

4 NOISE IMPACT

4.1 INTRODUCTION

4.1.1 This section presents an assessment of the potential noise impact associated with the construction and operation of Peng Chau Sewage Upgrade. Noise impacts during the construction phase are mainly associated with the use of powered mechanical equipment for the construction works. Noise impacts identified during the operational phase are primarily from plant noise of the upgraded facilities. The assessments are carried out based on standard acoustic principles.

4.2 RELEVANT LEGISLATION, POLICIES, PLANS, STANDARDS AND CRITERIA

Construction Noise

General

4.2.1 The principal legislation to provide statutory controls on environmental noise is the Noise Control Ordinance (Cap. 400) (NCO). Various Technical Memoranda (TMs), which stipulate control approaches and criteria, have been issued under the NCO. The following TMs are applicable to the control of noise from construction activities:

- (a) Technical Memorandum on Noise from Percussive Piling (PP-TM);
- (b) Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM)

4.2.2 The EIAO and the TM-EIAP also provide guidelines for the assessment of noise impacts associated with construction activities.

4.2.3 Regardless of any noise impact description or assessment made in this EIA report, the Noise Control Authority will be guided by the relevant TMs issued under the NCO in assessing any application, once filed, for a Construction Noise Permit (CNP) for works planned during restricted hours (i.e. 1900 to 0700 hours and any time on a general holiday including Sundays). The Authority will consider all the factors affecting its decision taking the then prevailing situations and conditions into account. Nothing in this EIA Report shall bind the Authority in making its decision and further, there is no guarantee that a CNP will be issued. If a permit is to be issued, the Authority may include any conditions it considers appropriate and such conditions must be followed during the execution of the works covered by the permit. Failing to do so may lead to cancellation of the permit and prosecution action under the NCO.

Percussive Piling

4.2.4 Under the PP-TM, percussive piling is prohibited at any time on Sundays and public holidays and during evening and night-time hours (1900-0700 hours),

Monday through Saturday. A CNP is required in order to carry out such work during daytime hours (0700-1900 hours), Monday through Saturday. As the issuance of a CNP by the Noise Control Authority would depend on the submission of an application by the Contractor, and therefore on the Contractor's compliance with the percussive piling noise limits set out within the PP-TM, the assessment of this type of noise has not been included in this EIA. However, for completeness, the process that would be followed in assessing a CNP application for percussive piling is described below.

- 4.2.5 In evaluating a CNP application for percussive piling, the Noise Control Authority would be guided by the PP-TM. In assessing the potential noise impact, the EPD would consider the difference between the Acceptable Noise Levels (ANLs), as specified in the PP-TM and the Corrected Noise Levels (CNLs) predicted to result from the proposed percussive piling activities. Depending on the projected noise impacts at nearby Noise Sensitive Receivers (NSRs), the Noise Control Authority would determine the allowable time periods for percussive piling operations, as indicated in **Table 4-1**.

Table 4-1 Permitted Hours of Operation for Percussive Piling (Note: the Use of Diesel, Pneumatic and/or Steam Hammers is prohibited)

Amount by which CNL exceeds ANL	Permitted hours of Operation on any day not being a holiday
More than 10dB(A)	0800 to 0900 and 1230 to 1330 and 1700 to 1800
Between 0 dB(A) and 10 dB(A)	0800 to 0930 and 1200 to 1400 and 1630 to 1800
No exceedance	0700 to 1900

General Construction Works During Restricted Hours

- 4.2.6 The NCO provides statutory controls on general construction works during restricted hours (i.e. 1900 - 0700 hours Monday to Saturday and at any time on Sundays and public holidays). The use of powered mechanical equipment (PME) for carrying out the construction works during these restricted hours would require a CNP. The Noise Control Authority will assess all CNP applications on a case by case basis and, in doing so, it will be guided by the GW-TM.
- 4.2.7 When assessing an application for the use of PME, the Noise Control Authority will compare the ANLs specified in the GW-TM with the CNLs (adjusted for any barrier and reflection effects) associated with the proposed PME operations. The NCO requires that noise levels from construction at affected NSRs be less than a specified ANL. The ANLs are related to the inherent noise sensitivity of the noise receiver areas in question, which in turn relate to the background noise characteristics of these areas. Each noise receiver area is then assigned an Area Sensitivity Rating based on its predominant land use and the presence, if any, of Influencing Factors such as nearby industrial areas, major roads or airports. The relevant ANLs for evenings and holidays and for night-time are provided in **Table 4-2**.

Table 4-2 Acceptable Noise Levels (ANLs, Leq, 5 min dB) for General Construction Works to be Carried out During Restricted Hours

Time period	Area Sensitivity Rating		
	A	B	C
All days during the evening (1900-2300 hours) and general holidays (including Sundays) during the day and evening (0700-2300 hours)	60	65	70
All days during the night-time (2300 - 0700 hours)	45	50	55

4.2.8 Factors influencing the outcome of a CNP application, such as the assigning of ANLs, would be determined by the Noise Control Authority at the time of the application review based on the then prevailing site conditions. It should be noted that conditions around the site may change from time to time.

General Construction Works during Normal Working Hours

4.2.9 Although the NCO does not provide for the control of noise from construction activities during normal working hours (0700 to 1900 hours, Monday to Saturday), Annex 5 of the EIAO-TM specifies a limit of L_{eq} (30 min) 75 dB(A) for residential NSRs. Annex 5 also provides construction noise limits for schools of L_{eq} (30 min) 70dB(A) and 65 dB(A) during normal teaching periods and examination periods respectively, as shown in **Table 4-3**.

Table 4-3 TMEIAP Construction Noise Standard

Use		Noise Standard (L_{eq} (30 min) dB(A))	
		Normal Working Hours	Restricted Hours
Domestic premises, including temporary housing		75	The NCO provides the statutory controls, a Construction Noise Permit is required.
Hotel and hostels		75	
Educational institutions including kindergartens, nurseries and all other where unaided voice communication is required	normal periods	70	
	examination periods	65	

Note: Normal working hours: 0700 to 1900 hours on any day not being a Sunday or public holiday
Restricted hours: 1900 to 0700 Monday to Saturday and any time on Sundays and public holidays

Operational Noise

4.2.10 Operational noise is controlled under the NCO's Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites. Table 2 of the TM specifies the ANLs.

4.2.11 To plan for a better environment, the TM-EIAP specifies the following requirements:

- ❑ 5dB(A) below the appropriate ANLs shown in Table 2 of the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (NCO-TM) ; or
- ❑ the prevailing background noise levels. (For quiet areas with 5dB(A) below the ANL).

4.2.12 **Table 4-4** shows the two criteria stipulated in NCO-TM and TMEIAP. Details of information on background noise measurements are provided in Section 4.3.

Table 4-4 Acceptable Noise Levels from Fixed Points (ANL, L_{eq} , 30min dB(A))

Time Period	Criteria in NCO-TM			Criteria in TMEIAP		
	ASR A	ASR B	ASR C	ASR A	ASR B	ASR C
Day (0700 to 1900 hours)	60	65	70	55	60	65
Evening (1900 to 2300 hours)	60	65	70	55	60	65
Night (2300 to 0700 hours)	50	55	60	45	50	55

Note: According to the TM-EIAP, the level of the intruding noise should be lower than the above TMEIAP criteria values and the background level, whichever is lower.

4.3 BASELINE ENVIRONMENTAL CONDITIONS

4.3.1 Peng Chau is a sparsely populated island (largely village-type development). The Peng Chau STW is located on Tai Lei Island and is connected to Peng Chau Island by Tai Lei Bridge. The assessment area is 300m from both the construction and operational phases of Peng Chau STW Upgrade. Most of the residential development and village houses are located in the central part of the island. Some relatively new low-rise apartment buildings are located on the northwestern tip of the island near Tai Lei Island, where the STW is located. Peng Chau has no conventional road system and is free from traffic noise source.

4.3.2 The noise climate of Peng Chau Island, however, has been affected by the ongoing construction of International Theme Park in Penny’s Bay of North Lantau together with its essential associated infrastructure. Several noise monitoring programmes were conducted in the vicinity of or at Sea Crest Villa of Peng Chau due to the development at Penny’s Bay. Noise monitoring information from various stages of Penny’s Bay development is depicted as follows:

4.3.3 A noise monitoring survey was carried out from mid November to early December 1999 as part of the EIA study for the Construction of an International Theme Park in Penny's Bay of North Lantau together with Its Essential Associated Infrastructures.

The survey was carried out over three periods at Sea Crest Villa near Tai Lei on the northwest shore of Peng Chau facing Penny’s Bay (**Figure 4-1**). The results of these noise measurements are summarised in **Table 4-5a**.

Table 4-5a Noise Measurement Summary at Sea Crest Villa in 1999

Measurement Period	Weekday ⁽¹⁾ (Leq)	Weekend ⁽²⁾ (Leq)
0700-1900 hours	50.5	49.3
1900 – 2300 hours	49.0	49.9

Note: (1) Weekday measurements performed on 25 Nov 1999 (Thursday)

(2) Daytime measurement on 4 Dec 1999 (Saturday) and evening time measurement on 20 Nov 1999 (Sunday)

The finding of the survey showed that background noise levels on the north-west shore of Peng Chau were controlled by natural sources (wind and waves) and were found to be quite consistent during both the daytime and evening. Since background noise levels at Peng Chau are controlled largely by natural sources (wind and waves), it is expected that these noise levels would be quite consistent from time to time. Night time noise level at the same location is estimated to be similar to the weekend measured noise levels 49-50dB(A).

- 4.3.4 In 2001, a baseline noise monitoring was carried out from August to October as part of the Environmental Monitoring and Audit for the Infrastructure for Penny’s Bay Development (CED, 2001-2003). One of the monitoring stations is at Sea Crest Villa near Tai Lei Island on the northwest shore of Peng Chau facing Penny’s Bay. Measurements of noise levels during daytime, evening and night-time are presented in **Table 4-5b** below.

Table 4-5b Noise Measurement Summary at Sea Crest Villa in 2001

Measurement Period	Leq
0700 – 1900 hours ⁽¹⁾	59.6
1900 – 2300 hours ⁽²⁾	56.5
2300 - 0700 hours ⁽²⁾	57.1

Note: (1) Measurement of Leq _(30min) (2) Measurement of Leq _(5min)

- 4.3.5 Impact monitoring of noise construction at the Penny’s Bay at Sea Crest Villa has been carried out since December 2001. The Phase 1 construction work will be finished in mid-2005. Phase 2 construction works were started in mid-2003 and will end in 2008/2009 and the impact monitoring locations are the same. **Table 4-5c** shows the impact monitoring results at Sea Crest Villa up to October 2003.

Table 4-5c Noise Measurement during Penny’s Bay Phase 1 Construction Work at Sea Crest Villa, Peng Chau

Measurement Period	Leq
0700 – 1900 hours ⁽¹⁾	60.1
1900 – 2300 hours ⁽²⁾	56.9
2300 - 0700 hours ⁽²⁾	56.2

Note: (1) Measurement of Leq _(30min) (2) Measurement of Leq _(5min)

- 4.3.6 The operation of Peng Chau STW Upgrade is anticipated to start in early 2008. In viewing of the completion of Penny’s Bay construction in 2008/2009, the baseline noise levels recorded in November and December 1999 best represent the prevailing background noise levels of Sea Crest Villa shortly after the commissioning of Peng Chau STW Upgrade.
- 4.3.7 Given the rural setting of Peng Chau and Tai Lei, and no influencing factor is anticipated in the area, the Area Sensitive Rating for the NSRs within the assessment area of Peng Chau STW Upgrade could be classified as “A”. In any event, however, the ASR assumed here is for indicative assessment only. It should be noted that fixed noise sources are controlled under section 13 of the NCO. Nothing in this report should bind the Noise Control Authority in assessing noise from these sources upon the receipt of complaints. The Authority should assess the noise impacts based on the contemporary conditions/situations.
- 4.3.8 The measured lowest prevailing daytime level was 49.3dB(A), which is more than 5dB(A) below the ANL stipulated in NCO-TM. The nighttime measurement was estimated to be 49 to 50dB(A). By comparing measured noise levels with TMEIAP criteria, the following noise criteria are adopted for this assessment (**Table 4-6**).

Table 4-6 Noise Limit for the Operation of Peng Chau STW Upgrade

Time Period	Noise Limit (dB(A))	Adopted from
Day and Evening (0700 to 2300 hours)	49	Prevailing background noise measurement (round up value)
Night (2300 to 0700 hours)	45	TMEIAP

4.4 NOISE SENSITIVE RECEIVERS

4.4.1 Noise Sensitive Receivers (NSRs) are identified with reference to Annex 13 of the TMEIAP. It is stated in Annex 13 that the potential NSRs could be, but are not limited to, the following:

1. Residential uses -- all domestic premises including temporary housing
2. Institutional uses -- educational institutions including kindergarten and nurseries
hospitals
medical clinics
homes for the aged
convalescent homes
places of public worship
libraries
courts of law
performing art centres
auditoriums
amphitheatres
3. Others -- Hostels
country parks

Construction Phase

- 4.4.2 The proposed works for Peng Chau STW Upgrade would be carried out on Tai Lei Island and Tai Lei bridge of Peng Chau Island. Residential developments in the vicinity are found mainly along the western coast and central part of Peng Chau Island.
- 4.4.3 Noise sensitive receivers identified within the 300m impact assessment zone from the construction works boundary are Sea Crest Villa and Kam Peng Estate located on Peng Chau Island (**Figure 4-2**). To the south of Sea Crest Villa a comprehensive residential development including a commercial complex is under planning. The implementation schedule of this development, as advised by the Planning Department, is not available. It is not anticipated the land would be developed during the construction stage from 2004-2007, the area is thus not considered as an NSR during construction stage. Nevertheless, the constructional noise impact at the identified NSRs in Table 4-7 could still cover that at this planned NSR if built during the construction period.
- 4.4.4 **Table 4-7** presents the relevant information of the identified NSRs during construction phase:

Table 4-7 Identified NSRs during Construction Phase

NSRs	Name of Buildings	Sensitive Uses	Ground Level (mPD)	No. of Storey
N-C1	Sea Crest Villa Block A	Residential	4.5	3
N-C2	Sea Crest Villa Block B	Residential	4.5	3
N-C3	Sea Crest Villa Block C	Residential	4.5	3
N-C4	Sea Crest Villa Block D	Residential	4.5	3
N-C5	Kam Peng Estate	Residential	4.7	7

Operational Phase

- 4.4.5 The operational noise of Peng Chau STW Upgrade would be confined within the existing Peng Chau STW. One of the identified noise sensitive receiver is Sea Crest Villa. Although the implementation schedule of the planned residential development to the south of Sea Crest Villa is not certain, it is anticipated that it would be affected by the operation of Peng Chau STW Upgrade when developed. It is thus considered as an operational NSR. Kam Peng House, however, is not included in the 300m impact assessment zone (**Figure 4-2**). **Table 4-8** presents the relevant information of the identified NSRs during operational phase.

Table 4-8 Identified NSRs during Operational Phase

NSRs	Name of Buildings	Sensitive Uses	Ground Level (mPD)	No. of Storey
N-O1	Sea Crest Villa Block A	Residential	4.5	3
N-O2	Sea Crest Villa Block B	Residential	4.5	3
N-O3	Sea Crest Villa Block C	Residential	4.5	3
N-O4	Sea Crest Villa Block D	Residential	4.5	3
N-O5	Planned Residential Development	Residential	4.7	2*

Note: * as shown in Peng Chau Outline Zoning Plan S/I-PC/4 dated August 03.

4.5 IMPACT IDENTIFICATION

Construction Phase

4.5.1 Key noise generating activities during Peng Chau STW Upgrade construction phase are:

- (a) construction of the twin rising mains;
- (b) construction of the components for the Upgrade works and demolition of the old structures; and
- (c) construction of submarine and emergency overflow outfalls.

4.5.2 Construction works would be carried out during daytime construction period. No works would be carried out during restricted hours.

4.5.3 Three main working zones are identified for the construction phases stated in Section 4.5.1 (Figure 4-2). In order to assess the construction noise impact on a particular NSR, the distances between the NSR and the notional source position are defined. The notional source position, according to GW-TM, is the position mid-way between the approximate geographical centre of the construction site and its boundary nearest to the NSR, if the site is somewhat a regular shape. The whole construction site is divided into three parts according to the construction activities. Notional source positions for construction activities for rising mains, STW upgrade works and outfalls are represented by X, Y and Z respectively. Different power mechanical equipment (PME) would be used for twin rising mains construction and two notional sources are defined (X1 and X2) for construction impact assessment.

4.5.4 The approximate distances of identified NSRs from the notional source positions and the proposed NSRs are listed in **Table 4-9**.

Table 4-9 Approximate Distance of NSRs from Noise Sources during Construction Phase

NSR	Description	Approximate Distance (m)			
		From X1	From X2	From Y	From Z
N-C1	Sea Crest Villa Block A	81	203	267	330
N-C2	Sea Crest Villa Block B	80	202	279	344
N-C3	Sea Crest Villa Block C	67	189	269	336
N-C4	Sea Crest Villa Block D	37	159	245	316
N-C5	Kam Peng House	300	422	471	522

4.5.5 An inventory of PME is developed for quantifying potential impact during each construction phase, including the PME required for open trench submarine outfall construction. This proposed PME list for construction, which has been agreed by the Project Proponent, is provided in **Appendix 4A**.

4.5.6 The calculated sound power levels (SWLs) for each construction stage are summarised in **Table 4-10**.

Table 4-10 Calculated Sound Power Level at Each Key Construction Stage

Activities	Calculated SWL (dB(A))
Extension of the Inlet Mains at X1	103.0
Extension of the Inlet Mains at X2*	122.0
Site Formation (earthworks and boulder/rock breaking) at Y	124.0
Piling and Foundation Works at Y	115.3
Concreting Works at Y	119.9
Modification and Demolition Works at Y	123.1
Submarine Outfall Construction at Z	119.7

Note: *The highest SWL of different construction phase for mainlaying works at X2 is adopted. See Appendix 4A for explanations.

Impact from Package H

4.5.7 The construction period of Peng Chau STW Upgrade is scheduled to begin in early 2005 while the Package H aims at completion in mid-2005. However, by the time the Peng Chau STW Upgrade construction works start, the main laying works of Package H would have been finished substantially. The remaining works before mid- 2005 would be testing and commissioning of the pumping station, which is distant away from the STW upgrade construction site. Cumulative noise impact is not anticipated.

Impact from Peng Chau Helipad

4.5.8 The construction activities of Peng Chau Helipad are scheduled to be started in March 2005 and will last for one year. These construction activities would be coincided with the proposed construction activities including site formation, piling and foundation works, concreting works, and excavation and mainlaying works. Cumulative noise impact is inevitable on the common noise sensitive receivers at Sea Crest Villa. Assessments on the noise cumulative impact are given in the later sections.

Operational Phase

4.5.9 The major noise generating equipment for operational phases are air blowers, ventilation fans and water pumps. Given the design capacity required, the number of equipment and their respective sound power levels are shown in **Table 4-11**. The proposed noisy equipment list has been agreed and accepted by the Project Proponent. The referenced sound power level for each equipment is provided in **Appendix 4G**.

Table 4-11 Plant Inventory for the Operation of the STW Upgrade

Location	Equipment Used	Number of Units	SWL (dB(A))/unit	Sub-total SWL (dB(A))
Blower Room	Blowers for SBR	4	104	110
	Blowers for Sludge Digestion Tank	1	104	104
Deodourization Unit	Deodourization Fans	4	96	102
Plant Rooms	Ventilation Fans	10 (total)	90	100
Total SWL dB(A)				111.8

4.5.10 Standby equipment would be used in case of failure or maintenance of duty units. Concurrent operation of both duty and standby equipment are not anticipated. It is anticipated that the maximum sound power levels during operation would not exceed that value stated in the above table.

4.5.11 All the operations of Peng Chau STW Upgrade would be confined within the existing STW site boundary, the same notional source position as Y is therefore identified (**Figure 4-3**). The distances between the notional source position of the operational area (denoted as X in **Figure 4-3**) and the identified NSRs are measured and presented in **Table 4-12**.

Table 4-12 Approximate Distance of NSRs from Noise Sources during Operational Phase

NSR	Description	Approximate Distance (m)
N-O1	Sea Crest Villa Block A	267
N-O2	Sea Crest Villa Block B	279
N-O3	Sea Crest Villa Block C	269
N-O4	Sea Crest Villa Block D	245
N-O5	Planned Residential Development	317

4.5.12 All equipment are likely to be operated at the same time during operational phase. However, most of these equipment will be enclosed and noise impact would be reduced. The presence of STW plant buildings and other facilities may provide noise shielding for identified noise sensitive receivers.

Impact from Package H

4.5.13 The noise impact on the surrounding are from the pumping station (Package H) is not expected to be significant since it is enclosed in a concrete structure. No cumulative operational impact is envisaged.

Impact from Peng Chau Helipad

4.5.14 Operational noise from the helipad will mainly originate from helicopters transporting patients during an medical emergency. As this type of emergency will not take place often or regularly, cumulative operational noise impact from the two projects is unlikely be an issue to the residents living nearby. The cumulative operational noise impact is thus considered insignificant.

4.6 IMPACT ASSESSMENT

Construction Phase

4.6.1 The following assumptions are made in the assessment of noise impact:

- (a) The notional sources are in the direct sight of the identified noise sensitive receivers;
- (b) Given the openness of the environment, no correction for acoustic reflection is taken into account for the assessment; and
- (c) Nearest NSRs of each residential block at ground level are assessed.

4.6.2 The prediction of the sound pressure levels at identified sensitive receivers is carried out by the following equation:

$$\text{SPL} = \text{SWL} - \text{DA} + \text{Façade correction}$$

Where SPL = Sound Pressure Level at Noise Sensitive Receiver (dB(A))

SWL = Sound Power Level at Source (dB(A))

DA = Distance Attenuation (dB(A))

4.6.3 The distance attenuation calculation follows the following standard equation:

$$DA = 20 \log d + 8$$

Where d = Distance between the noise source and sensitive receivers

4.6.4 The summary of the worst predicted noise levels is given in **Table 4-13** and the detailed assessment is provided in **Appendix 4B**.

Table 4-13 The Worst Predicted Noise Levels at Identified Noise Sensitive Receivers

NSR	Description	Worst Predicted Noise Levels dB(A)
N-C1	Sea Crest Villa Block A	72.2
N-C2	Sea Crest Villa Block B	72.1
N-C3	Sea Crest Villa Block C	72.6
N-C4	Sea Crest Villa Block D	74.0
N-C5	Kam Peng House	66.2

4.6.5 The predicted results show that noise levels perceived by the identified NSRs comply with the daytime construction limit of 75dB(A).

Cumulative Construction Noise Impact

4.6.6 The worst case noise levels calculated from construction activities, however, do not include the construction works of Peng Chau helipad which would be carried out concurrently for the first year of project construction. Elevated cumulative noise impacts at the identified noise sensitive receivers would be inevitable. **Appendix 4C** shows the predicted cumulative noise levels at the closest NSR N-C4 at Sea Crest Villa. Cumulative noise levels from STW upgrade and helipad during the concurrent construction period is provided in **Table 4-14**.

Table 4-14 Cumulative Construction Noise Impact at N-C4

Description	STW Upgrade Predicted Noise Levels dB(A)	Helipad Predicted* Worst Noise Levels dB(A)	Cumulative Noise Levels dB(A)
Year 2005			
02 May to 19 May	71.2	72.1	74.7
20 May to 04 Jun	71.2	74.6	76.2
05 Jun to 02 Jul	71.2	71.2	74.2
03 Jul to 02 Aug	71.2	71.6	74.4
03 Aug to 22 Aug	73.3	62.9	73.7
23 Aug to 24 Aug	73.3	65.5	74.0
25 Aug to 21 Sept	73.3	65.0	73.9
22 Sept to 22 Sept	73.3	65.3	74.0
23 Sept to 06 Oct	73.3	62.6	73.7
07 Oct to 30 Oct	73.3	68.1	74.5
31 Oct to 07 Nov	73.3	69.6	74.9
08 Nov to 11 Nov	73.3	69.6	74.9
12 Nov to 23 Nov	73.3	67.9	74.4
24 Nov to 29 Nov	73.3	67.8	74.4
30 Nov to 04 Dec	74.0	68.2	75.0
05 Dec to 05 Dec	74.0	67.0	74.8
06 Dec to 18 Dec	74.0	68.8	75.1
19 Dec to 29 Dec	74.0	69.3	75.2
30-Dec	74.0	69.3	75.2
Year 2006			
01 Jan to 05 Jan	74.0	69.3	75.2
06 Jan to 10 Jan	74.0	66.2	74.6
11 Jan to 25 Jan	74.0	61.7	74.2
26 Jan to 28 Jan	74.0	59.5	74.1
29 Jan to 28 Feb	74.0	64.3	74.4

Note: * predicted noise levels adopted from draft Final EIA for Construction of Helipad at Peng Chau and Yung Shue Wan, Lamma Island (May 2004)

- 4.6.7 The predicted results show that exceedance of recommended daytime construction noise limit of 75dB(A) are predicted from May to June 2005. The corresponding construction works are shown in Appendix 4C.
- 4.6.8 It is proposed that a more stringent daytime construction limit of 72dB(A) should be observed by both construction sites when construction activities are carried out. The resultant noise level from both construction sites would then comply with the recommended 75dB(A) daytime construction limit if the more stringent limit is complied.

4.6.9 As shown in Table 4-13, the worst predicted noise levels at N-C3 and N-C4 exceeded 72dB(A). Noise mitigation measures are recommended to reduce noise impacts at these identified NSRs.

Construction Noise Mitigation Measures

4.6.10 The elevated noise levels are mostly contributed by PME with high sound power levels. It is recommended that quiet equipment is used to reduce the construction noise impact. Quiet equipment specifically recommended for this Project include:

- (a) Excavated Mounted Hydraulic Breaker, with reference to BS 5228 (British Standard, 1997), Table C.8, item 13, SWL of 110dB(A); and
- (b) Hand Held Electric Vibratory Poker, with reference to BS 5228, Table C.6, item 32, SWL of 100dB(A);

4.6.11 The PME inventory of using specified silencing equipment is shown in **Appendix 4D**. Detailed predicted noise levels after adopting the quiet equipment are given in **Appendix 4E**. Summary of the worst predicted noise levels after incorporating quiet equipment are shown in **Table 4-15**.

Table 4-15 The Worst Predicted Noise Levels at Identified Noise Sensitive Receivers (Mitigated Scenario)

NSR	Description	Worst Predicted Noise Levels dB(A)
N-C1	Sea Crest Villa Block A	68.0
N-C2	Sea Crest Villa Block B	67.7
N-C3	Sea Crest Villa Block C	68.2
N-C4	Sea Crest Villa Block D	70.3
N-C5	Kam Peng House	63.0

4.6.12 With the use of recommended silencing and replacement equipment, the predicted noise level at all identified noise sensitive receivers would comply with the more stringent limit of 72dB(A).

4.6.13 It is shown in the above tables that the highest noise construction noise levels would be perceived by residents at Sea Crest Villa Block D (N-C4). Cumulative noise levels at this NSR from both Peng Chau STW Upgrade and Peng Chau Helipad construction activities are provided in **Appendix 4F** and summarised in **Table 4-16**.

Table 4-16 Cumulative Construction Noise Impact at N-C4 (Mitigated Scenario)

Description	STW Upgrade Predicted Noise Levels dB(A)	Helipad Predicted* Worst Noise Levels dB(A)	Cumulative Noise Levels dB(A)
Year 2005			
02 May to 19 May	67.4	72.1	73.3
20 May to 04 Jun	67.4	74.6	75.3
05 Jun to 02 Jul	67.4	71.2	72.7
03 Jul to 02 Aug	67.4	71.6	73.0
03 Aug to 22 Aug	65.8	62.9	67.6
23 Aug to 24 Aug	65.8	65.5	68.6
25 Aug to 21 Sept	65.8	65.0	68.4
22 Sept to 22 Sept	65.8	65.3	68.5
23 Sept to 06 Oct	65.8	62.6	67.5
07 Oct to 30 Oct	65.8	68.1	70.1
31 Oct to 07 Nov	65.8	69.6	71.1
08 Nov to 11 Nov	65.8	69.6	71.1
12 Nov to 23 Nov	65.8	67.9	70.0
24 Nov to 29 Nov	65.8	67.8	69.9
30 Nov to 04 Dec	67.1	68.2	70.7
05 Dec to 05 Dec	67.1	67.0	70.0
06 Dec to 18 Dec	67.1	68.8	71.0
19 Dec to 29 Dec	67.1	69.3	71.3
30-Dec	67.1	69.3	71.3
Year 2006			
01 Jan to 05 Jan	67.1	69.3	71.3
06 Jan to 10 Jan	67.1	66.2	69.6
11 Jan to 25 Jan	67.1	61.7	68.2
26 Jan to 28 Jan	67.1	59.5	67.8
29 Jan to 28 Feb	67.1	64.3	68.9

Note: predicted noise levels adopted from draft Final EIA for Construction of Helipad at Peng Chau and Yung Shue Wan, Lamma Island (May 2004)

4.6.14 With implementation of silencing equipment as noise mitigation measures, no exceedance of 72dB(A) is predicted from the construction of the STW upgrade at all time. Despite that elevated noise levels up to 74.6 dB(A) is predicted from the construction of Helipad, cumulative noise impact at the worst identified NSR still comply with the daytime recommended noise level of 75dB(A).

Operational Phase

4.6.15 For the assessment of operational noise, it is assumed that all the equipment proposed in Table 4-11 would be operated at the same time and are located outdoors without shielding. The total sound power level during the operational phase is calculated to be 111.8 dB(A) (See Appendix 4G). To simplify the assessment, a notional source position is assigned (Figure 4-2). The prediction of noise levels at the identified sensitive receivers follows the equation shown in Section 4.5.2.

4.6.16 The predicted noise levels during the operational phase at the identified NSRs are shown in Table 4-17.

Table 4-17 Predicted Noise Level during Operational Phase (without Shielding)

NSR	Description	Predicted Noise Level dB(A)
N-O1	Sea Crest Villa Block A	58.3
N-O2	Sea Crest Villa Block B	57.9
N-O3	Sea Crest Villa Block C	58.2
N-O4	Sea Crest Villa Block D	59.0
N-O5	Planned Residential Development	56.8

4.6.17 It is shown that if all the noisy equipment for STW are located outdoors without shielding, the predicted noise levels would exceed the recommended noise limit at all times (49dB(A) during daytime/evening and 45dB(A) during night time).

4.6.18 However, these noisy equipment are designed to be enclosed inside their respective treatment buildings. A reduction of 20dB(A) can be achieved if the building enclosures are built using suitable material such as concrete with a surface density of 25kg/m². With the proposed enclosure, the predicted noise levels during the operational phase at identified noise sensitive receivers are reduced and the results are shown in Table 4-18.

Table 4-18 Predicted Noise Level during Operational Phase (with concrete building enclosure)

NSR	Description	Predicted Noise Level dB(A)
N-O1	Sea Crest Villa Block A	38.3
N-O2	Sea Crest Villa Block B	37.9
N-O3	Sea Crest Villa Block C	38.2
N-O4	Sea Crest Villa Block D	39.0
N-O5	Planned Residential Development	36.8

4.6.19 With the implementation of mitigation measures, the predicted noise levels at identified noise sensitive receivers comply with the daytime/evening and night

time operation noise limit of 49dB(A) and 45dB(A), respectively. Operational noise impacts are insignificant.

Cumulative Operational Noise Impact

4.6.20 As identified in Section 4.5, no additional noise sources are identified during the operational phase of the STW Upgrade. The cumulative operational noise impacts are predicted to be the same as the operational noise shown in Table 4-18, and are in compliance with both daytime/evening and night time operation noise limit.

4.7 MITIGATION MEASURES

Construction Phase

4.7.1 Noise mitigation measures during construction phase are recommended to reduce the potential cumulative noise impacts with Peng Chau Helipad project. Recommended measures include adoption of the following silencing equipment:

- (a) Excavated Mounted Hydraulic Breaker, with reference to BS 5228 (British Standard, 1997), Table C.8, item 13, SWL of 110dB(A); and
- (b) Hand Held Electric Vibratory Poker, with reference to BS 5228, Table C.6, item 32, SWL of 100dB(A);

4.7.2 In addition to using quiet PME, good site practices are recommended, as follows:

- (a) Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction program;
- (b) Mobile plant, if any, should be sited as far away from NSRs as possible;
- (c) Machines and plant that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- (d) Plant known to emit noise strongly in one direction, should, wherever possible, be orientated so that the noise is directed away from the nearby NSRs; and
- (e) Material stockpiles and other structures should be effectively utilized, wherever practicable, in screening from on-site construction activities.

4.7.3 As shown in Section 4.6, no identified NSR would exceed the daytime construction noise limit from the construction of the proposed Peng Chau STW Upgrade. The elevated construction noise levels predicted are from the cumulative impacts of both the Peng Chau STW Upgrade and Peng Chau Helipad and the most affected residential NSRs are Sea Crest Villa (where predicted noise levels from Peng Chau STW upgrade exceed 72dB(A)). The Sea Crest Villa consist of 42 residential units. With the implementation of the proposed mitigation measures, a minimum of 42 residential units would be benefited from the provision of mitigation measures.

Operational Phase

4.7.4 Enclosure of noisy equipment are proposed as noise mitigation measures for operational phase. These measures are to be incorporated into design of the STW Upgrade.

4.7.5 The identified operational NSRs include the Sea Crest Villa and a planned residential development. It is anticipated that at least 42 residential units would be benefited by the proposed noise mitigation measures during operational phase.

4.8 RESIDUAL IMPACTS

4.8.1 With the implementation of recommended mitigation measures for construction phase and operational phases, no residual adverse noise impacts are anticipated.

4.9 ENVIRONMENTAL MONITORING AND AUDIT

Construction Phase

4.9.1 With the implementation of recommended mitigation measures during the construction of the STW Upgrade and Helipad, noise impact at the identified NSRs comply with the recommended standard. Nevertheless, EM&A is recommended to ensure the noise level compliance.

Operational Phase

4.9.2 Insignificant impact from operational phase would be expected. EM&A during operational phase is not required.

4.10 CONCLUSIONS AND RECOMMENDATIONS

Construction Phase

4.10.1 Construction noise impacts from STW upgrade was evaluated. Key noise generating activities include construction of pumping mains, treatment works upgrade and demolition of old units, as well as outfall construction.

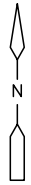
4.10.2 The predicted results show that the construction noise standard of 75 dB(A) stipulated in TMEIAP is complied at all identified NSRs from the proposed construction activities at all phases. However, the construction of Peng Chau Helipad would be taken place concurrently during the first year of construction when most noisy equipment plants are scheduled to be operated. To minimise the cumulative noise impact, a more stringent noise level of 72dB(A) is recommended to be observed by both construction sites.

4.10.3 Noise mitigation measures are proposed for the construction of STW upgrade. Two types of silencing PME are recommended to reduce the noise impact. Noise levels at identified NSRs after mitigating are all well below the proposed noise level of 72dB(A).

- 4.10.4 Exceedance of 72dB(A) noise level would occur by Helipad construction activities at the worst identified NSR with the implementation of mitigation measures. Scheduling of the STW construction have been properly arranged to avoid the elevated cumulative noise impact at the worst identified NSR. No exceedance of cumulative noise level of 75dB(A) would be resulted within the concurrent construction period of both projects.
- 4.10.5 No unacceptable/adverse residual impacts are anticipated during the construction phase.

Operational Phase

- 4.10.6 The major noise generating equipment for operational phases are air blowers, ventilation fans and water pumps. Operational noise prediction is carried out assuming all the noisy equipment would be located outdoor without shielding. The predicted noise levels at identified NSRs exceed the daytime/evening and night time operational noise standard of 49d(B)A and 45dB(A), respectively.
- 4.10.7 However these noisy equipment are designed to be enclosed inside their respective treatment buildings. A reduction of 20dB(A) can be achieved if the building enclosures are built using suitable material such as concrete with surface density of 25kg/m². With the proposed enclosure, the predicted noise levels during operational phase at identified NSRs are reduced and would comply with the operational noise standard during both daytime/evening and night time.
- 4.10.8 No adverse residual operational noise impacts are encountered after implementation of mitigation measures.



PROPOSED PENG CHAU
STW UPGRADE

PROPOSED OUTFALLS

TAI LEI ISLAND

TAI LEI

Motor Transfer Station

PENG LEI ROAD

SEA CREST VILLA

Block 1
Block 2
Block 3

Rocky Area

Stream

LEGEND:



Location of Noise Monitoring Survey

20 0 20 Meter

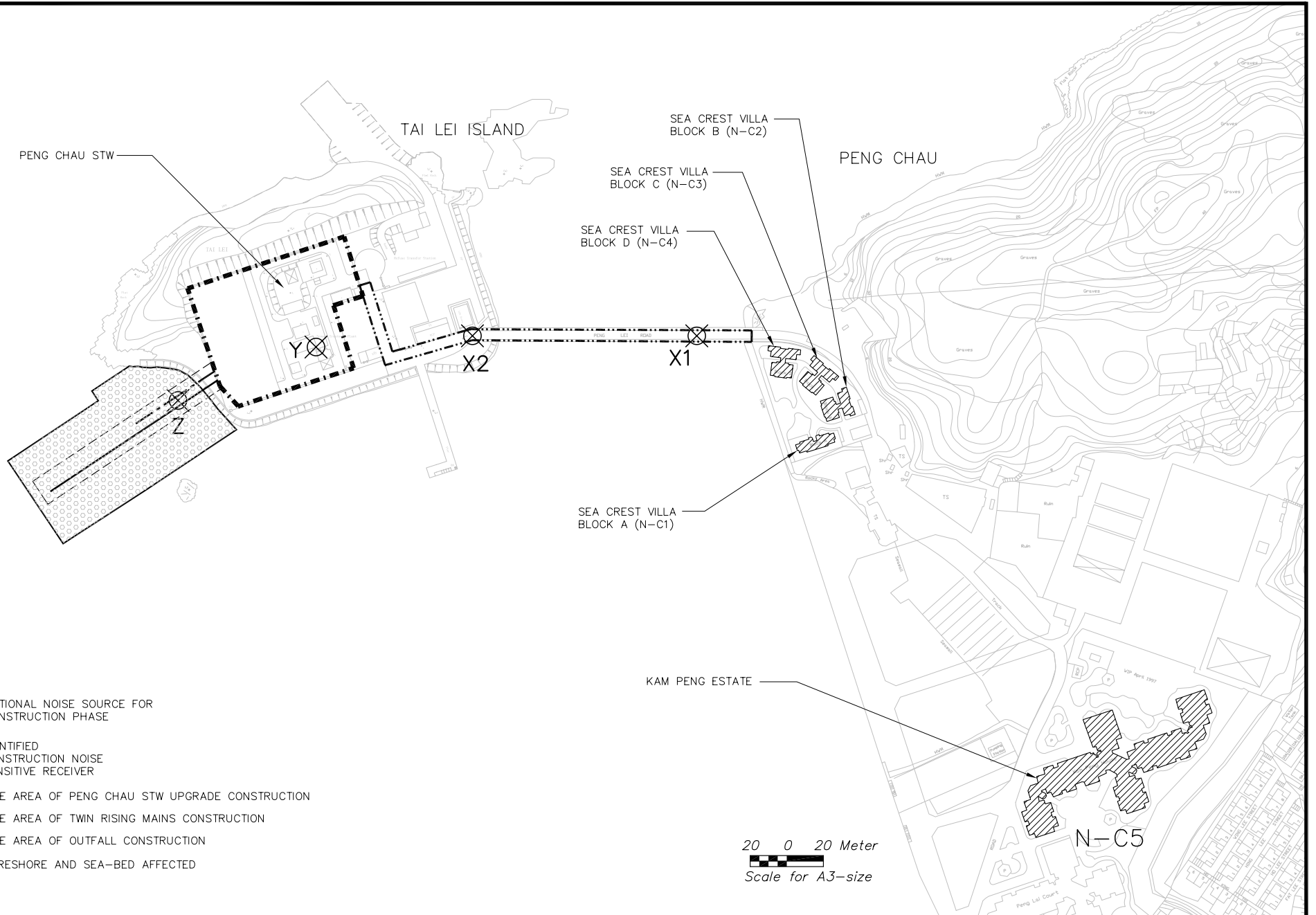
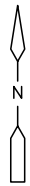


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Figure 4-1

Location of Noise Monitoring at Peng Chau from Project of Infrastructure for Penny's Bay Development



LEGEND:

-  NOTIONAL NOISE SOURCE FOR CONSTRUCTION PHASE
-  IDENTIFIED CONSTRUCTION NOISE SENSITIVE RECEIVER
-  SITE AREA OF PENG CHAU STW UPGRADE CONSTRUCTION
-  SITE AREA OF TWIN RISING MAINS CONSTRUCTION
-  SITE AREA OF OUTFALL CONSTRUCTION
-  FORESHORE AND SEA-BED AFFECTED


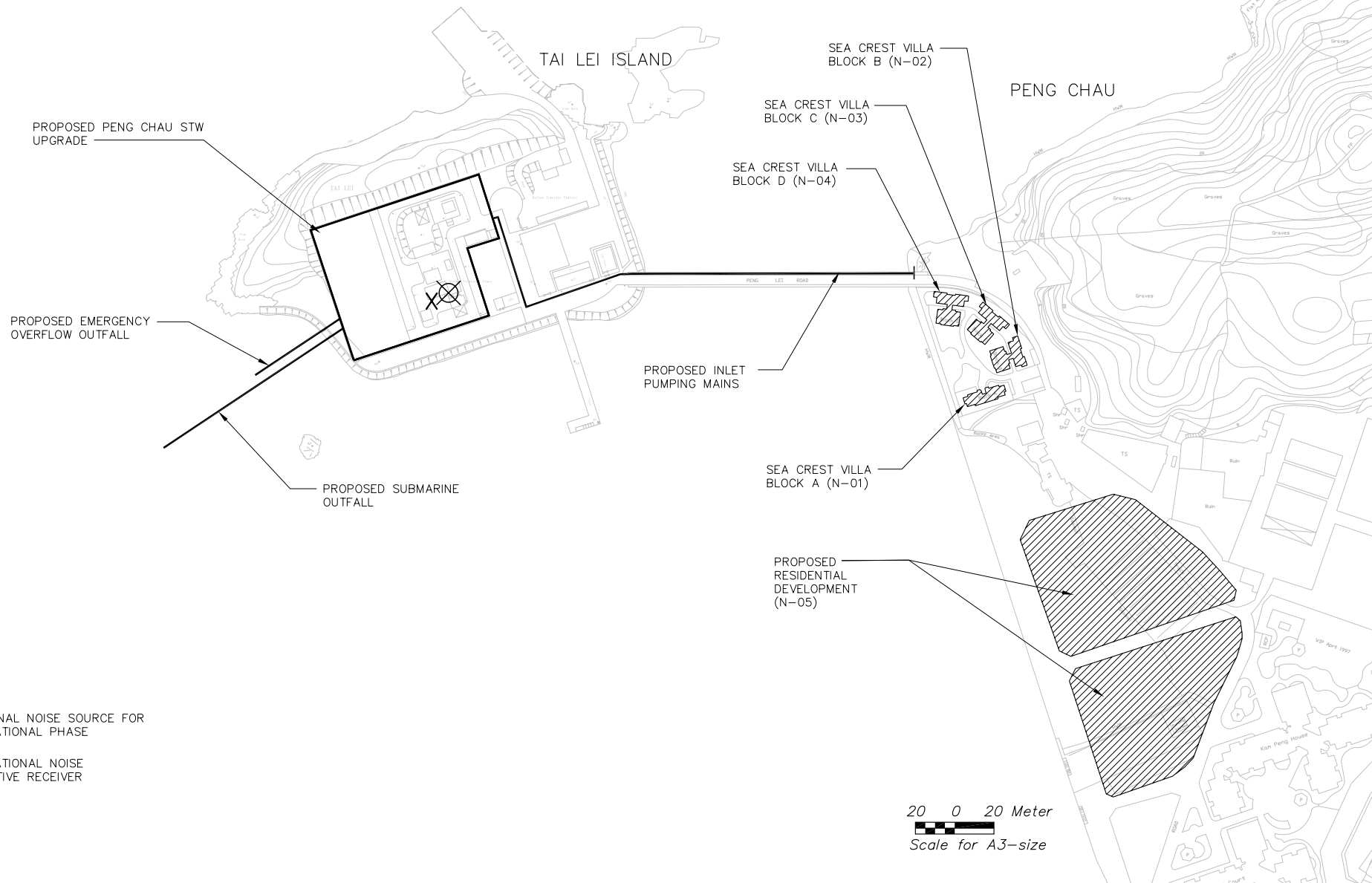
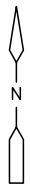
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Figure 4-2
Locations of Identified Noise Sensitive Receivers
(Construction Phase)



LEGEND:



-  NOTIONAL NOISE SOURCE FOR OPERATIONAL PHASE
-  OPERATIONAL NOISE SENSITIVE RECEIVER



Figure 4-3
Locations of Identified Noise Sensitive Receivers
(Operational Phase)