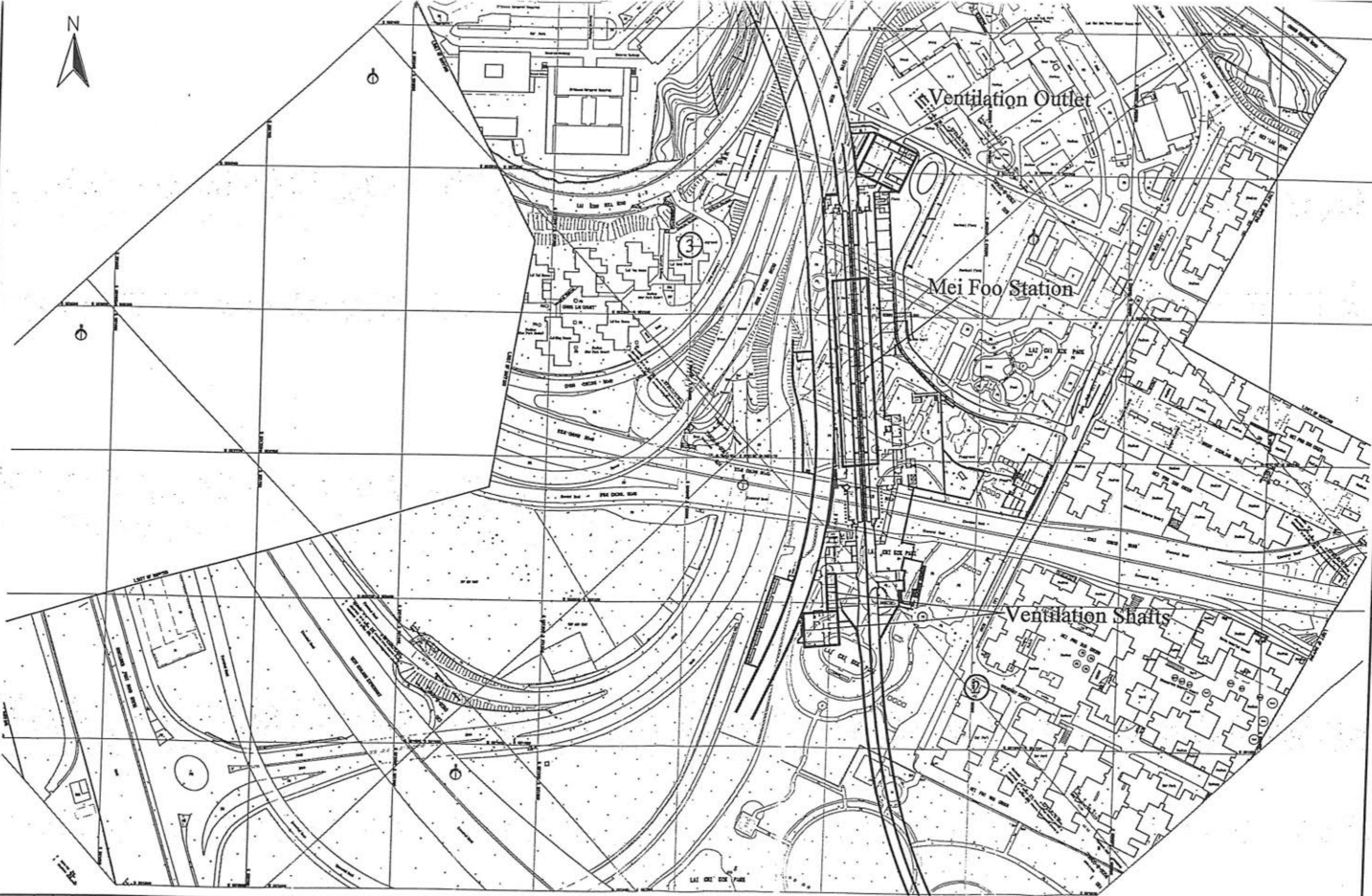
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OPERATION NOISE MONITORING PLAN		CAD FILE NO	CAD DATE
LOCATION PLAN OF NSR6 IN NAM CHEONG		SCALE	AUG 2003
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		SHEET NO	1
		STAGE CODE	REV



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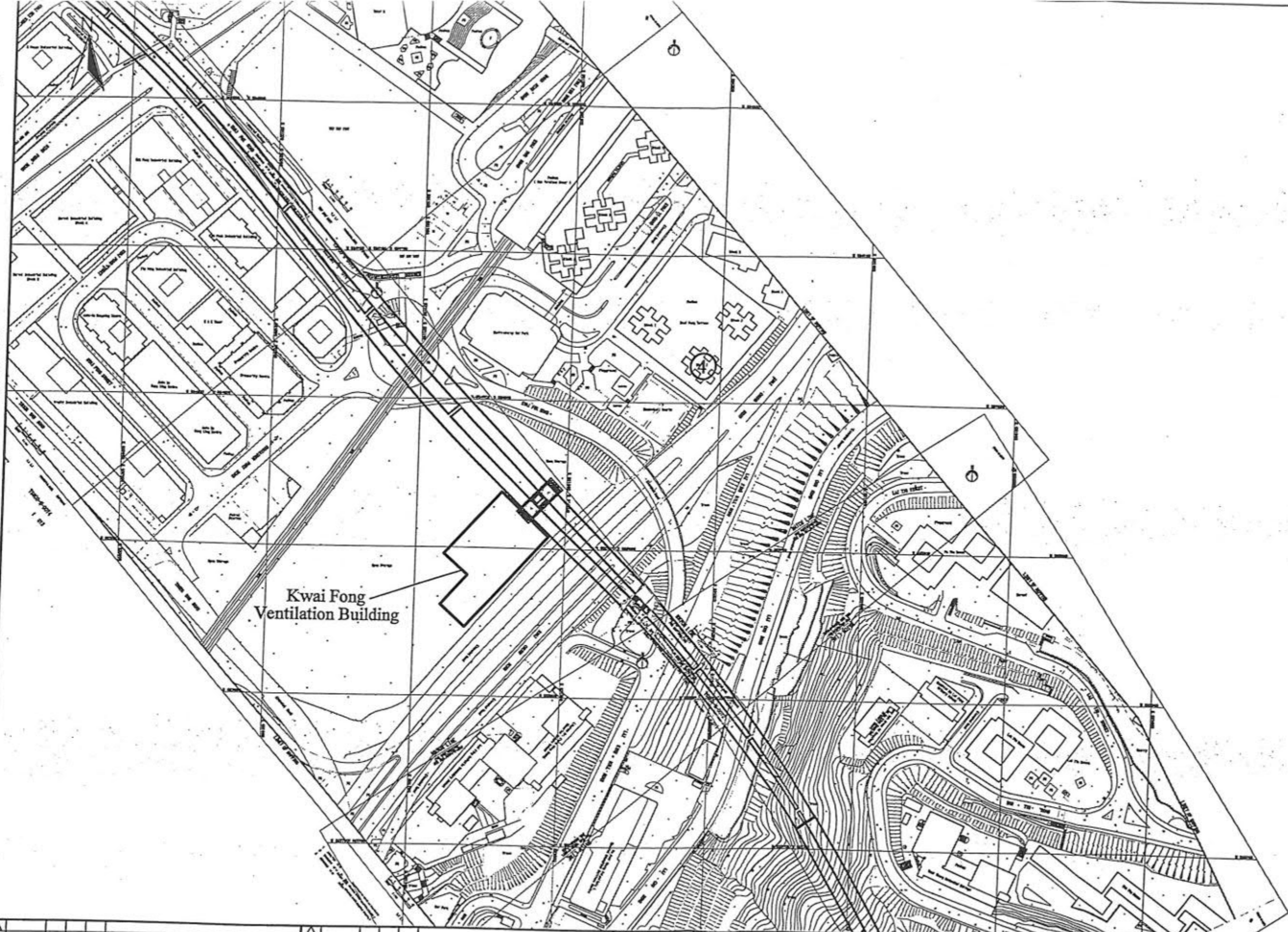
**西鐵 West Rail**

OPERATION NOISE MONITORING PLAN

LOCATION PLAN OF NSRs IN MEI FOO

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SHEET NO	
STAGE CODE	REV

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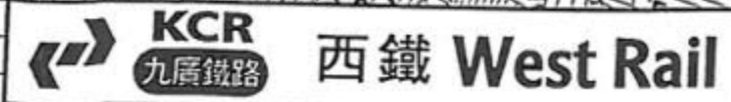


Kwai Fong  
Ventilation Building

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OPERATION NOISE MONITORING PLAN  
LOCATION PLAN OF NSRs IN KWAI FONG

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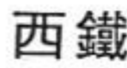
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**西鐵 West Rail**

**OPERATION NOISE MONITORING PLAN**  
**LOCATION PLAN OF NSRs IN TSUEN WAN**

CAD FILE NO		CAD DATE	AUG 2003
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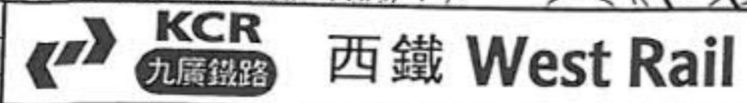


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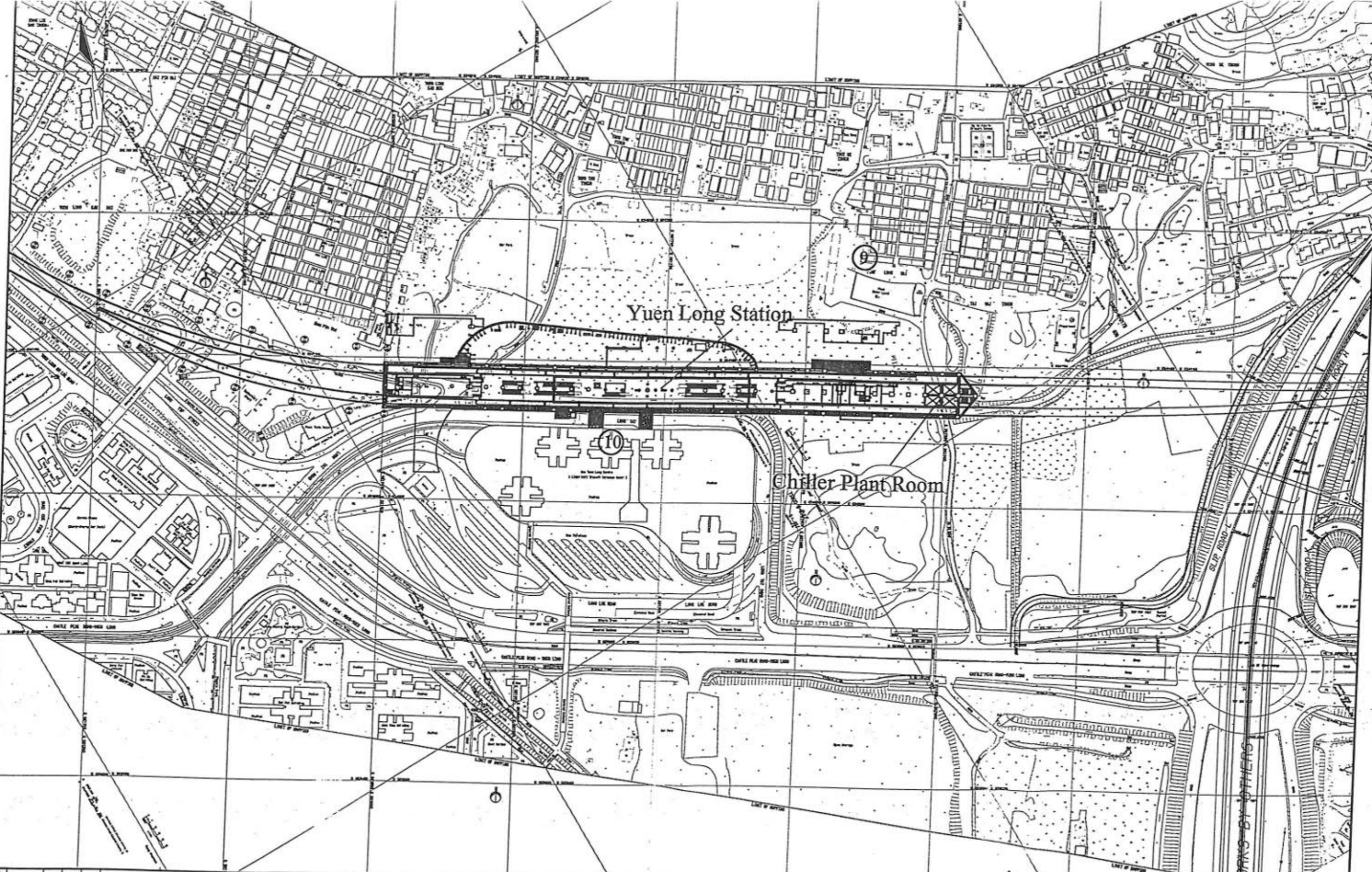
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 LOCATION PLAN OF NSRs IN PAT HEUNG

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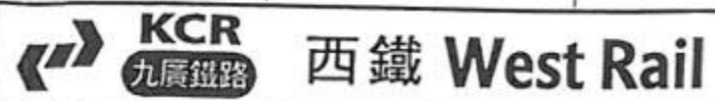
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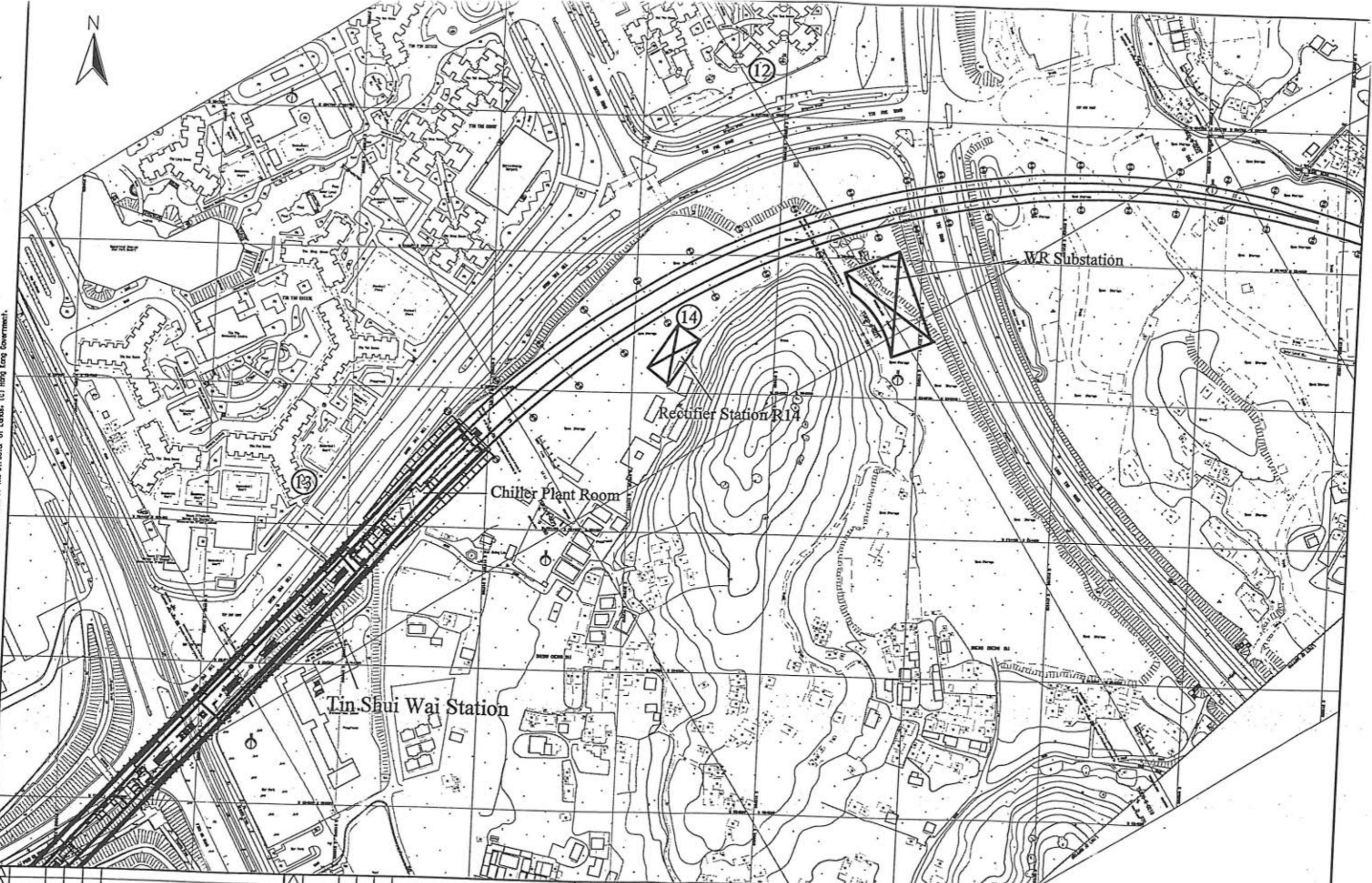
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 LOCATION PLAN OF NSRs IN YUEN LONG

DATE FILED	AUG 2003
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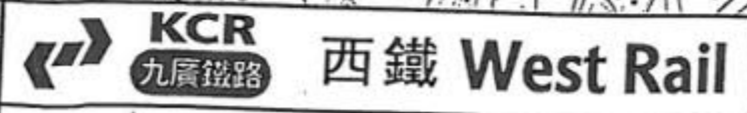
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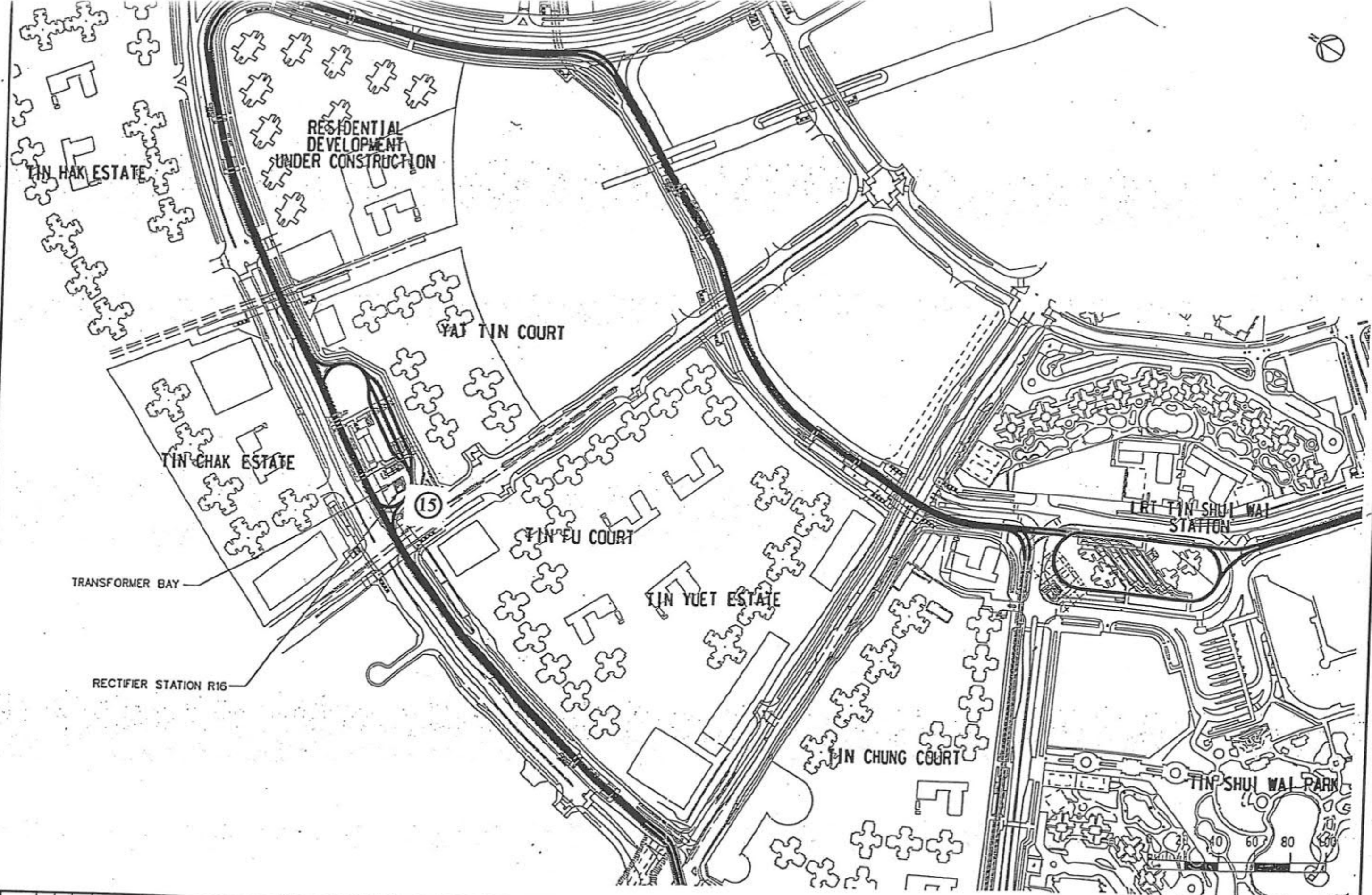
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OPERATION NOISE MONITORING PLAN  
 LOCATION PLAN OF NSRs IN TIN SHUI WAI

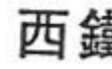
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**KCR**  
 九廣鐵路


**西鐵 West Rail**

**OPERATION NOISE MONITORING PLAN**  
**LOCATION PLAN OF RECTIFIER STATION (R16)**  
**FOR LIGHTRAIL EXTENSION**

DATE	AUG 2003
SCALE	1:10
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SHEET SIZE	A3


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**KCR**  
 九廣鐵路

**西鐵 West Rail**

**OPERATION NOISE MONITORING PLAN**  
 LOCATION PLAN OF NSRs IN YICK YUEN

ROAD FILE NO	ROAD DATE
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SCALE	1 : 2500 @A3
DRAWING NUMBER	11
SHEET NO	STAKE CODE / REV



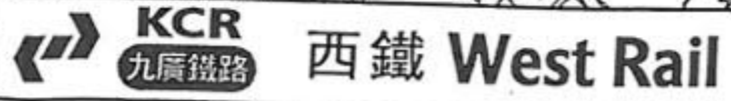
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**OPERATION NOISE MONITORING PLAN**  
 LOCATION PLAN OF NSRs IN SIU HONG

PLANT FILE NO	DATE
	AUG 2003
SCALE	1 : 2500 @A3
DRAWING NUMBER	12
SHEET NO	STAGE CODE / REV





KCRC West Rail  
Operational Noise Monitoring  
Field Record Sheet

Equipment	Model	Equipment No.	Last Calibration/Due Date
Sound Level Meter			/
Sound Pressure Calibrator			/

Noise Monitoring Period	Calibration Before Measurement			Calibration After Measurement		
	Noise Level (dB)	Freq. of Signal (kHz)	Display (dB)	Noise Level (dB)	Freq. of Signal (kHz)	Display (dB)

Monitoring Location (NSR No.)					
Description of Location					
Position of Sound Level Meter		Façade / Free Field			
Date of Monitoring					
Weather Condition		Sunny / Cloudy / Rainy			
Average Wind Speed (m/s)					
Measurement Start Time (hh:mm)					
Measurement Time Length (min/hr)					
Measurement Results	L90 (dB(A))				
	L10 (dB(A))				
	Leq (dB(A))				
	Lmax				
Major Fixed Plant Noise Source(s) During Measurement		Chiller		Rectifier	
		Ventilation shaft		Substation	
		Others, pls specify			
Frequency of Train pass by During Measurement		No. of train within monitoring period		Average train interval	
Other Noise Source(s)		Traffic noise pls specify:			
		Village activities or animal noise pls specify:			
Remarks					

	Name	Signature	Date
Recorded By			
Checked By			

## **Annex B**

# **Ecological Monitoring Plan**

## **1. Introduction**

- 1.1 Although there is currently on-going monitoring of the created wetlands the baseline monitoring as detailed in Table 8 of the Habitat Creation and Management Plan (ERM 2001) will commence in September 2003. The general approach to be followed will be that monitoring of the wildlife will commence upon ‘creation’ of the wetland habitats within each of the land parcels with the aim of detailing colonisation of wildlife. Creation in this context is the point at which the habitat within each of the land parcels is formed, flooded and fully planted. Monitoring of the plant community will commence later, when the planting within each parcel is considered established. Establishment is expected to occur 12 months after creation and is the point at which the contractor is no longer responsible for supplemental planting. The reason for monitoring of the plant community starting at the point of establishment is that there is likely to be supplemental planting, die-off and general disturbance of the vegetation during this period. Conversely, utilisation of the wetland habitats by wildlife is not dependant upon establishment of the vegetation, and therefore should commence prior to this.
- 1.2 Baseline monitoring will cover the 12 months following the creation of the wetland habitats in each land parcel. An annual review of the monitoring will be undertaken in conjunction with AFCD and EPD. This review will cover the requirements for future monitoring; unless varied in agreement with AFCD and EPD the monitoring requirements in subsequent years will be the same as that of the baseline monitoring. Monitoring will be conducted for at least five years following creation of the wetlands.
- 1.3 Under CEDD project namely CE34/2014 (CE) Site Formation and Infrastructure Works for Development at Kam Tin South, Yuen Long, section of Kam Ho Road between Kam Tin Road and Tung Wui Road will be improved in order to meet the future traffic demand. The existing single 2-lane Kam Ho Road will be widened to a dual 2-lane carriageway under this project. Implementation of this CEDD project would affect a significant portion of Land Parcels G and H, as well as a minor portion of Land Parcel J at the southwest. Though not the whole Land Parcels G and H will be completely lost, the remaining unaffected portion of these two land parcels will have limited ecological function after the construction. In order to provide a better linkage with other wetlands and enhance the wetland characteristic, the whole Land Parcel G (approx. 0.13 ha) and H (approx. 0.44 ha) will be surrendered completely, and relevant portion of Land Parcel J (approx. 135m<sup>2</sup>) will also be surrendered. A new mitigation wetland, named as Land Parcel M (approx. 0.7 ha), will be re-provided by CEDD on a “like-to-like” basis.

### **Occurrence and abundance of wildlife**

- 1.4 Monitoring of the created wetlands is important to identify the occurrence and abundance of fauna for which they are designed to provide compensatory habitats for in order to judge success and to allow for adaptive management of the created wetlands.
- 1.5 The West Rail EIA identified the following functions that the wetland habitats are intended to perform:

- Re-creation of freshwater habitat
- Re-provisioning of habitat suitable for dragonflies
- Re-provisioning of habitat suitable for reptiles and amphibians including the Narrow-mouthed Frog
- Re-provisioning of habitat suitable for wetland dependent birds including Greater Painted-snipe

1.6 Accordingly the following will be monitored within the created wetlands:

- Floristics and structure of wetland vegetation
- Water quality
- Wetland dependent birds including Greater Painted-snipe
- All reptiles and amphibians
- All dragonflies

1.7 However, monitoring effort for these faunal groups will not be even across the land parcels. This is because the target species/groups vary between the land parcels (Table 1).

Table 1. Target species/groups for the different land parcels

Land Parcel	A	B	C	D	E	F	G <sup>#</sup>	H <sup>#</sup>	I	J <sup>#</sup>	K	L	M <sup>#</sup>
Greater Painted-snipe	✓	✓		✓	✓								
Wetland dependent birds	✓	✓		✓									
Reptiles and amphibians		✓		✓	✓			✓	✓	✓	✓	✓	✓
Dragonflies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note:

# Land Parcel G, H and relevant portion of J will be replaced by Land Parcel M to be constructed by CEDD on the date of the confirmation letter of the completion of the construction of Land Parcel M by CEDD (the "Date"). Land Parcel G, H and relevant portion of J will no longer form part of the wetland habitats under this Operational EM&A Manual and the latest approved HCMP and thus all maintenance, management and/or monitoring obligation and any other liability/obligation in relation to these land parcels shall cease with immediate effect on the date. All maintenance, management and/or monitoring obligation and any other liability/ obligation in relation to Parcel M will commence immediately on the Date.

## 2. Monitoring of birds

### 2.1 Introduction

2.1.1 Detailed monitoring of Greater Painted-snipe is problematic using conventional visual survey techniques. This is mainly due to the behaviour of the species in that during daytime it tends to roost in areas of dense vegetation, often allowing close approach by people before taking flight. This means that it is easy to both overlook and flush birds, neither of which are ideal for long-term monitoring. When flushed they will often relocate to another daytime roost site. This is clearly undesirable, and frequent flushing of individual birds may in fact deter them from the very habitats that have been created for them. In addition, it is known that Greater Painted-snipe are highly active at night when much of their foraging and territorial activities are undertaken. A

consequence of this is that the habitats utilised during the day and at night are often very different.

- 2.1.2 However, the fact that it is possible to get close to Greater Painted-snipe without flushing them makes them ideal for radio-tracking and a skilled radio-tracker is able to obtain highly accurate locational data without disturbing the birds. Radio tracking also permits the collection of data at night, which would otherwise be impossible.
- 2.1.3 Land Parcels A, B, D and E have specified Greater Painted-snipe as one of the target species. From the commencement of these wetlands until 2009, this species was monitored in the area using radio-tracking, but individuals have also been recorded fairly regularly during standard bird surveys. It was then considered that the information so far obtained from the radio-tracking was sufficient for understanding the habitat requirements of this bird species, and it was considered that routine radio-tracking was no longer essential in monitoring this species.
- 2.1.4 Given that some of the key habitats currently utilised by the Greater Painted-snipe in the Kam Tin area are not protected or managed for wildlife, any change in land-use or habitat there could have a significant negative effect upon the numbers of Greater Painted-snipe in the Kam Tin area. This in turn could reduce the utilisation of the created wetlands by this species.
- 2.1.5 While there is inevitably some disturbance during the trapping process, it has become clear during previous radio-tracking work that tagged Greater Painted-snipe quickly recover from this, and that it does not affect the behaviour of tagged birds. Once this has occurred, this is virtually no further disturbance to the birds. Thus, radio-tracking is considered to cause the least disturbance of the monitoring options available.
- 2.1.6 From the long-term monitoring data collected so far, no records of Greater Painted-snipe in these land parcels has been made since 2010. Land filling has occurred at many locations in Kam Tin area where this species was recorded during radio-tracking in previous years (including the Buffalo Fields and agriculture at Shui Mei) since late 2009. Data extracted from the Hong Kong Bird Reports from 2009 to 2016 (HKBWS 2012, 2013, 2015, 2016, 2017 and 2018) revealed that the frequency and the peak count of this species in Kam Tin area has decreased substantially. No Greater Painted-snipe were recorded in Kam Tin area from 2012 to 2015 (HKBWS 2014, 2015, 2016 and 2017), and up to two individuals were recorded at Kam Tin in September and October 2016 (HKBWS 2018). Though records of this species have decreased in recent years, probably as a result of declining population due to significant wetland loss around Kam Tin, regular bird surveys will be used as the key monitoring methodology to study its use of the wetlands. Radio-tracking on a routine basis has been ceased since 2010 and this technique remains as an option for future monitoring if more information is needed about the presence of Greater Painted-snipe in the wetlands, or the habitat requirements of the species. Details of the recommended radio-tracking methodology are provided in section 2.4.
- 2.1.7 In addition to Greater Painted-snipe, all bird species will be surveyed in each of the created wetlands using more conventional survey techniques. While it is envisaged that this will in time be refined to cover wetland dependent species only, initially at least all bird species will be monitored. One important reason for initially monitoring all bird species is that a bird community within the created wetlands that is comprised

primarily of non-wetland species may well indicate that the created wetlands are not fulfilling their intended ecological function.

## **2.2 Monitoring methodology of birds**

2.2.1 A single fixed transect within each of the land parcels will be followed and all bird species seen or heard within the land parcels will be recorded. Surveys will commence within one hour of dawn to coincide with peak bird activity. As several land parcels will be surveyed in a single morning, the order in which the parcels are surveyed should be varied to avoid bias. The transect will vary in length according to the size of the land parcel, but will cover wetland and terrestrial habitats if both are present. Species lists for each of the land parcels will be provided.

## **2.3 Monitoring Schedule of birds**

2.3.1 Those land parcels targeting birds or Greater Painted-snipe (A, B, D and E) will be surveyed six times per quarter. All other land parcels (C, F, G<sup>#</sup>, H<sup>#</sup>, I, J<sup>#</sup>, K, L and M<sup>#</sup>) will be surveyed three times per quarter. Surveys shall commence as soon as each of the land parcels have been created, i.e. prior to establishment, as vegetation establishment is not necessarily a constraint on the utilisation of the created habitats by birds. (*N.B.: # reference to the note in Table 1*)

## **2.4 Radio tracking of Greater Painted-snipe (Optional)**

2.4.1 Routine radio-tracking of Greater Painted-snipe has been ceased since 2010 and this technique remains as an option monitoring if more information of Greater Painted-snipe is needed. Previous radio-tracking work on Greater Painted-snipe at Kam Tin has also shown a high degree of seasonality in the use of certain areas and habitats (with extremely marked differences during the dry and wet season), and that passage of birds (presumably from outside of Hong Kong) occurs in spring and autumn. This species also has a long breeding season, from March to October. Use of the created wetlands by Greater Painted-snipe should be expected to vary considerably during the course of a year, and is likely to vary between day and night. Accordingly, quarterly radio-tracking covering day and night is considered necessary to adequately monitor this key target species and its use of the created wetlands.

## **2.5 Monitoring Methodology of Radio tracking of Greater Painted-snipe (Optional)**

2.5.1 Greater Painted-snipe will be trapped using mist nets by personnel who have a relevant licence issued for trapping birds at Kam Tin by AFCD. Up to ten birds in each season will be fitted with radio-transmitters (tags). Following this the tagged birds will be tracked for two periods of ten days that will be separated by a gap of approximately ten days. During tracking each bird will be searched for during the day and at night. This is mobile species and radio-tracking will cover all suitable wetlands in the Kam Tin area within at least 1.5km of the created wetlands.

2.5.2 The tags to be used will be 4.5 g gauze-mounted TW-4 single button celled tags (Biotrack Ltd., Dorset, UK) and will be attached on the back with epoxy glue. The birds will be tracked using an M57 receiver (Mariner Radar Ltd, Suffolk, UK) and a hand-held flexible 3-element yagi antenna (Lintec, Dorset, UK). Location of detected

birds will be determined as accurately as possible through triangulation and recorded using a hand-held GPS. The distance between the receiver and tag will be kept low in order to reduce triangulation error.

## **2.6 Monitoring Schedule of Radio tracking of Greater Painted-snipe (Optional)**

2.6.1 In line with previous studies, radio-tracked Greater Painted-snipe should be located once each day and once each night for two periods of ten days that should be separated by a gap of approximately ten days. Birds should be located throughout the Kam Tin area, to monitor local movements and favoured sites. The radio-tracking for Greater Painted-snipe remains as an option for future monitoring.

## **3. Monitoring of amphibians**

### **3.1 Introduction**

3.1.1 Amphibian surveys will be based on identification of breeding vocalisations, since this is the most effective way of detecting which species are present. Accordingly, fieldwork will be conducted during evenings in the wet season, as this is the optimal time and period for amphibian breeding activities.

### **3.2 Monitoring methodology**

3.2.1 A single fixed transect within each of the land parcels will be followed and will cover wetland and terrestrial habitats if both are present, while adhering as closely as practicable to the wetland margin. Surveys will be conducted whenever possible on evenings following or during periods of rainfall, since such conditions are generally conducive to amphibian breeding activities. During surveys all breeding amphibians will be identified and their abundance assessed as accurately as possible. Records of calling amphibians will form the bulk of the data collected but this will be supplemented when possible by visual observations of eggs, tadpoles and adult frogs and toads. Species lists for each of the land parcels will be provided. Any amphibians observed or heard during the day-time reptile surveys will also be recorded.

### **3.3 Monitoring schedule**

3.3.1 For those land parcels that are targeting amphibians (B, D, E, H<sup>#</sup>, I, J<sup>#</sup>, K, L and M<sup>#</sup>) field visits will be conducted on two evenings per month during the period from March to September. For those land parcels not targeting amphibians (A, C, F and G<sup>#</sup>) field visits will be conducted on one evening per month during the period from March to September. (*N.B.: # reference to the note in Table 1*)

## **4. Monitoring of reptiles**

### **4.1 Introduction**

4.1.1 Since many reptiles are secretive and cryptic, appropriate microhabitats (e.g. shallow vegetated water margins, crevices, piled materials, bankside vegetation etc.) will be

actively searched during survey visits, which will be undertaken during the warmer months of the year when reptiles are most active.

## **4.2 Monitoring methodology**

4.2.1 A single fixed transect within each of the land parcels will be followed and will cover wetland and terrestrial habitats if both are present. During surveys careful searches of appropriate microhabitats and refugia will be undertaken and all reptiles observed will be identified and counted. In addition to this active searching, observations of exposed, basking or foraging reptiles at a greater distance from the fixed transect will also be recorded. Species lists for all land parcels will be provided, including any species recorded outside dedicated reptile surveys. Since reptiles are exothermic and more active on warm, sunny days, surveys will be conducted whenever possible on days when such weather conditions are prevailing.

4.2.2 As some reptile species are active at night, reptiles should be recorded during the evening amphibian surveys.

## **4.3 Monitoring schedule**

4.3.1 For those land parcels that are targeting reptiles (B, D, E, H<sup>#</sup>, I, J<sup>#</sup>, K, ~~and~~ L and M<sup>#</sup>) field visits will be conducted on two days per month during the period from April to November. For those land parcels not targeting reptiles (A, C, F and G<sup>#</sup>) field visits will be conducted on one day per month during the period from April to November. (*N.B.: # reference to the note in Table 1*)

## **5. Monitoring of dragonflies**

### **5.1 Introduction**

5.1.1 Dragonflies will be surveyed at all land parcels on two days per month during the warmer months of the year when they are most active.

### **5.2 Monitoring methodology**

5.2.1 A single fixed transect within each of the land parcels will be followed and will cover wetland and terrestrial habitats if both are present, while adhering as closely as practicable to the wetland margin. During surveys all dragonflies will be counted as accurately as possible. In addition, breeding behaviour will be noted, and dragonfly larval exuviae found within 2m either side of the transect and those on emergent vegetation around the ponds (both by direct observation) in the land parcels will be counted and identified. This is to give a further measure of successful dragonfly breeding in the compensation wetlands. Survey of dragonfly exuviae will be carried out while having the routine adult dragonfly monitoring. Species lists for dragonfly adults and exuviae will be provided.



### **5.3 Monitoring schedule**

- 5.3.1 For those land parcels that are targeting dragonflies (A, B, C, D, E, F, G<sup>#</sup>, H<sup>#</sup>, I, J<sup>#</sup>, K, L and M<sup>#</sup>; i.e. all land parcels), field visits will be conducted on two days per month during the period from April to November. (*N.B.: # reference to the note in Table 1*)

## **6. Floristics and structure of wetland vegetation**

### **6.1 Introduction**

6.1.1 Vegetation is a key element in a wetland ecosystem providing physical habitat structure for wildlife and serving as a major source of nutrients. Monitoring of the structural attributes, such as the distribution and diversity of plant communities, is therefore one of the most effective means of assessing and evaluating the status and trends of development of a created wetland.

6.1.2 Accordingly, three important plant community parameters in a wetland system will be monitored and evaluated in the wetland created by West Rail in the Kam Tin area, including:

- Plant species diversity,
- Plant community physical structure, and
- The invasion of non-native species.

### **6.2 Monitoring methodology**

6.2.1 According to the Habitat Creation and Management Plan, four different types of habitat that appear to provide distinct habitats for wetland species will be incorporated into the twelve wetland parcels created under the West Rail habitat compensation scheme, namely: seasonal marshes, permanent marshes, permanent ponds and terrestrial vegetation. The twelve created wetland parcels are all different in size, dimension and design, and vegetation planted on the created wetland is uniformly distributed and arranged in clusters. A systematic walk-through survey by following transect covering all the above distinct habitats (i.e. both terrestrial and wetland habitats) will be adopted.

6.2.2 In order to comprehend the floristic and structural characteristic of the created wetland, the three plant community parameters (plant species diversity, plant community physical structure, and the invasion of non-native species) will be surveyed throughout each of the land parcel by following transect covering the above key habitat types. All floral species observed during the walk-through survey will be identified to species level as far as possible, and their relative abundance will also be recorded. General characteristics of the plant community parameters in each key habitat types will be noted to describe the seasonal changes, spatial pattern and dominant plant species identified. The survey will also record any undesirable colonisation by exotic species in the habitats in each land parcel.

6.2.3 A comprehensive plant list will be compiled for all plant species found within the land parcels.

### **6.3 Monitoring Schedule**

- 6.3.1 The monitoring will be conducted in all land parcels on a bi-annual basis, once during the wet season (approx. May – July) and once during the dry season (approx. October – December), commencing at the point of establishment, as this is the point at which the contractor is deemed to have finished the planting. The exact timing of the monitoring period will also depend partly on seasonal weather conditions.

## **7. Water quality**

### **7.1 Introduction**

- 7.1.1 To ensure that water quality within the created wetlands is suitable for the target species and freshwater wetlands and also to identify any problems with water quality or levels, water quality and levels will be monitored regularly.
- 7.1.2 Additional water quality surveys will be conducted if pollution of the water supply is suspected in any land parcel and if required to determine the pollution level.

### **7.2 Monitoring methodology**

- 7.2.1 The following water quality parameters will be measured using a hand-held water quality checker:
- Temperature (°C)
  - pH
  - Turbidity (NTU)
  - Conductivity (mS/cm)
  - Dissolved oxygen (mg/l)
- 7.2.2 In addition, water depth will be recorded from permanent marker posts that will be placed centrally in the certain land parcels (B, D, E, I, J, K1, K2, L and M).
- 7.2.3 If additional water quality survey is required to determine the water pollution level in any land parcel, additional water sample will be taken and sent to a HOKLAS accredited laboratory for analysis.

### **7.3 Monitoring schedule**

- 7.3.1 Water quality and depth will be recorded in each of the land parcels twice per quarter.

## **8. Habitat characteristics**

### **8.1 Introduction**

- 8.1.1 General habitat characteristics will be collected as part of the baseline data (details in Table 5). These characteristics will be analysed using GIS software to allow for the overlap of the various characteristics to be determined. For example, the relationship

between shallow water and vegetation cover is important for Greater painted-snipe and other wetland-dependent birds.

## 8.2 Monitoring methodology

8.2.1 Detailed mapping of the parameters in Table 5 will require permanent markers being placed within each the land parcels. These will be placed at 10m intervals along at least two sides of the land parcel (and up to four sides on the larger parcels if required). These will provide permanent reference points, and with the addition of a marked rope (with marks at 10m intervals) a temporary grid will be created. From this the parameters referred to in Table 5 will be marked on to a base map which will be overlaid with a 1m grid. From this a very accurate series of base maps will be created using GIS software which will allow for the overlap of various parameters to be calculated. The areas can be identified as being particularly attractive or poorly utilised by various fauna can be characterised for on-going and adaptive management.

## 8.3 Monitoring schedule

8.3.1 Habitat mapping will be carried out in both dry and wet seasons in every three years. The mapping will be carried out in the period which coincides with middle of the dry and the wet season, and with the aim of recording the maximum and minimum extent of water in each land parcel. Data collected in the field should be entered into a GIS program to facilitate calculation of habitat areas and to permit comparison of habitat characteristics between seasons and monitoring years.

Table 5. Additional habitat characteristics to be monitored

Habitat characteristic	Number of measurements	Timing of measurements	Frequency of measurements	Reporting
% of each habitat <sup>3</sup>	The whole of each land parcel	Wet season <sup>1</sup> and dry season <sup>2</sup>	Every 3 years	In Annual Report
% of open water	The whole of each land parcel	Wet season <sup>1</sup> and dry season <sup>2</sup>	Every 3 years	In Annual Report
% of open bare wet mud	The whole of each land parcel	Wet season <sup>1</sup> and dry season <sup>2</sup>	Every 3 years	In Annual Report
% of bare dry mud	The whole of each land parcel	Wet season <sup>1</sup> and dry season <sup>2</sup>	Every 3 years	In Annual Report
% cover of plant species in dry areas	The whole of each land parcel	Wet season <sup>1</sup> and dry season <sup>2</sup>	Every 3 years	In Annual Report

<sup>1</sup> July – September (habitat mapping was carried out in the early wet season (April – May) before 2010)

<sup>2</sup> January – March (habitat mapping was carried out in the early dry season (September – October) before 2010)

<sup>3</sup> The habitat mapping will continue mapping the locations and extent of open water, open tidal area, bare wet soil, bare dry soil, terrestrial vegetation and vegetation growing in water. These elements are the components for determining the key habitats created in the land parcels.

## 9. Monitoring of Egrettries in the vicinity of West Rail

### 9.1 Introduction

9.1.1 In addition to monitor the created wetlands, the West Rail EIA identified the potential for impacts on egrettries within the vicinity of West Rail due to operation of the railway and monitoring of these egrettries is required for the first 3 year following commencement of operation.

9.1.2 There are currently three egrettries close to West Rail, at Ma On Kong, Ho Pui and Tung Shing Lei (near Au Tau). The Tung Shing Lei egrettry became established during the construction of West Rail and is not, therefore, mentioned in the EIA or EM&A Manual. However, it will be included in the monitoring programme with Ma On Kong and Ho Pui.

## **9.2 Monitoring methodology**

9.2.1 During each egrettry count, the total number of ardeids nesting will be recorded, along with data on brood size wherever possible.

9.2.2 Should any egrettry be abandoned or if there is a decline in ardeid nest numbers, assessment should begin immediately under the direction of a qualified ornithologist to determine the following:

- Cause of the abandonment/decline in nest numbers
- Prospects for management action to remove the cause of abandonment/decline in nest numbers
- Potential for West Rail involvement in corrective management if abandonment is attributed to West Rail operation; and
- Appropriate management response

9.2.3 Prescribed management responses should be implemented as soon as possible, and results should be monitored to determine efficacy.

## **9.3 Monitoring schedule**

9.3.1 Three counts will be made at each egrettry per year, one each in April, May and June.

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