

5 NOISE IMPACT

5.1 Legislation and Standards

General

5.1.1 The relevant legislation and associated guidance applicable to present the study for the assessment of noise impacts include:

- (1) Noise Control Ordinance (NCO) (Cap.400);
- (2) Technical Memorandum (TM) on Noise from Construction Work other than Percussive Piling (TM-GW);
- (3) TM on Noise from Percussive Piling (TM-PP);
- (4) TM on Noise on Construction Work in Designated Areas (TM-DA);
- (5) TM on Noise from Places other than Domestic Premises, Public Places or Construction Sites (TM-Places);
- (6) EIAO (Cap. 499) and TM-EIAO;
- (7) Hong Kong Planning Standards Guidelines (HKPSG); and
- (8) Noise Control Guidelines for Holding Open Air Entertainment Activities.

Construction Noise

5.1.2 The NCO provides the statutory framework for noise control in Hong Kong. Assessment procedures and standards are set out in the respective TM promulgated under NCO.

5.1.3 To ensure a better environment, the TM-EIAO promulgated under the EIAO has imposed more stringent criteria. For construction, there is no statutory limit on daytime construction noise under the NCO and related TMs. Nevertheless, the TM-EIAO stipulates criteria of 65 – 75 dB(A) for daytime construction activities, as shown in the **Table 5.1**.

Table 5.1: Noise standards for construction activities

Uses	Noise Standards ^[1] , L_{eq} (30mins) dB(A)
	0700 to 1900 hours on any day not being a Sunday or general holiday
All domestic premises including temporary housing accommodation	75
Hotels and hostels	75
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	70 65 (During examinations)

Note:

- [1] The above standards apply to uses that rely on opened windows for ventilation.

Construction Noise During Restricted Hours

- 5.1.4** The NCO also provides statutory control on general construction works during restricted hours (i.e. 1900 to 0700 hours (of the next day) from Monday to Saturday and at any time on Sundays or public holidays). The use of Powered Mechanical Equipment (PME) for construction works during restricted hours would require a Construction Noise Permit (CNP). The TM-GW details the procedures adopted by EPD for assessing such application. The granting of a CNP is subject to conditions stated in the CNP and it may be revoked at any time for failure to comply with the permit conditions.
- 5.1.5** In addition to the general controls on the use of PME during restricted hours, the use of Specified Powered Mechanical Equipment (SPME) and the undertaking of Prescribed Construction Work (PCW) during the restricted hours in a designated area are controlled by the TM-DA. Construction plant or equipment classified as SPME under the TM-DA includes hand-held breakers, bulldozers, concrete mixer lorries, dump trucks and poker vibrators. The PCW includes the erection or dismantling of formwork or scaffolding, hammering, handling of rubble, wooden boards, steel bars, or scaffolding material, and the disposal of rubble through plastic chutes.
- 5.1.6** The TM-DA details the procedures that should generally be adopted by the Authority for assessing the use of SPME during restricted hours and for determining whether a CNP would be issued.
- 5.1.7** Maximum noise levels from construction activities during restricted hours at affected Noise Sensitive Receivers (NSRs) are controlled under the TMs and shall not exceed the specified Acceptable Noise Levels (ANLs). These ANLs are stipulated in accordance with the Area Sensitivity Ratings established for the NSRs. The ANLs for construction works in Designated Areas are more stringent than those given in the GW-TM and are summarised in **Table 5.2**.

Table 5.2: ANLs for construction during restricted hours

Time Period	ANLs for Area Sensitive Ratings ^[1] , dB(A)		
	A	B	C
All weekdays during the evening (1900 to 2300 hours), and general holidays (including Sundays) during the day and evening (0700 to 2300 hours)	60 (45)	65 (50)	70 (55)
All days during the night-time (2300 to 0700 hours)	45 (30)	50 (35)	55 (40)

Note:

[1] Figures in brackets are ANLs for SPME construction work in designated areas.

- 5.1.8** As defined in the Noise Control Designated Area Plan No. EPD/AN/K & NT-02, Kowloon East areas such as Shun Lee Estate, Shun Tin Estate, Shun On Estate, Sau Mau Ping Estate, Sau Mau Ping South Estate, Po Tat Estate etc are within the Designated Area.
- 5.1.9** Despite any description made in this report, there is no guarantee that a CNP will be issued for the project construction. The Noise Control Authority will consider a well-justified CNP application, once filed, for construction works within restricted hours as guided by the relevant TMs issued under the NCO. The Noise Control Authority will take into account contemporary conditions / situations of adjoining land uses and any previous complaints against construction activities at the site before making a decision in granting a CNP. Nothing in the report shall bind the Noise Control Authority in

making a decision. If a CNP is to be issued, the Noise Control Authority shall include in it any conditions it may demand. Failure to comply with any such conditions will lead to cancellation of the CNP and prosecution under the NCO.

Percussive Piling

- 5.1.10** Under the TM-PP, CNPs are also required for percussive piling works, involving the use of diesel, pneumatic and / or steam hammer. This TM specifies the permitted hours and other conditions for percussive piling. **Table 5.3** lists the acceptable percussive piling noise levels for various types of NSR.

Table 5.3: ANLs for percussive piling

NSR Window Type or Means of Ventilation	ANL, dB(A)
(i) NSR (or part of NSR) with no window or other opening	100
(ii) NSR with central air conditioning system.	90
(iii) NSR with windows or other openings but without central air conditioning system	85

- 5.1.11** Depending on the number and type of piling machines and the separation distance from NSRs, percussive piling may be restricted to 12, 5 or 3 hours per day. For NSRs that are particularly sensitive to noise, such as hospitals, medical clinics, educational institutions and courts of law, a further reduction of 10dB(A) shall be applied to the above ANLs.
- 5.1.12** To minimize the construction noise impact, alternative construction methods to replace percussive piling and blasting shall be proposed as far as practicable.

Construction Groundborne Noise

- 5.1.13** Noise arising from general construction works that may generate groundborne noise during normal working hours is governed by the TM-EIAO under the EIAO as shown in **Table 5.1**. The Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (TM-Places) under the NCO stipulates that noise transmitted primarily through the structural elements of building, or buildings, shall be 10 dB(A) less than the relevant ANLs.
- 5.1.14** Based on the same principle for the groundborne noise criteria (i.e. ANL-10 dB(A) under the TM-Places), the construction groundborne noise levels inside domestic premises and schools shall be limited to 65 dB(A) and 60 dB(A) respectively when compared to the TM-EIAO.
- 5.1.15** For construction works conducted on general holidays, Sundays and weekdays during evening (i.e. 1900-2300 hrs) and night time (i.e. 2300-0700 hrs) the following day, the construction groundborne noise level shall be limited to 10 dB(A) below the respective ANLs for the Area Sensitive Rating appropriate to those NSRs affected by the Project. A summary of these criteria is given in the **Table 5.4** below.

Table 5.4: Construction groundborne noise criteria

NSR type	Noise Criteria, dB(A)		
	[1]	[2]	[3]
All domestic premises including temporary housing accommodation	65	50/55/60 ^[4,5]	35/40/45 ^[4,5]
Hotels and hostel			
Educational institutions including kindergarten,	60	N/A ^[6]	N/A ^[6]

NSR type	Noise Criteria, dB(A)		
	[1]	[2]	[3]
nurseries and all others where unaided voice communication is required	55 (for during examination)		

Notes:

[1] Daytime (0700 – 1900) except general holidays and Sunday

[2] Daytime (0700 – 1900) during general holidays and Sundays and all days during Evening (1900 – 2300 hrs)

[3] Night-time (2300 – 0700 hrs)

[4] Based on the Basic Noise Level for NSRs with Area Sensitivity Ratings of A, B, and C detailed in the Technical Memorandum on Noise From Construction Work Other Than Percussive Piling.

[5] Construction Noise Permit is required for works during this period.

[6] No sensitive use in educational institutions during evening and night-time period is assumed except specified.

Operational Noise

5.1.16 The TM-EIAO (Annex 5 of TM) stipulates the noise standards for various noise sources as shown in **Table 5.5**. It should, however, be noted that the following noise criteria are only applicable to uses that rely on opened windows for ventilation.

Table 5.5: Noise standards for operational phase

Common Uses	Noise Standards ^[1]	
	Road Traffic Noise L ₁₀ (1hour) dB(A)	Fixed Noise Sources
All domestic premises including temporary housing accommodation	70	a) 5dB(A) below the appropriate ANLs shown in Table 3 of the Technical Memorandum for the Assessment of Noise from Places Other than Domestic Premises, Public Places or Construction Sites, or
Hotels and hostels	70	
Offices	70	
Educational institutions including kindergartens, nurseries & all others where unaided voice communication is required	65	b) the prevailing background noise levels (For quiet areas with level 5 dB(A) below the ANL)
Places of public worship and courts of law	65	
Hospitals, clinics, convalescences and homes for the aged (diagnostic rooms and wards only)	55	

Note:

[1] The above standards apply to uses that rely on opened windows for ventilation.

Road Traffic Noise

5.1.17 The criteria for assessing road traffic noise is given in the TM-EIAO and tabulated in **Table 5.5**. For domestic premises, hotels, hostels and offices, the criterion is 70dB(A). For educational institutes and places of worship, the criterion is 65dB(A). For hospitals, clinics etc, a more stringent criterion of 55dB(A) is stipulated. It should be noted that all these criteria only apply to NSRs that rely on open-windows for ventilation.

Fixed Noise Sources

5.1.18 Operational noise from fixed noise sources is controlled under the NCO's TM on Noise from Places other than Domestic Premises, Public Places or Construction Sites (TM-Places). To plan for a better environment, the TM-EIAO has specified the following requirements, whichever is more stringent.

- (1) 5dB(A) below the appropriate ANLs in the TM-Places; or
- (2) the prevailing background noise levels.

The ANLs for different Area Sensitivity Ratings during different periods are summarised in **Table 5.6**.

Table 5.6: ANLs for fixed noise sources

Time Period	ANL, dB(A)		
	Area Sensitivity Rating A	Area Sensitivity Rating B	Area Sensitivity Rating C
Day (0700 to 1900 hours)	60	65	70
Evening (1900 to 2300 hours)	60	65	70
Night (2300 to 0700 hours)	50	55	60

5.1.19 For assessing fixed noise sources, the Area Sensitivity Ratings at the NSRs are defined in accordance with the relevant TMs. Clear Water Bay Road and Sau Mau Ping Road have an Annual Average Daily Traffic (AADT) of 27,470 and 22,640 respectively in Year 2012 and hence it is not considered as an Influencing Factor (IF) due to the daily traffic flow of lower than 30,000 vehicles. An Area Sensitivity Rating of "B" is therefore assigned for the NSRs indirectly influenced by the IF and "C" for NSRs directly influenced by the IF according to the TM. The Assessment Area of ARQ consists of high-rise building blocks at south and low density residential area at north. As ARQ is located in between these two areas, the NSRs of ARQ are considered as "Type (iv) Others Area" according to the TM. An Area Sensitivity Rating of the NSRs of ARQ is considered as "B".

Noise from Bus Terminus

5.1.20 There are no noise level standards stipulated for the noise from the operation of bus terminus. Chapter 9 of Hong Kong Planning Standards and Guidelines (HKPSG) provides considerations for the Project Proponent to determine the location and layout of the bus terminus during planning stage.

5.2 Description of Existing Environment

5.2.1 The major land use in the vicinity of the Study Area is residential, with high-rise developments. The existing noise climate is dominated by the road traffic noise from New Clear Water Bay Road, Clear Water Bay Road, Anderson Road, Sau Mau Ping Road, Shun On Road, Lee On Road, Po Lam Road, etc. The Study Area is far away (~1500m) from the existing industrial areas in Kwun Tong and Kowloon Bay. Noise impacts attributed by existing industrial premises on the Study Area would be insignificant.

5.3 Study Area & Noise Sensitive Receivers

Study Area

5.3.1 The Study Area, as delineated in **Figure 227724/E/0001**, is located on the south-western slopes of the Tai Shueng Tok Hill at the far north-eastern edge of urban East Kowloon, and is close to the major population centres of Kwun Tong, Lam Tin and Sau Mau Ping. Specifically, the Study Area covers an area of about 86 ha, which includes a platform area of about 40 ha.

Sensitive Receivers

5.3.2 With reference to Annex 13 of the TM-EIAO, NSRs include residential uses (all domestic premises including temporary housing), institutional uses (educational institutions including kindergarten and nurseries), hospitals, medical clinics, homes for the aged, convalescent homes, places of worship, libraries, court of law, performing arts centres, auditoria and amphitheatres, country park and others.

5.3.3 Representative NSRs within the assessment area have been identified with the first layer of NSRs selected for assessment. These NSRs cover all existing sensitive developments and planned NSRs during construction and operational phases.

5.3.4 The existing NSRs are identified by means of topographic maps, aerial photos, land status plans, S.16 / S.12a Town Planning Ordinance and site inspections. Planned / committed NSRs are identified by making reference to relevant Outline Zoning Plans (OZP), Outline Development Plans (ODP), Layout Plans and other published plans in relation to the Town Planning Board.

5.3.5 Referring to **Section 1.1**, prior to this Investigation Study, a Planning Study on Future Land Use at Anderson Road Quarry to examine the future land use and explore the development potential of the upper quarry area has been carried out. A Recommended Outline Development Plan (RODP) under the Planning Study is shown in **Figure 227724/E/0002**. The recommendations for noise mitigation measures under the Planning Study including the setback distance and/ or non-openable windows/ maintenance window that are not opened for ventilation facing the road networks, use of non-sensitive structure and building orientation have been adopted and summarized in **Table 5.7** below. **Figure 227724/E/2000** illustrates the recommendations and the assumed building layout plans within ARQ are for assessment purpose.

Table 5.7: Recommended noise mitigation measures in RODP

Zone	Recommendations
R2-1, R2-2, R2-3, R2-5	5m building setback
R2-6	8m building setback
R2-7 (facing north)	8m building setback
R2-7 (facing east)	8m building setback; Proper building layout; Use of architectural fins; and Non-openable windows/ maintenance window that are not opened for ventilation
R2-8 (facing north)	8m building setback; Proper building layout; Use of architectural fins;

Zone	Recommendations
	Non-openable windows/ maintenance window that are not opened for ventilation; and Absorptive type balcony
R2-8 (facing east)	8m building setback
R2-9&10	8m building setback; Proper building layout; Use of architectural fins; Non-openable windows/ maintenance window that are not opened for ventilation; and Absorptive type balcony
RS-1	10m building setback
E-1	Proper orientation of L-shaped standard design school layout; Use of non-sensitive structure for noise screening; and Provision of non-openable windows/ maintenance window that are not opened for ventilation (no specific location of non-openable windows/ maintenance window that are not opened for ventilation in Planning Study)
E-2	Proper orientation of L-shaped standard design school layout; Use of non-sensitive structure for noise screening; and Non-openable windows/ maintenance window that are not opened for ventilation

Note:

[1] All the building setback is measured from the nearest site boundary.

5.3.6

The existing and planned NSRs in the vicinity, which may be affected within the Study Area of ARQ are identified and summarized in **Table 5.8** and illustrated in **Figures 227724/E/2010-2040**. Photos showing the existing NSRs are given in **Appendix 5.1**.

Table 5.8: Existing and planned NSRs

Location	NSR ID.	Land Use ^[1]	Potential Impact ^[2]	Intake Year
ARQ – Planned				
Development of Anderson Road Quarry	R2-1 – R001 ~ R005	R	R	2026
	R2-1 – R006	R	F	2026
	R2-2 – R002 ~ R012	R	R	2026
	R2-2 – R013	R	F	2026
	R2-3 – R001 ~ R009	R	R	2026
	R2-4 – R001 ~ R009	R	R	2026
	R2-5 – R001 ~ R009	R	R	2026
	R2-6 – R001 ~ R010	R	R	2026
	R2-6 – R010	R	F	2026
	R2-7 – R001 ~ R004, R007 ~ R011	R	R	2026
	R2-7 – R009 ~ R010	R	F	2026

Location	NSR ID.	Land Use ^[1]	Potential Impact ^[2]	Intake Year
	R2-8 – R003 ~ R010, R013 ~ R014, R016 ~ R019, R022	R	R	2022
	R2-8 – R010	R	C, R	2022
	R2-8 – R009, R016	R	F	2022
	R2-9&10 – R001 ~ R003, R005 ~ R006, R008, R011 ~ R019	R	R	2022
	R2-9&10 – R001	R	C	2022
	RS-1 – R001 ~ R010	R	R	2022
	RS-1 – R001	R	F	2022
	RS-1 – R008	R	C, R	2022
	E-1 – R002 ~ R003	E	R	2026
	E-2 – R001 ~ R002	E	R	2022
	E-2 – R003	E	C	2022
	E-3 – R001 ~ R002	E	R	2026
DAR – Under Construction				
Development at Anderson Road	Site A&B – R102 ~ R906	R	R	2016
	Site A&B – R203	R	C, F	2016
	Site A&B – R803	R	C	2016
	Site A&B – R903	R	C	2016
	Site A&B – School 01	E	C, R, F	Unknown at this stage ^[4]
	Site A&B – School 02	E	R	Unknown at this stage
	Site C1 – R1001 ~ R1105	R	R	Unknown at this stage
	Site C2 – R101 ~ R103	R ^[3]	R	Unknown at this stage
	Site C2 – R102	R ^[3]	C	Unknown at this stage
	Site C2 – School 02 ~ 04	E	R	Unknown at this stage
	Site C2 – School 05	E	C, R	Unknown at this stage ^[4]
	Site E – R501 ~ R1004	R	R	2015
	Site E – R502, R604, R803, R904, R1003	R	C	2015
	Site E – School	E	C, R	2015
Existing				
Lung Wo Tsuen	CYCS – 01	W	R	-
	Lung Wo Tsuen 01 ~ 02	R	R	-

Location	NSR ID.	Land Use ^[1]	Potential Impact ^[2]	Intake Year
Tan Shan Tsuen	TSV-01	R	R	-
Anderson Road	Leighton Pavilion 01 ~ 02	R	R	-
Ma Yau Tong Village	Fat Yuen Temple	W	R	-
	Haven of Hope Sunnyside School	E	R	-
	Ma Yau Tong Village	R	C, R	-
	Ma Yau Tong Village No.1	R	C, R	-
	Missionary Society of St. Columban	W	R	-
Sau Mau Ping Estate	Holm Glad Primary School 01 ~ 02	E	R	-
	Sau Ching House 01 ~ 02	R	R	-
	Sau Fai House	R	R	-
	Sau Hong House	R	R	-
	Sau Lok House	R	R	-
	Sau Nga House 01 ~ 02	R	R	-
	Sau Yee House 01 ~ 02	R	R	-
	Sau Yin House 01 ~ 02	R	R	-
Shun Lee Estate	Sau Ming Primary School 01 ~ 02	E	R	-
	Lee Foo House 01 ~ 02	R	R	-
Shun Tin Estate	Shun Lee General Out-patient Clinic	C	R	-
	Ning Po No.2 College	E	R	-
Po Tat Estate	Tin Wan House 01 ~ 02	R	R	-
	Kwun Yam Temple	W	R	-
	Planned City God Temple	W	R	-
	Planned Monkey King Temple	W	R	-
	Sau Mau Ping Catholic Primary School 01 ~ 02	E	C, R	-
	Tat Cheung House 01	R	R	-
	Tat Cheung House 02	R	C	-
	Tat Chui House	R	R	-
	Tat Fung House	R	R	-
	Tat Hong House 01 ~ 02	R	R	-
	Tat Yan House	R	C, R	-
	Tat Yi House	R	R	-
Tin Hau Temple	W	R	-	

Notes:

- [1] R – Residential Premises, E – Educational Institutions, W – Places of Public Worship, C – Clinic
- [2] C – Construction Airborne Noise, R – Operational Road Traffic Noise, F – Operational Fixed Noise
- [3] According to the building layout provided by Housing Department, a dormitory use of the Ancillary Facilities Building is facing the Road L4.
- [4] As there is no confirmed intake programme of the schools, worst-case scenario of assuming the schools will be occupied during the construction period is therefore adopted for assessment purpose.

5.4 Potential Concurrent Projects

5.4.1 In order to assess the cumulative impacts, it is critical to identify the implementation programme and details of concurrent projects in the vicinity that would have an environmental bearing on the noise sensitive receivers for the Project.

5.4.2 After collating the information available in the public domain (e.g. approved EIA reports, LegCo paper etc.), the project proponents of these concurrent projects has been approached to verify the best available information for incorporation into the report. Referring to **Section 3.8**, there are four major concurrent projects including the Development at Anderson Road (DAR); Road improvement works at J/O Lin Tak Road and Sau Mau Ping Road, at J/O New Clear Water Bay Road and Anderson Road, as well as at the merging lane at Clear Water Bay Road near Shun Lee Tsuen Road; proposed rock cavern development within ARQ and pedestrian connection. Locations of the concurrent projects are shown in **Figure 227724/E/0008**. Each concurrent project is discussed in the following.

5.4.3 DAR is located in the East Kowloon District. It is bounded by Anderson Road to the north, the realigned Sau Mau Ping Road to the south, Po Lam Road to the east, and Lee On Road and Shun On Road to the west. The scope of works of DAR includes construction of site formation, roads, drains and upgrading of existing infrastructure to provide usable land of about 20 hectares for housing and associated government, institution or community uses at the site between existing Anderson Road Quarry and Sau Mau Ping Road in Kwun Tong District. The construction works of DAR has commenced in early-2008 and is scheduled for completion in early 2017 according to the latest programme advised by Housing Department. As mentioned in **Section 3.8**, the tentative major construction work of ARQ is envisaged to commence in mid 2016. Although there may have half year overlapping period from late 2016 to early 2017, the major construction works of DAR including site formation and building foundation would be completed in 2016, and the remaining works would be minor building works which construction noise is minimal. The cumulative construction noise impact arising from the minor building works of DAR should be minimal.

5.4.4 Road improvement works at J/O Lin Tak Road and Sau Mau Ping Road, at J/O New Clear Water Bay Road and Anderson Road, as well as at the merging lane at Clear Water Bay Road near Shun Lee Tsuen Road are located outside the 300m assessment area of Study Area and would also be blocked by the high-rising buildings in the vicinity. Hence, these improvement works are considered insignificant.

5.4.5 The proposed rock cavern with the ARQ and proposed vertical transfer system are located within the 300m assessment area and hence has been assessed in the cumulative impact.

5.4.6 The cumulative impacts have been considered during the operational phase of the project. The impacts from the committed roads and the impacts to the committed NSRs have been addressed in this report.

5.5 Assessment Methodology

Construction Phase - Construction Noise

5.5.1 The construction noise impact assessment during daytime, on weekdays other than general holidays have been assessed in accordance with the methodology in paragraphs 5.3 and 5.4 of Annex 13 of the TM.

5.5.2 Construction noise assessment has been conducted based on the following procedures:

- (1) Determine the assessment area, and identify representative NSRs that may be affected by the works;
- (2) Obtain the construction method and work sequence for the construction period;
- (3) Obtain the plant items for each corresponding construction work sequence;
- (4) Determine the sound power levels of the plant items according to the information stated in the TM-GW or other recognised sources of reference, where appropriate;
- (5) Calculate the correction factors based on the distance between the NSRs and the notional noise source positions of the work sites;
- (6) Apply corrections for façade, distance, barrier attenuation, acoustic reflection where applicable;
- (7) Quantify the level of impact at the NSRs, in accordance with TM-GW;
- (8) Predict the cumulative noise impacts by any concurrent construction works in the vicinity; and
- (9) For any exceedance of noise criteria, all practical mitigation measures such as alternative construction methodology, quiet plant, silencer, enclosure, etc, shall be examined to alleviate the predicted noise impacts as much as practicable.

5.5.3 Consideration of noise mitigation measures follows Annex 13 of TM-EIAO and EIAO Guidance Note "Preparation of Construction Noise Impact Assessment under the Environmental Impact Assessment Ordinance" [GN 9/2010].

5.5.4 As there is no construction activities related to the use of tunnel boring machine, construction groundborne noise impacts are not anticipated.

Scenarios

5.5.5 The construction noise assessment would include the following scenarios:

- (1) Unmitigated scenario (Construction noise impacts without any mitigation measures); and
- (2) Mitigated scenario (Construction noise impacts after implementing practicable mitigation measures such as movable barrier, enclosure, etc).

5.5.6 Both the unmitigated and mitigated scenarios would consider the implementation strategy.

Prediction of Noise Impact

- 5.5.7 The predicted construction noise levels in $L_{eq(30\text{ min})}$ dB(A) at the selected assessment points have been presented in tables and plans of suitable scale.

Mitigation of Construction Noise Impact

- 5.5.8 Where the predicted construction noise impact exceeds the criteria set in Table 1B of Annex 5, TM, direct mitigation measures including noise barriers, enclosures, quieter alternative methods, re-scheduling, restricting hours of operation of noisy tasks, etc. have been adopted. The feasibility, practicability, programming and effectiveness of the recommended mitigation measures have been confirmed by Civil Engineer and stated in this report.

Construction Noise Assessment Tool

- 5.5.9 An in-house program has been used for construction noise calculations. Initially, the program runs were conducted without any mitigation measures (i.e. the "Unmitigated Scenario"). Where noise level exceedance was identified, further runs would be made assuming different combinations of mitigation measures to be incorporated (i.e. the "Mitigated Scenario").

Operational Phase – Road Traffic Noise

- 5.5.10 The calculation method stated in the UK Department of the Transport "Calculation of road Traffic Noise" (CRTN) would be adopted. The predicted noise levels at the building facades include 2.5dB(A) facade reflection and correction factors for effects due to gradient, distance, view angle, road surface and barriers.
- 5.5.11 In the preparation for noise prediction, the project road scheme and surrounding road networks within the Study Area have been included in the model with parameters of road width, surface type, and traffic condition.
- 5.5.12 The future road traffic noise has been calculated based on the peak hour traffic flow in respect of maximum traffic projection within the next 15 years upon commencement of operation of the Project.

Scenarios

- 5.5.13 The road traffic noise impact assessment of the Project has been conducted with respect to the criteria set in Annex 5 of the TM (i.e. refer to **Section 5.1** for details).
- 5.5.14 The road traffic noise model adopted in the EIA include following scenarios:
- (1) Unmitigated scenario at assessment year;
 - (2) Mitigated scenario at assessment year; and
 - (3) Prevailing scenario for indirect mitigated measures eligibility assessment.
- 5.5.15 The assessment year of unmitigated and mitigated scenarios which is the future road traffic noise shall be calculated based on peak hour traffic flow in respect of maximum traffic projection within the next 15 years upon commencement of operation of the Project, i.e. $2026 + 15 = 2041$. The noise assessment for prevailing year would adopt the year before the commencement of road construction works, i.e. $2016 - 1 = 2015$. The traffic data adopted in the EIA study has been endorsed by Transport Department on 25 September 2013 and given in **Appendix 5.2**.

Prediction of Noise Impact

- 5.5.16** The predicted noise levels in L_{10} (1 hour) dB(A) at the selected assessment points at various representative floor levels (in mPD) have been presented on tables and plans of suitable scale.
- 5.5.17** The assessment covers the cumulative road traffic noise impact resulting from road traffic noise due to the Project and existing road network on existing, committed and planned NSRs within the assessment area.
- 5.5.18** The total number of dwellings, classrooms and other noise sensitive receivers that would be exposed to noise impact exceeding the criteria set in Annex 5 in the TM have been quantified.

Consideration of Noise Mitigation Measures

Direct Mitigation Measures

- 5.5.19** Consideration of noise mitigation measures follows Annex 13 of TM-EIAO and EIAO Guidance Note “Road Traffic Noise Impact Assessment under the Environmental Impact Assessment Ordinance” [GN 12/2010].
- 5.5.20** Where the predicted noise impact exceeds the noise criteria, direct mitigation measures shall be considered on the project road to reduce the noise from the project road to a level that it
- (1) Is not higher than the standard; and
 - (2) Has no significant contribution to the overall noise from other existing roads, if the cumulative noise level, i.e. noise from the new road together with other existing roads exceeds the standard (i.e. not more than 1.0 dB(A))
- 5.5.21** Where the predicted road traffic noise impact exceeds the criteria set in Table 1B of Annex 5, TM, direct mitigation measures including screening by noise tolerant buildings, etc. have been adopted. The feasibility, practicability, programming and effectiveness of the recommended mitigation measures have been confirmed by Civil Engineer and stated in this report.
- 5.5.22** Where necessary, noise mitigation measures such as building setback and building orientation for planned NSRs have been proposed to minimise noise impact during the operation of the Project. For the planned residential premises, mitigation measures have been proposed such that the noise criterion is achieved.
- 5.5.23** The total numbers of NSRs that would be benefited from and be protected by direct mitigation measures have been provided. The total numbers of other noise sensitive receivers that would still be exposed to noise above the criteria with the implementation of all recommended direct mitigation measures have been quantified.
- 5.5.24** The environmental requirements / constraints identified in the EIA study to assess the development potential of concerned sites would be made known to the relevant parties.

Indirect Mitigation Measures

- 5.5.25** According to EPD’s Guidance Note 12/2010, in the case where NSRs are still exposed to noise levels exceeding the relevant noise criteria after the implementation of all direct mitigation measures, the total number of existing dwellings, classrooms and other noise sensitive elements which may qualify for indirect technical remedies, the associated costs and any implications for such implementation should be identified and estimated.

The eligibility of the affected premises for indirect technical remedies is determined with reference to the following three criteria:

- (1) the predicted overall noise level must be above a specified noise level (e.g. 70 dB(A) for domestic premises and 65 dB(A) for education institutions, all in $L_{10,1hr}$);
- (2) the predicted overall noise level is at least 1.0 dB(A) more than the prevailing traffic noise level, i.e. the total traffic noise level existing before the works to construct the road were commenced; and
- (3) the contribution to the increase in the predicted overall noise level from the road project must be at least 1.0dB(A).

5.5.26 For planned noise sensitive uses which are also subject to potential road traffic noise impacts, the overall noise levels for maximum projected traffic within 15 years has been predicted. In the case where the planned NSRs are exposed to excessive noise levels, direct mitigation measures shall be proposed to ensure compliance of the relevant noise criteria.

Operational Phase – Fixed Plant Noise

5.5.27 The following general procedures in accordance with methodology in paragraph 5.2 of Annex 13 of the TM have been adopted for the operation noise assessment.

- (1) Identify and locate representative NSRs that may be affected by the noise sources;
- (2) Determine the noise criteria for both daytime and night-time;
- (3) Use standard acoustic principle for attenuation and directivity;
- (4) Determine the maximum sound power levels (SWLs) of the fixed noise sources identified during EIA study; and
- (5) Cumulative impacts will be included, if any.

5.5.28 The assessment has been based on the best available information during the preparation of EIA process. However, given the nature of the study, some of the detailed information may not be available by the time of EIA preparation. In such case, maximum sound power levels (SWLs) of the fixed noise sources has been predicted.

Prevailing Background Noise Levels

5.5.29 The proposed noise criterion depends on the prevailing noise level. The locations of prevailing noise measurement are illustrated in **Figure 227724/E/2050**. Consideration of its transient and impulsive characteristics has been taken into account.

5.5.30 The DAR is under construction, which construction noise would be the dominated noise source in ARQ. In order to determine the future noise climate of ARQ, prevailing background noise levels have been measured in the vicinity of the Study Area in January 2013. The environment of the selected monitoring locations are considered similar to future ARQ, the measured noise level was then be used to determine noise criteria. A summary of the noise measurement results are given in the **Table 5.9**.

Table 5.9: Prevailing background noise measurements

Monitoring Location ^[3]	Prevailing Background Noise Levels ^[1] , dB(A)		
	Day ^[2]	Evening ^[2]	Night ^[2]
Shun Lee Estate (PNM-1)	58 - 59	56 - 57	49 - 50

Monitoring Location ^[3]	Prevailing Background Noise Levels ^[1] , dB(A)		
	Day ^[2]	Evening ^[2]	Night ^[2]
Shun Tin Estate (PNM-2)	59	53 - 54	50
Sau Mau Ping Estate (PNM-3)	65 - 66	63 - 65	60 - 61
Po Tat Estate (PNM-4)	59 - 61	58 - 60	54 - 55

Notes:

[1] Measurements conducted in January 2013.

[2] Day: 0700 – 1900 hours, Evening: 1900 – 2300 hours, Night: 2300 – 0700 hours.

[3] PNM represents prevailing background noise measurement location.

5.5.31 The proposed noise criteria at representative NSRs due to general fixed plant noise sources are summarized in **Table 5.10**.

Table 5.10: Proposed noise criteria at representative NSRs due to fixed plant sources

No.	NSR	ANL – 5, dB(A) ^[1]		Background Noise Level, dB(A)		Criteria, L _{Aeq} (30 min) dB(A)		Reference Location
		Day & Evening	Night	Day & Evening ^[2]	Night	Day & Evening	Night	
R2-1 ~ R2-7	Planned Residential Buildings at ARQ	60	50	56	49	56	49	PNM-1
R2-8 ~ R2-10	Planned Residential Buildings at ARQ	60	50	58	54	58	50	PNM-4
E-1	Planned Schools at ARQ	60	50	56	49	56	49	PNM-1
E-2, E-3	Planned Schools at ARQ	60	50	58	54	58	50	PNM-4
Site A, B, C1	Planned Public Housing at DAR	60	50	53	50	53	50	PNM-2
Site E	Planned Public Housing at DAR	60	50	63	60	60	50	PNM-3

Notes:

[1] An Area Sensitivity Rating of “B” is assumed for NSRs at “Others Area” which do not have any IF in the vicinity.

[2] Lowest background noise among day and evening time is adopted.

5.6 Construction Noise Assessment

Inventory of Noise Sources

5.6.1 Despite the construction methodologies are yet to be established, it is anticipated that the major construction works would include the following activities:

- (1) Site clearance and formation activities;
- (2) Internal roads;
- (3) Installation of utilities; and

(4) Superstructure.

Phases of Construction

5.6.2 Given the scale of development, it is anticipated that the Project has been implemented in phases. This phasing strategy would depend on a number of considerations. This landuse option and its implementation strategy would form the implementation assumption for the construction noise assessment. The construction workfronts showing the construction of ARQ and new access roads are shown in **Appendix 5.3**.

5.6.3 These construction activities would be carried out with the use of Powered Mechanical Equipment (PME) including breakers, pipe pile rigs, excavators, lorries, mobile cranes, concrete pumps, concrete mixers, pokers, rollers, etc. The types of PME adopted are listed in **Appendix 5.3**.

5.6.4 The utilization rates, which have been reviewed by the Project Engineer, are also presented in **Appendix 5.3**. In practice, the PME would not be operating at all times within a work site. However, the following construction noise assessment would demonstrate a worst case scenario. The construction plant inventory used in the assessment has been confirmed to be representative of the works by the project proponent.

Assessment Results - Unmitigated Scenario

5.6.5 According to the latest engineering design, the construction works would mainly comprise of the activities as described in **Section 3.6**. The corresponding Sound Power Levels (SWLs) of these activities have been estimated according to the PME's SWLs and the assessment methodology in the GW-TM. **Appendix 5.4** presents the PME inventory adopted in construction works area of ARQ. **Appendix 5.5A** presents the detailed PME inventory for each works area of ARQ. **Appendix 5.5B** presents the distance between the notional sources and the NSRs. **Appendix 5.5C** presents the monthly unmitigated noise contribution during the construction period. **Appendix 5.5D** also presents the unmitigated construction noise impacts at selected representative NSRs and the duration of exceedance could be referred to **Appendix 5.5D**. The predicted construction noise impacts on the NSRs are summarized in **Table 5.11** below.

Table 5.11: Predicted maximum unmitigated construction noise levels at NSRs

Location	NSR ID.	Uses	Criterion, dB(A) ^[1]	Unmitigated Noise Level, dB(A) ^[2]	Exceedance, dB(A)
DAR	Site A&B – R203	R	75	71	-
	Site A&B – School 01	E	70 (65)	74	4 (9)
	Site A&B – R803	R	75	75	-
	Site A&B – R903	R	75	79	4
	Site C2 – R102	R ^[3]	75	94	19
	Site C2 – School 05	E	70 (65)	91	21 (26)
	Site E – R502	R	75	92	17
	Site E – R604	R	75	79	4
	Site E – R803	R	75	79	4
	Site E – R904	R	75	80	5
Site E – R1003	R	75	80	5	

Location	NSR ID.	Uses	Criterion, dB(A) ^[1]	Unmitigated Noise Level, dB(A) ^[2]	Exceedance, dB(A)
	Site E – School	E	70 (65)	83	13 (18)
Po Tat Estate	Tat Cheung House	R	75	85	10
	Sau Mau Ping Catholic Primary School 02	E	70 (65)	80	10(15)
	Tat Yan House	R	75	74	-
Ma Yau Tong Village	Ma Yau Tong Village	R	75	83	8
	Ma Yau Tong Village No. 1	R	75	86	11
ARQ	R2-9&10 – R001	R	75	80	5
	E2-R003	E	70 (65)	87	17 (22)
	RS-1 – R008	R	75	80	5
	R2-8 – R010	R	75	79	4

Notes:

- [1] Values in parentheses indicate the noise criterion during examination period of educational institution.
- [2] Bolded values mean exceedance of the relevant noise criteria.
- [3] According to the building layout provided by Housing Department, a dormitory use of the Ancillary Facilities Building is facing the Road L4.

Mitigation Measures

5.6.6

The predicted construction noise levels show that the unmitigated construction noise impacts would exceed the daytime noise criteria. Mitigation measures are therefore required. The following mitigation measures have been considered:

- (1) Good site practices to limit noise emissions at the source;
- (2) Use of quiet plant and working methods;
- (3) Use of site hoarding as noise barrier to screen noise at ground level of NSRs;
- (4) Use of shrouds / temporary noise barriers to screen noise from relatively static PMEs;
- (5) Use of large full enclosure to screen all the plant, wherever practicable;
- (6) Scheduling of construction works outside school examination periods in critical area; and
- (7) Alternative use of plant items within one worksite, wherever practicable.

5.6.7

The above mitigation measures would need to be implemented in all work sites as good practices. It should be noted that whilst “Good Practice” mitigation measures would help to alleviate the noise impacts, some of these measures have not been included in the quantitative assessment as discussed in the following sections. This would ensure a more conservative assessment.

5.6.8

Detailed descriptions of these mitigation measures are given in the following sections.

Good Site Practices and Noise Management Techniques

5.6.9 Good site practice and noise management techniques could considerably reduce the noise impact from construction site activities on nearby NSRs. The following measures should be followed during each phase of construction:

- (1) only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;
- (2) machines and plant (such as trucks, cranes) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- (3) plant known to emit noise strongly in one direction, where possible, be orientated so that the noise is directed away from nearby NSRs;
- (4) silencers or mufflers on construction equipment should be properly fitted and maintained during the construction works;
- (5) mobile plant should be sited as far away from NSRs as possible and practicable; and
- (6) material stockpiles, site office and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.

5.6.10 The benefits of these techniques can vary according to specific site conditions and operations. The environmental noise climate would certainly be improved through these control practices, although the improvement can only be quantified during implementation when specific site parameters are known. The assessment has therefore not taken into account the effectiveness of “Good Site Practices and Noise Management Techniques”.

Use of “Quiet” Plant and Working Methods

5.6.11 The use of quiet plant is a feasible solution to tackle noise impacts associated with construction works. It is generally known (supported by field measurement) that particular models of construction equipment are quieter than standard types given in the TM-GW. Whilst it is generally considered too restrictive to specify that the Contractor has to use specific models or items of plant, it is reasonable and practicable to set plant noise performance specifications for specific PME so that some flexibility in selection of plant is allowed. A pragmatic approach would be to request that the Contractor independently verifies the noise level of the plant proposed to be used and demonstrates through furnishing of these results, that the plant proposed to be used on the site meets the requirements.

5.6.12 An inventory of SWLs of quiet plant associated with the construction works is given in EPD’s Quality Powered Mechanical Equipment (QPME) and additional reference is made to typical SWLs for international manufacturer. It should be also noted that while various types of silenced equipment could be found in Hong Kong, EPD when processing a CNP application for evening or night time works may apply the noise levels specified in the TM-GW and TM-DA. CNP applications which contain sufficient details of any particularly quiet items of PME or any special noise control measures which the CNP applicant proposes to employ on the site may be given special consideration by the Noise Control Authority.

5.6.13 A summary of the “Quiet” PMEs adopted and the associated SWLs is given in **Appendix 5.4**.

Use of Site Hoarding

- 5.6.14** Purpose built temporary noise barriers (approximately 2.5m high) located on the site boundaries between noisy construction activities and NSRs could generally reduce noise levels at low-level zone of NSRs through partial screening. In general, this would provide minimum 5 dB(A) attenuation for the low level receivers. It would be possible for the Contractor to provide these in the form of site hoardings to achieve this attenuation effect, provided that the barriers have no openings or gaps. Good site practice shall also be adopted by the Contractor to ensure the conditions of the hoardings are properly maintained throughout the construction period. For conservative assessments, however, the site hoarding has not been taken into consideration in the construction noise assessments.

Use of Temporary Noise Barrier & Enclosure (with Sufficient Ventilation)

- 5.6.15** Movable temporary noise barriers that can be located close to noisy plant and be moved concurrently with the plant along a worksite can be very effective for screening noise from NSRs. A typical design which has been used locally is a wooden framed barrier with a small-cantilevered on a skid footing with 25mm thick internal sound absorptive lining. This measure is particularly effective for low level zone of NSRs. A cantilevered top cover would be required to achieve screening benefits at upper floors of NSRs.
- 5.6.16** Movable barriers would be used for some PME (e.g. asphalt paver, excavator etc). It is anticipated that suitably designed barriers could achieve at least 5 - 10dB(A) reduction. For a conservative assessment, only a reduction of 5dB(A) is assumed. Acoustic mat would be used for other plant items such as trench cutter, piling, oscillator and drilling rig and a 10 dB(A) noise reduction is anticipated. Barrier material with surface mass at least 7kg/m² is recommended to achieve the predicted screening effect. This assumption has been adopted in other approved EIA Reports.
- 5.6.17** The use of enclosure (with sufficient ventilation and surface mass at least 10 kg/m²) has been considered in this assessment to shelter relatively static plant including air compressor, generator. The enclosures barriers can provide about 10dB(A) noise reduction.
- 5.6.18** A summary of the temporary movable barriers and enclosures adopted for various PMEs, and the associated noise reduction is given in **Appendix 5.4** and summarised in **Table 5.12** below. **Appendix 5.6** shows the sketch of typical temporary noise barrier / enclosure.

Table 5.12: Summary of barrier and noise enclosure adopted for PMEs

PME	Enclosure / Shed / Silencer / Barriers / Acoustic Mat	Attenuation, dB(A)
Air compressor	Enclosure / Shed	-10
Asphalt paver	Movable Barriers	-5
Bar bender, cutter	Movable Barriers	-5
Breaker, handheld	Movable Barriers	-5
Breaker	Movable Barriers	-5
Breaker, excavator mounted (pneumatic)	Movable Barriers	-5
Breaker, excavator mounted (Hydraulic)	Movable Barriers	-5
Bulldozer	Movable Barriers	-5

PME	Enclosure / Shed / Silencer / Barriers / Acoustic Mat	Attenuation, dB(A)
Concrete lorry mixer	Movable Barriers	-5
Water truck	Movable Barriers	-5
Concrete pump	Movable Barriers	-5
Mobile crane	Movable Barriers	-5
Tower crane	Movable Barriers	-5
Truck	Movable Barriers	-5
Dump truck	Movable Barriers	-5
Backhoe	Movable Barriers	-5
Excavator	Movable Barriers	-5
Generator	Enclosure / Shed	-10
Piling, large bored pile	Acoustic Mat	-10
Piling machine	Acoustic Mat	-10
Vibratory poker	Movable Barriers	-5
Rock drill, crawler mounted (hydraulic)	Movable Barriers	-5
Roller	Movable Barriers	-5
Roller, vibratory	Movable Barriers	-5
Saw, circular, wood	Movable Barriers	-5
Ventilation fan	Enclosure with silencer system	-15
Water pump	Enclosure / Shed	-10

Sequencing Operation of Construction Plant Equipment

5.6.19 In practice, some plant items would operate sequentially within the same work site, and certain reduction of the predicted noise impacts could be achieved. However, any additional control on the sequencing of plant would impose a restrictive constraint to the Contractor on the operation and planning of plant items, and the implementation of the requirement would be difficult to be monitored. Hence, sequencing operation of PME has not been taken into consideration in the construction noise assessments.

Assessment Results - Mitigated Scenario

5.6.20 With the implementation of the abovementioned mitigation measures, the construction noise levels at the affected NSRs are predicted. The predicted noise levels at most of the NSRs would comply with the corresponding noise criteria, except some NSRs near the works area at Road L4 of ARQ. Non-compliance at these NSRs is due to the shorter separation distance between the worksites. **Appendices 5.5E** present the mitigated noise contribution on a monthly basis during the construction period. **Appendices 5.5F** present the predicted mitigated construction noise levels at selected representative NSRs. The predicted construction noise impacts on the NSRs are summarized in **Table 5.13** below.

Table 5.13: Predicted maximum mitigated construction noise levels at NSRs

Location	NSR ID.	Uses	Criterion, dB(A) ^[1]	Mitigated Noise Level, dB(A) ^[2]	Exceedance, dB(A)
DAR	Site A&B – R203	R	75	59	-
	Site A&B – School 01	E	70 (65)	61	-
	Site A&B – R803	R	75	61	-
	Site A&B – R903	R	75	63	-
	Site C2 – R102	R ^[3]	75	77	2
	Site C2 – School 05	E ^[4]	70 (65)	74	4 (9)
	Site E – R502	R	75	77	2
	Site E – R604	R	75	67	-
	Site E – R803	R	75	67	-
	Site E – R904	R	75	69	-
	Site E – R1003	R	75	67	-
	Site E – School	E	70 (65)	68	0 (3)
Po Tat Estate	Tat Cheung House	R	75	70	-
	Sau Mau Ping Catholic Primary School 02	E	70 (65)	65	-
	Tat Yan House	R	75	61	-
Ma Yau Tong Village	Ma Yau Tong Village	R	75	66	-
	Ma Yau Tong Village No. 1	R	75	68	-
ARQ	R2-9&10 – R001	R	75	66	-
	E2-R003	E	70 (65)	73	3 (8) ^[5]
	RS-1 – R008	R	75	66	-
	R2-8 – R010	R	75	68	-

Notes:

- [1] Values in parentheses indicate the noise criterion during examination period of educational institution.
- [2] Bolded values mean exceedance of the relevant noise criteria.
- [3] According to the building layout provided by Housing Department, a dormitory use of the Ancillary Facilities Building is facing the Road L4.
- [4] As there is no confirmed intake programme of the school, worst-case scenario of assuming the school will be occupied during the construction period is therefore adopted for assessment purpose.
- [5] Refer to **Table 5.14** and **Table 5.15** for details.

Residual Noise Impact from the Project Exceeding the Construction Noise Criterion

5.6.21

As discussed above, even with all practicable construction noise mitigation measures adopted, such as the use of quiet PME, temporary movable noise barrier and enclosure, residual impacts exceeding the construction noise criterion are still expected at some NSRs, as summarized in **Table 5.14** below. Only those NSRs with residual construction noise impact from the Project exceeding the construction noise criterion are shown.

Table 5.14: Residual impacts at noise sensitive receivers

NSR ID	Uses	Criterion, dB(A) ^[1]	Maximum Mitigated Noise Level, dB(A)	Exceedance, dB(A)
Site C2 – R102	R ^[3]	75	77	2
Site C2 – School 05	E ^[4]	70 (65)	74	4 (9)
Site E – R502	R	75	77	2
Site E – School	E	70 (65)	68	0 (3)
E2 – R003	E	70 (65)	73	3 (8) ^[5]

Notes:

- [1] Values in parentheses indicate the noise criterion during examination period (typical examination period in May, June, November and December) of educational institution.
- [2] Values in parentheses indicate the duration of residual impact in consideration of the noise criterion during examination period.
- [3] According to the building layout provided by Housing Department, a dormitory use of the Ancillary Facilities Building is facing the Road L4.
- [4] As there is no confirmed intake programme of the school, worst-case scenario of assuming the school will be occupied during the construction period is therefore adopted for assessment purpose.
- [5] Please refer to **Table 5.16** and **Table 5.17** for the total impact duration for noise exceedance.

5.6.22 The above table indicates that the maximum residual impacts and the associated duration despite of the implementation of all practicable noise mitigation measures.

5.6.23 Extensive mitigation measures have been considered and implemented exhaustively to abate construction noise impacts on neighbouring NSRs. These mitigation measures include but not limited to the use of quiet construction plant, movable noise barrier, noise enclosure, acoustic mat etc. With all the mitigation measures implemented, assessment results indicate that the majority of the NSRs would comply with the noise criteria in TM-EIAO.

5.6.24 Two planned NSRs (residential) would exceed the noise criteria, one NSR (Site C2 – R102) is located close to the Road L4 of ARQ and the other NSR (Site E – R502) is located close to the proposed vertical transfer system A would have residual construction noise impact. It should be noted that all of these receivers would only exceed the relevant noise criteria by less than 5dB(A) as shown in **Table 5.15** below. However, it should be noted that the impact duration for noise exceedance for these two residential uses would be 9-10 months out of the whole construction period of mid 2016 to 2026, i.e. around 125 months. The duration of exceedance could be referred to **Appendix 5.5F**.

Table 5.15: Residual noise impacts (residential premises)

NSR-ID	Impact Duration (Month) for Noise Exceedance	
	1 dB(A)	2 dB(A)
Site C2 – R102	8	2
Site E – R502	-	9

5.6.25 Three planned NSRs (educational institution) closer would exceed the noise criteria, one NSR (Site C2 – School 05) is located close to the Road L4 of ARQ, the one NSR (Site E – School) is located close to the proposed vertical transfer system B would have residual construction noise impact and one NSR (E-2 – R003) is located close to the construction site of ARQ E-2. It should be noted that only Site C2 – School 05 would

exceed the relevant noise criteria by only 1dB(A) during normal period as shown in **Table 5.16** below. However, it should be noted that the impact duration for noise exceedance during normal period for these two educational institutions would be 6-13 months out of the whole construction period of mid 2016 to 2026, i.e. around 125 months. The duration of exceedance could be referred to **Appendix 5.5F**.

Table 5.16: Residual noise impacts (educational institution during normal period)

NSR-ID	Impact Duration (Month) for Noise Exceedance		
	1dB(A)	2dB(A)	3dB(A)
Site C2 – School 05 ^[1]	-	-	6
Site E – School	-	-	-
E-2 – R003	8	4	1

Note:

- [1] As there is no confirmed intake programme of the school, worst-case scenario of assuming the school will be occupied during the construction period is therefore adopted for assessment purpose.

5.6.26

Further analysis has also been conducted to evaluate the potential noise impacts by adopting the noise criterion for examination period. It can be seen that a number of the schools along the alignment would be affected by construction noise during their examination periods. For assessment purpose, it is assumed that examination periods would be in May, June, November and December. The duration for construction noise impacts with exceedance during the school examination periods is shown in **Table 5.17** below. However, it should be noted that the impact duration for noise exceedance during examination period for these three educational institutions would be 6-8 months out of the whole construction period of mid 2016 to 2026, i.e. around 125 months. The duration of exceedance could be referred to **Appendix 5.5F**.

Table 5.17: Residual noise impacts (educational institution during examination period) ^[1]

NSR-ID	Impact Duration (Month) for Noise Exceedance								
	1dB(A)	2dB(A)	3dB(A)	4dB(A)	5dB(A)	6dB(A)	7dB(A)	8dB(A)	9dB(A)
Site C2 – School 05 ^[2]	-	2	-	-	-	-	-	2	2
Site E – School	6	-	2	-	-	-	-	-	-
E-2 – R003	-	-	-	-	-	2	2	2	-

Notes:

- [1] Typical examination period in May, June, November and December.
[2] As there is no confirmed intake programme of the school, worst-case scenario of assuming the school will be occupied during the construction period is therefore adopted for assessment purpose.

Evaluation of Residual Impact

Road L4 of ARQ

5.6.27

The noise impacts on Site C2 – R102 would only exceed the relevant noise criteria up to 2dB(A). The number of months of noise impact with exceeding the relevant noise criteria by less than or equal to 2dB(A) would be 10 months out of whole construction period of mid 2016 to 2026, i.e. around 125 months. It should be noted that the separation distance of Site C2 – R102 is about 10m from the construction site which

make it experiencing the residual construction noise impact despite all practical mitigation measures have been implemented.

5.6.28 The noise impacts on Site C2 – School 05 would only exceed the relevant noise criteria during normal period of 3dB(A). The number of months that would be exposed to 3dB(A) above the relevant criteria would be 6 months out of whole construction period of mid 2016 to 2026, i.e. around 125 months. The number of months of noise impact with exceeding the relevant noise criteria during examination by less than or equal to 9dB(A) would be 6 months out of whole construction period of mid 2016 to 2026, i.e. around 125 months. It should be noted that the separation distance of Site C2 – School 05 is about 15m from the construction site which make it experiencing the residual construction noise impact despite all practical mitigation measures have been implemented.

Proposed Vertical Transfer System A

5.6.29 The noise impacts on Site E – R502 would only exceed the relevant noise criteria up to 2dB(A). The number of months of noise impact with exceeding the relevant noise criteria by 2dB(A) would be 9 months out of whole construction period of mid 2016 to 2026, i.e. around 125 months. It should be noted that the separation distance of Site E – R502 is about 20m from the construction site which make it experiencing the residual construction noise impact despite all practical mitigation measures have been implemented.

Proposed Vertical Transfer System B

5.6.30 The noise impacts on Site E – School would not exceed the relevant noise criteria during normal period. However, the number of months of noise impact with exceeding the relevant noise criteria during examination by 1dB(A) and 3dB(A) would be 6 and 2 months out of whole construction period of mid 2016 to 2026, i.e. around 125 months respectively. It should be noticed that construction activity contributing noise impact with exceeding the relevant noise criterion is the piling and superstructure of the proposed vertical transfer system B where located next to this sensitive receiver. The number of PME used has been reviewed as practicable for the construction programme, the dominate noise source would be concrete lorry mixer, dump truck and rock drill for the construction works, mitigation measures including use of quiet plant and movable noise barrier have already been applied on this construction activity.

Development of Anderson Road Quarry

5.6.31 The noise impacts on E-2 – R003 would only exceed the relevant noise criteria during normal period of less than or equal to 3dB(A). The number of months that would be exposed to 1dB(A), 2dB(A) and 3dB(A) above the relevant criteria would be 8, 4 and 1 months out of whole construction period of mid 2016 to 2026, i.e. around 125 months respectively. The number of months of noise impact with exceeding the relevant noise criteria during examination by less than or equal to 8dB(A) would be 6 months out of whole construction period of mid 2016 to 2026, i.e. around 125 months. It should be noted that the separation distance of E-2 – R003 is about 25m from the construction site which make it experiencing the residual construction noise impact despite all practical mitigation measures have been implemented.

Summary of Residual Impact

- 5.6.32** All the practicable mitigation measures including use of quiet plant, acoustic mat, insulation fabric, movable noise barrier and scheduling of works have already been applied and exhausted on these construction activity. Hence, the residual noise impacts have been minimized. In general practice, examination period should only last for 2 weeks. By scheduling the construction works to avoid the examination period, the residual impact should be minimised.
- 5.6.33** To further reduce the noise impacts, it is proposed the Contractor should closely liaise with the school to avoid noisy construction works during examination period. The construction works should be carried out at summer holiday as far as possible.
- 5.6.34** Moreover, to further mitigate the construction noise impact along the Road L4, it is proposed to implement a temporary noise barrier during the construction stage. In order to maximize the possibility of enhancing its performance in noise screening, it is suggested to have the top section cantilevered towards the construction site, and the material to be used for the noise barrier should achieve a minimum surface density of 7kg/m². The exact extent of the temporary noise barriers would be adjusted to suit the need for construction activities and should be implemented as far as practicable. **Figure 227724/E/2100** illustrates the indicative extent of temporary noise barrier.
- 5.6.35** Furthermore, the construction noise level at designated monitoring locations after implementation of the proposed mitigation measures shall be monitored as stipulated in the EM&A Manual.

5.7 Road Traffic Noise Assessment

Inventory of Noise Sources

- 5.7.1** During the operational phase, road traffic could cause traffic noise impact on the NSRs within and in the vicinity of the Study Area, such as Sau Mau Ping Road, Po Lam Road, etc. Road sections for the purpose of road traffic noise impact assessment have been presented and confirmed with EPD prior to the commencement of the assessment. For the purpose of the assessment, roads have been classified as the following categories in **Table 5.18**. **Figure 227724/E/2200** illustrates the extent of project roads in ARQ.

Table 5.18: Road category

Category	Road
Project roads (by ARQ)	Road network in ARQ
Committed roads (by DAR)	Road network in DAR
Existing roads	Anderson Road, New Clear Water Bay Road, Clear Water Bay Road, Sau Mau Ping Road, Lee On Road, Shun On Road, Po Lam Road, etc.

Noise Model Setup

- 5.7.2** The road networks within the Study Area and the traffic flow within 300m assessment area have been summarised in **Appendix 5.7**. The extent of road sections paved with friction course materials have been provided by Highways Department and are shown in **Appendix 5.8**. The use of noise absorptive paving materials on project roads can theoretically reduce the traffic noise impact. As per the values specified in CRTN, the use of pervious road surface can reduce the basic noise level by 3.5 dB(A), as compared to that of 1.0 dB(A) for common impervious paving. This information has been

included in the road traffic noise model accordingly. The noise mitigation measures recommended during the Planning Study including setback from road, non-openable windows/ maintenance window that are not opened for ventilation facing the road networks, use of non-sensitive structure and building orientation have been adopted in the unmitigated scenario.

Evaluation of Unmitigated Road Traffic Noise Impact

5.7.3 The predicted road traffic noise levels at the representative NSRs for ARQ are summarized in **Table 5.19** below. **Appendix 5.9** shows the detailed breakdown of road traffic noise impacts on ARQ.

Table 5.19: Unmitigated road traffic noise impact in Year 2041

NSR ID	Uses [1]	Noise Criteria, L _{10(1 hr)} dB(A)	Predicted Project Road Noise Level, L _{10(1hr)} dB(A) [2]	Predicted Overall Noise Level, L _{10(1hr)} dB(A) [3]	Contribution from Project Roads, L ₁₀ (1hr) dB(A)	Affected Floor	No. of dwellings/ classroom per floor assumed [4]
ARQ - Planned							
R2-1 – R001 ~ R005	R	70	55 ~ 67	55 ~ 67	8.1 ~ 63.1	-	-
R2-2 – R002 ~ R012	R	70	24 ~ 67	47 ~ 67	0.0 ~ 58.6	-	-
R2-3 – R001 ~ R009	R	70	61 ~ 67	61 ~ 67	24.4 ~ 42.6	-	-
R2-4 – R001 ~ R009	R	70	54 ~ 68	54 ~ 68	14.6 ~ 67.5	-	-
R2-5 – R001 ~ R009	R	70	35 ~ 69	40 ~ 69	0.2 ~ 57.3	-	-
R2-6 – R001 ~ R010	R	70	55 ~ 69	55 ~ 69	29.3 ~ 68.1	-	-
R2-7 – R001 ~ R011	R	70	56 ~ 69	56 ~ 69	30.1 ~ 48.3	-	-
R2-8 – R003 ~ R022	R	70	55 ~ 70	55 ~ 70	8.8 ~ 53.0	-	-
R2-9&10 – R001 ~ R019	R	70	52 ~ 68	52 ~ 70	1.3 ~ 49.6	-	-
RS-1 – R001 ~ R010	R	70	48 ~ 69	48 ~ 69	4.0 ~ 38.4	-	-
E-1 – R002 ~ R003 [5]	E	65	63 ~ 65	63 ~ 65	36.0 ~ 38.4	-	-
E-2 – R001 ~ R002 [6]	E	65	50 ~ 65	50 ~ 65	16.9 ~ 29.0	-	-
E-3 – R001 ~ R002	E	65	53 ~ 59	56 ~ 59	2.1 ~ 25.7	-	-
DAR – Under Construction							
Site A&B – R102 ~ R906	R	70	14 ~ 64	56 ~ 75	0.0 ~ 1.4	-	-

NSR ID	Uses [1]	Noise Criteria, L _{10(1 hr)} dB(A)	Predicted Project Road Noise Level, L _{10(1hr)} dB(A) [2]	Predicted Overall Noise Level, L _{10(1hr)} dB(A) [3]	Contribution from Project Roads, L ₁₀ (1hr) dB(A)	Affected Floor	No. of dwellings/ classroom per floor assumed [4]
Site A&B – School 01 ~ 02	E	65	28 ~ 55	69 ~ 78	0.0 ~ 0.1	-	-
Site C1 – R1001 ~ R1105	R	70	47 ~ 63	65 ~ 72	0.0 ~ 1.1	-	-
Site C2 – R101 ~ R103	R [7]	70	68 ~ 76	68 ~ 76	6.7 ~ 37.3	1/F ~ 6/F	N/A
Site C2 – School 02 ~ 05	E	65	52 ~ 75	52 ~ 75	0.6 ~ 41.6	4/F ~ 8/F	N/A
Site E – R501 ~ R1004	R	70	34 ~ 67	36 ~ 70	0.0 ~ 34.3	-	-
Site E – School	E	65	47 ~ 54	55 ~ 59	0.7 ~ 1.9	-	-
Existing							
CYCS – 01	W	65	< 40	< 40	< 40	-	-
Lung Wo Tsuen 01 ~ 02	R	70	0 ~ 16	25 ~ 45	0.0 ~ 0.6	-	-
TSV-01	R	70	< 40	< 40	< 40	-	-
Leighton Pavilion 01 ~ 02	R	70	12	57 ~ 68	0.0	-	-
Fat Yuen Temple	W	65	41	62 ~ 63	0 ~ 0.1	-	-
Haven of Hope Sunnyside School	E	65	52 ~ 54	66 ~ 68	0.1 ~ 0.2	-	-
Ma Yau Tong Village	R	70	51 ~ 53	66 ~ 68	0.1 ~ 0.2	-	-
Ma Yau Tong Village No.1	R	70	57	71 ~ 72	0.1 ~ 0.2	-	-
Missionary Society of St. Columban	W	65	52 ~ 55	68 ~ 69	0.2	-	-
Holm Glad Primary School 01 ~ 02	E	65	36 ~ 44	63 ~ 74	0.0	-	-
Sau Ching House 01 ~ 02	R	70	21 ~ 49	70 ~ 74	0.0 ~ 0.1	-	-
Sau Fai House	R	70	29 ~ 39	76 ~ 79	0.0	-	-
Sau Hong House	R	70	40 ~ 60	66 ~ 73	0.0 ~ 0.5	-	-
Sau Lok House	R	70	41 ~ 59	65 ~ 73	0.0 ~ 0.4	-	-
Sau Nga House 01 ~ 02	R	70	42 ~ 58	64 ~ 74	0.0 ~ 0.4	-	-
Sau Yee House 01 ~ 02	R	70	34 ~ 59	62 ~ 72	0.0 ~ 0.4	-	-

NSR ID	Uses [1]	Noise Criteria, $L_{10(1\text{ hr})}$ dB(A)	Predicted Project Road Noise Level, $L_{10(1\text{ hr})}$ dB(A) [2]	Predicted Overall Noise Level, $L_{10(1\text{ hr})}$ dB(A) [3]	Contribution from Project Roads, L_{10} (1hr) dB(A)	Affected Floor	No. of dwellings/ classroom per floor assumed [4]
Sau Yin House 01 ~ 02	R	70	20 ~ 42	68 ~ 74	0.0 ~ 0.1	-	-
Sau Ming Primary School 01 ~ 02	E	65	34 ~ 42	60 ~ 71	0.0 ~ 0.1	-	-
Lee Foo House	R	70	0 ~ 14	71 ~ 75	0.0	-	-
Shun Lee General Out-patient Clinic	C	55	14	74	0.0	-	-
Kwun Yam Temple	W	65	42 ~ 43	69	0.0 ~ 0.1	-	-
Ning Po No.2 College	E	65	34 ~ 43	71 ~ 73	0.0	-	-
Tin Wan House 01 ~ 02	R	70	28 ~ 46	64 ~ 75	0.0 ~ 0.1	-	-
Planned City God Temple	W	65	32 ~ 34	69	0.0	-	-
Planned Monkey King Temple	W	65	28 ~ 29	68	0.0	-	-
Sau Mau Ping Catholic Primary School	E	65	36 ~ 44	56 ~ 74	0.0	-	-
Tat Cheung House 01	R	70	20 ~ 27	71 ~ 76	0.0	-	-
Tat Chui House	R	70	42 ~ 59	56 ~ 69	0.1 ~ 0.7	-	-
Tat Fung House	R	70	40 ~ 55	58 ~ 70	0.0 ~ 0.2	-	-
Tat Hong House 01 ~ 02	R	70	28 ~ 55	43 ~ 69	0.0 ~ 0.3	-	-
Tat Yan House	R	70	40 ~ 59	58 ~ 69	0.0 ~ 0.7	-	-
Tat Yi House	R	70	40 ~ 60	62 ~ 70	0.0 ~ 0.7	-	-
Tin Hau Temple	W	65	29	68	0.0	-	-

Notes:

- [1] R – residential; E – educational; C – clinic/ home for the aged/hospital; W – worship
- [2] Bold figure denotes the noise level from Project Roads is over the relevant TM-EIAO noise criteria.
- [3] Bold figure denotes the noise exceedance which is over the relevant TM-EIAO noise criteria and the contribution from new roads to the overall noise level is equal to or higher than 1.0 dB(A).
- [4] N/A denotes the number of dwellings / classroom cannot be determined due to planned uses.
- [5] According to the latest assessment, no non-sensitive structure is required between the school and the road.
- [6] A non-sensitive structure of approximately 60m long and 9m height is adopted between the school and the road.
- [7] According to the building layout provided by Housing Department, a dormitory use of the Ancillary Facilities Building is facing the Road L4.

5.7.4 The predicted cumulative road traffic noise level for the residential NSRs at Site C2 - R101, Site C2 - R102 and Site C2 - R103 is 69 – 76 dB(A) which exceed the stipulated noise criterion of 70dB(A) and significant contribution from project roads is predicted. Noise mitigation measures are required for these receivers.

5.7.5 The predicted cumulative road traffic noise level for the educational institutions NSRs at Site C2 - School 02, Site C2 - School 03, Site C2 - School 04 and Site C2 - School 05 is 52 – 75 dB(A) which exceed the stipulated noise criterion of 65dB(A) and significant contribution from project roads is predicted. The predicted noise levels from project roads at Site C2 - School 02, Site C2 - School 03, Site C2 - School 04 and Site C2 - School 05 has already exceed the noise criterion of 65dB(A). Noise mitigation measures are required for these receivers.

Recommended Noise Mitigation Measures

5.7.6 Exceedance of noise criteria are found in various sensitive receivers for both existing and planned uses, noise mitigation measures should therefore be required. According to the Section 6.1, Annex 13 of TM-EIAO, noise mitigation measures starting from direct ones should be considered and evaluated. Direct mitigation measure as listed below are recommended in the proposed development:

- (1) Setback from road;
- (2) Provision of non-openable windows/ maintenance window that are not opened for ventilation;
- (3) Use of non-sensitive structure;
- (4) Building orientation; and
- (5) Noise barrier/ enclosure.

Setback from road

5.7.7 During the planning stage of ARQ development, it is proposed to provide setback distance away from the nearby road network within the ARQ. A setback distance could help to reduce the road traffic noise impact to future resident. Different setback distances of 5m, 8m and 10m from the nearest site boundary is recommended in different residential sites.

Provision of non-openable windows/ maintenance window that are not opened for ventilation

5.7.8 Non-openable windows are window designs that do not include any sections of the window that are configured to open and close. The future resident would not be impacted by the road traffic noise.

Use of non-sensitive structure

5.7.9 A non-sensitive structure in between the road traffic and the noise sensitive receivers could block the propagation of the road traffic noise and hence reduce the noise impact.

Building Orientation

5.7.10 The sensitive buildings could be oriented such that the non-sensitive use such as kitchen, bathroom or store room of residential and staircase or store room of schools are located to the road traffic. Those sensitive uses such as bedrooms/ living rooms of residential and classroom of schools could be oriented away from the road traffic. These could reduce the road traffic noise impact.

Noise barrier/enclosure

- 5.7.11** In view of practicability, the erection of noise barrier/ semi-enclosure along the new road sections are considered as effective mitigation measures in tackling the road traffic noise impact to sensitive receivers.
- 5.7.12** Permanent noise mitigation measure in form of semi-enclosure will be provided prior to operation. The location of noise mitigation measures are described in the following paragraph.
- 5.7.13** For the Road L4 of ARQ, given the close proximity to planned G/IC uses including the planned schools (Site C2 – School 02 ~ 05) and planned Ancillary Facilities Building (Site C2 – R101 ~ R103). A semi-enclosure covering northbound with opening at east is therefore recommended.

Overall Noise Mitigation Measures

- 5.7.14** **Table 5.20** below summarised the recommended noise mitigation measures including the setback from road, provision of non-openable windows/ maintenance window that are not opened for ventilation, use of non-sensitive structure, building orientation and semi-enclosure. The recommended noise mitigation measures are shown in **Figures 227724/E/2210** and **227724/E/2220**. The typical cross section of the proposed semi-enclosure along Road L4 is shown in **Figure 227724/E/2221**.

Table 5.20: Recommended noise mitigation measures for road traffic noise impact

Location	Type of Noise Mitigation Measures	Benefited NSRs
		Representative Planned NSR
R2-1, R2-2, R2-3, R2-5	<ul style="list-style-type: none"> 5m building setback from nearest site boundary 	R2-1, R2-2, R2-3, R2-5
R2-6	<ul style="list-style-type: none"> 8m building setback 	R2-6
R2-7 (facing north)	<ul style="list-style-type: none"> 8m building setback 	R2-7 (facing north)
R2-7 (facing east)	<ul style="list-style-type: none"> 8m building setback; and Non-openable windows/ maintenance window that are not opened for ventilation 	R2-7 (facing east)
R2-8 (facing north)	<ul style="list-style-type: none"> 8m building setback; and Non-openable windows/ maintenance window that are not opened for ventilation 	R2-8 (facing north)
R2-8 (facing east)	<ul style="list-style-type: none"> 8m building setback 	R2-8 (facing east)
R2-9&10	<ul style="list-style-type: none"> 8m building setback; and Non-openable windows/ maintenance window that are not opened for ventilation 	R2-9&10
RS-1	<ul style="list-style-type: none"> 10m building setback 	RS-1
E-1	<ul style="list-style-type: none"> Proper orientation of L-shaped standard design school layout 	E-1
E-2	<ul style="list-style-type: none"> Proper orientation of L-shaped standard design school layout; Use of non-sensitive structure for noise screening; and Non-openable windows/ maintenance window that are not opened for ventilation 	E-2

Location	Type of Noise Mitigation Measures	Benefited NSRs
		Representative Planned NSR
Road L4 of ARQ	<ul style="list-style-type: none"> Semi-enclosure with opening at east: <ul style="list-style-type: none"> - Height above road level : 7m - Approximate Length : 265m 	Site C2 – School 02 ~ 05 Site C2 – R101 ~ R103

Evaluation of Mitigated Road Traffic Noise Impact

5.7.15

With the implementation of recommended noise mitigation measures as shown in the table above, the predicted road traffic noise levels at the representative NSRs within the Study Area are summarized in **Table 5.21** below. **Appendix 5.10** shows the detailed breakdown of road traffic noise impacts. **Appendix 5.12** shows the road plot of noise model and sample calculations of road traffic noise.

Table 5.21: Mitigated road traffic noise impact in Year 2041

NSR ID	Uses ^[1]	Noise Criteria L _{10(1 hr)} dB(A)	Predicted Project Road Noise Level L _{10 (1hr)} dB(A)	Predicted Overall Noise Level L _{10 (1hr)} dB(A)	Contribution from Project Roads, L _{10 (1hr)} dB(A)
Site C2 – R101 ~ R103	R ^[2]	70	46 ~ 68	53 ~ 70	0.9 ~ 23.2
Site C2 – School 02 ~ 05	E	65	42 ~ 61	45 ~ 65	0.1 ~ 24.1

Notes:

[1] R – residential; E – educational

[2] According to the building layout provided by Housing Department, a dormitory use of the Ancillary Facilities Building is facing the Road L4.

Evaluation of Eligibility of Indirect Technical Remedies

5.7.16

As mentioned in **Section 5.5.25**, in the case where NSRs are still exposed to noise levels exceeding the relevant noise criteria after the implementation of all direct mitigation measures, the total number of existing dwellings, classrooms and other noise sensitive elements which may qualify for indirect technical remedies should be identified. However, for those NSRs with cumulative noise level exceed the relevant noise criteria, i.e. 70 dB(A) for residential and 65 dB(A) for educational institutions, the noise contribution from “Project Road” would be lesser than 1.0 dB(A). The assessment result of the prevailing scenario is shown in **Appendix 5.11**. Hence, irrespective of the prevailing noise level, all the NSRs would not satisfy the eligibility assessment criteria.

Evaluation of Protected and Benefited Noise Sensitive Uses with the Noise Mitigation Measures

5.7.17

To study the noise performance of the project, traffic noise levels at the residential, schools and other noise sensitive uses including hospital/ clinic and place of worship which have a direct line of sight to the Project have been predicted. The numbers of dwellings, classrooms and other noise sensitive uses that would be benefited from and be protected by the provision of noise mitigation measures have been calculated. The definition of “exposed”, “benefited” and “protected” noise sensitive uses are defined as follow:

- (1) Exposed – Noise sensitive uses with unmitigated noise level greater than relevant noise criteria
- (2) Benefited – Exposed noise sensitive uses with a noise reduction of 1.0 dB(A) or greater in overall noise level with the noise mitigation measures in place
- (3) Protected – Exposed noise sensitive uses with an overall noise level not greater than relevant noise criteria with the noise mitigation measures in place

5.7.18 Number of dwellings and classrooms that would be benefited from and be protected by the provision of noise mitigation measures have been identified for existing residential and schools respectively. Moreover, the planned noise sensitive uses do not have detailed numbers of dwellings/ classrooms, the benefited/ protected have been identified as the number of floors. Results of planned noise sensitive uses are presented in **Table 5.22** below.

Table 5.22: Summary of protected and benefited noise sensitive uses (planned uses)

Noise Sensitive Uses	Total No. of Floors of Dwellings/ Classrooms/ Noise Sensitive Uses Considered	Unmitigated Scenario	Mitigated Scenario		
		No. of Exposed Floors of Dwellings/ Classrooms/ Noise Sensitive Uses	No. of Exposed Floors of Dwellings/ Classrooms/ Noise Sensitive Uses	Protected Floors of Dwellings/ Classrooms/ Noise Sensitive Uses	Benefited Floors Dwellings/ Classrooms/ Noise Sensitive Uses
Dwellings ^[1]	6	6	0	6	6
Classrooms ^[1]	16	9	0	9	9

Notes:

[1] Number of floors

5.8 Fixed Plant Noise Assessment

Inventory of Noise Sources

5.8.1 A summary of the fixed noise sources affecting the project area and the receivers in the vicinity is summarized below:

- (1) Proposed Pumping Station for saltwater and freshwater;
- (2) Proposed Public Transport Terminus; and
- (3) Planned Rock Cavern (+190mPD, +200mPD, +310mPD).

5.8.2 A summary of the fixed noise sources for ARQ is summarized in below sections. The locations of fixed noise sources are shown in **Figures 227724/E/2300 - 2310**. It should be noted that there are no existing /planned fixed noise sources is identified within 300 assessment area. The proposed DSD detention tank in ARQ site is also not a fixed noise source as pumping facility is not required for the detention tank.

Proposed pumping station for saltwater and freshwater

5.8.3 Pumping station for saltwater and freshwater is a planned facility located at the northern-west boundary of the Study Area at ARQ as shown in **Figure 227724/E/2310** to cater for the demand increase in water supply. This pumping station would need to

be operated during both daytime and night-time periods. The pumping station would be located at 180m from the planned ARQ NSR (R2-1-R006) and 125m from the planned DAR NSR (Site A&B - R203). As there is no information on the planned pumping station for saltwater and freshwater, the maximum SWL has been determined by backward calculation based on the separation distance and noise criteria taking into account the façade and tonality corrections.

Proposed public transport terminus

- 5.8.4** Fixed noise sources in public transport terminus are primarily due to the ventilation fans, idling engine and manoeuvring vehicle, etc. However, the public transport terminus would be designed to no direct line-of-sight of the noise sources at the noise sensitive uses in accordance to the HKPSG. The no direct line-of-sight would be achieved by providing rooftop of public transport terminus and proper mitigation measures such as barrier, silencer, louvers orientation, etc. External ventilation openings can be equipped with sound attenuators or acoustic louvers for proper noise control design. Hence, noise impacts are not expected from the public transport terminus during operational phase. In addition, the location of ingress and egress of the facilities should be planned in order to avoid adverse noise impacts to the adjacent area in detail design stage.

Planned rock caverns (+190mPD, +200mPD, +310mPD)

- 5.8.5** The planned cavern developments are located on the hillside of the proposed ARQ Development. Ventilation shafts may be required for the cavern development despite the future landuse of the caverns is yet confirmed. Fixed plant noise from the louvers of the ventilation shafts would be the major noise sources. The planned rock cavern (+190mPD) would be located at 45m from the planned ARQ NSR (R2-7-R009); the planned rock cavern (+200mPD) would be located at 80m from the planned ARQ NSR (R2-1-R006); and the planned rock cavern (+310mPD) would be located at 135m from the planned ARQ NSR (RS-1-R001). As there is no information on the planned rock caverns at +190mPD, +200mPD and +310mPD, the maximum SWLs are therefore determined by backward calculation based on the separation distance and noise criteria taking into account the façade and tonality corrections.

Evaluation of Fixed Plant Noise Impact

- 5.8.6** The predicted maximum allowable Sound Power Levels (SWLs) is summarized in **Table 5.23** below. Detailed calculations are presented in **Appendix 5.13**.

Table 5.23: Maximum allowable SWLs for the fixed noise sources

Plant Item	Maximum allowable Sound Power Level, dB(A)	
	Daytime/ Evening	Night-time
Pumping station for saltwater and freshwater	97	94
Rock cavern +190mPD	88	81
Rock cavern +200mPD	93	86
Rock cavern +310mPD	99	92

- 5.8.7** The equipment should be free of the characteristics of tonality, impulsiveness and intermittency. If the selected equipment could not be free of characteristics of tonality, impulsiveness and intermittency, the maximum SWL should be reduced in accordance

with the correction factors, in the range of 3 to 6 dB(A), as given in Section 3.3 of TM-Places.

5.8.8 It should be noted that the detailed design of the pumping station for saltwater and freshwater, and the rock caverns (e.g. the louver details) are yet to be developed. Hence, the Contractor shall review the latest design and update the noise assessment to ensure that the stipulated facade noise levels in **Table 5.10** can be achieved.

5.8.9 The Contractor shall install acoustic silencers, noise barriers and acoustic louvers where appropriate to ensure that the specified maximum SWLs shown in **Table 5.23** above would not be exceeded.

Mitigation Measures

5.8.10 The detailed design should incorporate the following good practice in order to minimize the nuisance on the neighbouring NSRs. In case the Contractor would change the design and locations of the louvers, they would need to comply with the legislative maximum impacts at the receivers.

- (1) Louvres should be orientated away from adjacent NSRs, preferably onto main roads which are less sensitive.
- (2) Direct noise mitigation measures including silencers, acoustic louvers and acoustic enclosures should be allowed for in the design for the pumping station for saltwater and freshwater.
- (3) The façade for the pumping station for saltwater and freshwater should have adequate sound insulation properties to minimise the noise emanating through the building fabric.

5.9 Assessment of Side Effects and Constraints

5.9.1 The adopted mitigation measures have been designed to balance between feasibility and effectiveness. The scheme has avoided blockage to the entrance way of the existing and planned premises. The induced impacts from noise barrier have been separately discussed in Air Quality and LVIA chapters.

5.10 Evaluation of Constraints on Planned Noise Sensitive Developments/ Land Uses

5.10.1 Given the assumed building layout plan with the ARQ development, constraints on the planned noise sensitive development/land uses are not anticipated. The recommendations for noise mitigation measures under the Planning Study including the setback distance and/ or non-openable windows/ maintenance window that are not opened for ventilation facing the road networks have been assessed and examined that these mitigation measures are engineering feasible. Therefore, no additional measures within the planned noise sensitive uses are required.

5.10.2 However, given the building layout plan, especially those five concerned sites (i.e. private development sites R2-7 to R2-10 and school development site E-2, refer to **Figure No. 227724/E/2210** and **Table 5.20**) with non-openable windows/ maintenance window that are not opened for ventilation, and another school development site (i.e. E-1, refer to **Figure No. 227724/E/2210** and **Table 5.20**) with assumed L-shape layout and orientation, might be changed by the future developers and school operators, a noise

impact assessment for the future development should be carried out prior to the commencement of the construction works in order to meet the noise criteria. This requirement would be set as a proposed land lease condition of the land lots. The requirement of setback distance ranged from 5 to 10m as noise mitigation measures for other sites (i.e. refer to **Figures No. 227724/E/2210** and **Table 5.20**) would also be set as a proposed land lease condition of the land lots. The proposed noise mitigation measures for two planned school sites E-1 and E-2 have also been accepted by Architectural Services Department (ArchSD) and Education Bureau (EDB). The correspondences between CEDD, Lands Department and ArchSD/EDB are given in **Appendix 5.14**.

5.11 Residual Impacts

5.11.1 Construction noise impact at most noise sensitive receivers arising from the Project could be properly mitigated by implementing the proposed noise control measures such as barrier and quiet plant. However, there would be some receivers still exceeding the respective noise criteria. The noise level would exceed the noise criterion of 75 dB(A) by 1 – 2 dB(A) for about 9 – 10 months at residential premises. For the educational institutions, there would be exceedance of the noise criterion of 70 dB(A) during normal period of 1 – 3 dB(A) for about 6 – 13 months and exceedance of the noise criterion of 65 dB(A) during examination period of 1 – 9 dB(A) for about 6 – 8 months. Given the transient nature of the residual impact, the residual impact is considered as acceptable.

5.11.2 During the operational phase, the impact arising from the Project can be properly mitigated by implementing the proposed noise control measures such as barrier, enclosure and silencer. Residual noise impacts are not anticipated. In order to ensure compliance of the operational noise level with the stipulated noise standards in TM, noise commissioning tests for all major fixed noise sources should be included in the Contract Document.

5.12 Environmental Acceptability of Schedule 2 Designated Projects

5.12.1 The engineering feasibility study of the proposed ARQ development is a Schedule 3 Designated Project (DP) under the EIAO, whilst there will be two Schedule 2 DPs; i.e. road improvement works and rock cavern developments under the ARQ project. Details of these two Schedule 2 DPs are provided in **Section 1.5** and shown in **Figure 227724/E/0002**.

Road Improvement Works

5.12.2 Three road improvement works was proposed at junction of (J/O) Lin Tak Road and Sau Mau Ping Road, at J/O Clear Water Bay Road and Road L1 of Development of Anderson Road (DAR), as well as at the new merging lane at New Clear Water Bay Road near Shun Lee Tsuen Road. The operation year of these three road improvement works are 2022, 2021 and 2019 respectively.

5.12.3 During operational phase, road traffic noise would be the dominate noise source to the nearby sensitive receivers, the impact on the identified NSRs is assessed following the criteria and guidelines set out in Annexes 5 and 13 of the TM-EIAO. The identified noise sensitive receivers of the road improvement works are summarised in **Table 5.24** and shown in the figures attached in **Appendix 5.15**.

Table 5.24: Identified noise sensitive receivers for the road improvement works

Road Improvement Works	Noise Sensitive Receivers
Junction of Lin Tak Road and Sau Mau Ping Road	Choi Tin House and Yee Hong House
Junction of Clear Water Bay Road and Road L1 of Development of Anderson Road (DAR)	Tai Pan Court
New merging lane at New Clear Bay Road	Block 5, Shun Lee Disciplined Services Quarters

5.12.4 Predicted road traffic noise is calculated in accordance to the UK methodology for the Calculation of Road Traffic Noise (CRTN) published by Department of Transport, UK. The assessment year of the future road traffic noise shall be calculated based on peak hour traffic flow in respect of maximum traffic projection within the next 15 years upon commencement of operation of the road improvement works. Year 2037 which is Year 2022 + 15 is selected for the three road improvement works as worst case assumption.

5.12.5 A boardbrush road traffic noise assessment of these three road improvement works has been carried out at the identified noise sensitive receivers. **Table 5.25** below shows the predicted road traffic noise level at these noise sensitive receivers. The boardbrush road traffic noise assessment is presented in **Appendix 5.15**.

Table 5.25: Predicted road traffic noise level at Year 2037

Road Improvement Works	Noise Sensitive Receivers	Noise Criteria, L _{10(1 hr)} dB(A)	Predicted Project Road Noise Level, L _{10(1hr)} dB(A)
Junction of Lin Tak Road and Sau Mau Ping Road	Choi Tin House	70	75
	Yee Hong House		78
Junction of Clear Water Bay Road and Road L1 of Development of Anderson Road (DAR)	Tai Pan Court		76
New merging lane at New Clear Bay Road	Block 5, Shun Lee Disciplined Services Quarters		78

5.12.6 Noise exceedance is predicted at the noise sensitive receivers given the close proximity to the road improvement works. Noise mitigation in form of use of low noise road surfacing, noise barrier and full enclosure could be implemented to mitigate the road traffic noise level in order to meet the EIAO-TM criteria. As these roads are new road sections, such that the engineering feasibility of implementing noise barrier and /or full enclosure could be well designed, i.e. allowing sufficient spacing for the noise barrier / enclosure foundation. Insurmountable noise impact is not anticipated with the implementation of appropriate mitigation measures.

5.12.7 Nevertheless, the detailed noise impact of this Schedule 2 DP will be further investigated in a separate EIA under the EIAO.

Rock Cavern Developments

5.12.8 The proposed cavern developments are located on the hillside of the proposed ARQ Development. There may have ventilation shafts for the cavern developments. Fixed plant noise from the louvers of the ventilation shafts would be the major noise sources.

To minimise the potential noise impact from the fixed noise sources, the following good practices should be adopted:

- Louvres should be oriented away from adjacent NSRs; and
- Direct noise mitigation measures including silencers, acoustic louvers and acoustic enclosures should be allowed for in the design of the ventilation shafts.

5.12.9 Insurmountable noise impact is not anticipated with the implementation of appropriate mitigation measures. Nevertheless, the detailed noise impact of this Schedule 2 DP will be further investigated in a separate EIA under the EIAO.

5.13 Conclusion

5.13.1 Construction noise assessment has been conducted. All practicable mitigation measures have been exhausted to minimise the noise impacts. These mitigation measures include the optimisation of construction methodology (i.e. schedule of using PME), quiet plant, temporary noise barrier and good site practices. However, given the site constraints, some of the receivers (See **Table 5.14**) would still be subject to residual impacts exceeding the construction noise criterion.

5.13.2 Residual impacts exceeding the construction noise criterion have been assessed and considered the impacts are temporary and reversible. With all the proposed mitigation measures, the residual impact exceeding the construction noise criterion has been reduced to be minimal.

5.13.3 For the operational phase, mitigation measures including setback from road, provision of non-openable windows/ maintenance window that are not opened for ventilation, use of non-sensitive structure and building orientation are required to fulfil the EIAO criteria. Besides, a semi-enclosure is also required along Road L4 for mitigating the traffic noise impact, and approximately of 6 floors of planned dwellings and 9 floors of planned classrooms would be benefited from and protected by the semi-enclosure.

5.13.4 Maximum sound power levels allowed to be emitted from louvers of fixed noise sources at pumping station for saltwater and freshwater and planned rock cavern developments were predicted. The public transport terminus would also be designed to no direct line-of-sight of the noise sources at the noise sensitive uses. With the proper selection of plant and adoption of noise control measure such as acoustic silencers, noise barriers, acoustic louvers, the NSRs located in the vicinity of these fixed noise sources would not be affected.