

12.1 INTRODUCTION

This EIA Study has been undertaken for the Preferred Development Option of Tuen Mun Area 54 in accordance with requirements of the EIAO, EIAO-TM, HKPSG and other relevant criteria. A summary of each of the issues assessed is given below. In addition, an impact summary table has been included to summarise the key findings of the EIA Study and to recommend any further studies assessment as part of the investigation and detailed design stage.

12.2 NOISE

12.2.1 Construction Phase

Noise during the construction phase of the project would impact on the surrounding environment. Unmitigated construction activities associated with the Project would cause exceedances of daytime construction noise standards stipulated in the EIAO-TM at NSRs located close to the work sites. Noise exceedances in the range of 1-9 dB(A) have been predicted, and critical noisy construction activities identified were site formation works, road construction and building construction.

Adequate control measures would be required for general construction works to meet the EIAO-TM construction noise standards. Mitigation measures including the use of quiet plant, installing noise barriers and reducing the percentage of time of noisy equipment in operation were recommended to be included as part of the Action Plan of the EM&A programme. With the implementation of quiet plant, barriers and limiting the usage of operating PME to 50% on site, noise impact at all the identified NSRs from construction works could be mitigated to comply with the daytime construction noise criteria.

Noise impact of 1 dB(A) and 4 dB(A) were still predicted at N22 (Siu Hong Court) and N23 (Yau Tze Tin Memorial College during examination periods) during the construction for the widening of Tsing Lun Road in Phase 1. This is due to their close proximity to the proposed widening section of Tsing Lun Road. Further limiting the operating time of PME to 25% should be considered and careful time scheduling of the construction activities before the construction works proceed is required so as to reduce the noise impacts.

With the implementation of all the recommended mitigation measures, noise exceedance of 1 dB(A) was still predicted at N23 (Yau Tze Tin Memorial College) during examination periods. The critical activity found to cause the noise exceedance was excavation during roadwork construction and thus scheduling of construction activities to avoid the undertaking of excavation works during examination periods is required. *Table 3.8f* gives a summary of the proposed mitigation measures for affected NSRs during construction phase.

Regular monitoring of noise at NSRs would be required during the construction phase of the project, as part of the EM&A programme, in order to ensure the environmental performance of the works through the implementation of the Action Plan.

Road traffic noise impact is a key environmental issue for the proposed development. Based on the worst case traffic forecasts for the year 2021, noise impacts would be likely at most of the identified existing and planned NSRs. Direct technical remedies (cantilever and vertical barriers) on the proposed distributor road have been recommended in order to reduce the identified impacts.

Noise abatement measures have also been proposed at the housing sites to further reduce noise nuisance from road traffic. At Sites 1, 2 and 3, podia of appropriate scale, screening structures including multi-storey car park and commercial centres are recommended. Noise semi-enclosure is also suggested to maximise the screening potential with regard to traffic noise from the new distributor road. For Site 3, single aspect design has been used for the building blocks to mitigate traffic noise.

Even with the proposed direct mitigation measures in place, there would still be residual noise impacts at the planned sensitive uses. Options for the use of blank façade and internal building design for Site 2 may need to be further explored to reduce the noise level at affected receivers.

In cases where the direct technical remedies were exhausted, the use of noise insulation and installation of air-conditioning system should be considered, as the last resort, to protect the affected NSRs. *Table 3.8m* gives a summary of the constraints for the development of each planned site. *Tables 3.9b* and *3.9c* show the estimated number of existing and planned dwellings that would be eligible for ITR.

As suitable acoustic louvers, silencers, dampers and noise absorptive lining will be provided for the proposed sewage pumping station at Site 2 and as the proposed PTIs in Sites 2 and 3 will be covered and located under the proposed commercial centres, noise impacts from these fixed noise sources would be minimal.

Rail noise from the West Rail will be sufficiently screened by the residential towers of Siu Hong Court and, hence planned sensitive uses within Tuen Mun Area 54 would not be impacted by rail noise of West Rail.

A semi-quantitative noise assessment has been conducted for the not yet confirmed LRT extension in Tuen Mun Area 54, assessment results indicated that for NSRs at a distance of 25 m from the LRT track, noise exceedances of 2 dB(A) and 12 dB(A) were predicted during daytime and night time respectively. As such, track side barrier should be considered at positions with insufficient horizontal buffer between the LRT track and the nearby NSRs. Detail noise assessment is recommended during the detailed design stage after the LRT development is confirmed.

12.3

AIR QUALITY

12.3.1

Construction Phase

Road works, development and infrastructure construction will be major sources of air pollutants. Construction activities such as material handling, wind erosion and truck movement on the unpaved haul roads will be the main dust generating activities.

Exceedance of the hourly and daily criteria for TSP levels at A2 (Siu Hang Tsuen West) and A4 (Po Tong Ha West) during Phase 1 cut and fill works was predicted. However, implementation of appropriate mitigation measures, as recommended in the *Air*

Pollution Control (Construction Dust) Regulation, and a reduction of vehicle speed to 20 km hr⁻¹ should be sufficient to ensure compliance of the established air quality criteria. For the construction activities during Phase 2, no exceedance of hourly and daily TSP level was predicted at all identified ASRs. To ensure the efficacy of the recommended air quality control measures, environmental monitoring and audit is recommended.

The proposed concrete batching plant at Site 2, if used, would most likely be small in size. However, it is still recommended that the facility should be located at more than 100m from ASRs, as recommended in the HKPSG, and the *Best Practical Means for Cement Works (Concrete Batching Plant)* should be followed to ensure that there will be no air quality impact from concrete batching.

12.3.2 *Operational Phase*

The AQO will be satisfied at all ASRs at both low levels (ground level and 10 m above ground) and high levels (30 m - 90 m above ground) except A11 (San Hing Tsuen) and A15 (Tuen Mun Government School) with the existing layout. Exceedance of AQO was predicted at A11 (San Hing Tsuen) (60 m above ground) and at A15 (Tuen Mun Government School) (90 m above ground). However, no air sensitive uses are present at level of 30 m above ground of these ASRs, therefore, the AQO criteria will be satisfied. Hence, no further mitigation measures are required for receivers.

As advised by the Planning Department, industrial uses located in San Hing Tsuen are to be phased out as the Town Planning Board has agreed to rezone the area around San Hing Tsuen to the north of the proposed Road D7 from "Industrial (Group D)" to "Residential (Group E) (R(E))" on the draft Lam Tei and Yick Yuen OZP No. S/TM-LTY/1. Hence, adverse air quality impacts resulting from the industrial uses in San Hing Tsuen on the planned future residential development can be eliminated.

To minimise odour nuisance on the surrounding area, it is recommended that control measures such as activated carbon filter or scrubber system be incorporated in the design for the sewage pumping station. The site where the tentative sewage pumping station is proposed to be located is feasible on a land use basis as measures on both noise and odour control are available to mitigate the impacts to acceptable level. In addition, a buffer distance of more than 15 m has already been allowed from the nearby village developments and the proposed residential development is more than 90 m from the sewage pumping station, hence odour nuisance arising from the sewage pumping station can be considered minimal. However, as the proposed sewage pumping station is a Schedule 2 designated project under EIAO, details of the mitigation measures for the sewage pumping station would be proposed in the future EIA under separate cover to meet the requirements of the EIA Ordinance.

As the design of the PTIs within the Preferred Development Option would likely be of a semi-confined nature, the requirements specified in TTAQG and ProPECC PN 1/98 should be followed for the design of the ventilation system of the PTIs. In addition, it is suggested that the ventilation shafts should be located away from the ASRs by a distance of at least 10 m to avoid any potential air quality impacts from the exhausts.

12.4 *WATER QUALITY*

12.4.1 *Construction Phase*

Construction activities associated with construction of potential housing development in Tuen Mun Area 54 could lead to site runoff containing elevated concentration of SS

and associated contaminants in the water column. Detailed mitigation measures have been described which should effectively control all potential impacts. Unacceptable residual (that is, after adoption of the recommended mitigation measures) water quality impacts are not expected to occur.

12.4.2

Operational Phase

It is considered that the existing drainage facilities at Area 54 require upgrading and provision of new facilities to minimise the impact of flooding during heavy rainfalls at low lying and poor drainage area. New drainage systems should be designed according to the guidelines from the EPD and the DSD. With the drainage improvements to be implemented as part of the proposed developments, the threat of flooding at a number of blackspots in the Study Area, which is temporarily relieved by the RPIS Works, will be substantially reduced.

Appropriate sewage collection facilities should be incorporated into the design of potential housing development. Sewerage systems for residential development should be installed and designed according to the EPD's guidelines. A sewage pumping station is proposed as a tentative arrangement subject to findings of the *Tuen Mun Sewerage Master Plan Review Study*. The sewage pumping station would be a *Schedule 2 Designated Project* under the EIAO. In the event that this sewage pumping station is confirmed to be required by the forthcoming *Review of Tuen Mun and Tsing Yi Sewerage Master Plans*, a separate EIA Study would be conducted for the pumping station.

It is considered that, with the adoption of the recommended mitigation measures, no unacceptable water quality and drainage impacts will result from the operational phase of the potential housing development within and downstream of the proposed housing development site. However, in order to avoid stormwater pollution of the drainage system, measures should be devised during the detailed design of the markets, carparks, garages and restaurants in the housing areas, as these are considered as the key sources of expedient connections and stormwater pollution.

12.5

WASTE MANAGEMENT

The potential environmental impacts of waste arising from the construction and operation of the proposed housing and commercial developments, and the associated infrastructure and community facilities have been assessed. Key issues include the need for effective waste management planning during both of these phases. Waste management methods and practices and other environmental control measures have been recommended to ensure that potential impacts are avoided or controlled to acceptable levels. With the implementation of the recommended measures, no residual environmental impact is expected with respect to waste management.

12.6

TERRESTRIAL ECOLOGY

The ecological resources within the Study Area comprises secondary woodland, agricultural field (active/abandoned), orchard and degraded area (open storage/wasteland). Field visits conducted within the period from November 1997 to July 1998 identified that the secondary Woodland 2 within the Study Area is an ecologically important habitat that supports uncommon/rare or protected flora including *Tutcheria spectabilis*, *Camellia sinensis*, *Camellia crapnelliana*, *Rhodoleia championi* and *Michelia macclurei*. There are two other large secondary woodland areas with the Woodland 1 in better condition and more mature, therefore ecologically more

important than the Woodland 3 with fruit and plantation species, as well as the Woodland 4 with *Acacia* plantation. However, several individuals of protected tree species, *Tutcheria spectabilis*, were found in Woodland 3. The other identified habitats in the Study Area are mostly disturbed with low ecological importance. Animal wildlife recorded was limited and no species of conservation interest observed except some mammal scats in the secondary woodland.

Recommendations on alternative development options during the evaluation process were made to avoid and minimise the potential impact to the secondary woodland in general, and Woodland 2 in particular. The ecologically important Woodland 2 area has been conserved as a Conservation Area where no development should be allowed.

Although the Preferred Development Option will encroach upon some of the less important woodland areas and probably lead to fragmentation of the woodland habitat, compensation planting has been maximised within the project limit to mitigate the impact. Given the relatively small scale of the residual low quality woodland loss, approximately 1.9 ha as compared to the entire woodland area of over 15 ha, as well as the even larger woodland area further up the hill slope, low ecological impact is considered from the residual low quality woodland habitat loss and fragmentation. The designation of the majority of the unaffected secondary woodland area as Green Belt will also afford an appropriate level of protection to the woodland ecological resources.

12.7 LANDSCAPE AND VISUAL IMPACT

12.7.1 Landscape Impacts

The site planning solution proposed for Area 54 is considered to be the best practical design that satisfied planning, engineering and landscape. The design features which should be incorporated into the Preferred Development Option as part of the MLSP would substantially mitigate the direct landscape impacts in Area 54.

It is identified that the unmitigated impacts both during and immediately after construction will be of a high degree with many being significant adverse. However, the incorporation of the mitigation measures will, in general, result in these being acceptable with several being beneficial. While it is recognised that construction of the development will result in the removal of vegetation over a wide area, no significant vegetation will be affected. In particular, the proposal of a Conservation Area would enhance the protection of the existing landscape.

It is recommended that a woodland management plan should be formulated for woodland areas during the detail design stage. This management plan would be based on detailed ecological, landscape and species analysis of the woodland. Both short-term and long-term management goals and objectives would be formulated and would be achieved by the implementation of detailed maintenance schedules.

12.7.2 Visual impacts

During construction, the proposed developments would be seen from the sensitive viewpoints, particularly the high-rise buildings. The visual impact is predicted to be significant adverse but limited to the construction period. During operation, the impacts, when mitigated, will be acceptable.

The residents in the estates in Area 54 will be most affected by the construction and

operation of the road. This will occur mainly due to the introduction of direct noise mitigation measures such as roadside barriers. The detail design of these structures will assist in minimising these visual impacts.

12.8 *CULTURAL HERITAGE*

12.8.1 *Historical and Cultural Resources*

No known historic buildings and structures are to be directly impacted by the proposed development.

The proposed housing development may cause concerns on changes in the level of water table and the threat of flooding during heavy rainfall. However, the drainage improvements to be implemented as part of the proposed developments will substantially improve flooding blackspots being temporarily relieved by the Rural Planning and Improvement Strategy - Minor Rural Improvement Works, Package 4 (RPIS Works). With these drainage improvements during the operational phase and good site management during the construction phase, it is anticipated that the indirect impact of water table fluctuation can be effectively controlled and therefore should not affect the preservation of historical buildings and other cultural resources.

The preferred development layout has maintained access to the existing villages and therefore access to the identified sites of cultural heritage would not be affected. Four grave sites will be encroached by the proposed development and relocation of these graves is required. The relocation of graves should be undertaken in consultation with the relevant families. However, the detailed arrangements for grave relocation are beyond the scope of this cultural heritage assessment.

Moreover, a field survey is required before the relocation work is to be started, which should include a full photographic recording of each face of the grave sites and a detailed recording of the stone tablet inscriptions for AMO's record.

12.8.2 *Archaeological Resources*

The findings from the archaeological survey conducted by the archaeological team of Zhongshan University identified areas of archaeological deposit in Tuen Mun Area 54. Areas to be impacted by the development include Site 1, west of Siu Hang Tsuen and Site 2, north of Kei Lun Wai.

With the maximisation of housing flat production from the Study Area as the prime objective of the Planning Study, there would be little scope in adjusting the layout of the Preferred Development Option to maximise the preservation of archaeological deposits. As the adjustment of development layout is considered not practicable, it is recommended that archaeological excavation of identified deposits be undertaken in advance of construction activities and that a watching brief is provided during construction. Sufficient time has been allowed for archaeological investigation/survey/rescue work by AMO within Phase 1 and Phase 2 of the Implementation Programme. Sufficient funds should also be provided for such work.

12.9 *LAND CONTAMINATION*

Relevant background information with regard to land contamination has been reviewed and preliminary site surveys have been conducted for the identification of

potential areas of concerns. The potential impacts from land contamination, if any, would be related to the disposal of contaminated materials, including soil and groundwater, and the potential health risks to construction workers and future users of the sites.

A CAP for the Study Area has been prepared (see *Annex I*). Contamination investigations will be conducted as part of the Implementation Programme in accordance with the CAP. The site investigation programme will be reviewed prior to the site investigation works. If site contamination is confirmed, a Remediation Action Plan will be compiled and the necessary remedial actions will be carried out prior to any site clearance works in accordance with requirements of the EIAO-TM.

12.10

OVERALL CONCLUSION

The findings of the EIA Study has provided information on the nature and extent of environmental impacts arising from the construction and operation of the proposed development in Tuen Mun Area 54. The EIA Study has also been used as a means to provide continuous environmental planning input for the generation of the Preferred Development Option. Appropriate mitigation measures have been recommended, where environmental impacts are identified, in accordance with the EIAO-TM.

The findings of the EIA Study indicate that there will be limited residual environmental impacts even with the implementation of the recommended mitigation measures. The major findings of the EIA are summarised in *Table 12.10a* and *Table 12.10b* presents the implementation schedule environmental mitigation measures for the proposed development.

The recommended EM&A procedures for the construction phase will be detailed in a separate EM&A Manual.

Table 12.10a EIA Report Impact Summary

Issue	Construction Phase	Operational Phase
Noise	<p>Noise during the construction phase of the project would impact on the surrounding environment. Unmitigated construction activities associated with the Project would cause exceedances of daytime construction noise standards stipulated in the EIAO-TM at noise sensitive receivers (NSRs) located close to the work sites. Noise exceedances in the range of 1-9 dB(A) have been predicted, and critical noisy construction activities identified were site formation works, road construction and building construction.</p> <p>Adequate control measures would be required for general construction works to meet the EIAO-TM construction noise standards. Mitigation measures including the use of quiet plant, installing noise barriers, controlling the number of plant operating concurrently and reducing the percentage of time of noisy equipment in operation were recommended. With the implementation of quiet plant, barriers and limiting the usage of operating PME to 50% on site, noise impact at all the identified NSRs from construction works could be mitigated to comply with the daytime construction noise criteria.</p> <p>Noise impact of 1 dB(A) and 4 dB(A) were still predicted at N22 (Siu Hong Court) and N23 (Yau Tze Tin Memorial College during examination periods) during the construction for the widening of Tsing Lun Road in Phase 1. This is due to their close proximity to the proposed widening section of Tsing Lun Road. Further limiting the operating time of PME to 25% should be considered and careful time scheduling of the construction activities before the construction works proceed is required so as to reduce the noise impacts.</p> <p>With the implementation of all the recommended mitigation measures, noise exceedance of 1 dB(A) was still predicted at N23 (Yau Tze Tin Memorial College) during examination periods. The critical activity found to cause the noise exceedance was excavation during roadwork construction and thus scheduling of construction activities to avoid the undertaking of excavation works during examination periods is required.</p>	<p>Road traffic noise impact is a key environmental issue for the proposed development. Based on the worst case traffic forecasts for the year 2021, noise impacts would be likely at most of the identified existing and planned NSRs. Direct technical remedies (cantilever and vertical barriers) on the proposed distributor road and the proposed widening section of Tsing Lun Road have been recommended in order to reduce the identified impacts.</p> <p>Noise abatement measures have also been proposed at the housing sites to further reduce noise nuisance from road traffic. At Sites 1, 2 and 3, podia of appropriate scale, screening structures including multi-storey car park and commercial centres are recommended. Noise semi-enclosure is also suggested at specific location along the distributor road adjacent to Site 1 to provide cover for the noise. For Site 3, single aspect design has been used for the building blocks to mitigate traffic noise.</p> <p>Even with the proposed direct mitigation measures in place, there would still be residual noise impacts at the planned sensitive uses. Options for the use of blank façades and internal building design for Site 2 may be further explored to reduce the noise level at affected receivers.</p> <p>In cases where the direct technical remedies were exhausted, the use of noise insulation and installation of air-conditioning system should be considered, as the last resort, to protect the affected NSRs. Vertical Interim Housing in Area 29 and Siu Hong Court were recommended for window insulation and air condition installation. As Yau Tze Tin Memorial College has already implemented window insulation and air-conditioning, it is considered to be less sensitive to noise. It is recommended that the window insulation at the College should be checked and confirmed that it meets the EIAO-TM criteria, i.e. Type I window for less than 10 dB(A) exceedance over standard.</p>

Issue

Construction Phase

Regular monitoring of noise at NSRs would be required during the construction phase of the project, as part of the environmental monitoring and audit (EM&A) programme, in order to ensure the environmental performance of the works.

Operational Phase

As suitable acoustic louvers, silencers, dampers and noise absorptive lining will be provided for the proposed sewage pumping station at Site 2 and as the proposed PTIs in Sites 2 and 3 will be covered and located under the proposed commercial centres, noise impacts from these fixed noise sources would be minimal.

Rail noise from the West Rail will be sufficiently screened by the residential towers of Siu Hong Court and, hence planned sensitive uses within Tuen Mun Area 54 would not be impacted by rail noise of West Rail.

A semi-quantitative noise assessment has been conducted for the not yet confirmed LRT extension in Tuen Mun Area 54, assessment results indicated that for NSRs at a distance of 25 m from the LRT track, noise exceedances of 2 dB(A) and 12 dB(A) were predicted during daytime and night time respectively. As such, track side barrier should be considered at positions with insufficient horizontal buffer between the LRT track and the nearby NSRs. Detail noise assessment is recommended during the detailed design stage after the LRT development is confirmed.

Issue	Construction Phase	Operational Phase
Air Quality	<p>Road works, development and infrastructure construction will be major sources of air pollutants. Construction activities such as material handling, wind erosion and truck movement on the unpaved haul roads will be the main dust generating activities.</p> <p>Exceedance of the hourly and daily criteria for TSP levels at A2 (Siu Hang Tsuen West) and A4 (Po Tong Ha West) during Phase 1 cut and fill works was predicted. However, implementation of appropriate mitigation measures, as recommended in the <i>Air Pollution Control (Construction Dust) Regulation</i>, and a reduction of vehicle speed to 20 km hr⁻¹ should be sufficient to ensure compliance of the established air quality criteria. For the construction activities during Phase 2, no exceedance of hourly and daily TSP level was predicted at all identified ASRs. To ensure the efficacy of the recommended air quality control measures, environmental monitoring and audit is recommended.</p> <p>The proposed concrete batching plant at Site 2, if used, would most likely be small in size. However, it is still recommended that the facility should be located at more than 100m from ASRs, as recommended in the HKPSG, and the <i>Best Practical Means for Cement Works (Concrete Batching Plant)</i> should be followed to ensure that there will be no air quality impact from concrete batching.</p>	<p>The AQO will be satisfied at all ASRs at both low levels (ground level and 10 m above ground) and high levels (30 m - 90 m above ground) except A11 (San Hing Tsuen) and A15 (Tuen Mun Government School) with the existing layout. Exceedance of AQO was predicted at A11 (San Hing Tsuen) (60 m above ground) and at A15 (Tuen Mun Government School) (90 m above ground). However, as no air sensitive uses are present at level of 30 m above ground of these ASRs, the AQO criteria will be satisfied. Hence, no further mitigation is required.</p> <p>As advised by the Planning Department, industrial uses located in San Hing Tsuen are to be phased out as the Town Planning Board has agreed to rezone the area around San Hing Tsuen to the north of the proposed Road D7 from "Industrial (Group D)" to "Residential (Group E) (R(E))" on the draft Lam Tei and Yick Yuen OZP No. S/TM-LTY/1. Hence, adverse air quality impacts resulting from the industrial uses in San Hing Tsuen on the planned future residential development can be eliminated.</p> <p>To minimise odour nuisance on the surrounding area, it is recommended that control measures such as activated carbon filter or scrubber system be incorporated in the design for the tentatively proposed sewage pumping station. As the proposed sewage pumping station is a Schedule 2 Designated Project under the EIAO, details of the mitigation measures for the sewage pumping station would be proposed in the future EIA under separate cover to meet the requirements of the EIAO. As the designs of the PTIs within the Preferred Development Option would likely be of a semi-confined nature, the requirements specified in TTAQG and ProPECC PN 1/98 should be followed for the design of the ventilation system of the PTIs. In addition, it is suggested that the ventilation shafts should be located away from the ASRs by a distance of at least 10 m to avoid any potential air quality impacts from the exhausts.</p>

Issue	Construction Phase	Operational Phase
Water Quality	<p>Construction activities associated with construction of potential housing development in Tuen Mun Area 54 could lead to site runoff containing elevated concentration of SS and associated contaminants in the water column. Detailed mitigation measures have been described which should effectively control all potential impacts. Unacceptable residual (that is, after adoption of the recommended mitigation measures) water quality impacts are not expected to occur.</p>	<p>It is considered that the existing drainage facilities at Area 54 require upgrading and provision of new facilities to minimise the impact of flooding during heavy rainfalls at low lying and poor drainage area. New drainage systems should be designed according to the guidelines from the EPD and the DSD. With the drainage improvements to be implemented as part of the proposed developments, the threat of flooding at a number of blackspots in the Study Area, which is temporarily relieved by the RPIS Works, will be substantially reduced.</p> <p>Appropriate sewage collection facilities should be incorporated into the design of potential housing development. Sewerage systems for residential development should be installed and designed according to the EPD's guidelines. A sewage pumping station is proposed as a tentative arrangement subject to findings of the Tuen Mun Sewerage Master Plan Review Study. The sewage pumping station would be a <i>Schedule 2</i> Designated Project under the EIAO. In the event that this sewage pumping station is confirmed to be required by the forthcoming <i>Review of Tuen Mun and Tsing Yi Sewerage Master Plans</i>, a separate EIA Study would be conducted for the pumping station.</p> <p>It is considered that, with the adoption of the recommended mitigation measures, no unacceptable water quality and drainage impacts will result from the operational phase of the potential housing development within and downstream of the proposed housing development site.</p>

Issue

Construction Phase

Waste Management

It is estimated a total of 181,900 m³ of excavated materials will be generated from the construction of the proposed developments. With a shortfall in fill material, all the excavated materials generated from the Phase 1 and Phase 2 works are expected to be reused on site as fill materials for the construction of road embankments and general filling. With the on-site reuse of excavated materials, there will still be a requirement for extra fill materials. As a result, there will not be any impacts associated with disposal of surplus excavated material and the handling and disposal of surplus excavated material will not be an environmental issue.

Based on the development schedule for the Preferred Development Option, it is estimated that approximately 87,100 m³ of construction and demolition (C&D) materials will be generated from the construction of new buildings during the period between 2003 and 2008. On average, there will be about 40 m³d⁻¹ of such materials. The Preferred Development Option has avoided encroachment of the indigenous villages and the quantity of C&D materials generated from demolition of existing structures should be small. As the quantity of C&D materials to be disposed of is relatively small, it is anticipated that there will not be any significant environmental impact.

Despite the above, waste management planning and other suitable environmental control measures are still recommended to minimise waste generation and any environmental effects that may occur as a result of the handling, transfer and disposal of waste during the construction phase.

Operational Phase

Based on the population forecast for the proposed residential developments in the Study Area, it is estimated that approximately 44 tonnes of waste will be generated each day. With the provision of properly designed waste storage and collection facilities and appropriate arrangements for the collection and disposal of waste, it is not anticipated that the handling and collection of waste will cause unacceptable environmental impacts during the operational phase.

Terrestrial Ecology

The ecological resources within the Study Area comprises secondary woodland, agricultural field (active/abandoned), orchard and degraded area (open storage/wasteland). Field visits conducted within the period from November 1997 to July 1998 identified that the secondary woodland 2 within the Study Area is an ecologically important habitat that supports uncommon/rare or protected flora including *Tutcheria spectabilis*, *Camellia sinensis*, *Camellia crampelliana*, *Rhodoleia championi* and *Michelia macclurei*. There are two other large secondary woodland areas with the Woodland 1 in better condition and more mature, therefore ecologically more important than the Woodland 3 with fruit and plantation species, as well as Woodland 4 with *Acacia* plantation. However, several individuals of protected tree species, *Tutcheria spectabilis*, were found in Woodland 3. The other identified habitats in the Study Area are mostly disturbed with low ecological importance. Animal wildlife recorded was limited and no species of conservation interest observed except some mammal scats in the secondary woodland.

Recommendations on alternative development options during the evaluation process were made to avoid and minimise the potential impact to the secondary woodland in general, and Woodland 2 in particular. The ecologically important Woodland 2 area has been conserved as a Conservation Area where no development should be allowed.

Although the Preferred Development Option will encroach upon some of the less important woodland areas and probably lead to fragmentation of the woodland habitat, compensation planting has been maximised within the project limit to mitigate the impact. Given the relatively small scale of the residual low quality woodland loss, approximately 1.9 ha as compared to the entire woodland area of over 15 ha, as well as the even larger woodland area further up the hill slope, low ecological impact is considered from the residual low quality woodland habitat loss and fragmentation. The designation of the majority of the unaffected secondary woodland area as Green Belt will also afford an appropriate level of protection to the woodland ecological resources.

Issue	Construction Phase	Operational Phase
Landscape and Visual Impact	<p data-bbox="127 862 183 974"><i>Landscape Impacts</i></p> <p data-bbox="183 862 694 974">The site planning solution proposed for Area 54 is considered to be the best practical design that satisfied planning, engineering and landscape. The design features which should be incorporated into the Preferred Development Option as part of the MLSP would substantially mitigate the direct landscape impacts in Area 54.</p> <p data-bbox="183 974 694 1310">It is identified that the unmitigated impacts both during and immediately after construction will be of a high degree with many being significant adverse. However, the incorporation of the mitigation measures will, in general, result in these being acceptable with several being beneficial. While it is recognised that construction of the development will result in the removal of vegetation over a wide area, no significant vegetation will be affected. In particular, the proposal of a Conservation Area would enhance the protection of the existing landscape.</p> <p data-bbox="183 1310 694 1377"><i>Visual Impacts</i></p> <p data-bbox="183 1377 694 1556">During construction, the proposed developments would be seen from the sensitive viewpoints, particularly the high-rise buildings. The visual impact is predicted to be significantly adverse but limited to the construction period.</p>	<p data-bbox="127 1310 183 1377"><i>Landscape Impacts</i></p> <p data-bbox="183 1310 694 1377">It is recommended that a woodland management plan should be formulated for woodland areas during the detail design stage. This management plan would be based on detailed ecological, landscape and species analysis of the woodland. Both short-term and long-term management goals and objectives would be formulated and would be achieved by the implementation of detailed maintenance schedules.</p> <p data-bbox="183 1377 694 1444"><i>Visual Impacts</i></p> <p data-bbox="183 1444 694 1556">The impacts during operation will be acceptable when mitigated.</p> <p data-bbox="183 1556 694 1870">The residents in the estates in Area 54 will be effected by the construction and operation of the road. This will occur mainly due to the introduction of direct noise mitigation measures such as roadside barriers. The detail design of these structures will assist in minimising these visual impacts.</p>

Issue	Construction Phase	Operational Phase
Cultural Heritage	<p data-bbox="159 851 207 1545"><i>Historical and Cultural Resources</i></p>	
	<p data-bbox="207 851 287 1545">No known historic buildings and structures are to be directly impacted by the proposed development.</p>	
	<p data-bbox="287 851 718 1545">The proposed housing development may cause concerns on changes in the level of water table and the threat of flooding during heavy rainfall. However, the drainage improvements to be implemented as part of the proposed developments will substantially improve flooding blackspots being temporarily relieved by the Rural Planning and Improvement Strategy - Minor Rural Improvement Works, Package 4 (RPIS Works). With these drainage improvements during the operational phase and good site management during the construction phase, it is anticipated that the indirect impact of water table fluctuation can be effectively controlled and therefore should not affect the preservation of historical buildings and other cultural resources.</p>	
	<p data-bbox="718 851 829 1545">The preferred development layout has maintained access to the existing villages and therefore access to the identified sites of cultural heritage would not be affected.</p>	
	<p data-bbox="829 851 1037 1545">Four grave sites will be encroached by the proposed development and relocation of these graves is required. The relocation of graves should be undertaken in consultation with the relevant families. However, the detailed arrangements for grave relocation are beyond the scope of this cultural heritage assessment.</p>	
	<p data-bbox="1037 851 1236 1545">Moreover, a field survey is required before the relocation work is to be started, which should include a full photographic recording of each face of the grave sites and a detailed recording of the stone tablet inscriptions for AMO's record.</p>	

Archaeological Resources

Areas of archaeological deposit have been identified during an archaeological survey conducted by the archaeological team of Zhongshan University in the Study Area, indicating that Tuen Mun Area 54 was a favourable site of settlement during the Sung, Ming and Ching dynasties; and a long history of human occupation appears to have been centred around the areas of Siu Hang Tsuen and Kei Lun Wai.

Development at Site 1, to the west of Siu Hang Tsuen and Site 2, to the north of Kei Lun Wai, is considered to result in significant impacts to archaeological deposits during the construction phase on the basis of the nature and extent of construction activities (the level of impact) and the predicted potential (the predicted value of the resource) of the area within which the activities are to take place.

With the maximisation of housing flat production from the Study Area as the prime objective of the Planning Study, there would be little scope in adjusting the layout of the Preferred Development Option to maximise the preservation of archaeological deposits. As the adjustment of development layout is considered not practicable, it is recommended that archaeological excavation of identified deposits be undertaken in advance of construction activities and that a watching brief is provided during construction. Sufficient time has been allowed for archaeological investigation/survey /rescue work by AMO within Phase 1 and Phase 2 of the Implementation Programme. Sufficient funds should also be provided for such work.

Issue**Construction Phase****Operational Phase**

Land Contamination

A review of old survey plans and aerial photographs indicates that the Study Area has comprised primarily village land and agricultural use during its history. However, there are a number of open storage areas and scrap yards.

Based on the review of background information and observations during several site visits, a number of properties or land lots within the Study Area were noted to be open storage areas and vehicle maintenance facilities. Some areas were noted to store chemicals in various drums and containers, and some properties have visible staining and apparent contamination, which was suspected to be derived from the particular land uses.

Although these areas of concern and the contamination appeared to be localised, the implications for development relate to the following:

- Disposal of potentially contaminated soils which will arise during excavation of such areas in the development works.
- Disposal of groundwater where any excavations take place below the water table.
- Potential health risks to site construction workers during development works.
- Potential health risks to future site users.

A CAP for the Study Area has been prepared (see *Annex I*). Contamination investigations will be conducted as part of the Implementation Programme in accordance with the CAP. The site investigation programme will be reviewed prior to the site investigation works. If site contamination is confirmed, a Remediation Action Plan will be compiled and the necessary remedial actions will be carried out prior to any site clearance works in accordance with requirements of the EIAO-TM.

Table 12.10b

Environmental Mitigation Implementation Schedule for the Proposed Development

Location	Recommendations	Funding Agent/Implementation Agent/Maintenance Agent	Timing
SCHEDULE 3 DESIGNATED PROJECT - HOUSING DEVELOPMENT IN TUEN MUN AREA 54			
Within the Tuen Mun Area 54 works boundary	Environmental pollution control measures for minimising construction impacts.	TDD / Contractor / TDD	During the construction period (2002 - 2008)
Development constraints for Sites 1, 2, and 3 (Figure 3.8a refers)	<p>Podia of appropriate scale, screening structures including multi-storey carparks and commercial centres, description as follows:</p> <p>For Site 1, the podium is of 13.5 m high and a distance of at least more than 40 m is used as setback from the proposed Road D7</p> <p>For Site 2, a 2-storey commercial centre with a 4-storey car park are recommended</p> <p>For Site 3, single aspect design used for building blocks and the car park block recommended is about 2 levels high and the commercial block is about 3 storeys high</p>	<p>HKHA / HKHS / Developer according to lease conditions imposed by DLO / TM (Site 1)</p> <p>HKHA according to lease conditions imposed by DLO / TM (Site 2 and Site 4)</p> <p>HKHA / Developer according to lease conditions imposed by DLO / TM (Site 3)</p>	Before completion of construction works for housing developments
LRT reserve	A separate EIA Study need to be conducted	KCRC (if LRT development is committed)	Before detailed design stage of LRT extension
Public Transport Interchanges (PTIs) in Site 2 and Site 3 - Noise Impact	<p>Building structures on top to mitigate noise generated</p> <p>Suitable acoustic treatment to be incorporated into the design of the PTIs</p> <p>Ingress and egress of the PTIs should be located away from the nearby noise sensitive developments</p>	<p>HKHA according to lease conditions imposed by DLO / TM (Site 2)</p> <p>HKHA / Developer according to lease conditions imposed by DLO / TM (Site 3)</p>	Detailed design stage
Public Transport Interchanges (PTIs) in Site 2 and Site 3 - Air Impact	Air quality required to meet TTAQO and ProPECC PN1/98	<p>HKHA according to lease conditions imposed by DLO / TM (Site 2)</p> <p>HKHA / Developer according to lease conditions imposed by DLO / TM (Site 3)</p>	Before completion of construction works for PTIs

Location	Recommendations	Funding Agent/Implementation Agent/Maintenance Agent	Timing
Within the Tuen Mun Area 54 works boundary - Water Quality	<p>Appropriate sewage collection facilities should be incorporated into the design of the housing developments</p> <p>Sewerage systems for residential development should be installed and designed according to the EPD's guidelines</p> <p>Upgrading of existing drainage facilities and provision of new facilities to minimise the impact of flooding during heavy rainfalls at low lying and poor drainage area</p> <p>New drainage systems designed according to the guidelines from the EPD and the DSD</p> <p>Provision of the possible interim sewage holding tank prior to the completion of the sewerage system under the Tuen Mun and Tsing Yi Sewerage Master Plans.</p> <p>Measures to avoid stormwater pollution, e.g. sufficient wastewater disposal facilities in markets, carparks and garages</p> <p>Compensatory replanting scheme & Woodland Management Plan</p>	<p>TDD/TDD & DSD/DSD</p> <p>TDD/TDD & DSD/DSD</p> <p>TDD/DSD/DSD</p> <p>TDD/DSD/DSD</p> <p>TDD/TDD/TDD to sort out the maintenance responsibility prior to its construction</p> <p>TDD/DSD/HKHA</p>	<p>Detailed Design Stage</p> <p>Detailed Design Stage</p> <p>Detailed Design Stage</p> <p>Detailed Design Stage</p> <p>Detailed Design Stage</p>
Within the Tuen Mun Area 54 works boundary	Compensatory replanting scheme & Woodland Management Plan	Compensatory planting scheme - TDD Woodland Management Plan - TDD Woodland Management Work - AFD	After civil engineering construction works is completed & during operation of the project
Within the Tuen Mun Area 54 works boundary	Planting works	TDD/TDD/AFD	Before completion of construction phase
Within the Tuen Mun Area 54 works boundary	Archaeological investigation/survey/rescue work in two areas of archaeological deposits and uninvestigated open storage areas	TDD (provision of funds) AMO (management of investigation and rescue work)	Before commencement of site clearance and formation works
Field survey required which should include a full photographic recording of each face of the grave sites and a detailed recording of the stone tablet inscriptions for AMO's record	TDD/Contractor or investigator/-	Before relocation of graves is to be started	

Location	Recommendations	Funding Agent/Implementation Agent/Maintenance Agent	Timing
Within the Tuen Mun Area 54 works boundary	Implement landscape and visual mitigation measures of the Master Landscape Plan (MLSP) on green belt zoning, existing woodland, viewcorridors, primary pedestrian corridors, local open space, landscape design for roads as recommended in <i>Section 8.7.2</i> of the EIA Report.	TDD/TDD/-	Detailed design stage and during project implementation
Within the Tuen Mun Area 54 works boundary	Implement landscape and visual mitigation measures including tree preservation, minimisation of glare, views of construction works, topsoils reservation as recommended in <i>Section 8.7.3</i> in the EIA Report during the construction phase.	TDD/TDD/-	During construction phase of the development.
Within the Tuen Mun Area 54 works boundary	Implement landscape and visual mitigation measures after construction as recommended in <i>Section 8.7.3</i> in the EIA Report which include roadside hardworks, roadside planting, landscape work in open space within housing development, amenity areas, conservation areas and the implementation of the noise barriers.	Roadside hardworks: TDD/HyD/HyD Roadside planting: TDD/RSD/RSD Open space within housing development: HD/PSPS developer /HD/HD Amenity Areas: TDD/RSD/ASD or RSD Conservation Areas: TDD/TDD/AFD Noise Barrier: TDD/HyD/HyD (TDD confirmed to obtained agreements from the responsible departments on funding, management/maintenance of the above measures)	During construction of the development and operation phase
Within the Tuen Mun Area 54 works boundary	Land contamination investigation in accordance with the EPD-approved Contamination Assessment Plan, preparation of a Contamination Assessment Report, formulation of remediation measures in a Remediation Action Plan (if land contamination is confirmed) for approval by EPD, and implementation of remediation measures in accordance with the EPD-approved Remediation Action Plan (if land contamination is confirmed)	TDD/TDD or investigator/-	Before commencement of site clearance and formation works

Location	Recommendations	Funding Agent/Implementation Agent/Maintenance Agent	Timing
SCHEDULE 2 DESIGNATED PROJECT: ROAD D7 IN TUEN MUN AREA 54			
Along specific locations of Road D7 (Figure 3.8a refers)	5 m roadside cantilever barriers (reflective) at locations between: - 51 m north of CH300 to 18 m south of CH500 (a total length of about 135 m) to protect N7 (Siu Hang Tsuen) Material used can be: aluminum panels with mineral wool claddings	TDD/Contractor/HyD	Before completion of roadworks
Along Road D7 adjacent to Site 1 (Figure 3.8a refers)	Noise semi-enclosure of 280 m in length along Road D7 at locations between: - 30 m north of CH500 to 21 m north of CH800 to protect N2 (Planned SH at Site 1) 1 m roadside vertical barriers (reflective) at locations between: - 60 m south of CH900 to 39 m west of CH1600 (a total length of 714 m) to protect N3 (Planned Educational Uses at Site 1A), N4 (Po Tong Ha) and N27 (Village extension area north of Po Tong Ha) Material used can be: aluminum panels with mineral wool claddings	TDD/Contractor/HyD	Before completion of roadworks
Along specific locations of Road D7 (Figure 3.8a refers)	5 m roadside cantilever barriers (absorptive) at locations between: - 39 m west of CH1600 to 45 m east of CH1900 (a total length of about 354 m) to protect N5 (Village house, north of Tsz Tin Tsuen) and N6 (Tsz Tin Tsuen) Material used can be: aluminum panels with mineral wool claddings	TDD/Contractor/HyD	Before completion of roadworks

Location	Recommendations	Funding Agent/Implementation Agent/Maintenance Agent	Timing
Along specific locations of Road D7 (Figure 3.8a refers)	5 m roadside cantilever barriers (absorptive) at locations between: -45 m east of CH1800 to 45 m east of CH1900 (a total length of about 100 m) to protect N26 (Rezoning area south of San Hing Tsuen)	TDD/Contractor/HyD	Before completion of roadworks
VIH Development in Area 29 Siu Hong Court	Material used can be: aluminum panels with mineral wool claddings Window insulations and air-conditioning for residential units expose to residual traffic noise impacts	TDD/Contractor/-	Before commencement of operation of Road D7 and the widened Tsing Lun Road
Yau Tze Tin Memorial College	Window insulation should be checked	-	Before commencement of operation of Road D7 and the widened Tsing Lun Road
G/IC Site 6	Not suitable for noise sensitive development	TDD	-

Location	Recommendations	Funding Agent/Implementation Agent/Maintenance Agent	Timing
SCHEDULE 2 DESIGNATED PROJECT: PROPOSED TSING LUN ROAD WIDENING			
Along specific sections of the proposed widening section of Tsing Lun Road (<i>Figure 3.8a refers</i>)	<p>5 m roadside cantilever and vertical barriers (absorptive and reflective) of various lengths along the widening section of Tsing Lun Road:</p> <ul style="list-style-type: none"> - a 115 m in length absorptive barrier from Lam Tei Interchange at western side of Tsing Lun Road and a 65 m in length absorptive barrier at eastern side to protect the housing development at Site 2 and Yau Tze Tin Memorial College respectively - a total length of 114 m reflective barriers (56 m cantilever barrier and 58 m vertical barrier) at eastern side of Tsing Lun Road to protect Siu Hong Court 	TDD/Contractor/HyD	Before completion of the widening of Tsing Lun Road
Material used can be: aluminum panels with mineral wool claddings			
SCHEDULE 2 DESIGNATED PROJECT: PROPOSED SEWAGE PUMPING STATION IN SITE 2			
Sewage pumping station near Site 2 (tentative arrangement subject to findings of the Tuen Mun Sewage Master Plan Review Study)	<ul style="list-style-type: none"> -A separate EIA Study conducted for the pumping station -Installation of suitable acoustic louvres, silencers, dampers and noise absorptive lining 	DSD/Contractor/DSD	Before detailed design of sewage pumping station