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2. Project Description

2.1 Purposes and Objectives of the Project

- 2.1.1.1 At present, connectivity between Northwest New Territories (NWNT) and Tuen Mun West (i.e., from Yuen Long and Tin Shui Wai heading to the Tuen Mun West and Tuen Mun – Chek Lap Kok Tunnel (TM-CLKT)) relies heavily on Tuen Mun Road (Fu Tei and Town Centre Sections), Wong Chu Road and Lung Fu Road. Subsequent to the commissioning of TM-CLKT, the vehicles commuting between NWNT and Lantau Island via TM-CLKT need to pass through the above-mentioned local roads in Tuen Mun, causing an increase in traffic loading to the concerned local roads. With the progressive implementation of various new development areas in NWNT such as Hung Shui Kiu/Ha Tsuen New Development Area and Yuen Long South Development, the traffic demand and loading may further increase.
- 2.1.1.2 Tuen Mun Bypass (i.e., the Project) is proposed to enhance the strategic road network in NWNT. It will not only provide a direct north-south route linking TM-CLKT in the south and Yuen Long Highway (YLH) (near Lam Tei Quarry) and Kong Sham Western Highway (KSWH) in the north, but also further improve the traffic conditions of some local roads in Tuen Mun, including Tuen Mun Road (Fu Tei and Town Centre Sections), Wong Chu Road and Lung Fu Road, with some spare capacity to accommodate the traffic demand from the future developments in Tuen Mun West.
- 2.1.1.3 The northern portion of the Project connecting YLH and KSWH and the planned Lam Tei Tunnel of Route 11 are all located at Lam Tei Quarry Interchange (LTQI). Design coordination with Route 11 is required to achieve full integration of various highway schemes and best level of connectivity, including the possible connections to YLH (Tuen Mun Section).
- 2.1.1.4 The general layout plan of the Project is presented in **Figure 1.1**. It comprises the construction of a tunnel of running underneath Tai Lam Country Park, Tuen Mun Typhoon Shelter and town centre of Tuen Mun. Within the Tai Lam Country Park, there is no other aboveground works including ground investigation (GI) works required for the Project apart from the underground tunnelling works.

2.2 Benefit of the Project

- 2.2.1.1 With the growing long-term traffic demand of the NWNT and Lantau, the Project forming part of the strategic road network, could support the developments in the vicinity, shorten the travelling time between the NWNT and North Lantau upon completion and improve the traffic conditions of local roads in Tuen Mun.
- 2.2.1.2 For the longer-term vision, the Project is to provide transport capacity that is interconnected with other strategic routes under planning such as Route 11 that together seek to strengthen transport links across the Greater Bay Area. The Project will provide direct route between NWNT and the Hong Kong – Zhuhai-Macao Bridge, the Hong Kong International Airport and North Lantau. It will also enable transport capacity to be released to support future developments in Tuen Mun West.

2.3 Consideration of “With” and “Without” Project Scenarios

2.3.1 Consideration of “With” Project Scenario

2.3.1.1 The Project would improve the traffic conditions of some strategic and local roads in Tuen Mun including Tuen Mun Road, Wong Chu Road, Lung Fu Road and Lung Mun Road and would be beneficial to the resilience of transport system as it provides more connections in key junctions, providing convenient alternative routes. By optimising the alignment of the Project, it does not only save the travelling time of road users, but also minimise energy consumption and environmental impact to the surrounding area.

2.3.2 Consideration of “Without” Project Scenario

2.3.2.1 In present, the vehicles commuting between NWNT and Lantau Island via TM-CLKT will rely heavily on the key roads including Tuen Mun Road (Fu Tei and Town Centre Sections), Wong Chu Road and Lung Fu Road. Taken account into the relevant interfacing existing and planned works including the HSK/HT NDA, YLS DA, and other housing projects in Tuen Mun, the traffic flow is expected to increase in the future. Although there will be interim measures including extension works of major roads in Tuen Mun, the traffic condition will be further deteriorated where traffic congestion problems are identified in long term without TMB (i.e., overloaded junctions and road links). As such, traffic impact and the associated environmental impacts are expected to increase for the “Without” Project Scenario.

2.4 Design Changes to the Project

2.4.1.1 Since the issue of EIA Study Brief (No ESB-348/2021), the Project Proponent has been optimising the alignment and design of the Project proactively to avoid and minimise environmental impacts where practicable. A summary of the key changes is given in the sections below. It could be seen that some of these changes would reduce the environmental impacts and the others could be readily mitigated by mitigation measures (see respectively assessments in **Section 3 – Section 12**).

2.4.2 Provision of Temporary Explosive Magazine Sites

2.4.2.1 The critical path of the construction programme for the Project is largely governed by tunnelling work, especially the drill-and-blast activities underneath Tai Lam Country Park. This would require the provision of temporary explosive magazine sites to provide sufficient storage capacity for explosives to suit the cycle time of the blasting works.

2.4.2.2 According to the current design, a total of 3 magazine sites is required, including 1) at Lam Tei Quarry; 2) at Siu Lam; and 3) at Pillar Point. The locations of the 3 magazine sites are shown in **Figure 2.9**. The magazine sites at Pillar Point and Siu Lam are proposed as the primary supply of explosives for the drill-and-blast activities at Wah Fat playground workfront, while the underground magazine at Lam Tei Quarry is to supply explosives for the drill-and-blast activities at the Northern portal workfront. These magazine sites are currently proposed to be coordinated and shared with Route 11 due to overlapping in their respective construction programme periods envisaged at the time of preparing this EIA Report.

2.4.2.3 Details on the consideration of the selected locations for the 3 explosive magazine sites are presented in **Section 2.5.7**. The associated potential hazard-to-life impact and mitigation measures required are evaluated and proposed in **Section 8**.

2.4.3 Deletion of the Reclamation Scheme and the Change on the Location of the Middle Ventilation Building (MVB)

2.4.3.1 The Project Profile (No. PP-631/2021) presented a scheme that would require a MVB on a permanent reclamation site (approximately 1 ha in area) to be built at the northern corner of Tuen Mun Typhoon Shelter. Having further review on the construction programme, risk and cost of reclamation scheme for the MVB, the scheme in the EIA Study Brief is less preferable when compared to the latest proposed scheme at Wah Fat Option (see **Section 2.5.5** for more details) in which reclamation can be totally avoided. Hence, the reclamation scheme is not further considered. Details of the development options and evaluation are presented in **Section 2.5.5**.

2.4.3.2 Hence, according to the Section 3.4.12.1 of the EIA Study Brief, fisheries impact assessment is not required for the Project as reclamation is no longer required. Besides, by avoiding the reclamation, the associated water quality and marine ecological impacts are also avoided.

2.4.4 Use of East Side of Existing TM-CLKT Northern Landfall as Barging Point Facilities

2.4.4.1 According to the current construction planning, 3 barging points and 1 delivery point are required at the Northern Landfall of the existing TM-CLKT. The locations of the 3 barging points and the delivery point are shown in **Figure 2.9**. As the current capacity of Tuen Mun Area 38 Fill Bank is deemed inadequate for the volume and frequency of spoil excavation from the Project, barging points are proposed at the TM-CLKT northern landfall site to transport the spoil generated to other receiving sites in other areas of Hong Kong.

2.4.4.2 A delivery point is also required on the northern landfall to receive material delivery such as pre-cast tunnel segments, the Tunnel Boring Machine, construction plant, fill material and other bulk deliveries for the construction activities from other areas.

2.4.4.3 The barging points will only involve deployment and mooring of floating pontoons in front of the existing seawalls of TM-CLKT. Concrete sinkers (approximately 10-20 tonne, 2m x 2m x 2m in size) or anchors will be sunk into the seabed for mooring of the floating pontoons. These sinkers or anchors will stay in the seabed during the construction period and will be removed off the seabed after the construction. This activity is the same as sinking or lifting anchors for vessels. As discussed in **Section 2.4.3**, the reclamation is no longer required, and no marine piling nor marine works are anticipated for setting up these barging points. Hence, no marine archaeological impact is anticipated, Marine Archaeological Investigation is no longer necessary.

2.5 Consideration of Alternatives / Options

2.5.1.1 Several alternatives/options were developed during the preliminary design stage. The preferred scheme for the Project to be taken forward for design and construction was selected according to various engineering and environmental factors.

2.5.1.2 As part of the selection process, various construction methodologies have also been reviewed in order to determine the most effective means and environmentally friendly construction method(s). The review has considered environmental benefits, engineering feasibility, site conditions and programme aspects.

2.5.1.3 The sections below present the consideration of the alternatives/options of the Project's key elements and construction methodologies.

2.5.2 Preliminary Alignment Options and Connection Points

2.5.2.1 The Project sets the southern connection point at Pillar Point in order to connect with TM-CLKT and Lung Mun Road, and the northern connection point at Lam Tei Quarry in order to connect with KSHW, YLH, Route 11 and the Lam Tei Interchange. Underground tunnel instead of at-grade road or viaduct is considered to minimise the additional environment and land impacts to Tuen Mun new town.

2.5.2.2 Two preliminary alignment options (i.e., Preliminary Alignment Option 1 and Option 2) have been developed for evaluation. Preliminary Alignment Option 1 goes underneath Wu Shan Road, Tuen Mun Typhoon Shelter and Sam Shing Estate. Based on Preliminary Alignment Option 1, Preliminary Alignment Option 2 shifts the middle tunnel section within Tai Lam Country Park to the north, and it goes underneath Pui To Road, Wu Shan Recreation Playground, Tuen Mun River and Tuen Mun Park. These 2 preliminary alignment options are presented in **Figure 2.1**.

2.5.2.3 Both preliminary alignment options have roughly the same traffic performance. However, Preliminary Alignment Option 2 will have some portal sections partially fall within/adjacent the Tai Lam Country Park. Moreover, it has a longer length through Tuen Mun town centre and generally is closer to more residential blocks. This may result in more concerns on social acceptance, constructability (e.g., concern on settlement, impact to building structure integrity) and environmental impacts (e.g., natural habitat loss and impacts on Tai Lam Country Park). Preliminary Alignment Option 2 also has more interface with future developments and has deeper road level and gradient.

2.5.2.4 Preliminary Alignment Option 1 can totally avoid aboveground impact on Tai Lam Country Park and is further away from the Tuen Mun town centre and encroached less residential blocks. On this basis, **Preliminary Alignment Option 1 is the recommended alignment** for the Project.

2.5.3 Alignment Options at Sub-Areas

2.5.3.1 There are also several options in three sub-areas (near Wu Shan Road, at Sam Shing Estate and near Lam Tei Irrigation Reservoir) along the recommended Mainline Alignment Option 1. The discussion of alignment options near Wu Shan Road (Option A1 and A2), at Sam Shing Estate (Option B1, B2 and B3) and near Lam Tei Irrigation Reservoir (Option C1, C2 and C3) are presented in the following sections.

Near Wu Shan Road (Alignment Options A1 and A2)

2.5.3.2 Alignment Options near Wu Shan Road are the alignments connecting Castle Peak Road to Tuen Mun Typhoon Shelter. Two options, namely Options A1 and A2, are considered (see **Figure 2.2a**).

- 2.5.3.3 Option A1 starts with a bend to Tuen Tsing Lane and is extended beneath Wu Shan Recreation Playground and followed by a bend at the south of Hing On Lane Substation to connect with the mainline at Tuen Mun Typhoon Shelter.
- 2.5.3.4 Option A2 starts with a bend to Wu Shan Road and continues along the corridor of Wu Shan Road and has a bend at the north of Castle Peak Fish Market to connect with the mainline at Tuen Mun Typhoon Shelter. A summary of evaluation on alignment Option A1 and Option A2 is given in **Table 2.1**.

Table 2.1 Evaluation for Alignment Options A1 and A2 (Near Wu Shan Road)

Consideration	Option A1	Option A2 (Preferred Option)
Engineering Factors	<ul style="list-style-type: none"> Option A1 has a major direct conflict with CLP 132 kV tunnel shaft, which in term results in larger TBM with minimal separation with the nearby building piles. Diversion of this existing CLP 132kV in operation will require extremely long lead time. Option A1 encroaches into the geological complex area, which has lower constructability and require longer construction time. 	<ul style="list-style-type: none"> Option A2 locates underneath the Consultation Zone (CZ) of ExxonMobil LPG Storage Installation at Tuen Mun Area 44 Consultation Zone, careful planning and risk assessment are required during detail design stage. There are Minimal conflict with existing structure and geotechnical complex area.
Environmental Factors	<ul style="list-style-type: none"> Conflicts with existing CLP 132kV tunnel shaft which demolition and relocation of tunnel shaft may be required. The demolition required would generate more construction and demolition (C&D) waste. 	<ul style="list-style-type: none"> Option A2 locates underneath the CZ of the ExxonMobil LPG Storage Installation at Tuen Mun Area 44 which is a Potentially Hazardous Installation (PHI), at more than 30m from the storage. Tunnelling using TBM could avoid blasting in the vicinity of this PHI. Transportation routes for the explosives for the drill-and-blast sections in other areas could also avoid the CZ of the PHI. Individual risk contour and societal risk of this LPG storage installation would be the same as that predicted in the approved EIA report of Tuen Mun South Extension (see details in Section 8).
Other Factors	<ul style="list-style-type: none"> Option A1 is close to various stakeholders and planned housing site, it requires close liaison with nearby stakeholders. 	<ul style="list-style-type: none"> Option A2 is close to various stakeholders and planned housing site, it requires close liaison with nearby stakeholders.

- 2.5.3.5 Both options perform similarly in term of environmental and stakeholder impact. However, Option A2 is evaluated better in constructability by avoiding key engineering constrains. **Option A2 is recommended to be pursued.**

At Sam Shing Estate (Alignment Options B1, B2 and B3)

- 2.5.3.6 Alignment Options at Sam Shing Estate are the alignments connecting Tuen Mun Typhoon Shelter to Tai Lam Country Park. Three options, namely B1, B2 and B3, are considered (see **Figure 2.2b**).
- 2.5.3.7 Option B1 passes underneath Sam Shing Estate, Sam Shing Temple and Kam Fai Garden.
- 2.5.3.8 Option B2, which is a variation of Option B1, has an orientation slightly shifted from Tuen Mun Typhoon Shelter. This alignment optimizes Option B1 by avoiding the alignment passing underneath the building blocks of Kam Fai Garden with intention to avoid the lot boundary of both Kam Fai Garden and Palm Cove.
- 2.5.3.9 Option B3 further shifts the alignment at Tuen Mun Typhoon Shelter to the south by adopting a larger bend from Wu Shan Road. This alignment will pass underneath the breakwater of Castle Peak Bay to avoid interferences with Sam Shing Estate.
- 2.5.3.10 Evaluation for alignment Options B1, B2 and B3 are given in **Table 2.2**.

Table 2.2 Evaluation for Alignment Options B1, B2 and B3 (at Sam Shing Estate)

Consideration	Option B1	Option B2 (Preferred Option)	Option B3
Engineering Factors	<ul style="list-style-type: none"> Tunnel construction beneath rockhead, comparatively with higher constructability. 	<ul style="list-style-type: none"> Tunnel construction beneath rockhead, comparatively with higher constructability. 	<ul style="list-style-type: none"> Tunnel construction through complicated fault zone, which has low constructability and require longer construction time affecting critical path.
Environmental Factors	<ul style="list-style-type: none"> It passes beneath two residential zones (Sam Shing Estate and Kam Fai Garden) and has more implications to the residential zone. 	<ul style="list-style-type: none"> It passes beneath one residential zone (Sam Shing Estate) and has less implications to the residential zone. 	<ul style="list-style-type: none"> It passes beneath two residential zones (Palm Cove and Dragon Inn) and has more implications to the residential zone.
Other Factors	<ul style="list-style-type: none"> It passes through 2 residential zones and requires close liaison with stakeholders. 	<ul style="list-style-type: none"> It passes through 1 residential zone and requires close liaison with stakeholders. 	<ul style="list-style-type: none"> It passes through 2 residential zone and requires close liaison with stakeholders.

- 2.5.3.11 Option B2 passes underneath relatively less residential buildings (and subsequently expects to have lower stakeholder impact) when compared with Options B1 and B3. Besides, Option B2 has better constructability and shorter construction duration as compared with Option B3 which encroaches to intersection of major fault zone. Therefore, **Option B2 is recommended to be pursued.**

Near Lam Tei Irrigation Reservoir (Alignment Options C1, C2 and C3)

2.5.3.12 Alignment Options near Lam Tei Irrigation Reservoir are the alignments connecting Tai Lam Country Park to Northern Interchange. Three options, namely C1, C2 and C3, are proposed and presented on **Figure 2.2c**.

2.5.3.13 Option C1 is closer to the Lam Tei Irrigation Reservoir.

2.5.3.14 Option C2, which is a variation of Option C1, has an orientation shifted to avoid having the alignment in proximity to Lam Tei Irrigation Reservoir. It is also further away from the known fault line.

2.5.3.15 Option C3 has the alignment shifted eastward in order to locate the northern portal of the Project even further from the Lam Tei Irrigation Reservoir, but it brings the two portals of the Project and Route 11 closer.

2.5.3.16 Evaluation for alignment Options C1, C2 and C3 are given in **Table 2.3**.

Table 2.3 Evaluation for Option C1, C2 and C3 (Near Lam Tei Irrigation Reservoir)

Consideration	Option C1	Option C2	Option C3 (Preferred Option)
Engineering Factors	<ul style="list-style-type: none"> Tunnel construction through fault zone, constructability is low and required longer construction duration affecting critical path. The closest to the existing Lam Tei Irrigation Reservoir, only 70m away from the dam of Lam Tei Irrigation Reservoir, higher construction risk. 	<ul style="list-style-type: none"> Tunnel construction beneath rockhead comparatively with higher constructability. It is designed to avoid the fault zone but still close to the existing Lam Tei Irrigation Reservoir, risk to the dam of the Lam Tei Irrigation Reservoir is still considerable high. 	<ul style="list-style-type: none"> Tunnel construction beneath rockhead comparatively with higher constructability. It is furthest away from Lam Tei Irrigation Reservoir, risk to the dam of the Lam Tei Irrigation Reservoir is still considerable low. It is closer to Route 11 tunnel portal, allows an integrated site formation for tunnel portal of Tuen Mun Bypass and Route 11.
Environmental Factors	<ul style="list-style-type: none"> Aboveground works in Tai Lam Country Park is avoided. Potential groundwater infiltration, lead to potential drawdown of surface water bodies and groundwater. Impact can be managed by good practices and 	<ul style="list-style-type: none"> Aboveground works in Tai Lam Country Park is avoided. Potential groundwater infiltration, lead to potential drawdown of surface water bodies and groundwater. Impact can be managed by good practices and 	<ul style="list-style-type: none"> Aboveground works in Tai Lam Country Park is avoided. Potential groundwater infiltration, lead to potential drawdown of surface water bodies and groundwater. Impact can be managed by good practices and

Consideration	Option C1	Option C2	Option C3 (Preferred Option)
	mitigation measures.	mitigation measures.	mitigation measures.
Other Factors	<ul style="list-style-type: none"> Limited local community and hence minimal impact to the stakeholder. 	<ul style="list-style-type: none"> Limited local community and hence minimal impact to the stakeholder. 	<ul style="list-style-type: none"> Limited local community and hence minimal impact to the stakeholder.

2.5.3.17 The three options perform similarly in environmental and social aspects. Engineering aspect become the key criteria in the selection among Options C1, C2 and C3.

2.5.3.18 In summary, ***Option C3 is recommended to be pursued*** since it has the largest separation distance from the Lam Tei Irrigation Reservoir and allows site formation for tunnel portal to be integrated with Route 11.

Recommendation of Alignment Options

2.5.3.19 Based on the above option evaluation in **Section 2.5.3**, recommended options are summarized **Table 2.4**.

Table 2.4 Summary of Recommended Alignment Options for Sub-Areas

Sub-area of the Alignment	Recommended Option
Near Wu Shan Road	Option A2
At Sam Shing Estate	Option B2
Near Lam Tei Irrigation Reservoir	Option C3

2.5.4 Consideration of Alternatives/ Options – Tuen Mun Bypass Interchange

Options of Southern Interchange and Portal

2.5.4.1 Three options, namely Options S1, S2 and S3 have been identified for the Southern Interchange and Portal. The layouts of these options are presented on **Figure 2.3a to Figure 2.3c**.

Option S1

2.5.4.2 In Option S1, the link road crosses underneath the existing slip road underpass. The tunnel portal, crossover and ventilation building sit on western side of the existing underpass. The weaving length at tunnel portal is about 200m. On the west end, the slip road to Lung Mun Road joins with the at-grade roundabout at River Trade Terminal Gate 1. This would pose a greater junction capacity constraint to the future planning of Tuen Mun West and the upgrading of Lung Mun Road.

2.5.4.3 Bridge widening by stitching is required to join the link road to TM-CLKT mainline. Demolition of the existing footbridge joining the bus-bus interchange is also needed in this option.

2.5.4.4 In this option, the buses travelling from Lung Mun Road to TM-CLKT (and buses travelling from TM-CLKT to Lung Mun Road) can still use the existing bus-bus interchange. However, the buses travelling from the Project to TM-CLKT (and buses travelling from TM-CLKT to the Project) will bypass the bus-bus interchange and cannot interchange (see **Figure 2.3a**).

Option S2

2.5.4.5 In Option S2, the link road is at the same level as the current platform level of the running road and cross above the existing slip road underpass. The tunnel portal, crossover and ventilation building sites of eastern side of the existing underpass. The weaving length at tunnel portal is about 400m.

2.5.4.6 On the west side, the slip road to Lung Mun Road bypasses the existing at-grade roundabout. The slip road lands at the junction of second gate of River Trade Terminal. The existing signal junction needs to be modified to a roundabout for U-turn movement. This option will bypass the existing busy roundabout junctions and embedded enabling work for a future bypass to Lung Mun Road by others. This would pose greater planning flexibility for Tuen Mun West.

2.5.4.7 The link road to TM-CLKT is mostly within the existing platform so structural modification is reduced. The existing footbridge joining the bus-bus interchange is preserved. Moreover, since the existing level is kept, a separated nearside bus-only entrance/ exit can be provided near the tunnel portal. Buses can use this lane to enter the low-speed slip road and weave to the bus-bus interchange. Therefore, buses between the Project and TM-CLKT can interchange with the buses between Lung Mun Road and TM-CLKT in this option.

2.5.4.8 *Option S2* will unavoidably encroach into the existing EMSD Tuen Mun Vehicle Servicing Station and permanent relocation/ re-provisioning will be required, subject to programme of the planned permanent re-location of the EMSD Tuen Mun Vehicle Servicing Station to Hung Shui Kiu (see **Figure 2.3b**).

Option S3

2.5.4.9 Option S3 is similar to Option S2. The major difference is the tunnel portal level of Option S3 is lowered and closer to the crown of the existing slip road underpass. Other design elements of Option S3 are similar to Option S2 (see **Figure 2.3c**).

2.5.4.10 Evaluation for Options S1, S2 and S3 are given in **Table 2.5**.

Table 2.5 Evaluation for Southern Interchange and Portal

Consideration	Option S1	Option S2	Option S3 (Preferred Option)
Engineering Factor	<ul style="list-style-type: none"> Minimal clearance underneath existing under pass with live traffic Demolition of existing footbridge and 	<ul style="list-style-type: none"> Marginal clearance under sewage culvert. Preserve existing footbridge and bridge. 	<ul style="list-style-type: none"> Balance between clearance to sewage culvert and clearance to underpass. Preserve existing footbridge and

Consideration	Option S1	Option S2	Option S3 (Preferred Option)
	modification to existing bridge.		bridge.
Environmental Factor	<ul style="list-style-type: none"> Require demolition of existing footbridge which additional noise impact and C&D materials will be generated. 	<ul style="list-style-type: none"> Demolition of existing footbridge can be avoided. 	<ul style="list-style-type: none"> Demolition of existing footbridge can be avoided.
Other Factors	<ul style="list-style-type: none"> Greater encroachment to Tuen Mun Area 46. Constraint to future Lung Mun Road upgrading at roundabout. Insufficient tunnel portal weaving length, insufficient length for placement of directional sign. Buses using the Project cannot use bus-bus interchange. No encroachment on existing EMSD Tuen Mun Vehicle Servicing Station. 	<ul style="list-style-type: none"> Encroachment to Tuen Mun Area 46 has been minimised. Embed to future Lung Mun Road upgrading at roundabout. Sufficient tunnel portal weaving length, sufficient length for placement of directional sign. Buses using the Project can use bus-bus interchange. Permanent relocation of the existing EMSD Tuen Mun Vehicle Servicing Station is required; temporary re-provisioning may also be required. 	<ul style="list-style-type: none"> Encroachment to Tuen Mun Area 46 has been minimised. Embed to future Lung Mun Road upgrading at roundabout. Sufficient tunnel portal weaving length, sufficient length for placement of directional sign. Buses using the Project can use bus-bus interchange. Permanent relocation of the existing EMSD Tuen Mun Vehicle Servicing Station is required; temporary re-provisioning may also be required.

2.5.4.11 Based on the above evaluation, the benefits of both Options S2 and S3 will be similar, while Option S3 is preferable from engineering point of view proving a balance between clearance to sewage culvert and clearance to underpass. Hence, **Option S3 is recommended to be further pursued.**

Options for Northern Portal

2.5.4.12 Three options, namely Option N1, N2 and N3, have been identified for the Northern Portal. The layouts of these options are presented on **Figure 2.4a to Figure 2.4c.**

Option N1

2.5.4.13 The tunnel portal is placed closer to Lam Tei Irrigation Reservoir and encroaches to Tai Lam Country Park in this option. The distance between the portal and the dam of Lam Tei Irrigation Reservoir is around 50m.

Option N2

2.5.4.14 The tunnel portal of TMB remains closer to Lam Tei Irrigation Reservoir but shifting eastwards from Option N1. The distance between the portal and the dam of Lam Tei Irrigation Reservoir is around 55m.

Option N3

2.5.4.15 The tunnel portal of TMB is moved further away from Lam Tei Irrigation Reservoir. The distance between the portal and the dam of Lam Tei Irrigation Reservoir is around 150m.

2.5.4.16 Consideration evaluation for Option for Option N1, N2 and N3 are presented in **Table 2.6**.

Table 2.6 Summary of Consideration for Northern Portal

Consideration	Option N1	Option N2	Option N3 (Preferred Option)
Engineer Factors	<ul style="list-style-type: none"> The tunnel portals are placed closest to then dam of Lam Tei Irrigation Reservoir, with higher construction risk comparatively. 	<ul style="list-style-type: none"> The tunnel portals are placed close to the dam of Lam Tei Irrigation Reservoir with higher construction risk comparatively. 	<ul style="list-style-type: none"> The tunnel portals are placed furthest away from the dam of Lam Tei Irrigation Reservoir with lower construction risk comparatively.
Environmental Factors	<ul style="list-style-type: none"> Encroachment of the tunnel portal to Tai Lam Country Park Minimised potential impacts with separate distance from air and noise sensitive receiver. 	<ul style="list-style-type: none"> No encroachment of the tunnel portal to Tai Lam Country Park Minimised potential impacts with separate distance from air and noise sensitive receiver. 	<ul style="list-style-type: none"> No encroachment of the tunnel portal to Tai Lam Country Park Minimised potential impacts with separate distance from air and noise sensitive receiver.
Other Factors	<ul style="list-style-type: none"> Additional land requirement would result in disturbances near Lam Tei Irrigation Reservoir and Lam Tei Quarry. 	<ul style="list-style-type: none"> Additional land requirement would result in disturbances near Lam Tei Irrigation Reservoir and Lam Tei Quarry. 	<ul style="list-style-type: none"> No Additional land requirement that would result in disturbances near Lam Tei Irrigation Reservoir and Lam Tei Quarry.

2.5.4.17 Based on the above option evaluation, Option N2 and N3 do not encroach into Tai Lam Country Park and Option N3 tunnel portal is placed furthest away to the dam of Lam Tei Irrigation Reservoir and the Tai Lam Country Park. Therefore, **Option N3 is recommended to be further pursued.**

2.5.5 Consideration of Alternatives/ Options – Ventilation Buildings (VBs)

Options for Middle Ventilation Building (MVB)

2.5.5.1 Three options, namely Preliminary Scheme, Alternative Schemes 1 and 2 have been identified for the MVB. The locations of these options are presented in **Figure 2.5**.

MVB Preliminary Scheme

2.5.5.2 In MVB Preliminary Scheme, an aboveground MVB will be located on a permanent reclamation area (about 1 ha) at Tuen Mun Typhoon Shelter close to Sam Shing Estate and Hanford Garden. The area will be reclaimed permanently before the sinking of the shaft which will be used for both as a starting point of drill-and-blast excavation northward and for the retrieval of the Tunnel Boring Machine (TBM).

2.5.5.3 Due to the reduction of Tuen Mun Typhoon Shelter in relation with the reclamation, re-alignment of the breakwater is required such the Tuen Mun Typhoon Shelter is increased by the same area as reclamation. The MVB and hence the exhaust ventilation shaft will be located at breakwater and far away from the urbanised area.

MVB Alternative Scheme 1

2.5.5.4 In Alternative Scheme 1, the MVB is located at Wah Fat Playground area and placed as an underground structure, with a direct connection to the main tunnels. An extensive underground excavation is hence required to accommodate the MVB structure. Site formation is carried out on surface to provide with various connections to the underground MVB structure such as an Emergency Access Point (EAP) shaft, two ventilation shafts and rising main. An Emergency Vehicle Access (EVA) is required to provide the access from Wah Fat Street to those shafts.

MVB Alternative Scheme 2

2.5.5.5 In Alternative Scheme 2, the MVB is placed at Wah Fat playground at ground level. Site formation is required to accommodate the MVB structure with one level of basement and two levels of above ground structure. The required connections between the MVB on surface and the tunnel ensured with an Emergency Access Point (EAP) shaft, two ventilation shafts and the rising main.

2.5.5.6 Evaluation for MVB Preliminary Scheme, Alternative Schemes 1 and 2 are given in **Table 2.7**.

Table 2.7 Evaluation for MVB Schemes

Evaluation Criteria	Preliminary Scheme	Alternative Scheme 1	Alternative Scheme 2 (Preferred Option)
Engineering Factors	<ul style="list-style-type: none"> Permanent reclamation required for shaft excavation and MVB construction. Significant reconfiguration of the Tuen Mun Typhoon 	<ul style="list-style-type: none"> No reclamation required for shaft excavation. An extensive underground excavation and site 	<ul style="list-style-type: none"> No reclamation required for shaft excavation. Site formation is required. Adit but no carven

Evaluation Criteria	Preliminary Scheme	Alternative Scheme 1	Alternative Scheme 2 (Preferred Option)
	<p>Shelter is required.</p> <ul style="list-style-type: none"> No adit/carven construction is required. MVB construction can only be commenced after TBM retrieval. 	<p>formation is required.</p> <ul style="list-style-type: none"> Adit/carven construction is required. Interface in carvern between parallel activities: drill-and-blast works, MVB construction and TMB retrieval. Allow enhancement programme and decrease risk. Reprovisioning of Wah Fat Playground during construction phase is required. 	<p>construction is required.</p> <ul style="list-style-type: none"> Decoupling of MVB construction and tunnelling works: parallel activities without interface. Allow enhancement programme and decrease risk. Reprovisioning of Wah Fat Playground during construction phase is required.
Environmental Factors	<ul style="list-style-type: none"> Ventilation shaft will be located at breakwater and away from air sensitive receivers, resulting in less environmental impacts. Permanent reclamation will be required and may result in additional environmental impact particularly on water quality, marine ecology and fisheries. Tree felling is not required. Visual impact caused by the MVB to the Sam Shing Area. Disposal of sediment generated from reclamation and dredging works. 	<ul style="list-style-type: none"> Permanent reclamation will not be required, and hence associated impacts on water quality, marine ecology and fisheries are not anticipated. Tree felling required for site formation at Wah Fat Playground. Less visual impact caused by the MVB underground structures at Wah Fat Playground. Larger underground excavation volumes, more C&D materials are expected to be generated compared to Alternative Scheme 2. 	<ul style="list-style-type: none"> Permanent reclamation will not be required, and hence associated impacts on water quality, marine ecology and fisheries are not anticipated. Tree felling required for site formation at Wah Fat Playground. Visual impact caused by to MVB half-submerged structure at Wah Fat Playground area. Smaller underground excavation volumes and less C&D materials are expected to be generated compared to Alternative Scheme 1. Aboveground works located further away from Tai Lam Country Park as compared with Alternative Scheme 1.
Other Factors	<ul style="list-style-type: none"> More flexibility and easier for replacement / easier planning and logistic support for 	<ul style="list-style-type: none"> More complexity and difficulty for replacement/ more challenging logistic 	<ul style="list-style-type: none"> More flexibility and easier for replacement/ easier planning and logistic

Evaluation Criteria	Preliminary Scheme	Alternative Scheme 1	Alternative Scheme 2 (Preferred Option)
	<p>the installation of the Mechanical, Electrical Plumbing (MEP) plants for an aboveground building during operation.</p> <ul style="list-style-type: none"> • Larger fan pressure loss and more energy consumption as long ventilation adit is required. • Direct EVA access to the MVB and direct route to reach the Ultimate Place of Safety during operation. 	<p>support for the installation of MEP plants for an aboveground building during operation.</p> <ul style="list-style-type: none"> • Smaller fan pressure loss and less energy consumption as long ventilation adit is omitted. • Indirect EVA access to the MVB and indirect route to reach the Ultimate Place of Safety during operation. 	<p>support for the installation of the MEP plants for an aboveground building during operation.</p> <ul style="list-style-type: none"> • Smaller fan pressure loss and less energy consumption as long ventilation adit is omitted. • Direct EVA access to the MVB and direct route to reach the Ultimate Place of Safety during operation.

2.5.5.7 Both Alternative Schemes 1 and 2 with the MVB located in Wah Fat playground area, either underground or above ground, avoid reclamation as originally mentioned in the EIA Study Brief and Project Profile (No. PP-631/2021). Whilst Alternative Scheme 1 (underground) and Alternative Scheme 2 (aboveground) generally have similar performance in environmental impacts, Alternative 2 is more preferable in term of engineering constructability, future maintenance and operation as well as fire safety during operation. Therefore, **MVB Alternative Scheme 2 is recommended to be further pursued.**

Options for South Ventilation Building (SVB)

2.5.5.8 3 options, namely Preliminary Scheme, Alternative Schemes 1 and 2 have been identified for the SVB. The SVB location is directly related to the selected alignment and to the south portal locations. The locations of these options are given in **Figure 2.6**.

SVB Preliminary Scheme

2.5.5.9 In the Preliminary Scheme, the SVB is located in the hill of TM-CLKT northbound, and in the vicinity of the tunnel portal.

SVB Alternative Scheme 1

2.5.5.10 In the Alternative Scheme 1, the SVB is located close to TM-CLKT hillside at about +19mPD. This option is to start diving with TBM further south to provide more clearance with TM-CLKT.

SVB Alternative Scheme 2

2.5.5.11 In the Alternative Scheme 2, the SVB is located on the hillside at about +23mPD. It is proposed to raise the alignment above the existing TM-CLKT and implement the SVB on

a created platform on the hillside. The current clearance between the TM-CLKT vehicular underpass and the SVB is approximately 29m. This scheme targets to enhance the connectivity of the Project with Lung Mun Road and reduces interface with TM-CLKT.

2.5.5.12 Evaluation for SVB Preliminary Scheme, Alternative Scheme 1 and 2 are given in **Table 2.8**.

Table 2.8 Evaluation for Options of SVB

Consideration	Preliminary Scheme	Alternative Scheme 1	Alternative Scheme 2 (Preferred Option)
Engineering Factors	<ul style="list-style-type: none"> Very low ground cover between the TMB tunnel and TM-CLKT (less than 3m). 	<ul style="list-style-type: none"> More ground cover between the TMB project and TM-CLKT and roundabout. 	<ul style="list-style-type: none"> It is located right above the TM-CLKT, with a low clearance with it, which can be managed by applying the appropriate mitigation measures. Close to the existing pylons on the hillside, which can be managed by applying the appropriate mitigation measures.
Environmental Factors	<ul style="list-style-type: none"> Trees and vegetation close at the hillside will not be disturbed. 	<ul style="list-style-type: none"> Trees and vegetation close to hillside will require transplant or felling, disturb aboveground habitat. 	<ul style="list-style-type: none"> Trees and vegetation close to hillside will be required transplant or fell, disturb aboveground habitat. Ventilation shaft more further up from ground level with less impact on the nearby air quality sensitive receivers, future users and operators.
Other Factors	<ul style="list-style-type: none"> The location is very close to TM-CLKT portal, resulting in insufficient separation distance to allow for traffic weaving. There is no access between the Project and the existing bus stop. The furthest away from the tunnel portal and increase the 	<ul style="list-style-type: none"> The scheme does not provide improvement in connectivity to TM-CLKT and accessibility to the existing bus stop. Further away to the tunnel portal and increases the ventilation adit length, which results in larger fan pressure loss and more energy 	<ul style="list-style-type: none"> This scheme is located further in the north, allowing sufficient distance between the Project portal and TM-CLKT portal for a better connectivity, avoiding traffic weaving. The scheme is located further in the north, and it improves the connectivity with the

Consideration	Preliminary Scheme	Alternative Scheme 1	Alternative Scheme 2 (Preferred Option)
	ventilation adit length, which results in larger fan pressure loss and more energy consumption.	consumption.	existing Lung Mun Road and especially the accessibility from and to the existing bus stop. <ul style="list-style-type: none"> • Closer to the tunnel portal and minimize ventilation adit length, which results in smaller fan pressure loss and less energy consumption as long ventilation adit is omitted.

2.5.5.13 Whilst the Alternative Scheme 1 provides some improvement in engineering point of view, it does not have any benefit in term of connectivity to TM-CLKT and accessibility to the existing bus stop. Although there are some limitations on the constructability for the Alternative Scheme 2, they can be managed by appropriate mitigation measures (such as monitoring and additional ground support if necessary). In addition, Alternative Scheme 2 fulfils the operational criteria in term of connectivity and accessibility. Therefore, for long term consideration, **SVB Alternative Scheme 2 is recommended to be further pursued.**

Options for North Ventilation Building (NVB)

Three options, namely Preliminary Scheme, Alternative Scheme 1 and 2 have been identified for the NVB. The location of the NVB depends on whether the building can be integrated to the portal and the relative extent. The location of NVB has to consider the alignment and the portal of Route 11 as well. The locations of these options are given in **Figure 2.7.**

NVB Preliminary Scheme

2.5.5.14 In Preliminary Scheme for NVB, the NVB will be located at south of the crossover, on a created platform created at the entrance of the tunnel part, with an extensive cut slope.

NVB Alternative Scheme 1

2.5.5.15 In Alternative Scheme 1, the NVB will be located on an existing cut at Lam Tei Quarry at +45 mPD west of the crossover where the existing site office is with ventilation and E&M adit above the crossover. An adit across the crossover is to be constructed in order to link the tunnel's over head ventilation duct with the NVB. This adit will be used to connect the northbound and the southbound of the tunnels.

NVB Alternative Scheme 2

2.5.5.16 In Alternative Scheme 2, the tunnel portal will be moved northwards from NVB

preliminary scheme and the NVB will be located at the crossover and onto the grounds of Lam Tei Quarry.

2.5.5.17 Evaluation for NVB Preliminary Scheme, Alternative Schemes 1 and 2 are given in **Table 2.9**.

Table 2.9 Evaluation for Options of NVB

Consideration	Preliminary Scheme	Alternative Scheme 1 (Preferred Option)	Alternative Scheme 2
Engineering Factors	<ul style="list-style-type: none"> Extensive cut slope area required. 	<ul style="list-style-type: none"> Reduce the need to undergo significant rock cut. 	<ul style="list-style-type: none"> Reduce the need to undergo significant rock cut. Potential space proofing and interface problems with the gantry and foundation all lying within the footprint of the building.
Environmental Factors	<ul style="list-style-type: none"> More C&D materials are expected to generate from the extensive rock cut and slope. Direct disturbance of habitat the NVB area, as it is located on the natural slope. 	<ul style="list-style-type: none"> Less C&D materials are expected as the need to undergo significant rock cut is reduced. Furthest away from the Tai Lam Country Park boundary, avoid disturbance of habitat at the NVB, and it is located at the existing cut at Lam Tei Quarry. 	<ul style="list-style-type: none"> Less C&D materials are expected as the need to undergo significant rock cut is reduced. Direct disturbance of habitat the NVB area, as it is partially located on the natural slope.
Other Factors	<ul style="list-style-type: none"> Slope interface with Route 11. No Additional land requirement would result in disturbances near to Lam Tei Irrigation Reservoir and Lam Tei Quarry. 	<ul style="list-style-type: none"> Additional land requirement would result in disturbances near Lam Tei Irrigation Reservoir and Lam Tei Quarry. 	<ul style="list-style-type: none"> Slope interface with Route 11. No Additional land requirement would result in disturbances near Lam Tei Irrigation Reservoir and Lam Tei Quarry.

2.5.5.18 Both Alternative Schemes 1 and 2 reduce the need of significant rock out and slope cut. However, Alternative Scheme 2 is not feasible from engineering point of view as the space proofing and interface problems are expected. Hence, **NVB Alternative Scheme 1 is recommended to be further pursued.**

2.5.6 Adopted Design for the Project

2.5.6.1 Discussion of different design alternatives in **Section 2.5.5.2** to **Section 2.5.5.6** are summarized in **Table 2.10**.

Table 2.10 Summary of Adopted Design Option

TMB		Recommended Option
Preliminary Alignment Option		Preliminary Alignment Option 1
Sub-area of Preliminary Alignment	Near Wu Shan Road	Option A2
	At Sam Shing Estate	Option B2
	Near Lam Tei Irrigation Reservoir	Option C3
Southern Interchange and Portal		Option S3
Northern Portal		Option N3
Middle Ventilation Building (MVB)		MVB Alternative Scheme 2
South Ventilation Building (SVB)		SVB Alternative Scheme 2
North Ventilation Building (NVB)		NVB Alternative Scheme 1

2.5.7 Consideration for Explosive Magazine Sites

2.5.7.1 Three locations at Lam Tei Quarry, Siu Lam and Pillar Points are selected for the temporary explosive magazine sites for the shared use for the Project and Route 11.

2.5.7.2 The Lam Tei Quarry magazine is proposed as an underground magazine and located at the northern slope of the Lam Tei Quarry, targeted to primarily serve the two work fronts located inside the existing Lam Tei Quarry ((i) for TMB Lam Tei Tunnel and (ii) for Route 11 Lam Tei Tunnel). In order to serve these two workfronts, a minimum capacity of 950kg is required. In order to reach such capacity of storage, an underground magazine is proposed. Due to the number of proposed construction activities in the Lam Tei quarry, an underground magazine is essential. It is designed in such a way to create a physical barrier between the storage niches and the operational zones of the Lam Tei Quarry through the use of the horizontal alignment of the access adit.

2.5.7.3 The Siu Lam magazine site is to reinstate the previous magazine site used for the Express Rail Link. This magazine site will primarily serve Route 11 project work front due to the geographical locations of the magazine, but in high quantity demand time period, it could also serve all work fronts for the Project and Route 11 project (except those of Lam Tei Quarry served by Lam Tei Magazine).

2.5.7.4 The Pillar Point magazine site is located at a disturbed area to the north of the River Trade Terminal at Pillar Point, Tuen Mun. This magazine site was previously proposed as part of the Tuen Mun Western Bypass project (which was not taken forward). The site also falls within the Potential Development Areas under the Planning and Engineering Study for Lung Kwu Tan Reclamation and the Re-planning of Tuen Mun West Area. This magazine site is intended to primarily serve the TMB MVB underground excavation, and the southern section of tunnel.

2.5.7.5 Evaluation for the three selected explosive magazine sites is given in the **Table 2.11** below.

Table 2.11 Consideration for Magazine Sites

Consideration	Three Selected Locations
Engineering Factors	<ul style="list-style-type: none"> • The proposed magazine site at Siu Lam utilise the historical magazine for Express Rail Link project. • Utilised the location at Pillar Point has been carried out of the previous study. • Utilised disturbed/ development area to avoid further site formation works.
Environmental Factors	<ul style="list-style-type: none"> • Locations selected are generally disturbed/ developed area, minimised loss of natural habitat during construction of the magazine. • The locations of the three proposed magazine sites are generally located in the remote area with low density of receptors, the selected locations ensure that the magazines serve the work faces closest to the magazine to reduce the risk to public safety as low as reasonably practicable.
Other Factors	<ul style="list-style-type: none"> • Located in government lands.

2.5.8 Considerations for Barging Facility

2.5.8.1 A barging facility is required for the transportation of materials to facilitate the construction process. In terms of location selection, the proposed barging facility is located at the existing waterfront/ seawall of the east side of TM-CLKT northern landfall. No additional marine construction work is required for setting up the barging points such as provision of temporary of breakwater.

2.6 Consideration of Construction Methodologies

2.6.1 Tunnelling Works

2.6.1.1 According to the latest design, drill-and-blast/drill-and-break and Tunnel Boring Machine (TBM) will be adopted for the tunnel sections underneath Tai Lam Country Park, Tuen Mun Typhoon Shelter and Tuen Mun Town Centre. For the Northern section of the tunnel (i.e., from Tai Lam Country Park, Sam Shing Estate), drill-and-blast/drill-and-break method (typically suitable for hard rock condition) is proposed, drill-and-break method is proposed for section under the Water Supplies Department (WSD) tunnel and between MVB and Sam Shing Estate. For the Southern section of the tunnel (i.e., from Sam Shing Estate to Pillar Point) is TBM method (typically suitable for fractured rock/ mixed ground condition) is proposed. The tunnel construction methods for the Project are presented in **Figure 2.8**.

2.6.1.2 The majority of the tunnel section underneath Tai Lam Country Park would be in hard rock granite. The depth of tunnel section would vary between 43 – 465 m below local ground. After considering the latest geological information at Tai Lam Country Park, it has been determined that the most suitable construction method for these tunnel sections is drill-and-blast. By adopting the drill-and-blast method underneath Tai Lam Country Park could avoid above-ground works within the country park area and hence any direct environmental impacts especially terrestrial ecology aspect. Alternative tunnelling methods, including the use of TBM in Tai Lam Country Park were duly explored but considered not suitable from the engineering perspective. This construction method requires explosive magazine site and the transport of explosive, hazard to life assessment

has been discussed in **Section 8**.

- 2.6.1.3 Underground tunnelling within Tai Lam Country Park could potentially induce groundwater infiltration, which might lead to potential drawdown of surface water bodies and groundwater. Such impacts could be managed by implementing good practices and water control strategies such as including probing ahead, pre-grouting and posting grouting. Besides, as this drill-and-blast/drill-and-break tunnel section would be mostly in granite and at sufficient depth below ground, together with the good practices and mitigation measures, adverse impact from impulsive vibration and the change in groundwater table would be insignificant (see **Section 5** on water quality impact).
- 2.6.1.4 Adoption of TBM at the Tuen Mun Typhoon Shelter could avoid reclamation/ marine works with disturbance of seabed and hence any direct environmental impact on fisheries, water quality aspects. The advance rate of TBM could be altered to cater for different ground conditions and constraints. 24-hour tunnelling using a TBM is also considered feasible, and this will lead to significant benefit to the construction programme.
- 2.6.1.5 If cut-and-cover or immersed tube were adopted at the Tuen Mun Typhoon Shelter, significant marine works such as temporary reclamation and dredging works would be required. Major environmental impacts such as water quality, fisheries and marine ecology would be anticipated, even all practicable measures are implemented. Stakeholders of the Tuen Mun Shelter would have major concerns on any major water quality impacts.
- 2.6.1.6 The advantages and disadvantages of the above-mentioned construction methods are summarized in **Table 2.12** below.

Table 2.12 Comparison of Construction Methods for Tunnel Sections

Construction Method	Advantages	Disadvantages
Drill-and-Blast /Drill-and-Break (Preferred option for underneath Tai Lam Country Park)	<ul style="list-style-type: none"> • Avoids aboveground works at Tai Lam Country Park. • Avoids direct environmental impact to Tai Lam Country Park especially terrestrial ecology aspect. • Efficient excavation method in hard rock conditions (as expected in Tai Lam Country Park). • Minimises impact to the public during the construction stage. 	<ul style="list-style-type: none"> • Potential higher impulsive vibration impact but with the good practices and mitigation measures, adverse impacts from impulsive vibration would be insignificant. • Potential risk due to the use of explosives, which has been considered in Section 8. • Groundwater infiltration, lead to potential drawdown of surface water bodies and groundwater at Tai Lam Country Park. Impact can be managed by good practices and water control strategies.
Tunnel Boring Machine (Preferred option for underneath Tuen Mun Typhoon Shelter to Pillar Point)	<ul style="list-style-type: none"> • Avoid marine works such as temporary reclamation and dredging works, also avoid major environmental impacts on water quality, fisheries, and marine ecology, disposal of marine sediment at Tuen Mun Typhoon Shelter. 	<ul style="list-style-type: none"> • Large site installation required in the temporary condition under construction. • Power and other utility/ supply to the tunnel portal in temporary condition. • TBM is suitable for fractured

Construction Method	Advantages	Disadvantages
	<ul style="list-style-type: none"> • Shorten construction time • Minimises environmental impact associated with aboveground works. • Minimises impact to the public during the construction stage. • Able to provide confinement to prevent surface collapse or water ingress to tunnelling (in areas under the Tuen Mun Typhoon Shelter). • Pre-cast internals and tunnel segments increase quality control and reduce risk. 	<p>rock / mixed ground condition. The use of TBM in Tai Lam Country Park was duly explored but considered not suitable from the engineering perspective.</p>

2.6.1.7 Tunnelling has been considered as the most efficient and environmentally friendly method of construction and is recommended to be adopted for a large proportion of the Project. Having considered the scale of the Project and site conditions of the proposed tunnel sections, two primary tunnelling methods are proposed for different geographical areas. TBM is proposed for the south tunnel section (between the south portal and Sham Shing Estate) and drill-and-blast/drill-and-break will be adopted for the north tunnel (between Sham Shing Estate and the north portal).

2.6.1.8 Site formation or rock excavation by means of non-percussive quieter construction method such as chemical expansion agent or pulse plasma rock fragmentation would be considered as far as practicable, and use of excavator-mounted breaker or blasting with explosives would be kept in minimum.

2.6.2 Ventilation Buildings, Administration Building and Satellite Control Building

2.6.2.1 The Project's Ventilation Buildings, Administration Building and Satellite Control Building will be constructed by typical reinforced concrete construction method which includes i) formwork and falsework erection, ii) rebar fixing, iii) concrete pouring and curing, and iv) formwork striking and back propping. Superstructures will adopt bottom-up construction. Construct ground floor slabs, beams, columns and walls to the lowest level and process upwards to roof level. No percussive piling is envisaged under the construction scheme.

2.6.3 Middle Ventilation Building at Wah Fat Playground Works Area

2.6.3.1 A temporary adit for the works area at Wah Fat Playground will be constructed by drill-and-break tunnel for the first 50 meters, then drill-and-blast for the remaining part (location shown in **Figure 2.9**). Site formation will be carried out at the works area at Wah Fat Playground for MVB construction, the basement structure of the building will be constructed first, followed by the above ground structure of approximately 45m x 40m x 19m tall. The ventilation shafts connecting the basement of the middle ventilation building and the logistic caverns will be constructed via raised boring.

2.6.3.2 In addition, all the aboveground construction works at works area will be done within noise enclosures. In order to reduce construction noise impacts on the noise sensitive receivers (NSRs), temporary full noise enclosure is recommended to be installed before the commencement of the construction or as early as possible. It is recommended to complete the installation of the full noise enclosure prior to the bulk excavation for MVB so that most of the noise generated by the bulk excavation for MVB would be well contained. This temporary noise enclosure should be decommissioned only when most of the back filling works are completed. Details should be referred to **Section 4**.

2.6.3.3 To reduce noise impact, the drill-and-blast work for the temporary adit for the works area at Wah Fat Playground shall be carried out, as far as practicable, during day time, i.e. 7am to 7pm, on weekdays other than general holidays and with the best practicable noise mitigation measures. This shall be adopted until sufficient rock cover is reached and noise impact could be eliminated.

2.6.4 TBM Launching and Retrieval Points

2.6.4.1 The Southern Portal will be constructed first to provide a vertical face for TBM to launched from surface at the Southern Portal. The TBM will then be retrieved via a TBM dismantling chamber. A drill-and-blast/drill-and-break tunnel will be constructed from the Wah Fat works area towards the Tuen Mun Typhoon Shelter. The exact location of the TBM dismantling chamber is flexible subject to the actual construction programme. The TBM dismantling chamber will then be constructed also either by drill-and-blast/drill-and-break. No noise enclosure for the TBM dismantling operations is required as it was enclosed within the underground dismantling chambers. All the TBM pieces will be transported from the underground dismantling chamber to Wah Fah Site through the adit.

2.6.4.2 In order to reduce construction noise impacts on the NSRs, it is also recommended to install a temporary full noise enclosure to cover the temporary adit portal and spoil storage area, leaving only mucking outs for conveying spoil/transporting machinery etc during daytime period. Where practicable, the openings of these mucking outs should be facing towards existing terrain instead of the existing NSRs. The mucking outs should also be closed during evening, night-time and restricted periods to minimise noise emanating out.

2.6.5 Re-provisioning Works

2.6.5.1 Some existing facilities will be affected during construction stage, temporary re-provisioning of associated facilities will be required (i.e. basketball court, public toilet, carparking area, and EMSD vehicle servicing centre) (shown in **Figure 2.9**). As the facilities are temporary in nature and will be reinstated in original status, the site formation works, demolition works and associated civil and superstructure works will be kept minimal. Associated civil and superstructure works include foundation, building works, paving, underground utilities installation etc.

2.6.6 Integrated Design and Construction with Route 11 Project

2.6.6.1 The design and construction of TMB has been considered in an integrated manner with Route 11 project, taking into account the existing topography to minimize the slope cutting. For example, closer spacing of portals and shared use of some operation roads for the two projects will reduce the land required and hence slope cutting. The site formation at the northern portal area would be accommodating both TMB and Route 11 project,

which means the newly formed platform would allow portal construction for both projects, adequate administration and operation area for both projects. This would maximize the usable area, thus minimizing encroaching into natural hillsides and minimizing total volume of rock cut. The site formation work for TMB is also planned to be undertaken together with that for Route 11, which will minimise site formation extent due to the clearance requirement or works area for separate construction, and in turn the generation of excavated materials.

2.6.7 Adoption of Steeper Slope Angle

2.6.7.1 The site formation would adopt steeper slope angle to prevent significant excavation at the natural hillside. To ensure the slope stability, various slope stabilization measures could be adopted to prevent slope failure, such as construction of drain holes and installation of rock anchor. The steeper slope cut angle could minimize the total amount of excavation spoil generated.

2.6.8 Adoption of Excavation and Lateral Support (ELS)

2.6.8.1 ELS system instead of open cut excavation is proposed to be adopted for excavation works at the existing ground. The ELS system could provide lateral support to the cut slope, and it would facilitate the construction of pile caps, basement and underground structures. By making good use of the ELS, the excavation could be minimized by eliminating the excavation of slope that runs up the sides of the required excavation area.

2.7 Tackling Environmental Challenges

2.7.1.1 Due considerations have been given in formulating the design of the Project to overcome environmental challenges encountered. The hierarchy of “Avoid, Minimize and Mitigate” has been adopted during the process to protect the environment as much as practicable. A key action adopted to tackle all the environmental challenges are discussed in the following sections.

Avoidance of Aboveground Works within Country Park

2.7.1.2 The works under the Project have avoided any aboveground works within Tai Lam Country Park. Only tunnelling works and part of temporary underground adit for the Wah Fat Playground Works Area would be carried out underneath Tai Lam Country Park, no aboveground works within the Tai Lam Country Park boundary. Hence, there is no direct loss of aboveground natural habitats and resources within Tai Lam Country Park boundary.

2.7.1.3 After considering the latest geological information at Tai Lam Country Park, it has been determined that the most suitable construction method for these tunnel sections is drill-and-blast. Alternative tunnelling methods, including the use of TBM in Tai Lam Country Park were duly explored but considered not suitable from the engineering perspective.

Avoidance of Marine Works

2.7.1.4 In the MVB preliminary scheme, a MVB will be located on a permanent reclamation area

(approximately 1 ha) at the northern corner of Tuen Mun Typhoon Shelter. Having further review on the construction programme, risk and cost of preliminary scheme for the MVB, the scheme is less preferable when compared to the latest proposed scheme at Wah Fat Option (see **Section 2.5.5** for more details). Hence, the reclamation scheme is not further considered. The reclamation and the associated dredging works within Tuen Mun Typhoon Shelter have been totally avoided. This would also avoid the disturbance of seabed, marine habitat loss and generation and disposal of marine sediment.

Minimisation of Potential Water Drawdown in Tai Lam Country Park

2.7.1.5 Groundwater infiltration, lead to potential drawdown of surface water bodies and groundwater at Tai Lam Country Park can be induced by drill-and-blast tunnelling works. Hence, good practices and water control strategies such as including probing ahead, pre-grouting and posting grouting and groundwater monitoring will be implemented during construction to minimise any adverse impact. Besides, as this drill-and-blast tunnel section would be in granite and with sufficient depth below ground, together with the good practices and mitigation measures, adverse impact on the change in groundwater table would be insignificant.

Minimisation of Air Quality Impact

2.7.1.6 A number of standard dust suppression measures would be undertaken at the construction site. These measures include regular spray to suppress fugitive dust generation, exposed earth surface covered by tarpaulins, standard wheel washing facilities at the construction site exits, vehicle washing at the exit of the barging facility with the provision of vehicle washing facilities, etc. These measures would help to alleviate the generation of fugitive dust during the construction period and hence minimise any impacts on the neighbouring sensitive areas. Some of the key mitigation measures for fugitive dust are listed below. More detailed description of these mitigation measures are given in **Section 3**.

- Adopt dedicated spoil transportation routes away from the identified Air Sensitive Receivers (ASRs) as practicable;
- Adopt water spraying system for areas with heavy construction activities;
- Provide vehicle washing facilities at the exit of the barging facility and exit of works sites;
- Install 3-sided screen with top cover and provide water sprays at the unloading point to barges at the barging facility;
- Site hoardings of not less than 2.4m high should be provided as far as practicable along the site boundary with provision for public crossing. Taller site hoarding may be considered for ASRs in close vicinity to the site boundary, subject to actual site constrains and detailed design. Good site practice shall also be adopted by the Contractor to ensure the conditions of the hoardings are properly maintained throughout the construction period;
- Connect construction plant and equipment to mains electricity supply and avoid use of diesel generators and diesel-powered equipment as far as practicable to minimize air

quality impact arising from construction machinery;

- Close the impermeable blast covers at tunnel portals prior to blasting works in order to ensure blasting works in a fully enclosed environment;
- The engine of the barge shall be switched-off during berthing as far as practicable. Provision of on-shore power supply shall also be considered wherever possible to minimize air quality impact from the marine vessels, with consideration of actual site constraints or circumstances to be further reviewed during detail design stage; and
- Dust filtering system shall be installed at the exhausts of the tunnel.

2.7.1.7 Besides, the Contractor would be requested to avoid using exempted Non-Road Mobile Machines (NRMM) where practicable and alternatives are available from the market at the time of construction. Any use of exempted NRMM shall be fully justified by the Contractor and subject to agreement. The Contractor shall also use power supplied from power utilities when practicable.

Minimisation of Noise Impact

2.7.1.8 In order to minimise the noise impact to the neighbourhood, the use of Quality Powered Mechanical Equipment (QPME) and/or quieter mechanical equipment, quieter construction method, temporary/moveable noise enclosure will be considered during construction. For instance, temporary full enclosure is recommended at the bulk excavation area, temporary adit portal and spoil storage area of MVB to minimise construction noise impacts on the NSRs. Suitable noise mitigation measures such as low noise road surfacing will be used for the proposed roads and suitable noise control measures such as silencers and noise louvers will also be used to reduce the noise generated by noisy machines and plants in operation stage. The recommended mitigation measures are detailed in **Section 4**.

Minimisation of the C&D Material & Risk of Unauthorised Filling Activities

2.7.1.9 During design phase, a Construction and Demolition Material Management Plan (C&DMMP) would be prepared in accordance with Section 4.1.3 “Construction and Demolition Materials” of the Project Administration Handbook for Civil Engineering Works and will be submitted together with the EIA Report to the department Vetting Committee for endorsement and then to Public Fill Committee (PFC) for approval.

2.7.1.10 Wherever practicable, C&D materials will be segregated from other wastes to avoid contamination and ensure acceptability at PFRFs or reclamation sites. The following mitigation measures will be implemented in handling the excavated and C&D materials:

- Carry out on-site sorting;
- Make provisions in the Contract documents to allow and promote the use of recycled aggregates where appropriate;
- Implement a trip-ticket system for each works contract in accordance with DEVB TC(W) No. 6/2010 to ensure that the disposal/ handling of C&D materials is properly

documented and verified, so as to avoid the illegal dumping and landfilling of C&D materials; and

- All dump trucks and vessels engaged on site should be equipped with Global Positioning System (GPS) or equivalent automatic system for real time tracking and monitoring of their travel routings and parking locations to prohibit illegal dumping and landfilling of C&D materials.

2.7.1.11 The recommended mitigation measures are detailed in **Section 6**.

Minimisation of Cultural Heritage Impact

2.7.1.12 The three Sites of Archaeological Interest (SAIs), namely Shek Kok Tsui, Fu Tei Au and So Kwu Wat, has been avoided and will not be impacted by the Project. Any vibration and building movement induced from the proposed works will be strictly monitored to ensure no disturbance and physical damages made to the heritage sites during the course of works. The Project has avoided direct impact on the Built Heritage at the former Girl Guide Associate Campsite, no excavation works will be carried out and existing building structures will not be demolished or removed but only require some necessary restoration/ refurbishment/ repair.

2.8 Preliminary Design for the Project

2.8.1.1 **Section 2.5** has explained the rationale for selecting the preferred options for the alignment, interchange, ventilation buildings, the three explosive magazine sites and the barging facilities. **Section 2.6** has provided the justifications for selecting the tunnelling method, methodology for ventilation building. Besides, **Section 2.7** has summarised the approaches adopted to avoid minimised environmental impacts at the outset as much as practicable.

2.8.1.2 Considering all the environmental constraints identified and engineering/ operational requirements, the design team has developed the preliminary design for the Project, with the key elements summarized in the **Table 2.13** below. **Figure 2.9** shows all the key elements for the Project. The longitudinal profile for the project alignment is presented in **Figure 2.10**.

2.8.1.3 The construction elements of the Project have been identified based on the available preliminary design information at this stage and will be subject to further refinement during the detailed design stage.

Table 2.13 Key Elements of the Project

Key Element	Locations	Description
Drill-and-Blast / Drill-and-Break Tunnelling	<ul style="list-style-type: none"> • Between Tai Lam Country Park and Tuen Mun Typhoon Shelter 	<ul style="list-style-type: none"> • Tunnel section underneath Tai Lam Country Park would be in granite. The depth of this tunnel section would vary between 43 – 465m below local ground (Refer to Section 2.5 and Section 2.6 for details). • The longitudinal profile of the Project is given in Figure 2.10.

Key Element	Locations	Description
Tunnel Boring Machine Tunnelling	<ul style="list-style-type: none"> Between Tuen Mun Typhoon Shelter and Pillar Point 	<ul style="list-style-type: none"> The section within Tuen Mun Typhoon Shelter would be approximately 10 – 60m underneath seabed. The section from Tuen Mun Area 44 to Pillar Point would be land based and would be approximately 10 – 60m below local ground (Refer to Section 2.5 and Section 2.6 for details). The longitudinal profile of the Project presents in Figure 2.10.
Portal and Interchange	<ul style="list-style-type: none"> Northern Portal at Lam Tei Quarry Southern Interchange and Portal at TM-CLKT and Lung Mun Road 	<ul style="list-style-type: none"> Aboveground road structure and link road (Refer to Section 2.5 and Section 2.6 for details).
Ventilation Buildings ^[1]	<ul style="list-style-type: none"> NVB: at Lam Tei Quarry 	<ul style="list-style-type: none"> A building structure with main roof level at approximately 21m above ground level. Other structures, such as E&M plant, lift shaft structure, ancillary features, water tanks, etc. are located above the main roof. Exhaust discharge from louver of the E&M plant room above the roof.
	<ul style="list-style-type: none"> MVB: at Wah Fat Playground 	<ul style="list-style-type: none"> A building structure with the main roof level at approximately 19m above ground level. Exhaust discharge from wall louver of the E&M plant room at the top floor. Other structures, such as E&M plant, lift shaft structure, ancillary features, water tanks, etc. are located above the main roof.
	<ul style="list-style-type: none"> SVB: at hillside of TM-CLKT northbound. 	<ul style="list-style-type: none"> A building structure with the main roof level at approximately 24m above ground level. Exhaust discharge from wall louver of the E&M plant room at the top floor. Other structures, such as E&M plant, lift shaft structure, ancillary features, water tanks, etc. are located above the main roof.
Highway/Tunnel Operation Area (including satellite control building, administration building, maintenance compound, recovery/ supporting area and other highway / tunnel operation areas in Lam Tei)	<ul style="list-style-type: none"> Satellite control building at the northern portal 	<ul style="list-style-type: none"> An aboveground building structure.
	<ul style="list-style-type: none"> Administration building and maintenance compound at the southern interchange 	<ul style="list-style-type: none"> An aboveground building structure.
	<ul style="list-style-type: none"> Recovery area, training ground and other supporting area for highway / tunnel operation at the southern interchange. 	<ul style="list-style-type: none"> At-grade area for tunnel operation.

Key Element	Locations	Description
	<ul style="list-style-type: none"> Highway / tunnel operation area at the northern portal in Lam Tei 	<ul style="list-style-type: none"> At-grade area for tunnel operation.
Proposed Works Area for Re-provision of affected facilities	<ul style="list-style-type: none"> Temporary re-provisioning of basketball court and public toilet at the carpark near Sam Shing Hui (KW carpark) 	<ul style="list-style-type: none"> The Wah Fat Playground would be used at construction works area for MVB construction. The affected basketball court and public toilet at Wah Fat Playground would be temporary re-provided. After the completion of construction works, the Wah Fat Playground will be re-instated with more spacious area. The temporary basketball court and public toilet will be demolished.
	<ul style="list-style-type: none"> Temporary re-provisioning of carparking area at the existing parking lots and open area with planters in Fung On Street. 	<ul style="list-style-type: none"> Proposed works area for re-provisioning of temporary carparking area. After the reinstatement of KW carpark, the works area at Fung On Street will be reinstated.
	<ul style="list-style-type: none"> Temporary re-provisioning of EMSD vehicle servicing centre at the former TM-CKLT Site Office. 	<ul style="list-style-type: none"> The southern interchange will encroach into the existing EMSD Tuen Mun Vehicle Servicing Station and temporary re-provisioning will be required.
Proposed Works Area	<ul style="list-style-type: none"> Wah Fat Playground Works Area. 	<ul style="list-style-type: none"> Construction site of MVB and site for TBM retrieval points and storage spoils and construction material.
	<ul style="list-style-type: none"> Area at the former Girl Guide Association (GGA) Campsite for site office or other project uses. 	<ul style="list-style-type: none"> The site was established in late 1950s. Some restoration and repair of building will be carried for site office and other project uses. No demolition and removal of structures at the area.
	<ul style="list-style-type: none"> Temporary works area at Tuen Mun West (near Mong Fat Street). 	<ul style="list-style-type: none"> Storage of construction material and equipment, spoil storage area, slurry treatment plant and site office.
Barging Point	<ul style="list-style-type: none"> East side TM-CLKT northern landfall vertical seawall. 	<ul style="list-style-type: none"> 4 berths for delivery of construction waste/material. Barging point facilities for marine delivery, storage construction material, spoil storage area and plants laydown area and site office
Three magazines (for shared use with Route 11)	<ul style="list-style-type: none"> At Lam Tei Quarry (underground), Pillar Point and Siu Lam. 	<ul style="list-style-type: none"> Storage of explosives.

Note:

[1] Roof level refers to the approximate main roof finish floor level, excluding any E&M plant, lift shaft structure, ancillary features, water tanks, etc. above the main roof.

2.9 Tentative Construction Programme

2.9.1.1 A key summary of the key construction works period is listed in below **Table 2.14**. The construction phase of the Project will commence in 2025 and complete in 2033 Q3.

Table 2.14 Summary of the Key Construction Works for the Project

Description	Tentative Construction Programme
Re-provisioning works of affected facilities (at KW Carpark and Fung On Street).	2025 Q2 to 2025 Q4
Site formation works, construction northern and southern portals, and underground magazine site, setting up of the slurry treatment plant.	2025 Q2 to 2027 Q2
TBM and drill-and-blast / drill-and-break tunnelling works, building works, highway/tunnel operation area, road connecting to TM-CLKT.	2026 Q2 to 2031 Q3
Route-wide tunnel E&M works, thermal barrier, tunnel cladding, route-wide TCSS works and testing and commissioning for TMB.	2027 Q3 to 2033 Q3

2.10 Concurrent Projects

2.10.1.1 In order to assess the cumulative impacts, a review of best available information at the time of preparing this EIA report to identify a number of other concurrent projects in the vicinity that are undergoing planning, design, construction and/or operation within the construction and/or operation period of the Project has been conducted and a list of the tentative concurrent projects identified at this stage is summarised in **Table 2.15** below. The locations of the concurrent projects are presented in **Figure 2.11**.

2.10.1.2 Various cumulative impacts for different concurrent projects have been identified and detailed justifications on consideration of various cumulative environmental impacts from individual concurrent project has been included in the corresponding technical chapters of this EIA report.

Table 2.15 Summary of Potential Concurrent Projects

Project	Description	Tentative Programme			Potential Cumulative Impacts	
		Start	Complete	Reference for Programme	Construction Stage	Operation Stage
Route 11 (Section between Yuen Long and North Lantau)	A new highway with an approximate length of 20km between NWNT and North Lantau.	2025	2033	LC Paper No. CB(4)1046/2022(01)	Cumulative dust and noise impacts were evaluated in Section 3 and Section 4 of this EIA Report respectively. Potential risk due to transportation of explosives was evaluated in Section 8	Cumulative air quality and noise impacts were evaluated in Section 3 and Section 4 of this EIA Report respectively. Traffic noise and vehicular emission caused by induced traffic is anticipated.
Traffic Improvement Scheme in Tuen Mun- Widening and Addition of Slip Roads at Lung Fu Road/ Tuen Mun Road/ Wong Chu Road/ Hoi Wing Road	Road improvement works to increase road capacity	2024	2031	Approved EIA the Concurrent Project [AEIAR-251/2023]	Cumulative dust impacts were evaluated in Section 3 of this EIA Report	Cumulative air quality impacts were evaluated in Section 3 of this EIA Report. Vehicular emission caused by induced traffic is anticipated.

Project	Description	Tentative Programme			Potential Cumulative Impacts	
		Start	Complete	Reference for Programme	Construction Stage	Operation Stage
Underground Quarrying at Lam Tei, Tuen Mun	Development of an underground quarry	2024/25	2025/27	Project Profile of the Concurrent Project [PP-643/2022]	Cumulative dust and noise impacts were evaluated in Section 3 and Section 4 of this EIA report respectively. Potential risk due to transportation of explosives was evaluated in Section 8	There may be potential cumulative air quality and noise impact. However, details of the development (including its emission sources) are not available during the preparation of this EIA study for detailed impact assessment.
Cycle Track between Tsuen Wan and Tuen Mun (Tuen Mun to So Kwun Wat Section)	Development of a new cycling track	2023	2026	Approved EIA the Concurrent Project [AEIAR-239/2022]	Cumulative dust and noise impacts were evaluated in Section 3 and Section 4 of this EIA report respectively.	Not anticipated in view of the nature of the concurrent project.
Cycle Track between Bayview Garden and So Kwun Wat ^[1]	Development of a new cycling track	Under Planning ^{[2][3]}	Under Planning ^{[2][3]}	CEDD Project Page on Cycle Track between Bayview Garden and So Kwun Wat	There may be potential cumulative dust and noise impact. However, details of construction programme and plant inventory is not available during the preparation of this EIA study for detailed impact	Not anticipated in view of the nature of the concurrent project.

Project	Description	Tentative Programme			Potential Cumulative Impacts	
		Start	Complete	Reference for Programme	Construction Stage	Operation Stage
					assessment.	
Reprovision of Tuen Mun Swimming Pool and Tuen Mun centre Golf Centre Practice Green	Reprovision of recreation facilities	Commenced	2026	Approved EIA of Tuen Mun South Extension (AEIAR-246/2022)	Potential risk due to transportation of explosives was evaluated in Section 8 .	Not anticipated in view of the nature of the concurrent project.
Tuen Mun South Extension	Railway line extension of Tuen Ma Line	2023	2030	As confirmed with the respective Project Proponent	The concurrent project is located within 500m area from the underground alignment of TMB, no adverse cumulative impact is anticipated.	Not anticipated in view of the nature of the concurrent project.
Planned Property Development at Area 16, Tuen Mun	Potential residential development	Under planning ^[2]	Under planning ^[2]	Approved EIA of Tuen Mun South Extension (AEIAR-246/2022)	The underground alignment of TMB is located within 500m from the concurrent project, no adverse cumulative impact is anticipated.	The underground alignment of TMB is located within 500m from the concurrent project, no adverse cumulative impact is anticipated. Vehicular emission caused by induced traffic is anticipated.

Project	Description	Tentative Programme			Potential Cumulative Impacts	
		Start	Complete	Reference for Programme	Construction Stage	Operation Stage
Sports Ground and Open Space with Public Vehicle Park in Area 16, Tuen Mun	Proposed Ground and Open Space	2024-25	2028-29	AchSD Project Page on Sports Ground and Open Space with Public Vehicle Park in Area 16, Tuen Mun ^[4]	The underground alignment of TMB is located within 500m from the concurrent project, no adverse cumulative impact is anticipated.	The underground alignment of TMB is located within 500m from the concurrent project, no adverse cumulative impact is anticipated. Vehicular emission caused by induced traffic is anticipated.
Public Housing Developments at Tuen Mun Central-Wu Shan Road	Development of public housing sites to alleviate territorial housing needs	Commenced	2027	N/A	The underground alignment of TMB is located within 500m from the concurrent project, no adverse cumulative impact is anticipated.	The underground alignment of TMB is located within 500m from the concurrent project, no adverse cumulative impact is anticipated. Vehicular emission caused by induced traffic is anticipated.
Widening of Yuen Long Highway (Section between Lam Tei Quarry and Tong Yan San Tsuen Interchange)	Highway improvement works to increase road capacity	Under planning ^[2]	2036	Project Profile of the Concurrent Project [PP-647/2022]	Located more than 500m from the Project, no adverse cumulative impacts are anticipated.	Traffic noise and vehicular emission caused by induced traffic is anticipated.
Widening of Castle Peak Road - Castle Peak Bay	Road improvement works to increase road capacity	Commenced	2024	HyD Project Page on Widening of Castle Peak Road - Castle	There is no overlap of construction period. Therefore, cumulative impact	Traffic noise and vehicular emission caused by induced

Project	Description	Tentative Programme			Potential Cumulative Impacts	
		Start	Complete	Reference for Programme	Construction Stage	Operation Stage
				Peak Bay ^[5]	during construction phase is not anticipated.	traffic is anticipated.
Widening of Fuk Hang Tsuen Road (Between Castle Peak Road – Lam Tei and Fuk Hang Tsuen Lane)	Road improvement works to increase road capacity	Commenced	2025	HyD Project Page on Widening of Fuk Hang Tsuen Road (Between Castle Peak Road – Lam Tei and Fuk Hang Tsuen Lane) ^[6]	There is no overlap of construction period. Therefore, cumulative impact during construction phase is not anticipated.	Traffic noise and vehicular emission caused by induced traffic is anticipated.
Development at Lam Tei North East	Land development for housing and economic purposes	Under planning ^[2]	Under planning ^[2]	As confirmed with the respective Project Proponent	Details of construction programme and plant inventory is not available during the preparation of this EIA study for detailed impact assessment.	Vehicular emission caused by induced traffic is anticipated.

Project	Description	Tentative Programme			Potential Cumulative Impacts	
		Start	Complete	Reference for Programme	Construction Stage	Operation Stage
Relocation of Tuen Mun Water Treatment Works to Caverns	Relocation of a water treatment works to cavern	Under planning ^[2]	Under planning ^[2]	N.A.	There may be potential cumulative dust and noise impact. However, details of construction programme and plant inventory is not available during the preparation of this EIA study for detailed impact assessment.	Not anticipated in view of the nature of the concurrent project.
Lung Kwu Tan Reclamation and the Re-planning of Tuen Mun West Area	Land development for economic purposes and residential-oriented community	Under planning ^[2]	Under planning ^[2]	N/A	Details of construction programme and plant inventory is not available during the preparation of this EIA study for detailed impact assessment.	Details of implementation programme is not available during the preparation of this EIA study for detailed assessment.

Notes:

[1] The Project location is yet to be confirmed at this stage. Location of the Project is therefore not shown in **Figure 2.11**.

[2] For concurrent project which is still under study and under planning, any potential cumulative impact would be addressed in its respective EIA study.

[3] <https://www.twtm-cycletrack.hk/en/>

[4] <https://www.archsd.gov.hk/en/projects/capital-projects-under-detail/278RS.html>

[5] https://www.hyd.gov.hk/en/our_projects/road_projects/6853th/index.html

[6] https://www.hyd.gov.hk/en/our_projects/road_projects/6852th/index.html

2.11 Collating and Addressing Public Views

- 2.11.1.1 The Project was presented to the Traffic and Transport Committee (T&TC) meeting of Tuen Mun District Council (TMDC) in April 2021. At the meeting, DC members had raised a number of concerns which are summarised in **Table 2.16** below.
- 2.11.1.2 Consultation activities for the Project have been carried out during the application of the Study Brief under the EIAO. The Project Profile No. PP-631/2021 was exhibited for public for comments from 5 October 2021 to 18 October 2021. Public offered their views during the 14 days public inspection period of the Project Profile.
- 2.11.1.3 Key concerns received from the T&TC meeting and public during the public inspection period of the Project Profile are summarized in **Table 2.16** below.

Table 2.16 Summary of Key Concerns from Public Consultation and Follow Up Actions

Key Concerns / Issues	Follow Up Actions to be Taken
Road traffic noise impact due to the additional traffic generated from the Project	<ul style="list-style-type: none"> • Operation phase noise impact assessment and associated cumulative impacts have been conducted to comply with the requirements set out in the EIAO-TM. Suitable mitigation measures will be implemented during operation stages as necessary. • Please refer to Section 4 for road traffic noise impact assessment.
Adverse air quality impact from traffic and ventilation building during operation phase	<ul style="list-style-type: none"> • Operation phase air quality impact assessment and associated cumulative impacts have been conducted to comply with the requirements set out in the EIAO-TM. Suitable mitigation measures will be implemented during construction and operation stages as necessary. • Please refer to Section 3 for operational air quality impact assessment.
Tunnel construction method at the typhoon shelter to minimize environmental impact	<ul style="list-style-type: none"> • TBM tunnelling will be adopted to construct the tunnel section within Tuen Mun Typhoon Shelter instead of cut-and-cover/immersed tube to minimize the environmental impact and social impact to the stakeholders of the typhoon shelter.
Adverse environmental impact on reclamation	<ul style="list-style-type: none"> • The deletion of the reclamation scheme and the relocation of MVB to for the Project have totally avoided the reclamation and the associated dredging works within Tuen Mun Typhoon Shelter. • The use of TBM for the construction of tunnel section within Tuen Mun Typhoon Shelter has avoided reclamation.
Hazard to associated with onsite magazine and explosive transportation	<ul style="list-style-type: none"> • The potential impacts of hazard-to-life have been evaluated in compliance with the requirements set out in the EIAO-TM. Suitable mitigation measures will be implemented during

Key Concerns / Issues	Follow Up Actions to be Taken
	<p>construction stage.</p> <ul style="list-style-type: none"> • Please refer to Section 8 for hazard-to-life assessment.
<p>Generation and disposal of a large amount of construction and demolition (C&D) materials</p>	<ul style="list-style-type: none"> • The waste management implications and quantity of C&D materials have been evaluated in compliance with the requirements set out in the EIAO-TM. Suitable mitigation measures such as on-sorting, re-use, trip-ticket system will be implemented during construction stage. • Please refer for Section 6 for waste implication management.
<p>Landfill gas hazard from nearby restored Pillar Point Valley Landfill</p>	<ul style="list-style-type: none"> • During the detailed design stage, a review of this preliminary qualitative risk assessment will be carried out and a detailed Qualitative Landfill Gas Hazard Assessment (QLFGHA) will be prepared. The detailed QLFGHA Report together with the detailed design of landfill gas protection measures will be submitted to EPD for vetting. • Mitigation measures as recommended in the EIA and detailed QLFGHA will be implemented. As such, the potential risk of landfill gas migration to the respective targets would be minimal. • Please refer to Section 9 for the mitigation measures for minimizing landfill gas hazard.
<p>Potential hydrological impacts on the natural streams and reservoirs</p>	<ul style="list-style-type: none"> • Appropriate water control strategies will be implemented to minimize the groundwater infiltration during the tunnel construction. • Please refer to Section 5 for details of mitigation measures for minimizing groundwater infiltration. • As an additional precautionary measure, surface water level monitoring at natural watercourses within Tai Lam Country Park, Lam Tei Irrigation Reservoir, and in the vicinity of the tunnelling works would be conducted during the construction and operation stages. • Please refer to Section 10 for the details of monitoring on surface water level of natural watercourses.
<p>Loss of natural habitats</p>	<ul style="list-style-type: none"> • Drill-and-blast/drill-and-break method will be adopted to construct tunnel section and the temporary underground adit underneath Tai Lam Country Park. No aboveground works within Tai Lam Country Park will be conducted. Consideration has been taken to maximize the distance in between the project's works and the Tai Lam Country Park to further avoid and

Key Concerns / Issues	Follow Up Actions to be Taken
	<p>minimise indirect impacts on the Country Park.</p> <ul style="list-style-type: none"> • Please refer to Section 10 for details ecological impact assessment.
The potential vibration of the land due to construction might have an impact to wildlife and plants	<ul style="list-style-type: none"> • Drill-and-blast/drill-and-break tunnel section would be in granite and with sufficient depth below ground, together with the good practices and mitigation measures, adverse impacts from impulsive vibration would be insignificant.
Interfacing issues with Route 11 and other concurrent projects	<ul style="list-style-type: none"> • The cumulative impacts have been assessed in the EIA study (except for the concurrent projects under planning where potential cumulative impacts would be addressed in their respective EIA studies).

2.12 Summary of Key Environmental Outcome

2.12.1.1 Comments from district councils and public were also reviewed and incorporated where practicable. During the EIA study, site constraints and the impacts arising from the construction and operational phases were identified and assessed, mitigation measures/ good site practices, if necessary, were recommended to avoid/ minimise adverse environmental impacts to the surroundings.

Table 2.17 Key Recommended Mitigation Measures/ Good Site Practices/ Enhancement Measure and their Associated Benefit

Environmental Aspect	Key Recommended Mitigation Measures / Good Site Practices/ Enhancement Measure	Associated Benefits
Air Quality Impact	<ul style="list-style-type: none"> • Adopt dedicated spoil transportation routes away from the identified Air Sensitive Receivers (ASRs) as practicable. • Install 3-sided screen with top cover and provide water sprays at the unloading point to barges at the barging facility. • Avoid using exempted NRMM as much as practicable and when alternatives are available from the local market at the time of construction. • Site hoardings of not less than 2.4m high should be provided as far as practicable along the site boundary with provision for public crossing. Taller site hoardings may be considered for ASRs in close vicinity to the site boundary, subject to actual site constrains and detailed design. Good site practice shall also be adopted by the Contractor to ensure the conditions of the hoardings are properly maintained throughout the construction period. 	<ul style="list-style-type: none"> • Protect air sensitive receivers (ASRs) by reducing fugitive dust emissions; and • Ensure compliance with the requirements in Annex 4 of the EIAO-TM at the ASRs.

Environmental Aspect	Key Recommended Mitigation Measures / Good Site Practices/ Enhancement Measure	Associated Benefits
	<ul style="list-style-type: none"> • Adopt water spraying system for areas with heavy construction activities. • Connect construction plant and equipment to mains electricity supply, and avoid use of diesel generators and diesel-powered equipment as far as practicable to minimize air quality impact arising from construction machinery. • Close the impermeable blast covers at tunnel portals prior to blasting works in order to ensure blasting works in a fully enclosed environment. • Water spray before open blasting and on blasted material prior to transportation. • Provide vehicle washing facilities at the exit of the barging facility and exit of works sites. • The engine of the barge shall be switched-off during berthing as far as practicable. Provision of on-shore power supply shall also be considered wherever possible to minimize air quality impact from the marine vessels, with consideration of actual site constraints or circumstances to be further reviewed during detail design stage. • Close liaison between the contractors of other concurrent projects and the Project would be maintained to minimise dusty activities to be conducted concurrently as far as practicable. • During the subsequent design stage and the operational stage, the ventilation engineer should conduct reviews on the ventilation scheme covering different periods of a day, taking into account the contemporary circumstance such as latest traffic forecast, traffic composition, update on the ambient air quality, etc., and then review and update the air quality assessment as necessary to demonstrate full compliance of the AQO. These reviews would allow the designer and operator to optimize the operation of the ventilation system without compromising the compliance of AQO. • The planned air sensitive uses within the highway / tunnel operation and maintenance facilities of the TMB shall be properly designed such that any openings, openable windows, and/or fresh air intakes will be 	

Environmental Aspect	Key Recommended Mitigation Measures / Good Site Practices/ Enhancement Measure	Associated Benefits
	<p>located and avoided from the predicted exceedance zone at 1.5mAG. Further review of the layout and design of operation area will be conducted in Detailed Design Stage to ensure compliance of the AQOs.</p>	
Noise Impact	<ul style="list-style-type: none"> • Follow good site practices to limit construction noise emissions at the sources. • Use of quality powered mechanical equipments and quieter construction methods. • Use of temporary noise barriers and noise enclosures to screen noise from relatively static PMEs. • Install acoustic tunnel door or enclosure at the tunnel portal opening for tunnelling activities. • Install temporary noise enclosures for the construction sites near Wah Fat Playground. • Alternative use of plant items within one worksite, wherever practicable. • Provide mitigation measures for fixed noise sources (e.g. quieter equipment, silencer, barrier and enclosure) with reference to EPD’s “Good Practices on Ventilation System Noise Control”. • Orientate louvres away from adjacent NSRs, preferably onto main roads which are less noise sensitive. • Select façade for ventilation shafts with adequate sound insulation properties. 	<ul style="list-style-type: none"> • Protect noise sensitive receivers (NSRs) by reducing construction and operational noise. • Ensure compliance with the respective road traffic noise requirements at neighbouring NSRs. • Ensure compliance with the respective fixed noise requirements at neighbouring NSRs.
Water Quality Impact	<ul style="list-style-type: none"> • Follow Best Management Practices (BMPs) of mitigation measures in controlling water pollution and good site management as specified in the Professional Persons Environmental Consultative Committee (ProPECC) Practice Note (PN) 1/94 “Construction Site Drainage” and Environment, Transport and Works Bureau (ETWB) Technical Circular (Works) (TC(W)) No. 5/2005. • Adopt suitable water control strategies as far as practicable, including probing ahead, pre-grouting and post-grouting, during tunnelling works. • Control impact on groundwater through 	<ul style="list-style-type: none"> • Protect the neighbouring Water Sensitive Receivers (WSRs) during construction phase.

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	<p>adopting toe grouting and installation of recharge well during temporary dewatering for excavation works.</p> <ul style="list-style-type: none"> • Provide adequate and sufficient portable chemical toilets for construction workforce and temporary storage tank for collection of wastewater. • Carry out construction works close to inland waters in dry season as far as practicable. • Conduct watercourse removal and flow diversion in dry season as far as practicable. • Size all vessels to maintain adequate clearance between vessels and the seabed in all tide levels. • Control loading of barges and hoppers to prevent splashing of materials into the surrounding water. • Install and maintain roadside gullies and oil / grease interceptors for removal of pollutants from storm water as necessary. • Collect and treat wastewater generated by washing and maintenance activities, and discharge to public sewerage system properly. 	
Waste Management Implications	<ul style="list-style-type: none"> • During design phase, a Construction and Demolition (C&D) Material Management Plan (C&DMMP) will be prepared in accordance with Section 4.1.3 “Construction and Demolition Materials” of the Project Administration Handbook for Civil Engineering Works and will be submitted together with the EIA Report to the department Vetting Committee for endorsement and then to Public Fill Committee (PFC) for approval. • Carry out on-site sorting, re-use and recycled C&D materials, implement a trip-ticket system for each works contract to in accordance with Development Bureau TC(W) No. 6/2010 ensure that the disposal/handling of C&D materials is properly documented and verified, so as to avoid the illegal dumping and landfilling of C&D materials. • All dump trucks and vessels engaged on site should be equipped with Global Positioning System (GPS) or equivalent automatic system for real time tracking and monitoring of their travel routings and parking locations. 	<ul style="list-style-type: none"> • Minimise waste generation • Ensure proper handling of chemical waste • Ensure the C&D materials are disposed to the designated outlets

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	<ul style="list-style-type: none"> • Chemical wastes (e.g. spent lubricant oil) should be recycled at an appropriate facility as far as possible, while the chemical waste that cannot be recycled should be disposed of at either the CWTC, or another licensed facility, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation. • Standard formwork should also be used as far as practicable in order to minimise the arising of non-inert C&D materials. The use of more durable formwork (e.g. metal hoarding) or plastic facing should be encouraged in order to enhance the possibility of recycling. The purchasing of construction materials should be carefully planned in order to avoid over ordering and wastage. • Implement an education programme for workforce relating to avoiding, reducing, reusing and recycling general waste. Participation in a local collection scheme should be considered by the Contractor to facilitate waste reduction. • Measures and good site practices to be implemented at the works area during construction (Details to refer to Section 6). 	
Land Contamination	<ul style="list-style-type: none"> • Prior to the commencement of the site investigation (SI) works, review the Contamination Assessment Plan (CAP) provided in Appendix 7.1 and conduct site re-appraisal to confirm whether the proposed SI works (e.g. sampling locations, testing parameters etc.) are still valid, and to confirm the appropriate RBRGs land use scenario for the development. • Should any changes in operation which lead to any new or the relocation of contamination hotspots or occurrence of spillage or accident be found in the review, supplementary CAP(s), presenting the findings of the review, the latest site conditions and updated sampling strategy and testing protocol, should be submitted to EPD for approval. • The SI works should be carried out according to EPD's approved CAP(s). • Contamination Assessment Report(s) (CAR(s)) should be prepared to present the findings of the SI works and to discuss the presence, nature and extent of contamination. If contamination is identified in the CAR(s), 	<ul style="list-style-type: none"> • Land contamination issues could be resolved before commencement of construction works

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	<p>Remediation Action Plan(s) (RAP(s)) which provides details of the remedial actions for the identified contaminated soil and/or groundwater should be developed prior to construction works at the concerned areas. Submission to EPD for approval of the supplementary CAP(s), CAR(s) and, if required, RAP would be carried out in stages according to the programme of TMB.</p> <ul style="list-style-type: none"> • If required, carry out soil/groundwater remediation works according to EPD approved RAP(s) and submit Remediation Report(s) (RR(s)) afterwards for EPD approval prior to the commencement of construction works at the contaminated areas. 	
Hazard to Life	<ul style="list-style-type: none"> • Reduce the amount of combustibles in the cabin of truck. The fuel carried in the fuel tank should also be minimized to reduce the duration of any fire. • Implement defensive driving attitude and dedicate training programme for both driver and his attendants. • Transport the required quantity of explosive for a particular blast. • Combine explosive deliveries for a given work area as far as practicable. • Maintain a minimum headway between two consecutive truck convoys of 10 minutes whenever practicable. • Implement a better emergency response and training to ensure adequate fire extinguishers are used and attempt is made to evacuate the area of the incident or securing the explosive load if possible. • Equip bigger capacity AFFF-type extinguishers on all explosive vehicles. • Implement good practices as per Practice Note for Authorized Persons and Registered Structural Engineers – Control of Blasting (APP-72), and Mines Division Guidance Note Nos. GN 8 How to Apply for a Mode A Licence for Storage of Schedule 1 Dangerous Goods (Blasting Explosives) and GN 3 Application and Handling of a Conveyance Permit. • Formulate a Hazard Management Plan with a view to aligning the understanding of the risk 	<ul style="list-style-type: none"> • Protect nearby sensitive receivers from adverse impacts due to transportation, overnight storage and use of explosive for blasting.

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	<p>of the three projects (i.e. Route 11, Tuen Mun Bypass (TMB) and Lam Tei Underground Quarrying (LTUQ)) so that all the working populations at Lam Tei Quarry area, which includes the workforce induced under the construction and operational stage of three projects, could be considered as on-site populations in the QRA for all the three projects. The measures stipulated in the Hazard Management Plan may include, but not limited to, the adjustment of the blasting schedules of the three projects to minimize the potential cumulative impact, provision of common trainings and drills to the workforce of all the three projects, etc. The Hazard Management Plan, which would be agreed among the three projects, would be submitted to EPD for agreement prior to the tender invitation of construction phases of Route 11, TMB and LTUQ, whichever is earlier.</p>	
Landfill Gas Hazard	<ul style="list-style-type: none"> • Implementation of appropriate safety measures during construction works to minimise the risk of fire and explosions and asphyxiation of works, especially in confined space. • Periodically during ground-works construction, the works area should be monitored for methane, carbon dioxide and oxygen using appropriately calibrated portable gas detection equipment. • All access to confined spaces should be restricted only to authorized personnel and should be informed of the landfill gas hazard. No general public should be permitted or allowed to access the service voids, manholes, chambers or wells. • During operation, regular monitoring of landfill gas should be conducted at buildings and enclosures (e.g. proposed Administration Building, Maintenance Compound, temporary re-provisioning of EMSD servicing centre, service manholes, etc.) within the Consultation Zone to verify the effectiveness and to ensure the continued performance of the implemented protection measures. 	<ul style="list-style-type: none"> • Minimise the risk of fire and explosions and asphyxiation of works
Ecological Impact (Terrestrial)	<ul style="list-style-type: none"> • No aboveground works at the recognized sites of conservation importance (including Lam Tei and Yick Yuen Conservation Area and Tai Lam Country Park). A buffer clearance between the site formation works at northern portal and Tai Lam Country Park has been 	<ul style="list-style-type: none"> • Minimise direct and indirect impact to the habitat and species of conservation importance • Minimise physical disturbance

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	<p>considered. Provision of screening (e.g. hoarding) during construction phase is recommended to confine the proposed works within Project footprint and hence outside Tai Lam Country Park to avoid disturbance to adjacent habitats from the construction phase activities.</p> <ul style="list-style-type: none"> • Shifting the link roads and the mainline eastward away from the Lam Tei Irrigation Reservoir so as to allow integrated site formation for tunnel portals of TMB and which can also reduce environmental impact associated with site formation. • Shifting the works area at Wah Fat Playground away from the perennial stream where two freshwater crab species of conservation importance were recorded. • Upon the completion of construction works, the proposed works area and magazine sites would be decommissioned and reinstated to its original condition in principle. • Detailed vegetation survey should be conducted within mixed woodland and shrubland/grassland at Pillar Point and near Wah Fat Playground prior to the commencement of construction activities to confirm the presence of flora species of conservation interest. Transplantation and/or mitigation measures would be recommended as far as possible (Details to refer to Section 10). • Prior to commencement of the stream diversion and construction works near Wah Fat Playground, an update Freshwater Crab survey should be conducted and cover the stretch of the watercourse S2 and S2A. Should species of conservation importance be found within the affected watercourse sections, a Freshwater Crab Translocation Plan should be prepared. Freshwater crab translocation should be conducted to move the affected individuals from the Project area to suitable recipient site(s) (Details to refer to Section 10). • Measure and good site practices to be implemented at the works area during construction (Details to refer to Section 10). • Stream diversion works with green channel design elements incorporated will be carried out to divert any water flow from the upper 	<p>to the surrounding habitats</p>

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	<p>sections of the watercourses within Project Area (i.e. S1, S2 and S3) to the lower sections of the watercourses with similar ecological features and/or hydrology setting outside the Project Area so as to maintain the flow between unaffected sections of the stream and to avoid excessive water flow entering the construction area. Detailed design of any stream diversion should follow the guidelines in ETWB Technical Circular (Works) No. 5/2005 (Protection of natural streams/ rivers from adverse impacts arising from construction works) and appropriate construction methods should be used.</p> <ul style="list-style-type: none"> • Adopt suitable water control strategies, which are applicable to both TBM tunnelling and drill-and-blast/drill-and-break tunnelling, as far as practicable. (Details to refer to Section 5.7.2). • Compensatory woodland planting is suggested to mitigate the loss of approximately ~2.2ha of mixed woodland. (Details to refer to Section 10) 	
Landscape and Visual Impacts	<ul style="list-style-type: none"> • Tree protection works and tree transplantation to be undertaken in accordance with DEVB TC(W) 4/2020 on “Tree Preservation”. In accordance with DEVB TC(W) No. 4/2020, the compensatory planting proposal should have the basic primary objective of planting compensatory trees in a ratio not less than 1:1 in terms of quantity as far as practicable. • Construction area control, where possible, to ensure that the landscape and visual impacts arising from the construction activities are minimized. • Advance Implementation of Mitigation Planting. • Decorative screen hoarding will be erected along areas of the construction works site boundary where the works site borders publicly accessible routes and/or is close to visually sensitive receivers (VSRs) to screen undesirable views of the works site. • Control of night-time lighting and Construction traffic (land and sea) reduced to practical minimum. • The alignment and structures associated with the new road should be integrated, as far as 	<ul style="list-style-type: none"> • Minimise landscape and visual impact during construction and operational phases.

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	<p>technically feasible, with existing roadside structures and the landscape context to reduce the potential cumulative impact of the proposed works.</p> <ul style="list-style-type: none"> • Aesthetic treatment and Design of the building and tunnel ventilation shaft should be vetted and advised upon by ArchSD in accordance with ETWB TCW No. 8/2005 – Aesthetic Design of Ancillary Buildings in Engineering Projects. • Greening Provision in the early project planning stage and shall be in accordance with DEVB TCW No. 2/2012- allocation of space for quality greening on Roads. • Post-planting monitoring of the compensatory trees shall be undertaken (namely, duration of the post-planting monitoring and monitoring methodology). The monitoring will be aimed to assess the success and performance of the compensatory planting trees, monitor the growth performance of the planted seedlings and whips, and identify any need of vegetation and site maintenance work. • The design and implementation of the aesthetic appearance of the retaining wall and slopes will be undertaken in accordance with GEO Publication No. 1/2011 – Technical Guidelines on Landscape Treatment for Slopes (2011), and WBTC No. 17/2000 on Improvement to the Appearance of Slopes. 	
Cultural Heritage	<ul style="list-style-type: none"> • Three sites of Archaeological Interest, namely Shek Kok Tsui, Fu Tei Ha and So Kwu Wat, will not be impacted. • Avoid direct impact on the Built Heritage BH-03 at the GGA campsite, no excavation works will be carried out and existing building structures will not be demolished or removed but only require some necessary restoration/ refurbishment/ repair. Appropriate protective and mitigation measures are to be recommended during detail design stage of the Project when the structural condition and assessment of the Site and the historical buildings/ structures/ features are verified during detailed design stage of the Project. The protective and mitigation measures should be agreed by AMO, and to be implemented to the satisfaction of AMO to safeguard against any potential adverse impact. 	<ul style="list-style-type: none"> • Minimise adverse impact on any Sites of Archaeological Interest and historical building building/structure/feature/site. • Ensure compliance with all statutory requirements and those recommendations in the EIA report.

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	<ul style="list-style-type: none"> • Any vibration and building movement induced from the proposed works should be strictly monitored to ensure no disturbance and physical damages made to the heritage sites during the course of works. • Special attention should be paid to avoid adverse physical impact arising from the construction works to the heritage site. Design proposal, method of works and choice of machinery should be targeted to minimize adverse impacts to the heritage site. Any vibration and building movement induced from the construction works should be strictly monitored to ensure no disturbance and physical damages made to the heritage site during the course of works. • Excavation works in close vicinity to the heritage site should not jeopardize stability of the historic structures. It should not undermine or cause damage to foundation of the historic structures. Foundation information of the historic structures shall be verified on site if needed, sufficient lateral support should be provided and de-watering (if required) should be carried out with great cautions to control ground movement and change of ground water regime at the heritage site. • Installation of monitoring checkpoints shall be carried out in great care and adequate protection shall be provided so as to avoid unnecessary disturbance / damage to the historic fabrics. Photo records of monitoring checkpoints shall be submitted upon installation for AMO's records. Monitoring records should be submitted to AMO on regular basis and please alert AMO should the monitoring reach Alert/ Alarm/ Action levels. • As a precautionary measure, the project proponent and his/her contractor are required to inform AMO immediately when any antiquities or supposed antiquities under the Antiquities and Monuments Ordinance (Cap. 53) are discovered during the course of works. 	