7.0 WASTE MANAGEMENT

7.1 Background

7.1.1 The following section describes the quality, quantity and timing of waste materials that will be generated by the Project during both the construction and operational phases and provides recommendations for waste handling and disposal.

7.2 Baseline Conditions

7.2.1 The existing waste management issues within the study area relating largely to general refuse from the residential properties and any construction project ongoing in the area. Both the domestic and construction and demolition waste will be collected and likely deposited directly at the WENT Landfill facility which is the closest to the study area. Any material suitable for public fill will have to be transported to either Pak Shek Kok or Tsueng Kwan O which are the only facilities currently accepting pubic fill material.

7.3 Assessment Methodology

7.3.1 The assessment of the environmental impacts from the handling, storage, collection, transportation and disposal of waste material generated by the project has been undertaken in accordance with Annex 7 and Annex 15 of the TMEIAO.

7.3.2 The waste management hierarchy has been applied in the assessment and development of mitigation measures for waste. The waste management hierarchy is a concept which shows the desirability of various waste management methods and comprises the following in order of preference:

- avoidance;
- minimisation;
- recycling/reuse;
- treatment; and
- disposal.

7.3.3 All opportunities for reducing waste generation have been assessed based upon the following factors:

- avoiding or minimising waste generation through changes in the design;
- adopting better management practices to promote segregation of waste materials;
- reuse and recycling; and
- diverting waste to public dumps or other construction sites.

7.3.4 The types and quantities of waste have been estimated and disposal options for each category of waste identified, taking into account the existing or future spare capacities of the waste disposal facilities and the environmental implications of the handling, collection and disposal of waste material.

7.4 Waste Types

7.4.1 Activities during the construction phase will result in the generation of a variety of wastes which can broadly be classified into distinct categories based on their nature and the options for their disposal. These include:

- excavated materials suitable for reclamation and fill;
- construction and demolition waste some of which may be suitable for reclamation and fill. This category includes the vegetation cleared at the commencement of the works;
- chemical waste;
- general refuse; and
- sewage.

7.4.2 The excavation waste will include the following:

- broken concrete from the top layer of excavations along roads, tracks, paths and alleyways;
- broken asphalt from excavation in roadways; and
- soil from trench excavation and excavation for the pumping stations.

7.4.3 A large proportion of the soil material that will be excavated will be suitable for use as backfill material for the sewer alignment. The remaining earth and the broken surface material will require off-site disposal on the basis that it will be surplus to requirements or unsuitable for backfilling respectively. None of the material excavated for the pumping stations will be used for backfilling and all will require disposal. This inert material will largely be suitable for public fill.

7.4.4 The waste material generated during the operational phase will be limited to screening materials removed during the maintenance of the pumping station and manholes after removal of blockages.

7.5 Construction Phase Excavated Waste Arisings

7.5.1 The overall quantity of broken concrete and asphalt material that will require handling and disposal is dependant upon the length and size of the sewers and associated depths and width of the required trenches and size of the pumping stations.

7.5.2 Based upon the latest layout of the sewers and preliminary design information, estimates of the potential waste arisings and ultimate surplus material has been made.

7.5.3 The generation of waste can be divided into that produced during the construction of the sewer and the material excavation for the foundation of the pumping stations. Waste arisings from these areas are presented separately below.

Pumping Stations

7.5.4 Table 7.1 details the proposed plan areas of each of the pumping stations, together with the worst case maximum excavation depths and quantity of material to be excavated as supplied by DSD/Sewerage Projects.

Table 7.1: Approximate Waste Arisings from the Pumping Stations

Pumping Station	Plan Area (m^2)	Maximum Excavation Depth (m)	Excavation Quantity (m^3)
Tai Lam Correctional Institution	60	7.0	342
Tai Lam Chung Tsuen	143	9.0	1079
Luen On San Tsuen	77	7.4	462
Tai Lam Valley	169	5.7	923
So Kwun Wat Tsuen	74	8.5	593
Castle Peak Villas	112	5.5	538
TOTAL			3937

Sewer Alignments

7.5.5 The waste arisings for the construction of the sewer alignments have been determined using the lengths of sewer associated with each of the pumping stations. The extent of pipeline assumed for each pumping station is shown in Drawings 7.1a and 7.1b. The following basic assumptions have been made for the assessment:

- a minimum of 150mm of aggregate will surround the pipe;
- pipes have been assumed to be concrete, although in practice a combination of concrete, PVC and PVC lined concrete will be used;
- pipe external diameters and trench widths have been obtained from the DSD Sewerage Manual, Part 1, May 1995 and where particular pipe diameters are not specified an estimate has been made;
- 10% of excavated material will be hard material in the form of broken concrete and asphalt which cannot be used for backfilling;
- 55% of excavated soil material from the sewer trenches will be used for backfilling;
- surplus material will be subject to 25% bulking factor; and
- averages of trench depths have been made based upon minimum and maximum trench depths.

7.5.6 Tables 7.2 to 7.9 and the text below detail the pipe diameters and lengths, trench depths and calculations made to determine the waste arisings.

Table 7.2: Waste Arisings from the Tai Lam Chung Correctional Institution Pumping Station Sewer Alignment

Pipe Diameter (mm)	Pipe External Diameter (m)	Length (m)	Trench Width (m)	Minimum Trench Depth (m)	Maximum Trench Depth (m)
200	0.22(1)	60	0.7(1)	2.53	3.73
300	0.38	160	0.75		
Total/Average Values		220	0.74	3.13	

Note (1): Assumed value

7.5.7 Based upon the proposed total pipe length and associated trench width and depth, the total quantity of excavated material for this section would be 507 m^3. Assuming 10% of this material would be hard material, in the region of 456 m^3 would be suitable for backfilling. As only approximately 55% of this value would be used and taking into account the bulking factor of 25%, 257 m^3 of material would be surplus. The surplus soil material added to the hard material would yield a total of 307 m^3 to be removed from site for this section of alignment.

7.5.8 The waste arisings for the sewer alignment associated with the Tai Lam Chung Tsuen Pumping Station are detailed in Table 7.3 below:

Table 7.3: Waste Arisings from the Tai Lam Chung Tsuen Pumping Station Sewer Alignment

Pipe Diameter (mm)	Pipe External Diameter (m)	Length (m)	Trench Width (m)	Minimum Trench Depth (m)	Maximum Trench Depth (m)
225	0.28	700	0.7	1.42	6.00
300	0.38	110	0.75		
350	0.5(1)	530	1.0(1)		
375	0.5	340	1.05		
525	0.7(1)	5	1.2(1)		
Total/Average Values		1685	0.87	3.71	

Note (1): Assumed value

7.5.9 The calculation of waste arisings is as follows:

- Total Quantity of Excavated Material 5437 m^3
- Amount of Hard Material 544 m^3
- Material Suitable for Reuse 4893 m^3
- Surplus Material After Backfilling 2752 m^3

- Total Quantity of Material Requiring Disposal 3296 m^3

7.5.10 The waste arisings for the sewer alignment associated with the Luen On San Tsuen Pumping Station are shown in Table 7.4 as follows:

Table 7.4: Waste Arisings from the Luen On San Tsuen Pumping Station Sewer Alignment

Pipe Diameter (mm)	Pipe External Diameter (m)	Length (m)	Trench Width (m)	Minimum Trench Depth (m)	Maximum Trench Depth (m)
200	0.22(1)	55	0.7(1)	1.43	5.45
225	0.28	1020	0.7		
375	0.5	10	1.05		
Total/Average Values		1085	0.70	3.44	

Note (1): Assumed value

7.5.11 The calculation of waste arisings is as follows:

- Total Quantity of Excavated Material 2625 m^3
- Amount of Hard Material 262 m^3
- Material Suitable for Reuse 2362 m^3
- Surplus Material After Backfilling 1329 m^3
- Total Quantity of Material Requiring Disposal 1591 m^3

7.5.12 The waste arisings for the Tai Lam Valley Pumping Station are shown in Table 7.5 below:

Table 7.5: Waste Arisings from the Tai Lam Valley Pumping Station Sewer Alignment

Pipe Diameter (mm)	Pipe External Diameter (m)	Length (m)	Trench Width (m)	Minimum Trench Depth (m)	Maximum Trench Depth (m)
300	0.38	670	0.75	1.91	6.67
350	0.5(1)	1035	1.0(1)		
375	0.5	35	1.05		
525	0.7(1)	10	1.2(1)		
Total/Average Values		1750	0.91	4.29	

Note (1): Assumed value

7.5.13 The calculation of waste arisings is as follows:

- Total Quantity of Excavated Material 6805 m^3
- Amount of Hard Material 681 m^3
- Material Suitable for Reuse 6125 m^3
- Surplus Material After Backfilling 3445 m^3
- Total Quantity of Material Requiring Disposal 4126 m^3

7.5.14 The waste arisings for the sewer alignment associated with the Castle Peak Villas Pumping Station are shown in Table 7.6 as follows:

Table 7.6: Waste Arisings from the Castle Peak Villas Pumping Station Sewer Alignment

Pipe Diameter (mm)	Pipe External Diameter (m)	Length (m)	Trench Width (m)	Minimum Trench Depth (m)	Maximum Trench Depth (m)
375	0.5	320	1.0	2.05	3.10
450	0.58	30	1.15		
500	0.7(1)	210	1.2(1)		
Total/Average Values		560	1.08	2.58	

Note (1): Assumed value

7.5.15 The calculation of waste arisings is as follows:

- Total Quantity of Excavated Material 1562 m^3
- Amount of Hard Material 156 m^3
- Material Suitable for Reuse 1406 m^3
- Surplus Material After Backfilling 791 m^3
- Total Quantity of Material Requiring Disposal 947 m^3

7.5.16 The waste arisings for the sewer alignment associated with the So Kwun Wat Pumping Station are shown in Table 7.7 below:

Table 7.7: Waste Arisings from the So Kwun Wat Pumping Station Sewer Alignment

Pipe Diameter (mm)	Pipe External Diameter (m)	Length (m)	Trench Width (m)	Minimum Trench Depth (m)	Maximum Trench Depth (m)
200	0.22(1)	670	0.7(1)	1.41	7.07
225	0.28	1340	0.7		
375	0.5	5	1.05		
Total/Average Values		2015	0.7	4.24	

Note (1): Assumed value

7.5.17 The calculation of waste arisings is as follows:

- Total Quantity of Excavated Material 5988 m^3
- Amount of Hard Material 599 m^3
- Material Suitable for Reuse 5389 m^3
- Surplus Material After Backfilling 3031 m^3
- Total Quantity of Material Requiring Disposal 3630 m^3

7.5.18 Thus, the total amount of surplus material from the installation of the sewer alignment requiring removal from the site and disposal at a suitable landfill will be in the region of 14,000 m^3. Added to this the amount predicted for the six pumping stations, detailed in Table 7.1, and the total for the project as a whole will be approximately 18,000 m^3. Assuming an average truck capacity of 6.7 m^3, disposal of the surplus material would equate to approximately 2600 vehicle trips over the duration of the job, or 4 trips per day over the entire site. In practice, only one lorry trip would be expected in any one location and this will not result in any significant environmental impacts.

7.6 Construction and Demolition Waste

7.6.1 Construction and demolition (C&D) material will arise from a number of site activities and may include:

- cleared vegetation;
- wood from formwork;
- equipment and vehicle maintenance;
- materials and equipment wrappings;
- unusable cement/grouting mixes; and
- damaged or contaminated construction materials.

7.6.2 If C&D materials are generated in large quantities they may hinder normal construction activities and present a safety hazard if not removed, in addition to causing potential water quality impacts. C&D materials generally comprise 20% C&D waste and 80% material

suitable for public fill. However, if the public fill fraction is not separated, all the material will be disposed of at a licensed landfill facility. As the capacity of Hong Kong's existing landfill sites rapidly reduces, it is necessary to minimise the amount of waste material being disposed of in this manner by applying the principles of the waste management hierarchy. The project is not predicted to generate large quantities of material but this should be sorted, reused where practicable and disposed of appropriately.

7.7 Chemical Waste

7.7.1 Chemical wastes likely to be generated during the construction will, for the most part, arise from the maintenance of plant and equipment. These may include the following:

- spent filter cartridges containing heavy metals;
- scrap batteries or spent acid/alkali from their maintenance;
- brake clutch linings containing asbestos materials;
- used hydraulic and lubricating oil;
- spent mineral oils/cleaning fluids from mechanical machinery;
- spent solvents/solutions, which may be halogenated, from equipment cleaning; and
- paints and paint containers.

7.7.2 Chemical wastes can pose environmental and health and safety hazards if not stored and disposed of in an appropriate manner. However, it is unlikely that any large quantities of chemical wastes will be generated during the construction of this project and if handled, stored, transported and disposed of in an appropriate manner, no impacts are predicted.

7.8 General Refuse

7.8.1 The construction works will result in the generation of a variety of general refuse requiring disposal. These wastes will arise mainly at the major work sites. General refuse may include office waste, newspapers, food wastes from canteen and packaging waste and will generally be disposed of at landfill.

7.8.2 The storage of general refuse has the potential to give rise to a variety of adverse environmental impacts. These include odour if waste is not collected frequently (eg. daily), windblown litter, water quality impacts if waste enters water bodies, and visual impact. The site may also attract pests and vermin if the waste storage area is not well maintained and cleaned regularly. In addition, disposal of wastes at sites other than approved landfills, can also lead to similar adverse impacts at those sites.

7.9 Sewage

7.9.1 The construction workforce will produce sewage which requires proper disposal. It is anticipated that chemical toilets shall be provided. In order to avoid unacceptable odour problems and to safeguard the health of the workers, nightsoil will need to be removed and disposed off site frequently by a licensed contractor. Also, sewage from the site offices will require to be properly collected and disposed of.

7.10 Contaminated Material

7.10.1 The key concern for any contaminated material identified will be during the construction period, both in terms of health and safety aspects to construction workers and local villagers during the handling and on-site storage of excavated material. However, a preliminary review of the study area did not identify any areas within the scope of the proposed project that were contaminated. Notwithstanding, any material suspected as being contaminated on site should be tested in accordance with EPD's Technical Circular No. 1-1-92 and any contaminated material will need to be disposed of appropriately.

7.11 Operational Phase Waste

7.11.1 The material that will require disposal during the operational stage will be screenings, grit and the like from the pumping stations and material from blockages. The material will be removed on a regular basis during operation and maintenance but the amount is expected to be small and the material will be disposed of to a strategic landfill site. The material will be contained during transportation to avoid spillage and odour and, thus, no significant impacts are predicted.

7.12 Mitigation Measures

7.12.1 Mitigation measures to control the handling and transportation of the materials are recommended as follows:

- the Contractor shall identify a coordinator for the management of waste. The coordinator shall prepare a Waste Management Plan which specifies procedures such as a ticketing system, to facilitate tracking of loads and to ensure that illegal disposal of wastes does not occur, and protocols for the maintenance of records of the quantities of wastes generated, recycled and disposed. The Waste Management Plan shall be prepared with reference to Works Branch Technical Circular (WBTC) No. 5/99 for the Trip-ticket System for Disposal of Construction and Demolition Material and issued to the DEP and CED to confirm the availability for C&D and public fill waste;

- stockpiled material should avoid vegetated areas and areas adjacent to water courses and be covered by tarpaulins to prevent windblown dust and/or surface run-off. Storage of material on site should be kept to a minimum to avoid nuisance to local residents;

- surplus material generated from the installation of the sewer alignment and pumping stations should be sorted on site into construction and demolition (C&D) waste and the public fill fraction. The C&D waste should be disposed of at a licenced landfill and the material suitable for public fill delivered to a public filling area or reclamation site;

- the contractor should provide a temporary storage area for general refuse during the construction phase which should be enclosed to avoid refuse being windblown and affected by rain. General refuse should be stored on site for a minimum period and disposed of at a licenced facility;

- excavated material in trucks shall be covered by tarpaulins to reduce the potential for spillage;

- wheel washing facilities shall be used by all trucks leaving the site to prevent transfer of mud onto public roads;

- the Contractor shall register with EPD as a chemical waste producer under the Waste Disposal (Chemical Waste) (General) Regulation. A licensed contractor shall be employed to collect chemical waste for delivery to a licensed treatment facility. Suitable chemical waste storage areas shall be formed on the site for temporary storage pending collection. All chemical wastes shall be handled, stored, transported and disposed of in accordance with the Code of Practice on the Package, Labelling and Storage of Chemical Wastes and A Guide to the Chemical Waste Control Scheme published by EPD;

- nightsoil arising from chemical toilets and on site chemical treatment facilities shall be transported by a licensed contractor to government Sewage Treatment Works for disposal in accordance with the Sanitation and Conservancy (Regional Council) By-laws; and

- any screenings and grit that are removed during maintenance shall be disposed of at a landfill site. The material shall be suitably contained and covered.

7.13 Waste Disposal Recommendations

7.13.1 Based upon the estimated quantities and types of waste to be generated by the project, disposal options have been determined, as detailed in Table 7.8 below. In terms of C&D waste and general refuse, a proposed waste transfer station in Tuen Mun should be operational by mid 2001 and this would be the closest to the project site. Alternatively, the material could be transferred directly to the WENT landfill site. Both of these facilities are predicted to have sufficient capacity to accommodate the relatively small quantities of waste arising from the project. In respect of fill material, the proposed Kwai Chung Area 30D barging point would be the closest during the construction period.

Table 7.8 Recommended Waste Disposal Sites

Type of Waste	Disposal Site
Inert material (dirt/soil, concrete, bricks, masonry, ceramics, tiles, etc.) which comply with the requirements of the Public Dumping Licence	Proposed Kwai Chung Area 30D barging point or other suitable location
C&D waste (plastics, glass, wood, including cleared vegetation etc.)	NWNT refuse transfer station, Tuen Mun or WENT landfill
Chemical waste (as defined under Schedule 1 of the Waste Disposal (Chemical Waste) Regulation)	Chemical waste treatment facility at Tsing Yi or other approved facility.

Table 7.8 Cont'd....

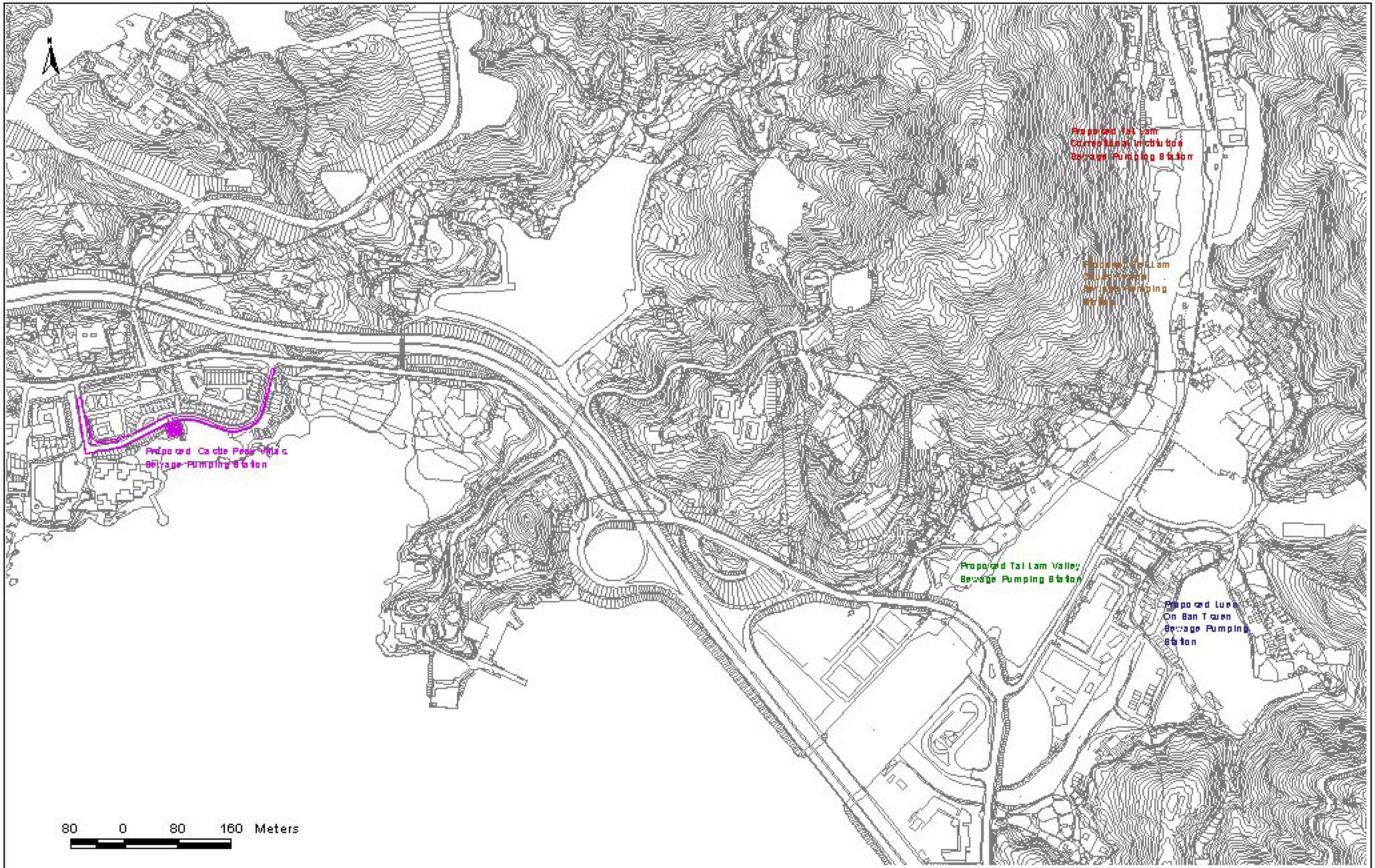
Type of Waste	Disposal Site
General refuse	NWNT refuse transfer station, Tuen Mun or WENT landfill

7.14 Residual Impacts

7.14.1 Assuming all the mitigation measures are implemented, no residual impacts from the handling, storage, transportation or disposal of the waste generated by the project are predicted.

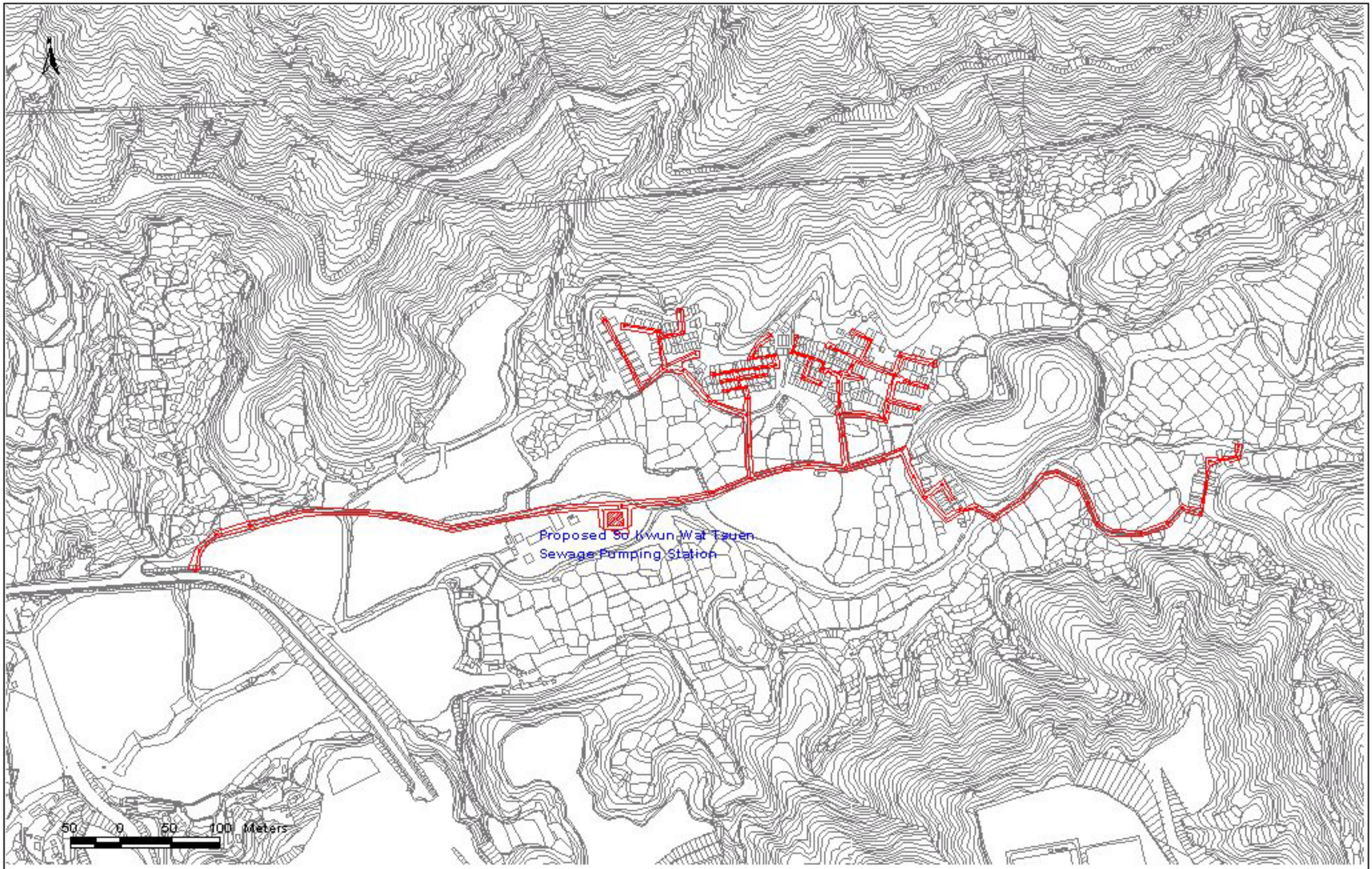
7.15 Environmental Monitoring and Audit

7.15.1 The assessment has concluded that the handling, transportation and disposal of waste materials during construction will not give rise to significant impacts. However, it is recommended that during the regular site inspections undertaken as part of the EM&A procedure, supervision of the waste management procedures is undertaken to ensure proper control. Waste EM&A during the operational stage is not required. Further details of the specific EM&A requirements are detailed in Section 11 of this report and in the EM&A Manual.



Sewer Alignment Associated with Each Pumping Station

Drawing 7.1a



Sewer Alignment Associated with Each Pumping Station

Drawing 7.1b