8 Land Contamination

8.1 Legislation, Standards and Guidelines

8.1.1 General

8.1.1.1 The relevant legislation, standards and guidelines applicable to the present study for the assessment of land contamination include:

- Annex 19 of the Technical Memorandum on Environmental Impact Assessment Ordinance (TM-EIAO), Guidelines for Assessment of Impact Assessment Process (TM-EIA), Guidelines for Assessment of Impact On Sites of Cultural Heritage and Other Impacts (Section 3: Potential Contaminated Land Issues), Environmental Protection Department (EPD), 1997;
- Guidance Note for Contaminated Land Assessment and Remediation EPD 2007;
- Guidance Manual for Use of Risk-Based Remediation Goals (RBRGs) for Contaminated Land Management, EPD, 2007; and
- Practice Guide for Investigation and Remediation of Contaminated Land, EPD, 2011.

8.1.2 Environmental Impact Assessment Ordinance (EIAO) (Cap. 499), Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO)

8.1.2.1 Under Annex 19 of the TM-EIAO, a number of potentially contaminating historical land uses should be considered, including oil installations, gas works, metal workshops, car repair and dismantling workshops, which have the potential to cause or have caused land contamination.

8.1.3 Guidance Note for Contamination Land Assessment and Remediation

8.1.3.1 In accordance with EPD's *Guidance Note for Contamination Land Assessment and Remediation*, a contamination assessment evaluation should:

- provide a clear and detailed account of the present land-use and the relevant past land history, in relation to possible land contamination;
- identify areas of potential contamination and associated impacts, risks or hazards; and
- submit a plan to evaluate the actual contamination conditions for soil and/or groundwater, if required.

8.1.4 Guidance Manual for Use of Risk-Based Remediation Goals (RBRGs) for Contaminated Land Management

8.1.4.1 The Guidance Manual introduces the risk based approach in land contamination assessment and present instructions for comparison of soil and groundwater data to the Risk-Based Remediation Goals (RBRGs) for 54 chemicals of concern commonly found in Hong Kong. The RBRGs were derived to suit Hong Kong conditions by following the international practice of adopting a risk-based methodology for contaminated land assessment and remediation and were designed to protect the health of people who could potentially be exposed to land impacted by chemicals under four broad post restoration land use categories. The RBRGs also serve as the remediation targets if remediation is necessary. The RBRGs for soil and groundwater are given in **Table 8.1** and **Table 8.2** respectively.

Table 8.1: Risk-Based Remediation Goals (RBRGs) for soil & soil saturation limit

Chemical	Risk-Based Remediation Goals (RBRGs) for Soil				Soil Saturation Limit (C_{sat}) (mg/kg)
	Urban Residential (mg/kg)	Rural Residential (mg/kg)	Industrial (mg/kg)	Public Park (mg/kg)	
VOCs					
Acetone	9,590	4,260	10,000*	10,000*	***
Benzene	0.704	0.279	9.21	42.2	336
Bromodichloromethane	0.317	0.129	2.85	13.40	1,030
2-Butanone	10,000*	10,000*	10,000*	10,000*	***
Chloroform	0.132	0.0529	1.54	253	1,100
Ethylbenzene	709	298	8,240	10,000	138
Methyl tert-Butyl Ether	6.88	2.80	70.1	505	2,380
Methylene Chloride	1.30	0.529	13.9	128	921
Styrene	3,220	1,540	10,000*	10,000*	497
Tetrachloroethene	0.101	0.0444	0.777	1.84	97.1
Toluene	1,440	705	10,000*	10,000*	235
Trichloroethene	0.523	0.211	5.68	69.4	488
Xylenes (Total)	95.0	36.8	1,230	10,000*	150
SVOCs					
Acenaphthene	3,510	3,280	10,000*	10,000*	60.2
Acenaphthylene	2,340	1,510	10,000*	10,000*	19.8
Anthracene	10,000*	10,000*	10,000*	10,000*	2.56
Benzo(a)anthracene	12.0	11.4	91.8	38.3	
Benzo(a)pyrene	1.20	1.14	9.18	3.83	
Benzo(b)fluoranthene	9.88	10.1	17.8	20.4	
Benzo(g,h,i)perylene	1,800	1,710	10,000*	5,740	
Benzo(k)fluoranthene	120	114	918	383	
Bis-(2-Ethylhexyl)phthalate	30.0	28.0	91.8	94.2	
Chrysene	871	919	1,140	1,540	
Dibenzo(a,h)anthracene	1.20	1.14	9.18	3.83	
Fluoranthene	2,400	2,270	10,000*	7,620	

Chemical	Risk-Based Remediation Goals (RBRGs) for Soil				Soil Saturation Limit (C_{sat}) (mg/kg)
	Urban Residential (mg/kg)	Rural Residential (mg/kg)	Industrial (mg/kg)	Public Park (mg/kg)	
Fluorene	2,380	2,250	10,000*	7,450	54.7
Hexachlorobenzene	0.243	0.220	0.582	0.713	
Indeno(1,2,3-cd)pyrene	12.0	11.4	91.8	38.3	
Naphthalene	182	85.6	453	914	125
Phenanthrene	10,000*	10,000*	10,000*	10,000*	28.0
Phenol	10,000*	10,000*	10,000*	10,000*	7,260
Pyrene	1,800	1,710	10,000*	5,720	
Metals					
Antimony	29.5	29.1	261	97.9	
Arsenic	22.1	21.8	196	73.5	
Barium	10,000*	10,000*	10,000*	10,000*	
Cadmium	73.8	72.8	653	245	
Chromium III	10,000*	10,000*	10,000*	10,000*	
Chromium VI	221	218	1,960	735	
Cobalt	1,480	1,460	10,000*	4,900	
Copper	2,950	2,910	10,000*	9,790	
Lead	258	255	2,290	857	
Manganese	10,000*	10,000*	10,000*	10,000*	
Mercury	11.0	6.52	38.4	45.6	
Molybdenum	369	364	3,260	1,220	
Nickel	1,480	1,460	10,000*	4,900	
Tin	10,000*	10,000*	10,000*	10,000*	
Zinc	10,000*	10,000*	10,000*	10,000*	
Dioxins / PCBs					
Dioxins (I-TEQ)	0.001	0.001	0.005	0.001	
PCBs	0.236	0.226	0.748	0.756	
Petroleum Carbon Ranges					
C6 - C8	1,410	545	10,000*	10,000*	1,000
C9 - C16	2,240	1,330	10,000*	10,000*	3,000
C17 - C35	10,000*	10,000*	10,000*	10,000*	5,000
Other Inorganic Compounds					
Cyanide, free	1,480	1,460	10,000*	4,900	
Organometallics					
TBTO	22.1	21.8	196	73.5	

Notes:
[1] For Dioxins, the cleanup levels in USEPA Office of Solid Waste and Emergency Response (OSWER) Directive of 1998 have been adopted. The OSWER Directive value of 1 ppb for residential use has been applied to the scenarios of "Urban Residential", "Rural Residential", and "Public Parks", while the low end of the range of values for industrial, 5 ppb, has been applied to the scenario of "industrial".

[2] Soil saturation limits for petroleum carbon ranges taken from the Canada-Wide Standards for Petroleum Hydrocarbons in Soil, CCME 2000.

[3] * indicates a 'ceiling limit' concentration.

[4] *** indicates that the Csat value exceeds the 'ceiling limit' therefore the RBRG applies.

Table 8.2: Risk-Based Remediation Goals (RBRGs) for groundwater and solubility limit

Chemical	Risk-Based Remediation Goals (RBRGs) for Groundwater			Solubility Limit (mg/L)
	Urban Residential (mg/L)	Rural Residential (mg/L)	Industrial (mg/L)	
VOCs				
Acetone	10,000*	10,000*	10,000*	***
Benzene	3.86	1.49	54.0	1,750
Bromodichloromethane	2.22	0.871	26.2	6,740
2-Butanone	10,000*	10,000*	10,000*	***
Chloroform	0.956	0.382	11.3	7,920
Ethylbenzene	1,020	391	10,000*	169
Methyl tert-Butyl Ether	153	61.1	1,810	***
Methylene Chloride	19.0	7.59	224	***
Styrene	3,020	1,160	10,000*	310
Tetrachloroethene	0.250	0.0996	2.95	200
Toluene	5,110	1,970	10,000*	526
Trichloroethene	1.21	0.481	14.2	1,100
Xylenes (Total)	112	43.3	1,570	175
SVOCs				
Acenaphthene	10,000	7,090	10,000*	4.24
Acenaphthylene	1,410	542	10,000*	3.93
Anthracene	10,000*	10,000*	10,000*	0.0434
Benzo(a)anthracene				
Benzo(a)pyrene				
Benzo(b)fluoranthene	0.539	0.203	7.53	0.0015
Benzo(g,h,i)perylene				
Benzo(k)fluoranthene				
Bis-(2-Ethylhexyl)phthalate				
Chrysene	58.1	21.9	812	0.0016
Dibenzo(a,h)anthracene				
Fluoranthene	10,000*	10,000*	10,000*	0.206
Fluorene	10,000*	10,000*	10,000*	1.98
Hexachlorobenzene	0.0589	0.0234	0.695	6.20
Indeno(1,2,3-cd)pyrene				
Naphthalene	61.7	23.7	862	31.0
Phenanthrene	10,000*	10,000*	10,000*	1.00
Phenol				
Pyrene	10,000*	10,000*	10,000*	0.135
Metals				
Antimony				

Chemical	Risk-Based Remediation Goals (RBRGs) for Groundwater			Solubility Limit (mg/L)
	Urban Residential (mg/L)	Rural Residential (mg/L)	Industrial (mg/L)	
Arsenic				
Barium				
Cadmium				
Chromium III				
Chromium VI				
Cobalt				
Copper				
Lead				
Manganese				
Mercury	0.486	0.184	6.79	
Molybdenum				
Nickel				
Tin				
Zinc				
Dioxins / PCBs				
Dioxins (I-TEQ)				
PCBs	0.433	0.171	5.11	0.031
Petroleum Carbon Ranges				
C6 - C8	82.2	31.7	1,150	5.23
C9 - C16	714	276	9,980	2.80
C17 - C35	12.8	4.93	178	2.80
Other Inorganic Compounds				
Cyanide, free				
Organometallics				
TBTO				

Notes:

[1] Blank indicates that RBRG could not be calculated because the toxicity or physical/chemical values were unavailable, or the condition of Henry's Law Constant>0.00001 was not met for the inhalation pathway.

[2] Water solubilities for Petroleum Carbon Range aliphatic C9-C16 and greater than C16 generally are considered to be effectively zero and therefore the aromatic solubility for C9-C16 is used.

[3] * indicates a 'ceiling limit' concentration.

[4] *** indicates that the solubility limit exceeds the 'ceiling limit' therefore the RBRG applies.

8.1.5 Practice Guide for Investigation and Remediation of Contaminated Land

8.1.5.1 The EPD's *Practice Guide for Investigation and Remediation of Contaminated Land* includes a summary of the general steps of a contamination assessment study, which include site appraisal, site investigation and remediation.

8.2 Assessment Methodology

8.2.1 Overview

8.2.1.1 Land contamination assessment has been conducted according to the following procedures. Each of these procedures listed below are further discussed in the following sections.

- Desktop review of site history;
- Conduct site survey to identify the potentially contaminated areas; and
- Prepare Land Contamination Assessment Report for EPD's agreement.

8.2.2 Desktop Review

8.2.2.1 For the purpose of conducting the desktop review, it is required to collect the best available relevant information in the public domain. This information includes the following that would illustrate the features of the area and any changes in land use over the previous decades. The following has been reviewed:

- Relevant historical aerial photographs;
- Hong Kong Geological Survey Map that provide information on geology of the site;
- Outline Zoning Plans that show the latest landuses; and
- Any relevant EIAs and environmental SIs conducted by other studies.

8.2.3 Site Surveys

8.2.3.1 Once the desktop review was completed, site surveys were conducted in September 2013, May 2014 and June 2014 to ground truth the findings of desktop study and to identify any other landuses within the EIA Study Brief Boundaries at Sandy Ridge, Choi Yuen Road, Lin Ma Hang Road and along Man Kam To Road which may have the potential for contamination in soil and groundwater. The identification of potentially contaminating activities has based on Table 2.3 of EPD's *Practice Guide for Investigation and Remediation of Contaminated Land*.

8.2.4 Preparation of Land Contamination Assessment Report

8.2.4.1 According to the findings of desktop study and site surveys, the Land Contamination Assessment Report for the Study Area was prepared and the latest version of the Land Contamination Assessment Report was submitted in February 2016 and is given in **Appendix 8.1**.

8.3 Desktop Review

8.3.1 Aerial Photographs and Historical Land Use

8.3.1.1 Selected historical aerial photographs between 1973 and 2010 of the area within the EIA Study Brief Boundary at Sandy Ridge (the Area), Choi Yuen Road, Lin Ma Hang Road and along Man Kam To Road have been reviewed in order to ascertain any historical landuse with the potential for land contamination. The review findings of the selected historical aerial photographs of the Area at Sandy Ridge, Choi Yuen Road, Lin Ma Hang Road and along Man Kam To Road are summarised in **Tables 8.3** to **8.6**. The aerial photographs are given in Appendices A to D of the Land Contamination Assessment Report (**Appendix 8.1**) respectively.

Table 8.3 Summary of historical aerial photographs for Sandy Ridge

Year	Description
1973	• The area consisted of natural terrain occupying the southern part, middle part and eastern part of the Area. • Macintosh Fort was observed in the northern part of the Area. • Scattered cemeteries were observed in the Area. • Lo Wu Train Station was observed in the north western part of the Area. • Agricultural land and village houses were observed below the southern boundary of the Area. • Ng Tung River was observed along the western boundary of the Area. • Shenzhen River was along the northern boundary of the Area. • Fish pond was observed next to the north western boundary of the Area. • The Lo Wu Village located beside Lo Wu Train Station was observed (excluded from the Area).
1983	• Lo Wu Train Station was observed in the north western part of the Area and extended with one more building. • Ng Tung River was observed along the western boundary of the Area and the lower part of its stream had re-alignment. • Fish pond was observed next to the north western boundary of the Area and two small parts of areas at its upper corner had been extended. • No significant changes for the historical land use of other features were observed as compared with Year 1973.

Year	Description
1993	• At the far south eastern end of the Area, warehouse type building structures were observed. • Lo Wu Train Station was observed in the north western part of the Area and developed into a larger building. • Ng Tung River was observed along the western boundary of the Area and had been widened. • Fish pond was observed next to the north western boundary of the Area and one small part of area at its south eastern corner had been reclaimed. • No significant changes for the historical land use of other features were observed as compared with Year 1983.
2000	• No significant changes for the historical land use were observed as compared with Year 1993.
2005	• At the far south eastern end of the Area, the area with warehouse type building structures had been changed to an open storage area. • Shenzhen River was along the northern boundary of the Area and had been widened. • Ng Tung River was observed along the western boundary of the Area and had been further widened. • Fish pond was observed next to the north western boundary of the Area and most of its area had been reclaimed. • No significant changes for the historical land use of other features were observed as compared with Year 2000.
2010	• At the far south eastern end of the Area, the open storage area had been built up with warehouse type building structures. • Fish pond was observed next to the north western boundary of the Area and one small part of reclaimed land had been changed to fish pond again. • No significant changes for the historical land use of other features were observed.

Table 8.4 Summary of historical aerial photographs for Choi Yuen Road

Year	Description
1973	• The Choi Yuen Road had not been built up. Farmland and village houses were observed instead within the Area. • Farmlands were observed at the western part from the Area. • Village houses were observed at the northern and southern parts from the Area. • Shek Wu Hui marketplace was observed at the far northeastern part from the Area.
1983	• The Choi Yuen Road had been built up within the Area. • Sheung Shui Train Station had been built up at the eastern

Year	Description
	part of the Area. • Construction in progress was changed from farmlands and was observed at the southern and northern parts from the Area. • Choi Yuen Estate was observed at the southern part from the Area.
1993	• Landmark North shopping centre had been built up at the northeastern part from the Area. • Choi Po Court had been built up from the previous construction in progress at the southern part from the Area. • Open car park was observed at the northern part from the Area. • No significant changes for the historical land use of other features were observed as compared with Year 1983.
2000	• No significant changes for the historical land use were observed as compared with Year 1993.
2005	• No significant changes for the historical land use were observed as compared with Year 2000.
2010	• No significant changes for the historical land use were observed as compared with Year 2005.

Table 8.5 Summary of historical aerial photographs for Lin Ma Hang Road

Year	Description
1973	• Lin Ma Hang Road had not yet been constructed. • Farmland, San Uk Ling, natural terrain and village houses were observed within the Area.
1983	• Lin Ma Hang Road had been constructed. • No significant changes for the historical land use of other features were observed as compared with Year 1973.
1993	• Man Kam To border crossing facilities were under construction. • Several areas of horticultural activities were observed. • No significant changes for the historical land use of other features were observed as compared with Year 1983.
2000	• The construction of the Man Kam To border crossing facilities had been completed. • No significant changes for the historical land use of other features were observed as compared with Year 1993.
2005	• No significant changes in historical land use were observed as compared with Year 2000 along Lin Ma Hang Road.
2010	• Several open areas were observed either side of Lin Ma Hang Road.

Year	Description
	• No significant changes for the historical land use of other features were observed as compared with Year 2005.

Table 8.6 Summary of historical aerial photographs for Man Kam To Road

Year	Description
1973	• Man Kam To Road, village houses and farmland were observed within the Area.
1983	• No significant changes in historical land use were observed as compared with Year 1973 along Man Kam To Road.
1993	• Several container storage areas adjacent to the utilities works area was observed. • No significant changes for the historical land use of other features were observed as compared with Year 1983.
2000	• No significant changes for the historical land use were observed as compared with Year 1993 Man Kam To Road.
2005	• The Police Dog Unit and Force Search Training School had been constructed. • No significant changes in historical land use of other features were observed as compared with Year 2000 Man Kam To Road.
2010	• No significant changes for the historical land use were observed as compared with Year 2005 along Man Kam To Road.

8.3.2 Geology

8.3.2.1 The geological strata likely to be encountered within the area at Sandy Ridge are mainly metasandstone, metaconglomerate and phyllite of the Tai Shek Mo Member, which belonged to the Lok Ma Chau Formation of the Carboniferous age. The site is overlain by debris flow deposit (colluvium) and alluvium, with estuarine deposits deposited near the Shenzhen River to the north of the area.

8.3.2.2 For Choi Yuen Road, there is a Tai Mo Shan Formation as the bedrock type within the site area. The quartz veins also present in the vicinity. The site is overlain by terraced alluvium and alluvium. In view of the developed nature of the site at Choi Yuen Estate, a layer of construction fill is also expected.

8.3.2.3 For Lin Ma Hang Road, there is the Tai Shek Mo Member of the Lok Ma Chau Formation as the bedrock type within the study area, comprising of metamorphosed siltstone, metamorphosed sandstone, some conglomerate horizons and phylite. It is anticipated that the Tai Shek Mo member found near the former Sam Wo Public School as the bedrock type comprises of metamorphosed siltstones and sandstones. The study area is overlain by

the Pleistocene terraced alluvium at the western side of Lin Ma Hang Road and debris flow deposits at the middle portion of Lin Ma Hang Road. Fill is expected to be found along Lin Ma Hang Road with a thickness ranging from 0.1-1m. A northwest-southeast trending photolineament is noted in the southwestern side of Lin Ma Hang Road. Two northeast-southwest trending photolineaments are in close proximity to the road. A syncline plunging towards the north is also noted across the middle of the road.

8.3.2.4 For Man Kam To Road, there is the Mai Po Member of the Lok Ma Chau Formation as the bedrock type comprises of metamorphosed siltstones, sandstones with thin conglomeratic beds and graphite schist within the study area. The study area is mainly overlain by debris flow deposits with locally alluvium identified near the Police Post and terraced alluvium near the junction with Sha Ling Road. Fill is expected to be found along the Man Kam To Road. Where encountered, the thickness ranges from 1.2-3.5m. A northwest-southeast and northeast-southwest trending photolineament are noted along the road.

8.4 Description of the Environment

8.4.1.1 Site surveys were conducted in September 2013, May 2014 and June 2014 to ground truth the findings of desktop review and to identify any other land uses within the EIA Study Brief Boundaries at Sandy Ridge, Choi Yuen Road, Lin Ma Hang Road and along Man Kam To Road which may have the potential for contamination in soil and groundwater.

8.4.1.2 Photo records of the site survey are given in Figure 2.1 and Figures 2.1a to 2.1e of the Land Contamination Assessment Report (**Appendix 8.1**) and the findings of the surveys are summarised as follows:

Western Access Road to MTR Lo Wu Station and Lo Wu Village

8.4.1.3 As shown in Figures 2.1a to 2.1c of the Land Contamination Assessment Report (**Appendix 8.1**), village houses (photo nos. 6263 and 6280), cemeteries (photo nos. 6261, 6274, 6281, 6286 and 6320), school (photo no. 6255) and roads (photo nos. 6268 and 6271) were identified along the EIA Study Brief Boundary in this area. They are not identified as potentially contaminated sites. Since there are no project works within the area of MTR Lo Wu Station (photo no. 6264), the contamination potential, if any, within this area is considered not the concern for this project.

Access Road to Macintosh

8.4.1.4 As shown in Figure 2.1c and Figure 2.1d of the Land Contamination Assessment Report (**Appendix 8.1**), the upper section of the access road to Macintosh comprised of a watercourse (photo no. 6302), grassland (photo nos. 6308 and 6313), fish ponds (photo no. 6373) and Nam Hang Police Post (photo no. 6291) which has replaced the Macintosh Fort. For the lower section, village houses (photo no. 6370) were observed. A site consisted of concrete factory (photo no. 6363), open storage area and

warehouse (photo no. 6364) was also observed. As this area is a private land lot, given the issue on privacy and rights of the land ownership, site inspection and photographs could only been taken outside the boundary of the site. Although site access to this site was not allowed for site appraisal, it is considered as potentially contaminated in view of its long industrial landuse history (i.e. warehousing and open storage since early 90).

Eastern Access Road to Sandy Ridge Cemetery

8.4.1.5 As shown in Figure 2.1e of the Land Contamination Assessment Report (**Appendix 8.1**), roads (photo no. 6332), water pipes (photo no. 6328), cemetery (photo no. 6327) and fish pond (photo no. 6323) were identified along the EIA Study Brief Boundary in this area. No potentially contaminated sites were identified.

Choi Yuen Road

8.4.1.6 Photo records of the site survey at Choi Yuen Road are given in Figure 2.2 of the Land Contamination Assessment Report (**Appendix 8.1**). Road, car park, housing estate were identified along the EIA Study Brief Boundary at Choi Yuen Road. Since there are no project works within the area of MTR Sheung Shui Station and those urban areas have been disturbed throughout the urban development, the contamination potential, if any, within this area is considered not the concern for this project.

Lin Ma Hang Road

8.4.1.7 Photo records of the site survey at Lin Ma Hang Road are given in Figure 2.3 and Figures 2.3a to 2.3c of the Land Contamination Assessment Report (**Appendix 8.1**).

8.4.1.8 Road (photo nos. P300, P396, P405 and 4620), open areas (photo nos. P323 and P343), grassland (photo no. P314), horticultural activities (photo nos. P405 and P385) and storage facilities (photo no. P408) were identified along the section of Lin Ma Hang Road that requires widening. No potentially contaminated sites were identified.

Man Kam To Road

8.4.1.9 Photo records of the site survey at Man Kam To Road are given in Figure 2.4 and Figures 2.4a to 2.4b of the Land Contamination Assessment Report (**Appendix 8.1)**.

8.4.1.10 Man Kam To Road (photo nos. 547, 550, 553, 558, 565, 572, 581, 587, 595 and 605) was the only landuse observed within the utilities construction area. No potentially contaminated sites were identified on Man Kam To Road.

8.4.1.11 Adjacent to the road, and outwith the utilities construction area, natural terrain, agricultural land and container storage areas were observed. However, since the utilities works will not encroach into these adjacent landuses, the contamination potential, if any, within these areas is not considered to be a concern for this project.

8.4.1.12 A portion of the utilities construction area lies outwith Man Kam To Road and overlaps with the site survey conducted at the access road to Macintosh where a potentially contaminated site was identified. The potentially contaminated site and its landuse are described in Section 2.4.3 of the Land Contamination Assessment Report (**Appendix 8.1**).

Proposed Off-site Pick-up and Drop-off Point

8.4.1.13 As discussed in **Section 1.2**, it is proposed to have off-site pick-up / drop-off points for shuttle buses at MTR Kwu Tung Station, MTR Fanling Station, existing Sheung Shui Landmark North Public Transport Interchange (PTI) and layby at Pak Wo Road near Flora Plaza. Given the conditions of these existing highway infrastructures, no excavation works would be required and only road furnishing would be conducted. All these off-site pick-up / drop-off areas are actually within existing highway corridors and these areas would not be affected and hence impacts are not anticipated.

Proposed Barging Point

8.4.1.14 The proposed barging point is located in Siu Lam (shown in **Figure 1.3**) and is an existing barging point facility currently being used for the Express Rail Link (XRL) project. In accordance with the contamination assessment undertaken as part of the approved EIA report for the Express Rail Link (XRL) (AEIAR-143/2009), there was no land contamination identified within the barging point site prior to the land being occupied by XRL.

8.4.1.15 Acquisition of other relevant information from FSD and EPD for the records of dangerous goods, reported accidents of spillage/leakage, records of Chemical Waste Producers Registration, past and present chemical spillage/leakage records has been made (see **Appendix 8.2**). The storage locations of dangerous goods is assumed to be at the barging point. However, FSD and EPD have already advised that no records of incidents of spillage/leakage and Chemical Waste Producers Registration within the barging point. In addition, according to site surveys conducted in October 2015, the entire site was observed to be fully paved and no potentially contaminating land uses / oil stains or signs of land contamination evidence have been observed. Given that only minor construction works for the tipping hall and a new ramp are required and would not involve any excavation, therefore it is not anticipated that there will be land contamination impacts associated with the proposed barging point.

8.5 Other Relevant Information

8.5.1 Fire Services Department

8.5.1.1 The Fire Services Department (FSD) has been contacted in September 2013 and June 2014 for:

- The records of Dangerous Goods License(s); and

- The reported accidents of spillage/leakage within EIA Study Brief Boundaries at Sandy Ridge, Choi Yuen Road at Sheung Shui, Lin Ma Hang Road and along Man Kam To Road.

8.5.1.2 Based on the information provided by FSD in October 2013, there is a record of a 5,000L above-ground diesel storage tank within the EIA Study Brief Boundary. The record available shows no incidents in the past.

8.5.1.3 As informed by FSD, the ownership of the identified storage tank is classified and hence cannot be released. Therefore, the area within EIA Study Brief Boundary at Sandy Ridge is further subdivided into 4 sub-areas (i.e. Area 1, 2, 3 and 4) for identification of the location of the DGs. Based on the information provided by FSD in November 2013, the DGs is identified within Area 3. Copy of FSD's correspondence is provided in Appendix F of the Land Contamination Assessment Report (**Appendix 8.1**).

8.5.1.4 In view of the current landuse in Area 3, only one industrial site is identified which consisted of concrete factory, open storage area and warehouse as mentioned in **Section 8.4.1.4**. It is reasonably believed that the 5,000L above-ground diesel storage tank is located within this industrial site in view of its relatively large site area (i.e. approx. 8,340m^2) and industrial activities.

8.5.2 Environmental Protection Department

8.5.2.1 The EPD has been contacted in September 2013 and June 2014 for

- The records of Chemical Waste Producers Registration; and
- The reported accidents of spillage/leakage within EIA Study Brief Boundaries at Sandy Ridge, Choi Yuen Road at Sheng Shui, Lin Ma Hang Road and along Man Kam To Road.

8.5.2.2 The Chemical Waste Producers Registration records in EPD office have been reviewed. A list of Chemical Waste Producers registration is provided in Table 2.5 of the Land Contamination Assessment Report (**Appendix 8.1**). The review findings revealed that there were 10 Chemical Waste Producers Registration (i.e. CWP1 to CWP10) within the EIA Study Brief Boundary at Sandy Ridge and there was no record within EIA Study Brief Boundary at Choi Yuen Road in Sheung Shui.

8.5.2.3 China Concrete Company Limited (Chemical Waste Producer 1(CWP1)) has already been identified as a potentially contaminated site (i.e. refer to **Section 8.4.1.4**. for details).

8.5.2.4 CWP2 to CWP9 refer to various government departments, train facilities and contractors at the MTR Lo Wu Station. Since there are no project works within the area of MTR Lo Wu Station, the contamination potential, if any, within this area is considered not the concern for this project.

8.5.2.5 Shanghai Urban Construction (Group) Corporation (CWP 10) with registration address at Sandy Ridge Cemetery has de-registered. The

previous construction works were supposed to be carried out within the area of the existing facilities of Sandy Ridge Cemetery. Since there are no project works within the area of the existing facilities of Sandy Ridge Cemetery, the contamination potential, if any, within this area is considered not the concern for this project.

8.5.2.6 Based on the information provided by EPD on 23 September 2013 and 2 July 2014 there was no reported accident of spillage/leakage within EIA Study Brief Boundaries at Sandy Ridge, Choi Yuen Road, Lin Ma Hang Road and Man Kam To Road. Copy of correspondence with EPD is provided in Appendix G of the Land Contamination Assessment Report (**Appendix 8.1**).

8.6 Future Land Uses

8.6.1.1 As discussed in **Section 8.1.4,** the RBRGs have adopted four different post-restoration landuses, namely "Urban Residential", "Rural Residential", "Industrial" and "Public Parks", to reflect the actual settings which people could be exposed to contaminated soil or groundwater. Definitions of post-restoration landuses are given in EPD's *Guidance Note for Contaminated Land Assessment and Remediation and Guidance Manual for RBRGs*.

8.6.1.2 This project mainly comprises the development of columbarium, crematorium and related facilities at Sandy Ridge cemetery and the drop-off road section(s). The corresponding RBRGs landuse for this project is therefore "Industrial".

8.7 Identification of Potentially Contaminated Site

8.7.1.1 Based on the desktop review findings of selected aerial photos, the information collected during site surveys and the information collected from EPD and Fire Services Department (FSD), there is only one site identified to be potentially contaminated in accordance with the criteria in *EPD's Practice Guide for Investigation and Remediation of Contaminated Land* for land use type of concrete and asphalt production and open storage area. Though access to site was constrained as the site is currently under operation, peripheral inspection was carried out instead and a paved open storage area, warehouses as well as a concrete factory were observed. This potentially contaminated site is located at the south of the Study Boundary next to Man Kam To Road and is described as ‘SRC-1’. The location of the potentially contaminated site SRC-1 is given in Figure 3.1 of the Land Contamination Assessment Report (**Appendix 8.1**).

8.8 Proposed Site Investigation for Potentially Contaminated Site

8.8.1.1 Though SRC-1 has been identified as potentially contaminated site, however, approximate 92 % of the site (~7,700m^2) is located within a

private land lot and it is currently under operation (see Figure 3.1 of the Land Contamination Assessment Report**)**. In addition, according to the latest land resumption programme as advised by Engineer, only the western portion of SRC-1 with an area of approximate 1,200m^2 inside private lot would require land resumption for the road widening work at Sha Ling Road and utilities construction works nearby. As such, the necessity of Site Investigation (SI) should focus on this area once the land is resumed and free for access.

8.8.1.2 For the remaining 8 % of the site (~620m^2) which falls within government lot (to the southeast of SRC-1), only paved ground was observed and neither concrete & asphalt production nor open storage activities were observed during the site survey. In addition, review of historical aerial photos (since Year 1973) also revealed no sign of land contamination. As such, SI is considered not required for this strip of land.

8.9 Re-appraisal of the Potentially Contaminated Site

8.9.1.1 In view of the above implication mentioned in **Section 8.8**, it is recommended that further site visit will be carried out by the Project Proponent (PP) once the works area for the Project is confirmed and site access is available (e.g. after land resumption), in order to identify any hot spots for SI within the southeast and western portions of SRC-1. A complete site walkover checklist should be completed and should any hot spots are identified, complete justification should be provided outlining the potential sources of contamination.

8.10 Re-appraisal of the Area

8.10.1.1 The construction of columbarium, crematorium and related facilities at Sandy Ridge cemetery and the drop-off road section(s) would only commence few years later. There may be changes in land usage within the Area. Therefore, re-appraisal would also be required to assess the latest site situation at that time after land resumption. The objective of re-appraisal is to ensure any new changes in landuse that involve potentially contaminating activities after the approval of the Land Contamination Assessment Report but before commencement of the construction could be addressed.

8.11 Submission Requirements of CAP, CAR, RAP and RR

8.11.1.1 The PP would need to prepare a Contamination Assessment Plan (CAP) presenting the findings of the re-appraisal and strategy of the recommended SI, if required, and submit to EPD for review and approval.

8.11.1.2 After approval of the CAP and upon completion of the SI works, if any, the PP would prepare a Contamination Assessment Report (CAR), to present findings of the SI works. If contamination has been identified, a

Remediation Action Plan (RAP) would be prepared to formulate appropriate remedial measures to deal with the contamination identified. Following completion of any necessary remediation works, a Remediation Report (RR) would be prepared to demonstrate adequate clean-up and submit to EPD for approval prior to the commencement of any construction or development works at the contaminated sites identified.

8.12 Conclusion

8.12.1.1 This land contamination assessment examined the potential contaminative land uses within the Area and their potential impacts to future use. The assessment involved desktop review, site survey and identification of potentially contaminated site etc.

8.12.1.2 Based on the findings in desktop study and site survey, one potentially contaminated site (SRC-1) within the Area has been identified. According to the latest land resumption programme as advised by Engineer, only the western portion of SRC-1 with an area of approximate 1,200m^2 inside private lot would require land resumption for the road widening work at Sha Ling Road and utilities construction works nearby. For the portion of the site (~620m^2) which falls within government lot (to the southeast of SRC-1), only paved ground was observed and neither concrete & asphalt production nor open storage activities were observed during the site survey. In addition, review of historical aerial photos (since Year 1973) also revealed no sign of land contamination. As such, SI is considered not required for this strip of land and the necessity of SI should focus on the western portion of SRC-1 once the land is resumed and free for access.

8.12.1.3 Following the submission of CAP after re-appraisal by PP for EPD's agreement and completion of site investigation and laboratory testing works, if required, a CAR needs to be prepared to present the findings and evaluate the level and extent of potential contamination. If land contamination is identified and remediation is required, a RAP will be prepared to recommend specific remediation measures. Upon completion of the remediation works, if any, a RR that demonstrates the clean-up works are adequate would also be prepared. CAR, RAP and RR would be submitted to EPD for approval prior to commencement of any construction.