Ocean Park Master Redevelopment Project

EP-249/2006/A – Condition 2.24

Noise Review Study Report

October 2010

Certified by _____ **on** 14-October-10

Lindsay Pickles (ETL)

Verified by Independent Environmental Checker on 19 October 2010
IEC Certificate attached in the submission? Yes

Ocean Park Master Redevelopment Project

Environmental Permit No. EP-249/2006/A - Condition 2.24

Noise Review Study Report

Submitted by ERM-Hong Kong, Limited dated 14-10-2010

This is to verify that

Noise Review Study Report

Submitted by ERM-Hong Kong, Limited

dated 14-10-2010

Has been verified by the undersigned.

Signed

Dr Anne F Kerr
Independent Environmental Checker (IEC)
Retained by Ocean Park Corporation
pursuant to Environmental Permit No. EP-249/2006/A

Date 19 October 2010

FINAL REPORT

Ocean Park Corporation, Hong Kong

Ocean Park Symbio Show:
Noise Review Study

October 2010

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FINAL REPORT

Ocean Park Corporation, Hong Kong

Ocean Park Symbio Show:
Noise Review Study

October 2010

Reference 0111415

For and on behalf of
ERM-Hong Kong, Limited

Approved by: Dr Andrew P Jackson

Signed:

Position: Managing Director

Date: 14 October 2010

CONTENTS

LIST OF ANNEXES

1 INTRODUCTION

1.1 BACKGROUND

Ocean Park Corporation, Hong Kong (OPC) is in the process of redeveloping its educational and recreational attractions as part of the Ocean Park Master Redevelopment Plan (MRP).

An open-air lagoon night show will be hosted at the Aqua City as one of the new attractions at Ocean Park. The most up-to-date layout plan of the lagoon and design drawings of the audio poles and audio speakers are presented in *Annex A*. Detailed description of the show and updated design details are presented in *Section* 2.

The potential environmental impacts of the MRP have been assessed and presented in the Environmental Impact Assessment Report for "*Repositioning and Long Term Operation Plan of Ocean Park*" (Register No. AEIAR-101/2006) (the approved EIA Report), and an Environmental Permit (EP-249/2006) for the MRP was granted on 28 July 2006. EP-249/2006 was replaced by EP-249/2006/A (EP) on 23 October 2006. Under the requirements of Conditions 2.23 and 2.24 of the EP, a noise review study based on the detailed design of fixed plant and noise impacts from the open-air night show in the Aqua City is required.

The show will involve no aerial fireworks and rather proposes to use close proximity theatrical pyrotechnics, produced by Pyrotechnic Special Effects Material (PSEM), that have been developed for indoor use for stage shows and concerts. The use of PSEM was not included in the assessment in the approved EIA Report.

ERM-Hong Kong, Limited (ERM) was appointed by the OPC to prepare the noise review study report based on the most updated detailed design layout and other relevant design details, including the product mix of PSEM, provided by the OPC.

1.2 PURPOSE OF THE REPORT

The objective of this Noise Review Study is to review the potential noise impacts arising from the proposed detailed design updates of the show and the fixed plant items at the Waterfront as compared with those assessed based on a conceptual design and presented in the approved EIA Report. It also provides recommendations as to whether any modification and/or refinement of proposed mitigation measures and monitoring and audit requirements are needed.

2 THE LAGOON NIGHT SHOW

2.1 OVERVIEW OF THE SHOW

The lagoon night show, *Symbio*, is an open-air entertainment event to be hosted at the Aqua City featuring a combination of audio and visual effects.

The duration of the show will be around 10 to 20 minutes. There will only be one show every night, and it will end before 22:00 hours, ie before Ocean Park closes daily.

The show comprises six scenes and is based on the theme of an ancient tale about dragons.

2.2 DESIGN OF THE AUDIO SYSTEM

The principal noise source will be the audio system. The speakers will be mounted on poles and on the ground around the lagoon. There will be a total of 17 nos. of lighting and audio poles, 15 nos. of point source speakers mounted at ground level and 5 nos. of audio support poles (see *Annex A*). Each lighting and audio pole or audio pole will hold 2 to 4 nos. of audio speakers.

The design of the audio system has incorporated the following features that address the recommendations given in the approved EIA Report:

- the audio system will comprise a cluster of low power speakers instead of a few large power speakers;
- the low power speakers will be distributed throughout the spectator area rather than being clustered at one end of the venue or directly pointing to Noise Sensitive Receivers (NSRs), and will be placed around the lagoon, in front of the audience;
- low power directional speakers will be used and oriented to point towards the audience and away from the nearby NSRs; and
- the audio system has been designed to comply with criteria set out in the *Technical Memorandum on Environmental Impact Assessment Process* (*EIAO-TM*), whilst also providing sufficient direct sound when considering the intelligibility of the audio system.

2.3 CHANGES IN DESIGN AS COMPARED WITH THAT OF THE APPROVED EIA REPORT

In accordance with the approved EIA Report, the entertainment noise impact was predicted based on two test scenarios, ie Scenarios A and B with 15 nos. and 5 nos. of speaker clusters in operation, respectively. In this Noise

Review Study, the noise assessment was conducted with the assumption that all speakers will be in use at the same time to represent the worst-case scenario. A comparison of assumptions employed in the approved EIA Report and those in this Noise Review Study is given in *Table 2.3a*. Details of SWLs for each speaker and speaker cluster, and the total SWL of all speakers are given in *Annex B*. The locations of the poles and speakers are shown in *Figure 2.1*.

Table 2.3a ***Comparison of Assumptions made in the Approved EIA Report and this Noise Review Study***

Assumptions	The Approved EIA Report[a]		This Noise Review Study [b]
	Scenario II A	Scenario II B	
Number of speaker clusters	15 nos.	5 nos.	• 17 nos. of lighting and audio poles; • 15 nos. of point source speakers at ground level; and • 5 nos. of audio support poles
Sound power level (SWL) of each speaker cluster	96dB(A)	102dB(A)	• 89dB(A) for each speaker of the lighting and audio pole and audio support pole; and • 88dB(A) for each point source speaker
Total SWL of all speaker clusters	108dB(A)	109dB(A)	108dB(A) [c]
Sound pressure level (SPL) at 9m of each speaker cluster/point source speaker	75dB(A)	75dB(A)	61 - 68dB(A) [c] (see *Annex B*)

Notes:

(a) The assumptions were extracted from Sections 3.61 and 3.65 of the approved EIA Report.

(b) Confirmation has been obtained from the OPC and their show design contractor that the above SWLs for each lighting and audio pole, audio support pole and point source speaker are practical and adequate to ensure the intelligibility of the broadcast and sound effects for audience enjoyment of the show.

(c) The SWL of all speaker clusters is 108dB(A) and SPL of each speaker cluster/point source speaker is in the range of 61 to 68dB(A) at 9 m, which are within the respective limits specified under EP condition 2.23.

2.4 THE USE OF PSEM

As one of the new attractions at the Park, the show will involve the use of PSEM, which was not included in the assessment in the approved EIA Report. The PSEM will be launched from 12 'lily pads' over the lagoon. The locations of the launching points are shown in *Figure 2.2*.

Three types of PSEM will be used: small comets, small mines and small gerbs. Small comets and mines will be used to provide effects at a height of 25 m, while small gerbs will be used to provide effects at a height of 5 m above the lagoon. A maximum total of 90 devices comprising 32 small comets, 40 small mines and 18 small gerbs will be used in the show. The noise data for the PSEM were obtained from PSEM measurements specifically conducted for this Noise Review Study by ERM for OPC on 30 April 2010 in Beihai, China.

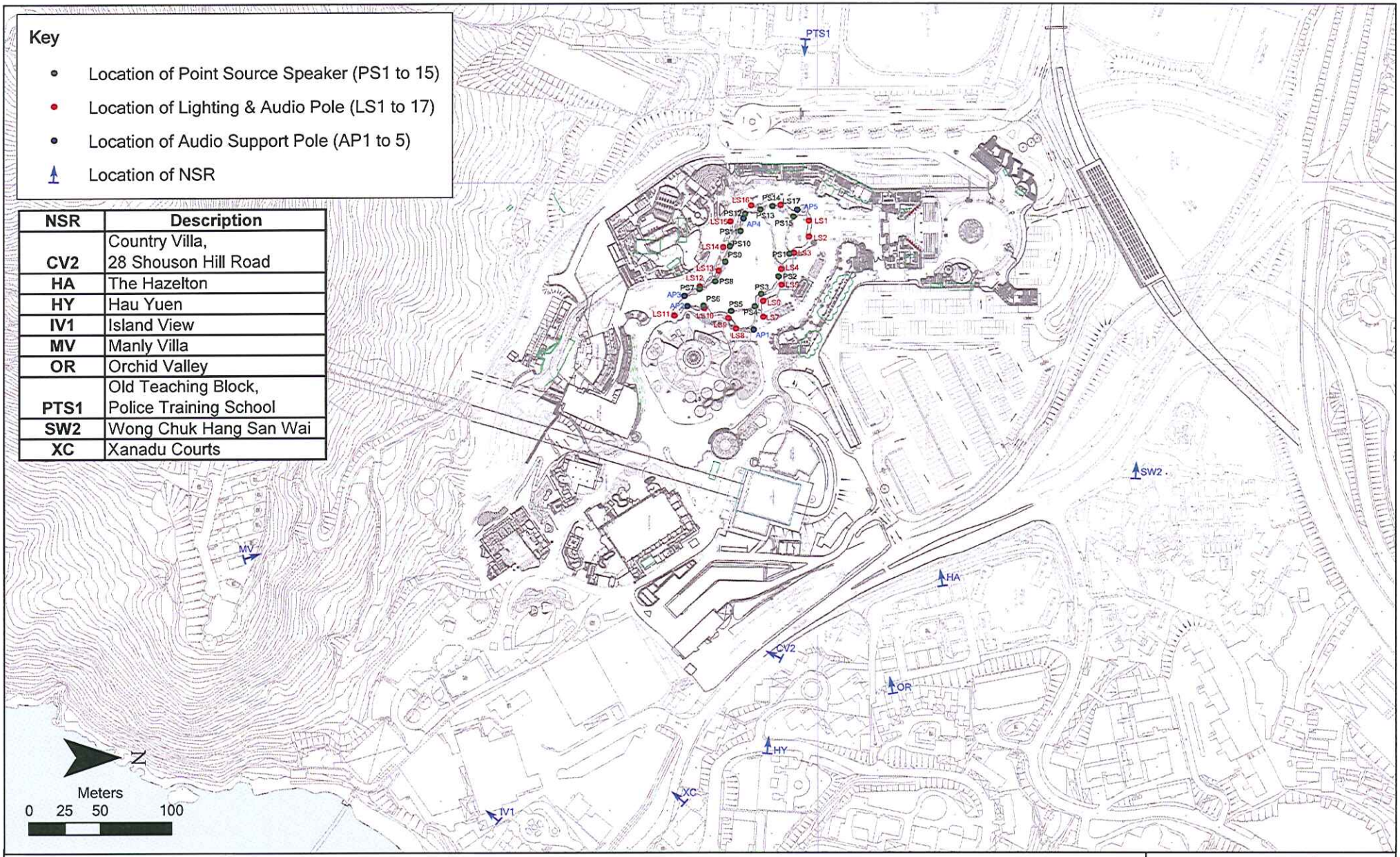

Figure 2.1

Locations of Noise Sensitive Receivers (NSRs) and Noise Sources of the Lagoon Night Show

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Date: 14/05/2010

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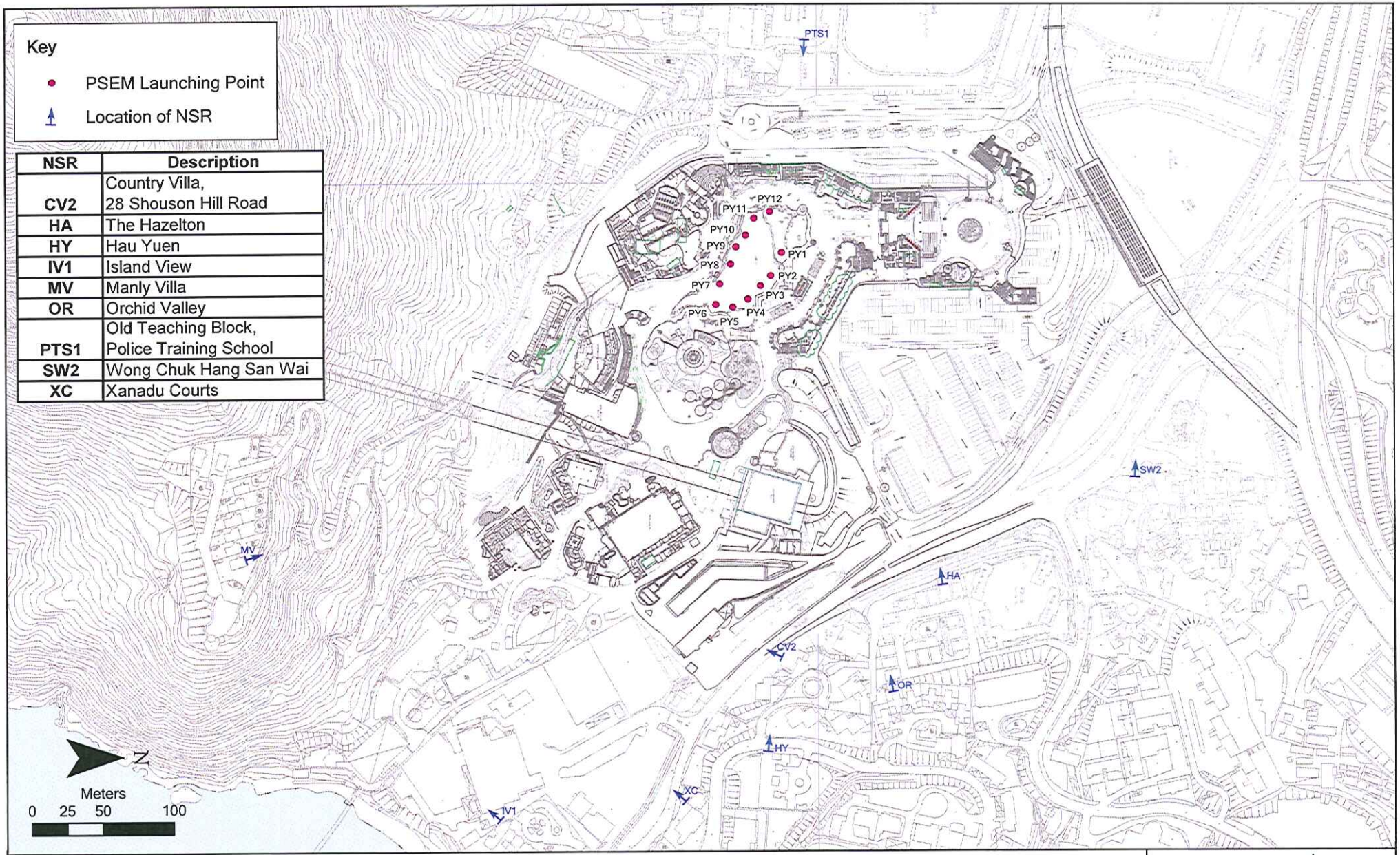

Figure 2.2

Locations of Noise Sensitive Receivers (NSRs) and PSEM Launching Points

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Date: 17/09/2010

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3 FIXED PLANT NOISE IMPACT ASSESSMENT

3.1 IDENTIFIED NOISE SENSITIVE RECEIVERS

In accordance with the approved EIA Report, the identified Noise Sensitive Receivers (NSRs) that may potentially be affected by the show are summarised in *Table 3.1a*. The locations of the identified NSRs are indicated in *Figure 2.1*.

Table 3.1a Identified Noise Sensitive Receivers (NSRs)

NSR	Description	Land use	Existing/Planned NSR	No. of Storey
PTS1	Old Teaching Block, Police Training School	Government /Institution /Community	Existing	4
SW2	Wong Chuk Hang San Wai	Residential	Existing	1
HA	The Hazelton	Residential	Existing	3
CV2	Country Villa, 28 Shouson Hill Road	Residential	Existing	3
XC	Xanadu Courts	Residential	Existing	3
IV1	Island View	Residential	Existing	2
OR	Orchid Valley	Residential	Existing	3
HY	Hau Yuen	Residential	Existing	3
MV	Manly Villa	Residential	Existing	3

3.2 FIXED PLANT NOISE CRITERIA

The *EIAO-TM* and *Technical Memorandum on Noise From Places Other than Domestic Premises, Public Places or Construction Sites* (*IND-TM*) specify the applicable Acceptable Noise Levels (ANLs) for the fixed plant noise impact from the show. The ANLs are dependent on the Area Sensitivity Rating (ASR) and the time of day. The ANLs are presented in *Table 3.2a*.

Table 3.2a ANLs to be used as Fixed Plant Noise Criteria

Time Period	$L_{Aeq, 30min}$ (dB(A))		
	ASR "A"	ASR "B"	ASR "C"
Day-time (ie 07:00-19:00 hrs)	60	65	70
Evening (ie 19:00-23:00 hrs)	60	65	70
Night-time (ie 23:00-07:00 hrs)	50	55	60

Fixed plant noise is controlled under *Section 13* of the *Noise Control Ordinance (NCO)* and the predictions were made in accordance with the *IND-TM*. The noise criteria for planning and design of Designated Projects are set out in the *EIAO-TM* as follows:

- The noise level at the façade of the nearest NSR is at least 5 dB(A) lower than the appropriate ANL (as shown in *Table 3.2a*) as specified in the *IND-TM*; or

- The prevailing background noise level (for quiet areas with a noise level 5 dB(A) below the appropriate ANL).

In accordance with the approved EIA Report, the fixed plant noise criteria, with consideration given to the prevailing background noise levels, for the identified NSRs are presented in *Table 3.2b*.

Table 3.2b *Fixed Plant Noise Criteria*

NSR	Description	Fixed Plant Noise Criteria, dB(A)
PTS1	Old Teaching Block, Police Training School	60
SW2	Wong Chuk Hang San Wai	60
HA	The Hazelton	60
CV2	Country Villa, 28 Shouson Hill Road	60
XC	Xanadu Courts	60
IV1	Island View	60
OR	Orchid Valley	55
HY	Hau Yuen	55
MV	Manly Villa	56

3.3 ASSESSMENT METHODOLOGY

The entertainment noise from the lagoon night show was assessed in this Noise Review Study based on the methodology for fixed plant noise assessment specified in the *IND-TM*. Reference was also made to Appendix 3.5 of the approved EIA Report, with details given in *Annex B1*. Directivity was not taken into account in the assessment in order to represent the worst-case scenario.

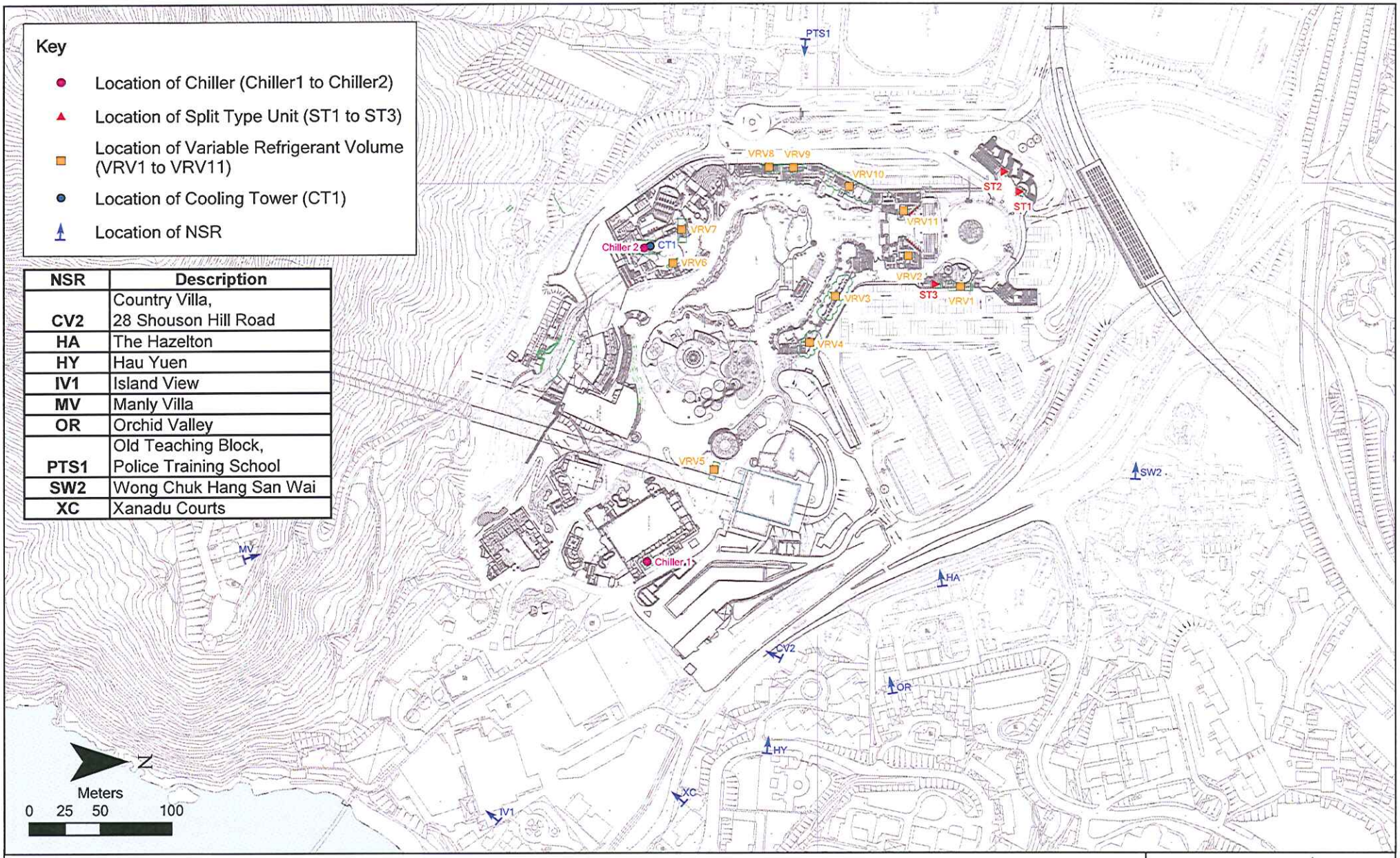
The noise impact due to other fixed plant noise from the Park, ie "Scenario II – During Lagoon Night Show" as presented in Section 3.114 of the approved EIA Report, was updated based on the latest fixed plant inventory. Updated locations of the fixed plant noise sources are shown in *Figure 3.1* and the updated fixed plant inventory is presented in *Annex B4*.

The cumulative impact due to the entertainment noise from the lagoon night show and other fixed plant noise from the Park, ie "Scenario II – During Lagoon Night Show", has been predicted and compared with the fixed plant noise criteria presented in *Table 3.2b*.

3.4 EVALUATION OF IMPACTS

3.4.1 *Entertainment Noise*

With the specified SWLs presented in *Table 2.3a*, the predicted entertainment noise levels from the show are equal to or lower than that predicted for Scenarios II A or B in the approved EIA Report. The predicted noise levels with a comparison with the results from the approved EIA Report are summarised in *Table 3.4a*. Details of calculation are presented in *Annexes B2* and *B3*.



NSR	Description
CV2	Country Villa, 28 Shouson Hill Road
HA	The Hazelton
HY	Hau Yuen
IV1	Island View
MV	Manly Villa
OR	Orchid Valley
PTS1	Old Teaching Block, Police Training School
SW2	Wong Chuk Hang San Wai
XC	Xanadu Courts

Figure 3.1

Locations of Noise Sensitive Receivers (NSRs) and Key Fixed Plant Noise Sources

File: 0111415_NSR_Key Fix Plant.mxd
Date: 15/09/2010

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Table 3.4a *Predicted Entertainment Noise Levels from the Lagoon Night Show*

NSRs	Predicted Entertainment Noise Levels from the Lagoon Night Show, dB(A)		
	Approved EIA Report		This Noise Review Study
	Scenario II A	Scenario II B	
PTS1	52	54	50
SW2	42	42	42
HA	52	52	52
CV2	49	43	43
XC	50	50	50
IV1	49	50	49
OR	49	51	48
HY	50	47	47
MV	51	51	49

3.4.2 *Other Fixed Plant Noise from Ocean Park*

The predicted noise levels due to other fixed plant noise from Ocean Park, ie "Scenario II - During Lagoon Night Show" were also predicted and are presented in *Table 3.4b*. Details of calculation are presented in *Annexes B4* and *B5*.

Table 3.4b *Predicted Fixed Plant Noise Levels during the Lagoon Night Show*

NSRs	Predicted Fixed Plant Noise Levels, dB(A) (Based on updated fixed plant design)	Noise Criteria, dB(A)
PTS1	52	60
SW2	49	60
HA	51	60
CV2	52	60
XC	51	60
IV1	53	60
OR	50	55
HY	51	55
MV	53	56

3.4.3 *Cumulative Impacts*

The cumulative impacts due to the entertainment noise from the lagoon night show and other fixed plant noise from the Park, ie "Scenario II - During Lagoon Night Show", were predicted and the results are presented in *Table 3.4c*.

Table 3.4c *Cumulative Fixed Plant Noise Levels from the Lagoon Night Show and Other Fixed Plant Noise from Ocean Park*

NSRs	Approved EIA Report (Scenario IIB – During Lagoon Night Show)			This Noise Review Study			Noise Criteria, dB(A)
	Fixed Plant Noise Level, dB(A) (1)	Entertainment Noise Level, dB(A) (2)	Cumulative Noise Levels, dB(A) (3)=(1)+(2)	Fixed Plant Noise Level, dB(A) (4)	Entertainment Noise Level, dB(A) (loudspeaker only) (5)	Cumulative Noise Levels, dB(A) (6)=(4)+(5)	
PTS1	51	54	56	52	50	54	60
SW2	49	42	50	49	42	50	60
HA	52	52	55	51	52	55	60
CV2	53	43	53	52	43	53	60
XC	51	50	53	51	50	54	60
IV1	53	50	55	53	49	55	60
OR	51	51	54	50	48	53	55
HY	51	47	52	51	47	53	55
MV	53	51	55	53	49	54	56

Notes:

(a) Noise levels in (1), (2) and (3) were assessed and presented in Table 3.13 for Scenario IIB of the approved EIA Report.

(b) Noise levels in (4) and (5) were assessed based on the updated detailed design layout and other design details provided by OPC.

(c) Noise levels in (6) are the cumulative noise levels calculated by the summation of fixed plant noise levels in (4) and the entertainment noise levels in (5) from this Noise Review Study.

The above results indicate that the cumulative noise levels were in the range of 50 to 55dB(A), which were slightly lower than those presented in the approved EIA Report, ie 50 to 56dB(A).

3.5 RECOMMENDATIONS

Although the predicted results indicate compliance with the relevant noise criteria, it is still recommended that the following mitigation measures proposed in the approved EIA Report be adopted and implemented to ensure noise compliance after the commencement of the lagoon night show:

- upon completion of system installation, sound tests to be witnessed by qualified professionals of Independent Environmental Checker (IEC) should be performed to demonstrate that the audio system will satisfy the acoustic design requirements specified in *Table 2.3a* and *Annex B*;
- good management practices should be in place, including noise monitoring, setting up a complaint hotline, and distributing advance notice to nearby NSRs. It is recommended that good management practices be implemented during both rehearsals and shows; and
- as a fallback option, should non-compliance of *EIAO-TM* noise criteria at the NSRs be identified for the lagoon night show, interim measures (such as turning down/off of music volume) should be implemented before long-

term measures such as redesigning show with no music/lower music volume are in place.

4 PSEM NOISE IMPACT ASSESSMENT

4.1 IDENTIFIED NOISE SENSITIVE RECEIVERS

The representative NSRs identified in *Section 3.1* have also been adopted to assess the potential noise impacts arising from the use of PSEM.

4.2 PSEM NOISE CRITERION

In view of the uniqueness of PSEM display in terms of the impulsive characteristics and the short duration (around 10 to 20 minutes as described in *Section 2.1*), neither the *EIAO-TM* nor any of the other technical memoranda address PSEM noise specifically. It has therefore been necessary to adopt an appropriate limit for PSEM noise, which, if met, would prevent any significant noise impacts from occurring at the identified NSRs.

Reference has been made to the "*Construction of an International Theme Park in Penny's Bay of North Lantau together with its Essential Associated Infrastructures – EIA Report*" (Register No. AEIAR-032/2000) (approved Theme Park EIA Report) in determining the appropriate noise limit for PSEM. In the approved Theme Park EIA Report, an evening noise limit of $L_{eq, 15\ min}$ 55 dB(A) at residential NSRs was adopted for noise from the evening firework displays.

Unlike the North Lantau Theme Park, the Ocean Park show will involve no aerial fireworks and rather proposes to use close proximity theatrical pyrotechnics, produced by Pyrotechnic Special Effects Material (PSEM), that have been developed for indoor use for stage shows and concerts. However, the same noise criterion of $L_{eq, 15\ min}$ 55 dB(A) has been adopted for the PSEM noise impact assessment in this Noise Review for the following reasons:

- neither the EIAO-TM nor any of the other Technical Memoranda address PSEM noise specifically ;
- similar duration of displays in the Theme Park and the Ocean Park; and
- the quietest areas in the vicinity are subject to a prevailing background noise level similar to this noise criterion (In accordance with the approved EIA Report, the measured background noise levels were 55 and 56 dB(A) at Orchid Valley and Manly Villa).

Using the same approach as the approved Theme Park EIA Report, to supplement the equivalent noise level, it is anticipated that the maximum Sound Exposure Level (SEL) of up to approximately 85dB(A) would be perceived at the identified NSRs (*Annex C-1*).

4.3 SOURCE NOISE DATA OF PSEM

As there are no source term data available for the proposed PSEM, data have been obtained based on PSEM measurements specifically conducted for this Noise Review Study by ERM for OPC on 30 April 2010 in Beihai, China.

References have been made to the approved Theme Park EIA Report and the *IND-TM* in developing the noise measurement methodology.

4.3.1 *Instrumentation*

In accordance with *IND-TM* and in order to provide a robust assessment, the sound level meters and sound calibrator employed in the PSEM noise measurement comply with International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1), and IEC 942, respectively.

4.3.2 *Calibration Procedures*

Immediately prior to and following each PSEM noise measurement the accuracy of the sound level meters were checked using the sound calibrator generating a known sound pressure level at a known frequency. Measurements were accepted as valid with the calibration levels recorded before and after the noise measurement agreed to within 1.0 dB.

4.3.3 *Acoustic Environment*

The PSEM noise measurements were carried out in an open area with relatively flat terrain. The measurements were not affected by any extraneous sources and there was no reflection by any building structure.

No noise measurements were made in the presence of fog, rain, or in wind with a steady speed exceeding 5 m/s, or wind with gusts exceeding 10 m/s. A portable wind speed meter was used to check the wind speed during the noise measurements.

Background noise levels were measured in the absence of PSEM and compared to the noise level including the PSEM. The difference is at least 10dB(A) and hence no acoustical measurement is required.

4.3.4 *Measurement Procedures*

Noise levels were measured simultaneously at distances of 10 m, 20 m and 30 m from the launching point. The microphones were placed at a height of 1.2 m above ground surface at free-field condition.

A minimum of four repetitions under equivalent conditions were measured for five types of PSEM, including small mines, small mines with crackling for final note, small comets, small gerbs (1 sec) and small gerbs new (5 sec).

A-weighted sound pressure levels of L_{Aeq}, L_{10}, L_{90}, L_{max}, L_{min} were recorded at 100 ms intervals.

4.3.5 *Results of PSEM Noise Measurements*

The maximum measured SEL obtained from each type of PSEM is summarised in *Table 4.3a*.

Table 4.3a *Measured Maximum SEL for Each Type of PSEM*

Type of PSEM	Maximum Measured SEL, dB(A)	Measurement Distance, m
Small Mines	95	10
Small Mines with crackling for final note	93	31.6
Small Comets	93	10
Small Gerbs (1 sec)	86	10
Small Gerbs New (5 sec)	89	10

Note:
Among all the proposed PSEM to be used for the show, only the small mines with crackling will have some crackling sound when it goes up after launching. However, the dominant noise source is still come from the launching point at low level. All other proposed PSEM, including the mines with crackling, do not have any second burst at high level after launching. To be conservative, slant distance is used for the small mines with crackling.

The product mix of PSEM, which accords strictly with the updated show design details, with the corresponding measured maximum SEL and the launching locations are presented in *Annex C-2*.

4.4 *ASSESSMENT METHODOLOGY*

Reference has been made to the approved Theme Park EIA Report for the assessment methodology. The maximum individual source noise data obtained were used to compute the resultant noise level of the PSEM display. Distance attenuation, barrier correction and façade effect were taken into account in the noise prediction.

4.5 *EVALUATION OF IMPACTS*

It has been demonstrated that the $L_{Aeq,\ 15min}$ 55 dB limit could be met based on the product mix of PSEM (*Annexes C-3* and *C-4*) from the latest show design.

It is noted that noise impact from the PSEM would be at low level, excepting the small mines with crackling for the final note. It is anticipated that noise from the low level PSEM display would be screened off by the proposed building structures surrounding the lagoon at the majority of the identified NSRs. Calculations of the barrier attenuation at the identified NSRs are given in *Annex C-5*.

4.6 *MITIGATION MEASURE*

No exceedance was predicted from the PSEM Noise Review Study, and therefore, no specific mitigation measures for the PSEM display are required. However for the PSEM display, a maximum no. of 4 small mines with crackling with maximum effect height of 25m for the show is recommended.

5 CUMULATIVE NOISE IMPACT FROM FIXED PLANT AND PSEM

5.1 CUMULATIVE NOISE CRITERIA

Despite the uniqueness of PSEM display in terms of the impulsive characteristics and the short duration, the cumulative noise impacts at the NSRs due to the operation of fixed plant (lagoon night show and other fixed plant noise from Ocean Park) and PSEM were reviewed in accordance with the fixed plant noise criteria as presented in the approved EIA Report and *Table 3.2b*.

5.2 EVALUATION OF IMPACTS

The cumulative noise levels at the NSRs were assessed based on the results of fixed plant noise impact assessment and PSEM noise impact assessment, which were presented in *Sections 3* and *4*, respectively. Results indicate that the cumulative noise levels comply with the fixed plant noise criteria as presented in the approved EIA Report and *Table 3.2b* (see *Table 5.1* and *Annex D*).

Table 5.1 ***Cumulative Noise Levels from the Fixed Plant (Lagoon Night Show and Other Fixed Plant Noise from Ocean Park) and PSEM***

NSRs	Approved EIA Report	This Noise Review Study			Noise Criteria, dB(A)
	Cumulative Noise Levels, dB(A) (1)	Fixed Plant Noise Levels, dB(A) (2)	PSEM Noise Levels, dB(A) (3)	Cumulative Noise Levels, dB(A) (4)=(2)+(3)	
PTS1	56	54	48	55	60
SW2	50	50	44	51	60
HA	55	55	52	57	60
CV2	53	53	46	54	60
XC	53	54	50	55	60
IV1	55	55	49	56	60
OR	54	53	52	55	55
HY	52	53	50	54	55
MV	55	55	52	56	56

Notes:

(1) Noise levels were extracted from Table 3.13 for Scenario IIB of the approved EIA Report.

(2) Noise levels refer to the cumulative fixed noise levels presented in *Table 3.4c*.

(3) Noise levels refer to the PSEM noise levels converted to $L_{Aeq, 30min}$ as presented in *Annex D*.

(4) Cumulative noise levels calculated by the summation of fixed plant noise levels in (2) and the PSEM noise levels in (3).

6 *ENVIRONMENTAL MONITORING AND AUDIT (EM&A) REQUIREMENT*

In accordance with the approved EIA Report, operational phase noise monitoring was recommended to be undertaken during the lagoon night show at the Aqua City as well as at times when the show is not operating (ie other noise due to the operation of the Park) as part of the EM&A programme to ensure compliance with the noise criteria. Details of the EM&A programme were provided in the EM&A Manual that form part of the approved documentation on the EIAO Register.

7 *CONCLUSION*

With the most up-to-date design of the audio system and the updated fixed plant noise design, the cumulative noise levels due to the entertainment noise and fixed plant noise are predicted to comply with the *EIAO-TM* noise criteria. No adverse noise impact is anticipated at the NSRs and no mitigation measures are required.

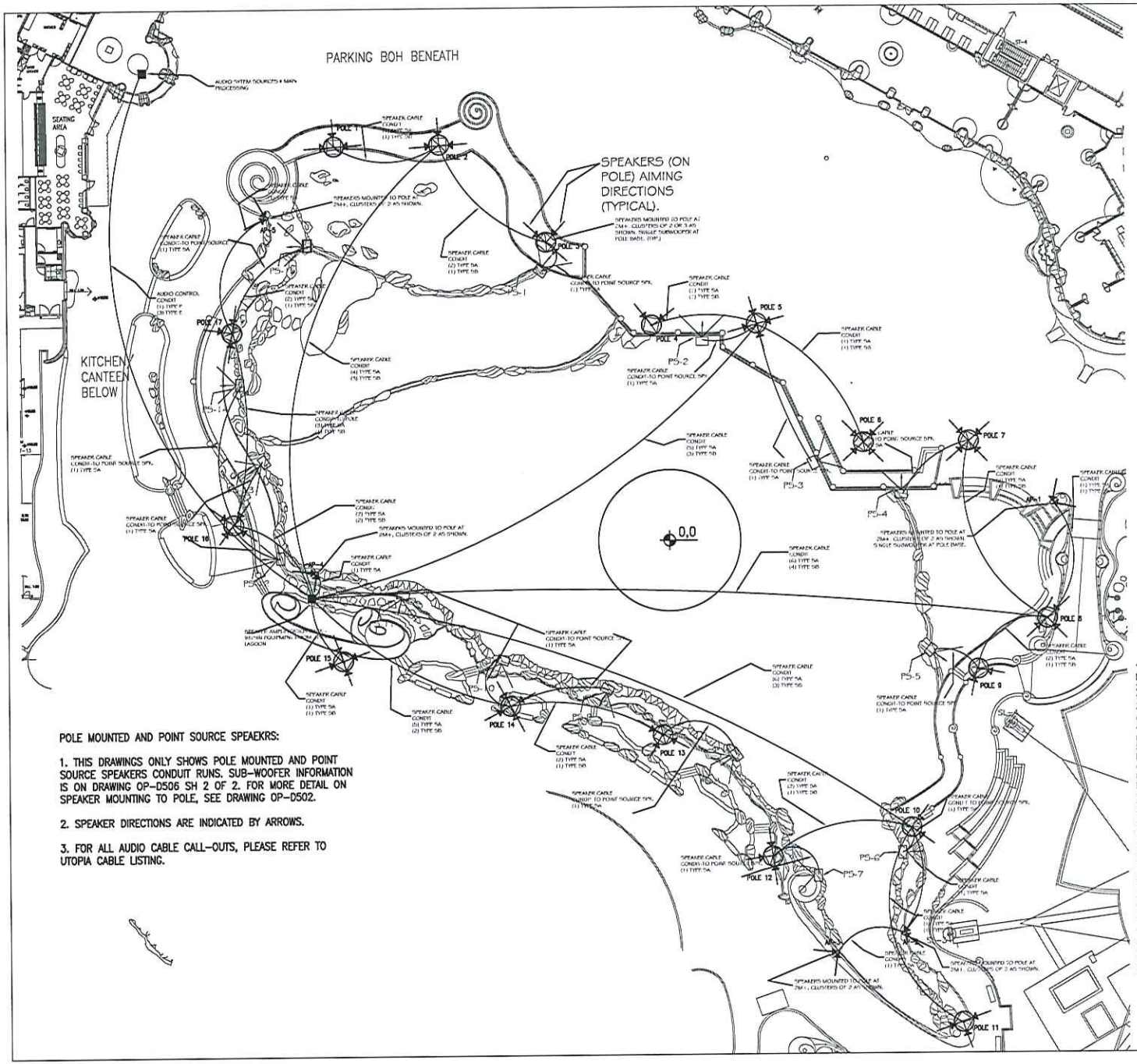
The noise impacts associated with the use of PSEM were assessed based on the show design and the measured maximum SEL of the PSEM. The results indicate that the noise levels at all NSRs would comply with the noise criterion of $L_{Aeq,\ 15\ min}$ 55 dB, and hence no mitigation is required.

While the cumulative noise levels due to the fixed plant noise, and the entertainment noise from lagoon night show and the PSEM display also comply with the *EIAO-TM* noise criteria.

It is recommended that noise monitoring be undertaken in accordance with the approved EIA Report and the EM&A programme provided in the EM&A Manual that form part of the approved documentation on the EIAO Register.

Annex A

Updated Design Layout Plans and Drawings



POLE MOUNTED AND POINT SOURCE SPEAKERS:

1. THIS DRAWINGS ONLY SHOWS POLE MOUNTED AND POINT SOURCE SPEAKERS CONDUIT RUNS. SUB-WOOFER INFORMATION IS ON DRAWING OP-D506 SH 2 OF 2. FOR MORE DETAIL ON SPEAKER MOUNTING TO POLE, SEE DRAWING OP-D502.

2. SPEAKER DIRECTIONS ARE INDICATED BY ARROWS.

3. FOR ALL AUDIO CABLE CALL-OUTS, PLEASE REFER TO UTOPIA CABLE LISTING.

LEGEND

- SPEAKERS MOUNTED TO POLE, NUMBER OF SPEAKERS VARIES AS INDICATED PER PLAN
- POINT SOURCE SPEAKER MOUNTING HEIGHT – 1M AFF
- AUDIO CONTROL

SPEAKER QTY.

All light poles and AP-1 have 1 subwoofer plus these quantities on the pole:

Pole 1 = 3
Pole 2 = 3
Pole 3 = 3
Pole 4 = 2
Pole 5 = 4
Pole 6 = 4
Pole 7 = 4
Pole 8 = 3
Pole 9 = 2
Pole 10 = 2
Pole 11 = 3
Pole 12 = 3
Pole 13 = 3
Pole 14 = 4
Pole 15 = 4
Pole 16 = 4
pole 17 = 3
AP-1 = 3
AP-2 = 2
AP-3 = 2
AP-4 = 2
AP-5 = 2

WIRETYPES

TYPE SA = Belden 5000FE speaker
TYPE SB = Belden 5T00UP speaker
TYPE D = Belden 3074F DMX
TYPE F = Belden B9B510T fiber
TYPE E = Belden 7923A ethernet

GENERAL NOTES

1. All field conduit stub ups into base of lighting pole.
2. All equipment room conduit stub ladder tray above equipment racks.
3. All field cabling to have 3 meter tails after reaching it's destination equipment.
4. All equipment room cabling to have 6 meter tails above end of conduit.
5. All cabling to have unique numeric labeling and as-installed drawing corresponding to cable numbers.
6. All conduit to be sized according to local Hong Kong electrical code for the type, quantity and size of conduit fill as indicated on this drawing.
7. No cable splices permitted within conduit or on cable tails. Only continuous run cable from end to end.
8. Maintain minimum bend radious as specified in specification documents for all lighting cables, fiber optic cables and ethernet cables.
9. Use only specified cable manufacturer and model unless otherwise approved in writing by the technical representative from Utopia Entertainment.
10. Poles 1 through 17 and AP-1 through AP-5 have JBL Control 30 speakers on them. Poles 1 through 17 have 1 JBL SB-210 subwoofer near the base. AP-1 has 1 JBL SB-210 subwoofer near the base.

GRAPHIC SCALE: 1:200

0 1M 5M 10M

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REV.	DESCRIPTION	P.E.	DATE
1	SHOW FACILITY INPUT DRAWING	-	11/08

香港海洋公園
OCEAN PARK HONG KONG

OCEAN PARK REDEVELOPMENT

CONTRACT NO. 0000XX
AQUA CITY – SYMBIO LAGOON SHOW

SITE PLAN
SPEAKER CONDUIT

SCALE	DATE
1:200	12.08.2008
DRAWN BY: S.P.	CHECKED BY: D.K.

PREPARED BY: RAW MEDIA TECHNOLOGIES

CONSULTANT:
UTOPIA ENTERTAINMENT, INC.
23638 LYONS AVE., SUITE 437
NEWHALL, CA 91321 USA
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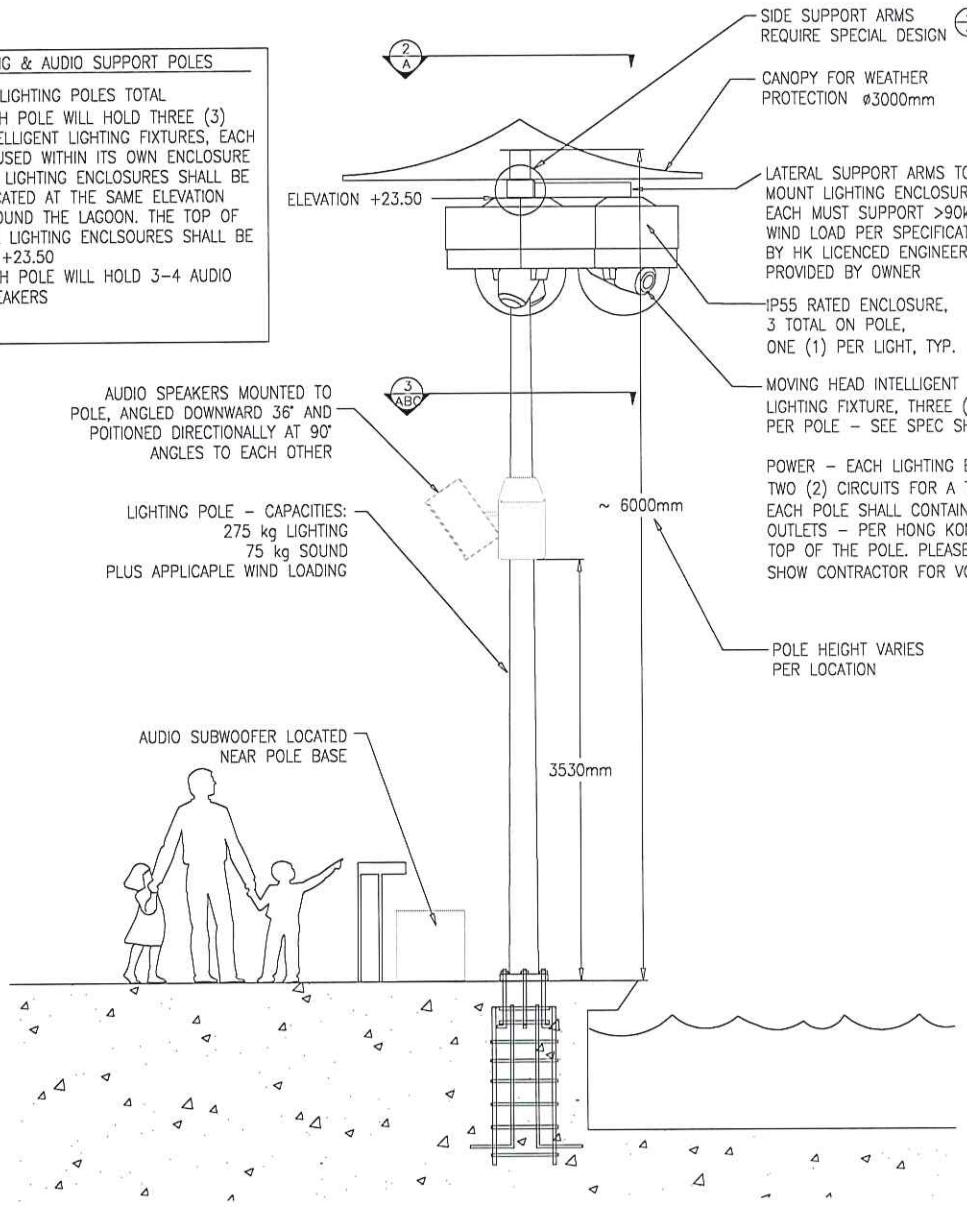
DRG. NO. OP-D506 - SH.1 OF 2 | REV. 5

LIGHTING & AUDIO SUPPORT POLES

- 17 LIGHTING POLES TOTAL
- EACH POLE WILL HOLD THREE (3) INTELLIGENT LIGHTING FIXTURES, EACH HOUSED WITHIN ITS OWN ENCLOSURE
- ALL LIGHTING ENCLOSURES SHALL BE LOCATED AT THE SAME ELEVATION AROUND THE LAGOON. THE TOP OF ALL LIGHTING ENCLSOURES SHALL BE AT +23.50
- EACH POLE WILL HOLD 3-4 AUDIO SPEAKERS



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REV.	DESCRIPTION	P.E.	DATE
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OCEAN PARK REDEVELOPMENT

CONTRACT NO. 210032
AQUA CITY - SYMBIO LAGOON SHOW

LIGHTING AND AUDIO
FUNCTIONAL REQUIREMENT

SCALE	DATE
1:20	23JUL2020
DRAWN BY: S.P.	CHECKED BY: B.K.

PREPARED BY
ZAM MEDIA TECHNOLOGIES

CONSULTANT
UTOPIA ENTERTAINMENT, INC.
23638 LYONS AVE., SUITE 437
NEWHALL, CA 91321 USA
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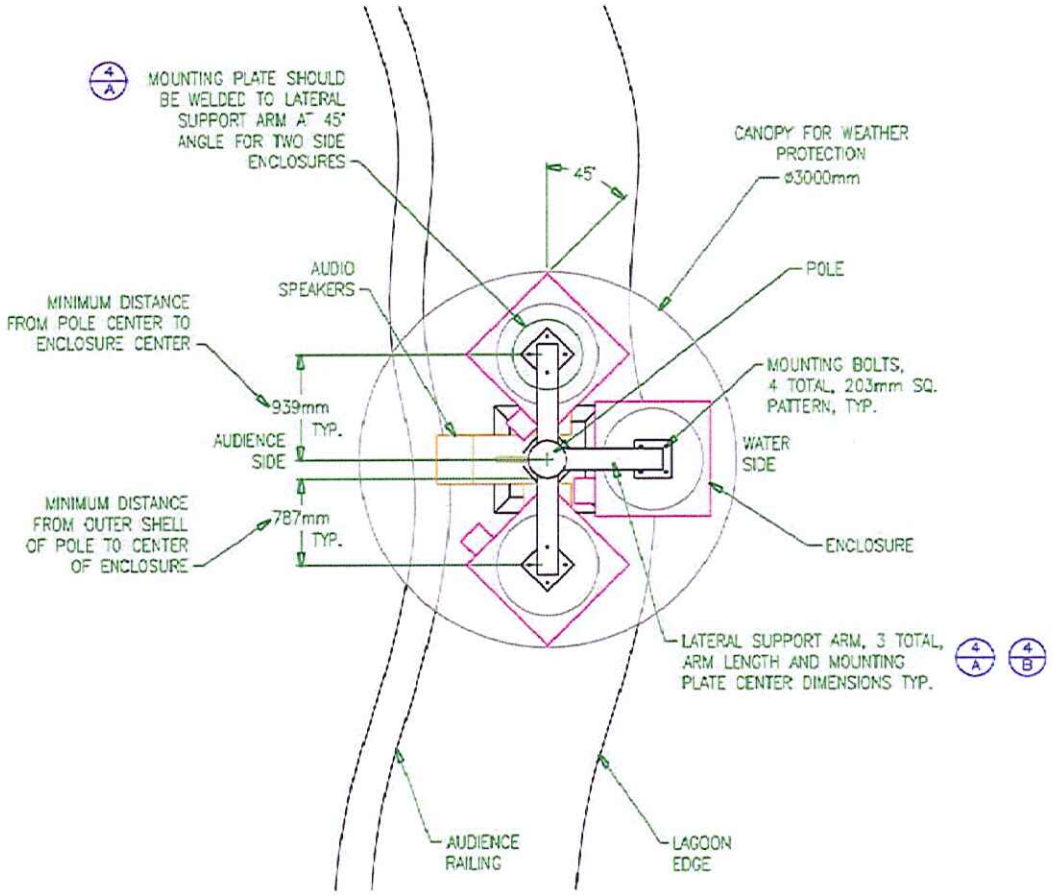
DWG. NO. OP-0502 - SH 1 OF 5 REV. G



LIGHT ENCLOSURE ORIENTATION - PLAN VIEW 2/A

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REV.	DESCRIPTION	P.E.	DATE
-	SHOW FACILITY INPUT DRAWING	-	-

香港海洋公園
OCEAN PARK HONG KONG

OCEAN PARK REDEVELOPMENT

CONTRACT NO. 230202
AQUA CITY – SYMBIO LAGOON SHOW

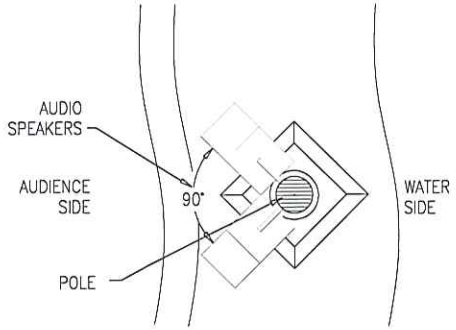
LIGHTING AND AUDIO
FUNCTIONAL REQUIEMENT

SCALE	DATE
1:20	22/03/2023
DRAWN BY: S.P.	CHECKED BY: B.K.

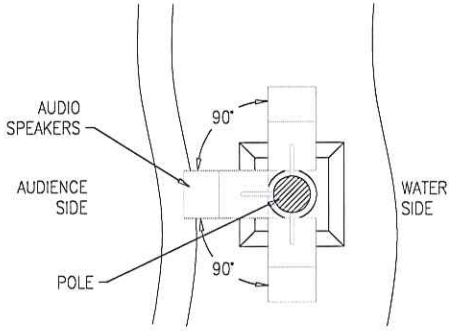
PREPARED BY
DAN MEDIA TECHNOLOGIES

CONSULTANT
UTOPIA ENTERTAINMENT, INC.
23638 LYONS AVE., SUITE 437
NEWHALL, CA 91321, USA
"JUST IMAGINE!"

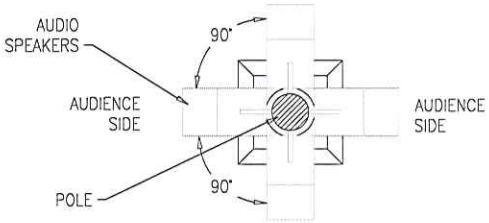
DRG. NO. DP-0502 - SH 2 OF 5 REV. G



2 SPEAKER ORIENTATION - PLAN VIEW (3/A)



3 SPEAKER ORIENTATION - PLAN VIEW (3/B)



4 SPEAKER ORIENTATION - PLAN VIEW (3/C)

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REV.	DESCRIPTION	P.E.	DATE
-	SHOW FACILITY INPUT DRAWING	-	-

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OCEAN PARK REDEVELOPMENT

CONTRACT NO. [illegible]
AQUA CITY – SYMBIO LAGOON SHOW

LIGHTING AND AUDIO
FUNCTIONAL REQUIEMENT

SCALE	DATE
1:20	[illegible]
DRAWN BY: S.P.	CHECKED BY: B.K.

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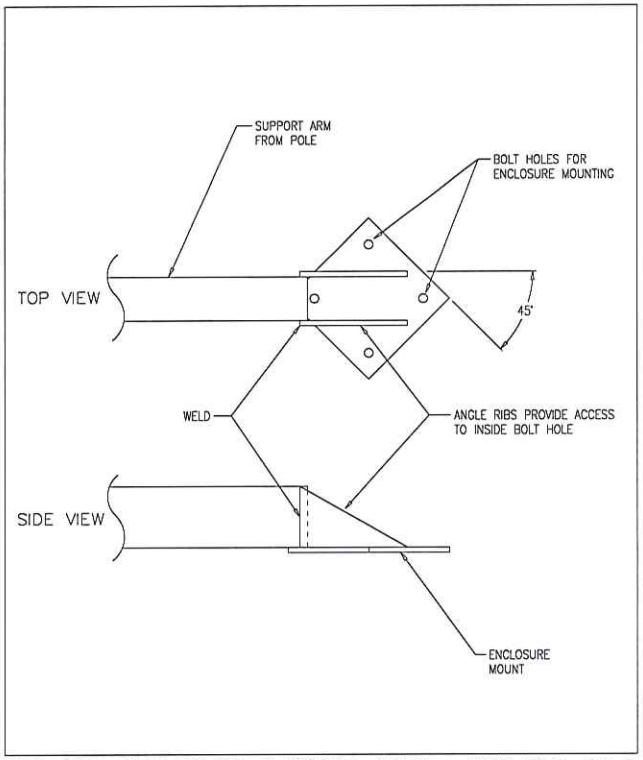
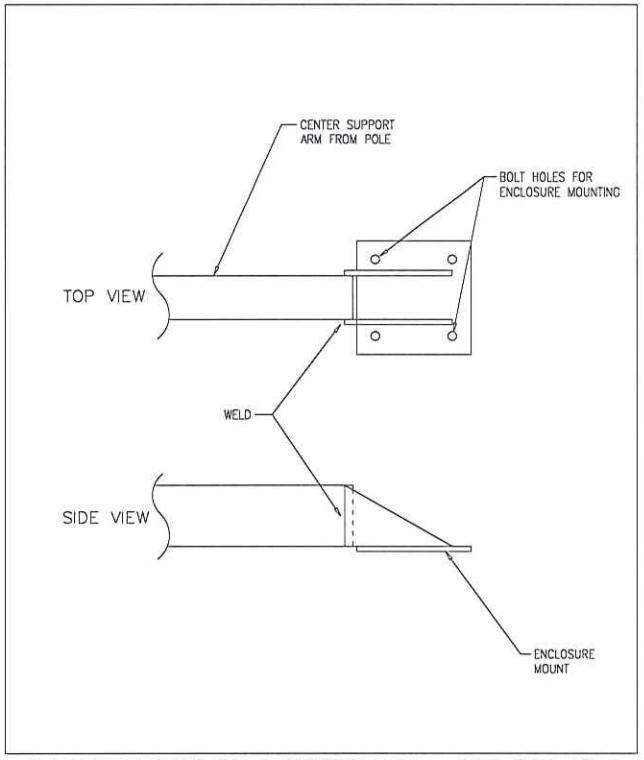
DRG. NO. DP-0502 - SH 3 OF 5 | REV. 6



TWO SIDE ENCLOSURE SUPPORT ARMS - TWO PER POLE

CONCEPT ONLY - NOT FOR CONSTRUCTION

SUGGESTED ANGLED SUPPORT ARM DESIGN 4/A



CENTER ENCLOSURE SUPPORT ARM - ONE PER POLE

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SUGGESTED CENTRAL SUPPORT ARM DESIGN 4/B

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-	SHOW FACILITY INPUT DRAWING	-	-
REV.	DESCRIPTION	P.E.	DATE

香港海洋公園 OCEAN PARK HONG KONG

OCEAN PARK REDEVELOPMENT

CONTRACT NO. 2110232
AQUA CITY – SYMBIO LAGOON SHOW

LIGHTING AND AUDIO
FUNCTIONAL REQUIREMENT

SCALE	DATE
1:20	23.JULY.2021
DRAWN BY	CHECKED BY
S.P.	D.K.

PREPARED BY
RAM MEDIA TECHNOLOGIES

CONSULTANT
UTOPIA ENTERTAINMENT, INC.
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NEWHALL, CA 91321 USA
"JUST IMAGINE!"

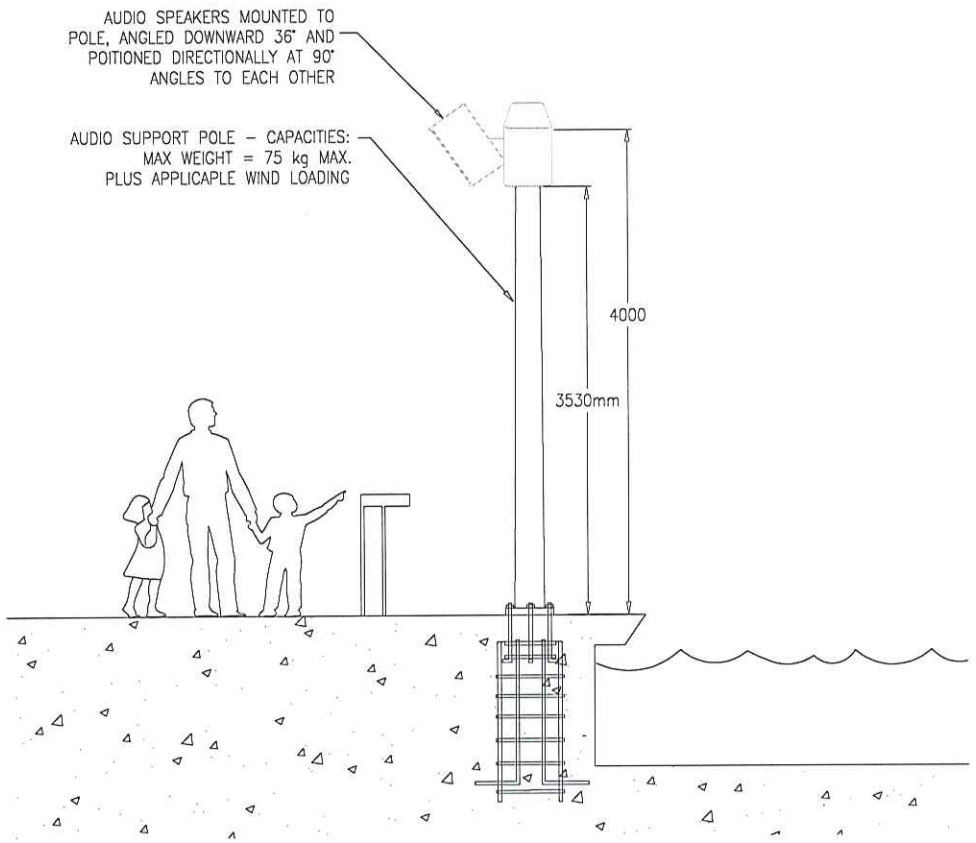
DRG. NO. DP-0502 - SH 4 OF 5

REV. G

CONCEPT ONLY - NOT FOR CONSTRUCTION

AUDIO SUPPORT POLES

- 5 AUDIO ONLY POLES TOTAL
- EACH POLE WILL HOLD 2-3 AUDIO SPEAKERS



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OCEAN PARK HONG KONG

OCEAN PARK REDEVELOPMENT

CONTRACT NO. [illegible]
AQUA CITY - SYMBIO LAGOON SHOW

AUDIO SUPPORT POLE - "AUDIO ONLY"
FUNCTIONAL REQUIEMENT

SCALE	DATE
1:N	[illegible]
DRAWN BY	CHECKED BY
S.P.	D.K.

PREPARED BY
[illegible] MEDIA TECHNOLOGIES

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DRG. NO. DP-0502 - SH 5 OF 5 | REV. G

Annex B

Fixed Plant Noise Impact Assessment (Lagoon Night Show and Other Fixed Plant Noise from Ocean Park)

Annex B-1

Sound Power Levels of Noise Sources (Fixed Plant Noise Items from Lagoon Night Show)

NSRs	Sound Power Level (SWL) of each speaker, dB(A)	No. of Speaker	Total Sound Power Level (SWL) from each pole/point source speaker, dB(A)	Sound Pressure Level (SPL) at 9m away from each pole/point source speaker, dB(A)
LS1	89	3	93.8	66.7
LS2	89	3	93.8	66.7
LS3	89	3	93.8	66.7
LS4	89	2	92.0	64.9
LS5	89	4	95.0	67.9
LS6	89	4	95.0	67.9
LS7	89	4	95.0	67.9
LS8	89	3	93.8	66.7
LS9	89	2	92.0	64.9
LS10	89	2	92.0	64.9
LS11	89	3	93.8	66.7
LS12	89	3	93.8	66.7
LS13	89	3	93.8	66.7
LS14	89	4	95.0	67.9
LS15	89	4	95.0	67.9
LS16	89	4	95.0	67.9
LS17	89	3	93.8	66.7
PS1	88	1	88.0	60.9
PS2	88	1	88.0	60.9
PS3	88	1	88.0	60.9
PS4	88	1	88.0	60.9
PS5	88	1	88.0	60.9
PS6	88	1	88.0	60.9
PS7	88	1	88.0	60.9
PS8	88	1	88.0	60.9
PS9	88	1	88.0	60.9
PS10	88	1	88.0	60.9
PS11	88	1	88.0	60.9
PS12	88	1	88.0	60.9
PS13	88	1	88.0	60.9
PS14	88	1	88.0	60.9
PS15	88	1	88.0	60.9
AP1	89	3	93.8	66.7
AP2	89	2	92.0	64.9
AP3	89	2	92.0	64.9
AP4	89	2	92.0	64.9
AP5	89	2	92.0	64.9
		Total SWL	107.9	

Notes:

LS	Lighting & audio pole, each will hold 2 to 4 nos. of speakers.
PS	Point source speaker
AP	Audio support pole, each will hold 2 to 3 nos. of speakers

Annex B-2

Fixed Plant Noise Prediction (Fixed Plant Noise Items from Lagoon Night Show)

NSR PTS1

Noise Source	Soud Power Level (SWL), dB(A)	Distance (m)	Correction, dB(A)			Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Façade	
LS1	93.8	129	-50	-14	3	32
LS2	93.8	140	-51	-13	3	33
LS3	93.8	152	-52	-12	3	33
LS4	92.0	164	-52	-12	3	31
LS5	95.0	175	-53	-11	3	34
LS6	95.0	188	-53	-11	3	34
LS7	95.0	199	-54	-11	3	34
LS8	93.8	211	-54	-6	3	37
LS9	92.0	205	-54	-6	3	35
LS10	92.0	204	-54	-6	3	35
LS11	93.8	217	-55	-5	3	37
LS12	93.8	191	-54	-6	3	37
LS13	93.8	175	-53	-6	3	38
LS14	95.0	159	-52	-6	3	40
LS15	95.0	140	-51	-7	3	40
LS16	95.0	124	-50	-8	3	41
LS17	93.8	119	-50	-15	3	32
PS1	88.0	153	-52	-14	3	25
PS2	88.0	169	-53	-13	3	25
PS3	88.0	183	-53	-12	3	25
PS4	88.0	193	-54	-12	3	25
PS5	88.0	200	-54	-7	3	30
PS6	88.0	202	-54	-7	3	30
PS7	88.0	192	-54	-7	3	30
PS8	88.0	183	-53	-8	3	30
PS9	88.0	168	-52	-8	3	30
PS10	88.0	156	-52	-9	3	30
PS11	88.0	144	-51	-9	3	30
PS12	88.0	131	-50	-10	3	30
PS13	88.0	125	-50	-11	3	30
PS14	88.0	121	-50	-14	3	28
PS15	88.0	126	-50	-16	3	25
AP1	93.8	209	-54	-6	3	37
AP2	92.0	207	-54	-6	3	35
AP3	92.0	201	-54	-6	3	35
AP4	92.0	134	-51	-7	3	37
AP5	92.0	122	-50	-15	3	31
					Total SPL	**50**

NSR	SW2					
Noise Source	Soud Power Level (SWL), dB(A)	Distance (m)	Correction, dB(A)			Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Façade	
LS1	93.8	296	-57	-11	3	28
LS2	93.8	289	-57	-13	3	27
LS3	93.8	291	-57	-12	3	27
LS4	92.0	293	-57	-12	3	26
LS5	95.0	287	-57	-13	3	28
LS6	95.0	293	-57	-12	3	29
LS7	95.0	288	-57	-13	3	27
LS8	93.8	303	-58	-11	3	28
LS9	92.0	311	-58	-11	3	26
LS10	92.0	329	-58	-10	3	27
LS11	93.8	347	-59	-8	3	30
LS12	93.8	338	-59	-9	3	30
LS13	93.8	331	-58	-9	3	30
LS14	95.0	336	-59	-9	3	31
LS15	95.0	341	-59	-8	3	31
LS16	95.0	335	-59	-9	3	31
LS17	93.8	319	-58	-10	3	29
PS1	88.0	293	-57	-15	3	19
PS2	88.0	292	-57	-14	3	19
PS3	88.0	297	-57	-15	3	19
PS4	88.0	297	-57	-16	3	18
PS5	88.0	311	-58	-14	3	20
PS6	88.0	331	-58	-12	3	21
PS7	88.0	338	-59	-11	3	22
PS8	88.0	330	-58	-11	3	22
PS9	88.0	330	-58	-11	3	22
PS10	88.0	332	-58	-11	3	22
PS11	88.0	331	-58	-11	3	22
PS12	88.0	335	-59	-11	3	22
PS13	88.0	328	-58	-11	3	22
PS14	88.0	323	-58	-11	3	21
PS15	88.0	306	-58	-13	3	21
AP1	93.8	292	-57	-14	3	25
AP2	92.0	341	-59	-9	3	28
AP3	92.0	345	-59	-9	3	28
AP4	92.0	335	-58	-9	3	28
AP5	92.0	307	-58	-11	3	26
					Total SPL	**42**

NSR HA

Noise Source	Soud Power Level (SWL), dB(A)	Distance (m)	Correction, dB(A)			Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Façade	
LS1	93.8	277	-57	-8	3	32
LS2	93.8	266	-56	-9	3	32
LS3	93.8	259	-56	-8	3	33
LS4	92.0	253	-56	-8	3	31
LS5	95.0	243	-56	-9	3	33
LS6	95.0	240	-56	-10	3	32
LS7	95.0	230	-55	0	3	43
LS8	93.8	235	-55	0	3	41
LS9	92.0	244	-56	0	3	39
LS10	92.0	260	-56	-5	3	34
LS11	93.8	271	-57	-5	3	35
LS12	93.8	274	-57	0	3	40
LS13	93.8	275	-57	0	3	40
LS14	95.0	287	-57	-5	3	36
LS15	95.0	300	-58	-5	3	36
LS16	95.0	303	-58	-5	3	36
LS17	93.8	294	-57	-5	3	34
PS1	88.0	260	-56	-10	3	24
PS2	88.0	250	-56	-11	3	24
PS3	88.0	245	-56	-14	3	21
PS4	88.0	240	-56	0	3	35
PS5	88.0	247	-56	0	3	35
PS6	88.0	262	-56	0	3	35
PS7	88.0	273	-57	0	3	34
PS8	88.0	270	-57	0	3	34
PS9	88.0	278	-57	0	3	34
PS10	88.0	285	-57	-7	3	27
PS11	88.0	290	-57	-6	3	28
PS12	88.0	300	-58	-6	3	28
PS13	88.0	297	-57	-6	3	28
PS14	88.0	296	-57	-6	3	27
PS15	88.0	283	-57	-8	3	26
AP1	93.8	227	-55	0	3	42
AP2	92.0	269	-57	0	3	38
AP3	92.0	275	-57	0	3	38
AP4	92.0	298	-57	-5	3	33
AP5	92.0	286	-57	-6	3	32
					Total SPL	**52**

NSR OR

Noise Source	Soud Power Level (SWL), dB(A)	Distance (m)	Correction, dB(A)			Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Façade	
LS1	93.8	342	-59	-5	3	33
LS2	93.8	331	-58	-5	3	33
LS3	93.8	322	-58	-5	3	34
LS4	92.0	313	-58	-5	3	32
LS5	95.0	302	-58	-6	3	34
LS6	95.0	295	-57	-7	3	33
LS7	95.0	284	-57	-5	3	36
LS8	93.8	284	-57	-5	3	35
LS9	92.0	293	-57	-5	3	33
LS10	92.0	306	-58	-5	3	33
LS11	93.8	311	-58	-6	3	33
LS12	93.8	321	-58	-4	3	34
LS13	93.8	326	-58	-4	3	34
LS14	95.0	340	-59	-4	3	36
LS15	95.0	356	-59	-3	3	36
LS16	95.0	362	-59	-5	3	34
LS17	93.8	357	-59	-5	3	33
PS1	88.0	322	-58	-7	3	26
PS2	88.0	309	-58	-7	3	26
PS3	88.0	300	-58	-10	3	23
PS4	88.0	294	-57	-5	3	29
PS5	88.0	297	-57	-5	3	29
PS6	88.0	308	-58	-5	3	28
PS7	88.0	320	-58	-5	3	28
PS8	88.0	320	-58	-5	3	28
PS9	88.0	331	-58	-5	3	28
PS10	88.0	340	-59	-5	3	28
PS11	88.0	347	-59	0	3	32
PS12	88.0	358	-59	-5	3	27
PS13	88.0	358	-59	-5	3	27
PS14	88.0	358	-59	-5	3	27
PS15	88.0	348	-59	-5	3	27
AP1	93.8	278	-57	-5	3	35
AP2	92.0	312	-58	-6	3	31
AP3	92.0	320	-58	-5	3	32
AP4	92.0	355	-59	-5	3	31
AP5	92.0	351	-59	-5	3	31
					Total SPL	**48**

NSR	CV2					
Noise Source	Soud Power Level (SWL), dB(A)	Distance (m)	Correction, dB(A)			Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Façade	
LS1	93.8	312	-58	-9	3	30
LS2	93.8	301	-58	-10	3	30
LS3	93.8	289	-57	-10	3	29
LS4	92.0	278	-57	-11	3	27
LS5	95.0	266	-57	-11	3	30
LS6	95.0	255	-56	-12	3	30
LS7	95.0	244	-56	-13	3	30
LS8	93.8	237	-56	-13	3	28
LS9	92.0	246	-56	-13	3	27
LS10	92.0	256	-56	-11	3	27
LS11	93.8	256	-56	-11	3	29
LS12	93.8	271	-57	-11	3	29
LS13	93.8	280	-57	-11	3	29
LS14	95.0	296	-57	-10	3	31
LS15	95.0	313	-58	-9	3	31
LS16	95.0	323	-58	-9	3	31
LS17	93.8	323	-58	-9	3	30
PS1	88.0	288	-57	-11	3	23
PS2	88.0	273	-57	-12	3	22
PS3	88.0	260	-56	-13	3	22
PS4	88.0	252	-56	-13	3	22
PS5	88.0	251	-56	-13	3	22
PS6	88.0	258	-56	-12	3	22
PS7	88.0	270	-57	-12	3	23
PS8	88.0	273	-57	-12	3	22
PS9	88.0	286	-57	-12	3	22
PS10	88.0	296	-57	-11	3	23
PS11	88.0	306	-58	-11	3	23
PS12	88.0	318	-58	-10	3	23
PS13	88.0	320	-58	-10	3	23
PS14	88.0	322	-58	-10	3	23
PS15	88.0	315	-58	-10	3	23
AP1	93.8	235	-55	-13	3	28
AP2	92.0	259	-56	-11	3	28
AP3	92.0	267	-57	-11	3	28
AP4	92.0	315	-58	-9	3	28
AP5	92.0	319	-58	-9	3	28
					Total SPL	**43**

NSR	HY					
Noise Source	Soud Power Level (SWL), dB(A)	Distance (m)	Correction, dB(A)			Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Façade	
LS1	93.8	381	-60	-5	3	32
LS2	93.8	370	-59	-5	3	33
LS3	93.8	358	-59	-5	3	33
LS4	92.0	346	-59	-5	3	31
LS5	95.0	335	-58	-5	3	35
LS6	95.0	323	-58	-5	3	34
LS7	95.0	312	-58	-6	3	34
LS8	93.8	305	-58	-6	3	33
LS9	92.0	312	-58	-5	3	32
LS10	92.0	321	-58	-5	3	32
LS11	93.8	320	-58	0	3	39
LS12	93.8	337	-59	-5	3	33
LS13	93.8	347	-59	-5	3	33
LS14	95.0	363	-59	-5	3	34
LS15	95.0	380	-60	-5	3	34
LS16	95.0	391	-60	-5	3	33
LS17	93.8	391	-60	-5	3	32
PS1	88.0	357	-59	-5	3	27
PS2	88.0	341	-59	-5	3	27
PS3	88.0	328	-58	-6	3	27
PS4	88.0	320	-58	-7	3	26
PS5	88.0	318	-58	-6	3	27
PS6	88.0	323	-58	-5	3	28
PS7	88.0	335	-59	-5	3	28
PS8	88.0	339	-59	-5	3	28
PS9	88.0	353	-59	-5	3	27
PS10	88.0	363	-59	-5	3	27
PS11	88.0	373	-59	-5	3	27
PS12	88.0	385	-60	-5	3	26
PS13	88.0	388	-60	-5	3	26
PS14	88.0	391	-60	-5	3	26
PS15	88.0	384	-60	-5	3	27
AP1	93.8	303	-58	-7	3	32
AP2	92.0	324	-58	-5	3	32
AP3	92.0	332	-58	-5	3	32
AP4	92.0	382	-60	-5	3	31
AP5	92.0	388	-60	-5	3	30
					Total SPL	**47**

NSR	XC					
Noise Source	Soud Power Level (SWL), dB(A)	Distance (m)	Correction, dB(A)			Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Façade	
LS1	93.8	424	-61	-6	3	30
LS2	93.8	412	-60	-6	3	30
LS3	93.8	399	-60	-6	3	30
LS4	92.0	386	-60	-6	3	29
LS5	95.0	375	-59	-7	3	32
LS6	95.0	362	-59	0	3	39
LS7	95.0	351	-59	0	3	39
LS8	93.8	340	-59	0	3	38
LS9	92.0	347	-59	0	3	36
LS10	92.0	353	-59	0	3	36
LS11	93.8	347	-59	0	3	38
LS12	93.8	368	-59	0	3	37
LS13	93.8	380	-60	0	3	37
LS14	95.0	396	-60	0	3	38
LS15	95.0	415	-60	0	3	38
LS16	95.0	428	-61	0	3	37
LS17	93.8	431	-61	0	3	36
PS1	88.0	398	-60	-7	3	24
PS2	88.0	381	-60	-8	3	24
PS3	88.0	367	-59	0	3	32
PS4	88.0	357	-59	0	3	32
PS5	88.0	352	-59	0	3	32
PS6	88.0	354	-59	0	3	32
PS7	88.0	366	-59	0	3	32
PS8	88.0	372	-59	0	3	32
PS9	88.0	386	-60	0	3	31
PS10	88.0	398	-60	0	3	31
PS11	88.0	409	-60	0	3	31
PS12	88.0	422	-60	0	3	31
PS13	88.0	426	-61	0	3	30
PS14	88.0	429	-61	0	3	30
PS15	88.0	424	-61	-6	3	24
AP1	93.8	341	-59	0	3	38
AP2	92.0	353	-59	0	3	36
AP3	92.0	360	-59	0	3	36
AP4	92.0	418	-60	0	3	35
AP5	92.0	429	-61	-5	3	29
					Total SPL	**50**

NSR	IV1					
Noise Source	Soud Power Level (SWL), dB(A)	Distance (m)	Correction, dB(A)			Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Façade	
LS1	93.8	481	-62	0	3	35
LS2	93.8	471	-61	0	3	35
LS3	93.8	455	-61	0	3	36
LS4	92.0	441	-61	0	3	34
LS5	95.0	431	-61	0	3	37
LS6	95.0	415	-60	0	3	38
LS7	95.0	405	-60	0	3	38
LS8	93.8	389	-60	-1	3	36
LS9	92.0	394	-60	-1	3	34
LS10	92.0	393	-60	-2	3	33
LS11	93.8	381	-60	-2	3	35
LS12	93.8	406	-60	-2	3	35
LS13	93.8	422	-61	-1	3	35
LS14	95.0	438	-61	-1	3	36
LS15	95.0	457	-61	-1	3	36
LS16	95.0	473	-62	-1	3	36
LS17	93.8	482	-62	0	3	35
PS1	88.0	453	-61	-1	3	29
PS2	88.0	436	-61	-1	3	29
PS3	88.0	419	-60	-2	3	28
PS4	88.0	409	-60	-2	3	29
PS5	88.0	399	-60	-3	3	28
PS6	88.0	395	-60	-3	3	28
PS7	88.0	405	-60	-2	3	28
PS8	88.0	414	-60	-3	3	28
PS9	88.0	430	-61	-2	3	28
PS10	88.0	441	-61	-2	3	28
PS11	88.0	454	-61	-3	3	27
PS12	88.0	466	-61	-3	3	27
PS13	88.0	473	-62	-2	3	28
PS14	88.0	479	-62	-2	3	28
PS15	88.0	478	-62	-1	3	28
AP1	93.8	394	-60	-1	3	36
AP2	92.0	390	-60	-2	3	33
AP3	92.0	396	-60	-2	3	33
AP4	92.0	463	-61	-1	3	32
AP5	92.0	484	-62	0	3	33
					Total SPL	**49**

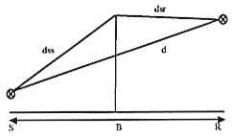
NSR MV

Noise Source	Soud Power Level (SWL), dB(A)	Distance (m)	Correction, dB(A)			Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Façade	
LS1	93.8	475	-62	0	3	35
LS2	93.8	470	-61	0	3	35
LS3	93.8	455	-61	0	3	36
LS4	92.0	442	-61	0	3	34
LS5	95.0	437	-61	0	3	37
LS6	95.0	420	-60	-2	3	36
LS7	95.0	416	-60	0	3	38
LS8	93.8	395	-60	0	3	37
LS9	92.0	394	-60	-5	3	30
LS10	92.0	382	-60	-6	3	29
LS11	93.8	362	-59	-13	3	25
LS12	93.8	387	-60	-7	3	30
LS13	93.8	404	-60	-5	3	32
LS14	95.0	415	-60	0	3	38
LS15	95.0	429	-61	0	3	37
LS16	95.0	447	-61	0	3	37
LS17	93.8	464	-61	0	3	35
PS1	88.0	452	-61	0	3	30
PS2	88.0	438	-61	-3	3	27
PS3	88.0	422	-61	-5	3	26
PS4	88.0	414	-60	-5	3	26
PS5	88.0	398	-60	-5	3	26
PS6	88.0	383	-60	-8	3	23
PS7	88.0	386	-60	-9	3	22
PS8	88.0	398	-60	-6	3	25
PS9	88.0	411	-60	-5	3	26
PS10	88.0	420	-60	0	3	31
PS11	88.0	432	-61	0	3	30
PS12	88.0	441	-61	0	3	30
PS13	88.0	451	-61	0	3	30
PS14	88.0	460	-61	0	3	30
PS15	88.0	468	-61	0	3	30
AP1	93.8	406	-60	0	3	37
AP2	92.0	373	-59	-9	3	26
AP3	92.0	375	-59	-10	3	26
AP4	92.0	438	-61	-4	3	30
AP5	92.0	472	-61	0	3	34
					Total SPL	**49**

Annex B-3

Calculation of Barrier Attenuation

The noise levels at the identified NSRs were predicted based on equation 1 below:



SPL = SWL - 20 log (D) – 8 +3 + D_z ------ equation 1

Where
SPL = Sound Pressure Level
SWL = Sound Power Level
D = Distance between the poles/point source speakers and identified NSRs
D_z = Barrier Attenuation, in accordance with ISO 9613-2 (see equation 2)

$D_z = 10 \log [3+C_2/\lambda\, C_3\, z\, K_{met}]$ ------ equation 2

Where
C_2 = 20, includes effects of ground reflection
λ = wavelength, λ_{500Hz} = 0.69m
C_3 = 1, for single diffraction
z = path length difference = dss + dsr – d
$K_{met} = \exp [-(1/2000) (dss\ dsr\ d/2z)^{1/2}]$ for z>0
K_{met} = 1 for z<0

NSR PTS1

	LS1	LS2	LS3	LS4	LS5	LS6	LS7	LS8	LS9	LS10	LS11	LS12	LS13	LS14	LS15	LS16	LS17	PS1	PS2	PS3	PS4	PS5	PS6	PS7	PS8	PS9	PS10	PS11	PS12	PS13	PS14	PS15	AP1	AP2	AP3	AP4	AP5
Source H =	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	18.8	18.8	18.8	18.8	18.8
Rec Ht =	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2
SB =	26	41	55	67	77	89	102	112	107	103	110	85	75	59	40	26	21	55	72	85	103	103	102	92	85	70	58	46	34	28	14	29	108	103	96	33	24
RB =	103	99	97	97	98	99	97	99	98	101	107	106	100	100	100	98	98	98	97	98	90	97	100	100	98	98	98	98	97	97	107	97	101	104	105	101	98
SR =	129	140	152	164	175	188	199	211	205	204	217	191	175	159	140	124	119	153	169	183	193	200	202	192	183	168	156	144	131	125	121	126	209	207	201	134	122
Barrier Ht =	24.9	24.9	24.9	24.9	24.9	24.9	24.9	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	24.9	24.9	24.9	24.9	24.9	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	24.9	20.8	20.8	20.8	20.8	24.9
dss =	27	41	55	67	77	89	102	112	107	103	110	85	75	59	40	26	22	56	73	85	103	103	102	92	85	70	58	46	34	28	15	30	108	103	96	33	25
dsr =	103	99	97	97	98	99	97	99	98	101	107	106	100	100	100	98	98	98	97	99	90	97	100	100	98	98	98	98	97	97	107	97	101	104	105	101	98
d =	129	140	152	164	175	188	199	211	205	204	217	191	175	159	140	124	119	153	169	183	193	200	202	192	183	168	156	144	131	125	121	126	209	207	201	134	122
z =	1.047	0.808	0.705	0.647	0.608	0.573	0.554	0.109	0.110	0.108	0.102	0.106	0.113	0.119	0.132	0.158	1.225	1.055	0.901	0.818	0.779	0.208	0.205	0.215	0.227	0.253	0.282	0.328	0.406	0.468	0.805	1.638	0.107	0.105	0.104	0.140	1.122
	1.047	0.808	0.705	0.647	0.608	0.573	0.554	0.109	0.110	0.108	0.102	0.106	0.113	0.119	0.132	0.158	1.225	1.055	0.901	0.818	0.779	0.208	0.205	0.215	0.227	0.253	0.282	0.328	0.406	0.468	0.805	1.638	0.107	0.105	0.104	0.140	1.122
tan a	0.235	0.149	0.111	0.091	0.079	0.069	0.060	0.018	0.019	0.019	0.018	0.024	0.027	0.034	0.050	0.077	0.290	0.156	0.119	0.101	0.083	0.044	0.044	0.049	0.053	0.064	0.078	0.098	0.132	0.161	0.321	0.297	0.019	0.019	0.021	0.061	0.254
tan b	0.020	0.019	0.017	0.016	0.015	0.014	0.013	0.012	0.013	0.013	0.012	0.014	0.015	0.016	0.019	0.021	0.022	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.012	0.013	0.013	0.019	0.021
shadow or illuminated zone (S or I)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	1.69	2.69	3.69	4.69
Kmet	0.81	0.74	0.68	0.63	0.59	0.55	0.51	0.19	0.21	0.21	0.17	0.24	0.30	0.37	0.48	0.61	0.85	0.73	0.67	0.62	0.58	0.33	0.32	0.36	0.40	0.47	0.53	0.61	0.69	0.74	0.84	0.85	0.19	0.20	0.21	0.53	0.83
20/0.69*z*Kmet	24.71	17.38	13.98	11.90	10.44	9.08	8.23	0.61	0.67	0.65	0.50	0.74	0.98	1.28	1.84	2.77	30.22	22.35	17.38	14.59	13.21	2.01	1.93	2.26	2.63	3.45	4.36	5.78	8.15	10.03	19.65	40.11	0.60	0.60	0.63	2.16	27.14
Dz	14.43	13.09	12.30	11.73	11.28	10.82	10.50	5.57	5.64	5.63	5.44	5.73	6.00	6.31	6.85	7.61	15.21	14.04	13.09	12.45	12.10	7.00	6.93	7.21	7.50	8.10	8.67	9.44	10.47	11.15	13.55	16.35	5.57	5.56	5.60	7.12	14.79

NSR SW2

	LS1	LS2	LS3	LS4	LS5	LS6	LS7	LS8	LS9	LS10	LS11	LS12	LS13	LS14	LS15	LS16	LS17	PS1	PS2	PS3	PS4	PS5	PS6	PS7	PS8	PS9	PS10	PS11	PS12	PS13	PS14	PS15	AP1	AP2	AP3	AP4	AP5
Source H =	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	18.8	18.8	18.8	18.8	18.8
Rec Ht =	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2
SB =	42	28	30	34	29	34	23	43	36	56	179	72	73	77	80	75	60	33	34	31	26	39	57	71	70	71	71	71	77	77	63	49	18	68	72	72	40
RB =	254	261	261	259	258	259	265	260	275	273	168	266	258	259	261	260	259	260	258	266	271	272	274	267	260	259	261	260	258	251	260	257	274	273	273	263	267
SR =	296	289	291	293	287	293	288	303	311	329	347	338	331	336	341	335	319	293	292	297	297	311	331	338	330	330	332	331	335	328	323	306	292	341	345	335	307
Barrier Ht =	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.0	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9
dss =	42	29	31	35	30	35	24	43	37	56	179	72	73	77	80	75	60	34	35	32	27	40	58	72	71	72	72	72	77	77	64	50	19	68	72	72	40
dsr =	254	261	261	259	258	260	266	261	275	274	169	267	258	259	261	260	259	261	258	266	271	272	274	267	260	259	262	261	259	251	260	258	274	273	274	263	267
d =	296	289	291	293	287	293	289	303	311	330	347	338	331	336	341	335	319	293	292	297	297	311	331	338	330	330	332	331	335	328	323	306	292	341	345	335	307
z =	0.712	0.916	0.874	0.807	0.897	0.806	1.048	0.696	0.761	0.587	0.478	0.525	0.531	0.517	0.507	0.522	0.581	1.418	1.390	1.480	1.688	1.240	0.949	0.832	0.848	0.842	0.839	0.840	0.803	0.813	0.905	1.071	1.249	0.532	0.518	0.529	0.720
	0.712	0.916	0.874	0.807	0.897	0.806	1.048	0.696	0.761	0.587	0.478	0.525	0.531	0.517	0.507	0.522	0.581	1.418	1.390	1.480	1.688	1.240	0.949	0.832	0.848	0.842	0.839	0.840	0.803	0.813	0.905	1.071	1.249	0.532	0.518	0.529	0.720
tan a	0.145	0.218	0.203	0.179	0.210	0.179	0.265	0.142	0.169	0.109	0.029	0.085	0.084	0.079	0.076	0.081	0.102	0.261	0.253	0.277	0.331	0.221	0.151	0.121	0.123	0.121	0.121	0.121	0.112	0.112	0.137	0.176	0.339	0.090	0.085	0.085	0.153
tan b	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.025	0.024	0.023	0.022	0.022	0.023	0.023	0.022	0.023	0.024	0.017	0.017	0.017	0.017	0.016	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.016	0.016	0.017	0.026	0.022	0.022	0.023	0.025
shadow or illuminated zone (S or I)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	1.69	2.69	3.69	4.69
Kmet	0.47	0.58	0.56	0.53	0.58	0.53	0.63	0.46	0.49	0.35	0.19	0.29	0.30	0.28	0.27	0.29	0.36	0.62	0.61	0.63	0.67	0.56	0.44	0.37	0.39	0.39	0.38	0.38	0.36	0.37	0.42	0.51	0.68	0.29	0.28	0.29	0.47
20/0.69*z*Kmet	9.77	15.42	14.22	12.36	14.96	12.33	19.06	9.19	10.78	6.00	2.65	4.38	4.56	4.19	3.89	4.32	5.99	25.45	24.76	27.00	32.65	20.04	11.99	9.01	9.55	9.42	9.29	9.34	8.37	8.74	11.12	15.78	24.53	4.55	4.16	4.50	9.77
Dz	11.06	12.65	12.36	11.86	12.54	11.86	13.44	10.86	11.39	9.54	7.52	8.68	8.79	8.57	8.39	8.64	9.54	14.54	14.43	14.77	15.52	13.62	11.76	10.80	10.99	10.94	10.90	10.91	10.56	10.70	11.50	12.74	14.40	8.78	8.55	8.75	11.06

NSR HA

	LS1	LS2	LS3	LS4	LS5	LS6	LS7	LS8	LS9	LS10	LS11	LS12	LS13	LS14	LS15	LS16	LS17	PS1	PS2	PS3	PS4	PS5	PS6	PS7	PS8	PS9	PS10	PS11	PS12	PS13	PS14	PS15	AP1	AP2	AP3	AP4	AP5
Source Ht =	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	18.8	18.8	18.8	18.8	18.8
Rec Ht =	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2
SB =	39	36	41	41	34	27	96	107	107	114	118	132	130	71	87	90	71	43	41	26	100	110	125	134	132	130	69	80	89	90	80	59	90	130	135	86	57
RB =	238	230	218	212	209	213	134	128	137	146	153	142	145	216	213	213	223	217	209	219	140	137	137	139	138	148	216	210	211	207	216	224	137	139	140	212	229
SR =	277	266	259	253	243	240	230	235	244	260	271	274	275	287	300	303	294	260	250	245	240	247	262	273	270	278	285	290	300	297	296	283	227	269	275	298	286
Barrier Ht =	24.9	24.9	24.9	24.9	24.9	24.9	18.0	18.0	18.0	24.9	27.0	18.0	18.0	24.9	24.9	24.9	24.9	24.9	24.9	24.9	18.0	18.0	18.0	18.0	18.0	18.0	24.9	24.9	24.9	24.9	24.9	24.9	18.0	18.0	18.0	24.9	24.9
dss =	39	37	41	41	35	28	96	107	107	114	118	132	130	71	87	90	71	44	42	27	100	110	125	134	132	130	70	80	89	90	80	60	90	130	135	86	57
dsr =	238	230	219	212	209	213	135	128	137	146	153	142	146	216	213	213	223	217	209	219	140	137	138	139	139	148	216	211	211	207	216	224	137	139	141	212	229
d =	277	266	260	253	243	240	230	235	244	260	271	274	275	287	300	303	295	261	250	245	240	247	262	273	271	278	285	291	300	298	296	284	227	269	276	298	286
z =	0.318	0.350	0.285	0.281	0.365	0.498	0.235	0.263	0.239	0.019	0.101	0.246	0.237	0.116	0.077	0.071	0.119	0.575	0.603	1.088	0.116	0.134	0.151	0.157	0.156	0.136	0.285	0.219	0.181	0.175	0.223	0.371	0.223	0.253	0.252	0.078	0.177
	0.318	0.350	0.285	0.281	0.365	0.498	-0.235	-0.263	-0.239	0.019	0.101	-0.246	-0.237	0.116	0.077	0.071	0.119	0.575	0.603	1.088	-0.116	-0.134	-0.151	-0.157	-0.156	-0.136	0.285	0.219	0.181	0.175	0.223	0.371	-0.223	-0.253	-0.252	0.078	0.177
tan a	0.156	0.169	0.149	0.149	0.179	0.226	-0.008	-0.007	-0.007	0.054	0.069	-0.006	-0.006	0.086	0.070	0.068	0.086	0.200	0.210	0.331	0.017	0.015	0.014	0.013	0.013	0.013	0.125	0.108	0.097	0.096	0.108	0.146	-0.009	-0.006	-0.006	0.071	0.107
tan b	0.038	0.039	0.040	0.041	0.043	0.043	0.045	0.044	0.043	0.040	0.038	0.038	0.038	0.036	0.035	0.034	0.035	0.050	0.052	0.053	0.054	0.052	0.049	0.047	0.048	0.046	0.045	0.044	0.043	0.043	0.044	0.046	0.046	0.039	0.038	0.035	0.036
shadow or illuminated zone (S or I)	S	S	S	S	S	S	I	I	I	S	S	I	I	S	S	S	S	S	S	S	I	I	I	I	I	I	S	S	S	S	S	S	I	I	I	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	1.69	2.69	3.69	4.69
Kmet	0.36	0.41	0.36	0.37	0.46	0.55	1.00	1.00	1.00	0.00	0.09	1.00	1.00	0.11	0.05	0.04	0.11	0.48	0.51	0.66	1.00	1.00	1.00	1.00	1.00	1.00	0.25	0.19	0.14	0.14	0.18	0.32	1.00	1.00	1.00	0.05	0.20
20/0.69*z*Kmet	3.35	4.15	3.00	3.01	4.86	7.97	-6.82	-7.62	-6.92	0.00	0.25	-7.14	-6.88	0.38	0.11	0.09	0.38	7.99	8.93	20.91	-3.35	-3.88	-4.38	-4.55	-4.51	-3.94	2.10	1.18	0.73	0.69	1.18	3.47	-6.47	-7.32	-7.31	0.12	1.00
Dz	8.03	8.54	7.78	7.79	8.96	10.40	0.00	0.00	0.00	4.77	5.12	0.00	0.00	5.29	4.93	4.89	5.29	10.41	10.77	13.79	0.00	0.00	0.00	0.00	0.00	0.00	7.07	6.21	5.71	5.67	6.21	8.11	0.00	0.00	0.00	4.94	6.02

NSR OR

	LS1	LS2	LS3	LS4	LS5	LS6	LS7	LS8	LS9	LS10	LS11	LS12	LS13	LS14	LS15	LS16	LS17	PS1	PS2	PS3	PS4	PS5	PS6	PS7	PS8	PS9	PS10	PS11	PS12	PS13	PS14	PS15	AP1	AP2	AP3	AP4	AP5
Source Ht =	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	18.8	18.8	18.8	18.8	18.8
Rec Ht =	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7
SB =	55	45	48	45	34	30	90	88	98	117	130	128	127	143	158	90	85	48	45	32	93	100	117	128	125	132	140	155	88	88	88	68	77	138	146	85	70
RB =	287	286	274	268	268	265	194	196	195	189	181	193	199	197	198	272	272	274	264	268	201	197	191	192	195	199	200	192	270	270	270	280	201	174	174	270	281
SR =	342	331	322	313	302	295	284	284	293	306	311	321	326	340	356	362	357	322	309	300	294	297	308	320	320	331	340	347	358	358	358	348	278	312	320	355	351
Barrier Ht =	24.9	24.9	24.9	24.9	24.9	24.9	27.0	27.0	27.0	27.0	35.0	27.0	27.0	27.0	27.0	24.9	24.9	24.9	24.9	24.9	27.0	27.0	27.0	27.0	27.0	27.0	27.0	18.0	24.9	24.9	24.9	24.9	27.0	35.0	35.0	24.9	24.9
dss =	55	45	48	45	35	31	90	88	98	117	131	128	127	143	158	90	85	49	46	33	94	101	117	128	125	132	140	155	88	88	88	69	77	139	147	85	70
dsr =	288	287	275	269	269	266	195	196	195	190	181	194	200	198	198	273	273	275	265	269	201	197	192	192	196	199	200	194	271	270	271	280	202	174	174	271	282
d =	343	332	323	314	303	296	285	285	294	307	312	322	327	341	357	363	358	323	310	302	295	298	309	321	322	332	341	348	359	359	359	349	279	313	320	356	352
z =	0.055	0.103	0.078	0.091	0.189	0.245	0.003	0.005	0.000	0.006	0.253	0.011	0.008	0.020	0.033	0.000	0.001	0.262	0.288	0.567	0.043	0.024	0.003	0.000	0.001	0.000	0.000	0.587	0.033	0.033	0.033	0.107	0.022	0.204	0.174	0.001	0.016
	0.055	0.103	0.078	0.091	0.189	0.245	0.003	0.005	0.000	-0.006	0.253	-0.011	-0.008	-0.020	-0.033	0.000	0.001	0.262	0.288	0.567	0.043	0.024	0.003	0.000	0.001	0.000	0.000	-0.587	0.033	0.033	0.033	0.107	0.022	0.204	0.174	0.001	0.016
tan a	0.111	0.136	0.127	0.136	0.179	0.203	0.091	0.093	0.084	0.070	0.125	0.064	0.065	0.057	0.052	0.068	0.072	0.179	0.191	0.269	0.115	0.107	0.091	0.084	0.086	0.081	0.076	0.011	0.098	0.098	0.098	0.126	0.106	0.117	0.111	0.072	0.087
tan b	0.070	0.072	0.074	0.076	0.079	0.081	0.084	0.084	0.082	0.078	0.077	0.074	0.073	0.070	0.067	0.066	0.067	0.082	0.085	0.088	0.090	0.089	0.086	0.083	0.082	0.080	0.078	0.076	0.074	0.074	0.074	0.076	0.086	0.077	0.075	0.067	0.068
shadow or illuminated zone (S or I)	S	S	S	S	S	S	S	S	S	I	S	I	I	I	I	S	S	S	S	S	S	S	S	S	S	S	I	I	S	S	S	S	S	S	S	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	1.69	2.69	3.69	4.69
Kmet	0.03	0.10	0.07	0.10	0.26	0.33	0.00	0.00	0.00	1.00	0.15	1.00	1.00	1.00	1.00	0.00	0.00	0.24	0.28	0.46	0.02	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.06	0.01	0.12	0.09	0.00	0.00
20/0.69*z*Kmet	0.05	0.30	0.16	0.27	1.40	2.34	0.00	0.00	0.00	-0.17	1.08	-0.33	-0.22	-0.59	-0.96	0.00	0.00	1.80	2.33	7.62	0.02	0.00	0.00	0.00	0.00	0.00	-0.01	-17.02	0.00	0.00	0.00	0.19	0.00	0.69	0.45	0.00	0.00
Dz	4.84	5.19	5.00	5.14	6.44	7.27	4.77	4.77	4.77	4.51	6.11	4.27	4.43	3.82	3.10	4.77	4.77	6.81	7.27	10.26	4.80	4.78	4.77	4.77	4.77	4.77	4.76	0.00	4.78	4.78	4.78	5.03	4.78	5.67	5.38	4.77	4.77

NSR CV2

	LS1	LS2	LS3	LS4	LS5	LS6	LS7	LS8	LS9	LS10	LS11	LS12	LS13	LS14	LS15	LS16	LS17	PS1	PS2	PS3	PS4	PS5	PS6	PS7	PS8	PS9	PS10	PS11	PS12	PS13	PS14	PS15	AP1	AP2	AP3	AP4	AP5
Source Ht =	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	18.8	18.8	18.8	18.8	18.8
Rec Ht =	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7
SB =	187	176	163	150	140	122	114	102	111	137	150	153	145	162	180	193	195	163	146	132	121	116	141	152	144	150	162	174	186	190	194	188	103	150	157	182	190
RB =	125	125	126	128	126	133	130	135	135	119	106	118	135	134	133	130	128	125	127	128	131	135	117	118	129	136	134	132	132	130	128	127	132	109	110	133	129
SR =	312	301	289	278	266	255	244	237	246	256	256	271	280	296	313	323	323	288	273	260	252	251	258	270	273	286	296	306	318	320	322	315	235	259	267	315	319
Barrier Ht =	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
dss =	188	177	164	151	141	123	115	103	112	138	151	154	146	163	181	194	196	164	147	133	122	117	142	153	145	151	163	175	187	191	195	189	104	151	158	183	191
dsr =	125	125	126	128	127	133	130	136	135	119	106	118	135	134	133	130	128	126	127	128	131	135	117	118	129	136	134	132	132	130	128	127	133	110	110	133	129
d =	313	301	289	278	267	256	244	238	246	256	256	271	280	296	313	324	323	289	273	261	252	251	258	270	273	286	296	306	318	320	323	315	236	260	267	315	319
z =	0.622	0.659	0.709	0.768	0.822	0.944	1.010	1.132	1.038	0.841	0.773	0.755	0.794	0.712	0.643	0.603	0.598	0.870	0.974	1.083	1.188	1.244	1.007	0.933	0.989	0.950	0.877	0.815	0.762	0.746	0.730	0.753	1.120	0.772	0.739	0.637	0.612
	0.622	0.659	0.709	0.768	0.822	0.944	1.010	1.132	1.038	0.841	0.773	0.755	0.794	0.712	0.643	0.603	0.598	0.870	0.974	1.083	1.188	1.244	1.007	0.933	0.989	0.950	0.877	0.815	0.762	0.746	0.730	0.753	1.120	0.772	0.739	0.637	0.612
tan a	0.087	0.092	0.099	0.108	0.116	0.133	0.142	0.159	0.146	0.118	0.108	0.106	0.112	0.100	0.090	0.084	0.083	0.115	0.128	0.142	0.155	0.161	0.133	0.123	0.130	0.125	0.115	0.107	0.101	0.098	0.096	0.099	0.157	0.108	0.103	0.089	0.085
tan b	0.035	0.036	0.038	0.039	0.041	0.043	0.045	0.046	0.044	0.043	0.043	0.040	0.039	0.037	0.035	0.034	0.034	0.046	0.049	0.051	0.053	0.053	0.052	0.050	0.049	0.047	0.045	0.044	0.042	0.042	0.042	0.043	0.046	0.042	0.041	0.035	0.034
shadow or illuminated zone (S or I)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	1.69	2.69	3.69	4.69
Kmet	0.30	0.32	0.36	0.39	0.43	0.47	0.51	0.55	0.51	0.45	0.44	0.40	0.39	0.34	0.30	0.27	0.27	0.40	0.45	0.49	0.52	0.53	0.48	0.45	0.45	0.42	0.38	0.35	0.32	0.31	0.31	0.33	0.55	0.43	0.41	0.29	0.28
20/0.69*z*Kmet	5.35	6.20	7.36	8.75	10.19	12.98	14.94	17.90	15.42	11.06	9.92	8.86	9.05	7.12	5.55	4.75	4.72	10.00	12.59	15.31	17.92	19.17	14.07	12.05	12.82	11.45	9.73	8.34	7.10	6.81	6.53	7.12	17.76	9.72	8.83	5.41	4.99
Dz	9.21	9.64	10.15	10.70	11.20	12.04	12.54	13.20	12.65	11.48	11.11	10.74	10.81	10.05	9.32	8.89	8.88	11.14	11.93	12.63	13.21	13.46	12.32	11.78	11.99	11.60	11.05	10.55	10.04	9.91	9.79	10.05	13.17	11.04	10.73	9.25	9.02

NSR HY

	LS1	LS2	LS3	LS4	LS5	LS6	LS7	LS8	LS9	LS10	LS11	LS12	LS13	LS14	LS15	LS16	LS17	PS1	PS2	PS3	PS4	PS5	PS6	PS7	PS8	PS9	PS10	PS11	PS12	PS13	PS14	PS15	AP1	AP2	AP3	AP4	AP5
Source H =	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	18.8	18.8	18.8	18.8	18.8
Rec Ht =	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3
SB =	185	174	161	149	137	124	112	115	130	152	175	171	170	180	185	190	193	161	144	128	119	131	155	166	165	168	174	170	184	188	192	188	100	183	190	178	192
RB =	196	196	197	197	198	199	200	190	182	169	145	166	177	183	195	201	198	196	197	200	201	187	168	169	174	185	189	203	201	200	199	196	203	141	142	204	196
SR =	381	370	358	346	335	323	312	305	312	321	320	337	347	363	380	391	391	357	341	328	320	318	323	335	339	353	363	373	385	388	391	384	303	324	332	382	388
Barrier Ht =	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	22.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
dss =	186	175	162	150	138	125	113	116	131	153	175	172	171	181	186	191	194	162	145	129	120	132	156	167	166	169	175	171	185	189	193	189	101	184	191	179	193
dsr =	197	196	197	198	198	200	200	190	183	170	147	166	177	183	196	201	199	197	198	201	201	187	169	170	175	185	190	204	202	200	199	196	204	142	142	205	196
d =	382	371	359	347	336	325	313	306	314	323	321	338	348	364	381	392	392	358	343	330	321	319	325	337	341	354	364	375	387	389	392	385	305	325	333	383	389
z =	0.029	0.042	0.064	0.090	0.126	0.179	0.245	0.203	0.122	0.046	0.956	0.017	0.028	0.023	0.028	0.028	0.023	0.125	0.187	0.276	0.338	0.223	0.090	0.066	0.077	0.087	0.081	0.112	0.078	0.069	0.061	0.064	0.339	0.000	0.000	0.045	0.022
	0.029	0.042	0.064	0.090	0.126	0.179	0.245	0.203	0.122	0.046	-0.956	0.017	0.028	0.023	0.028	0.028	0.023	0.125	0.187	0.276	0.338	0.223	0.090	0.066	0.077	0.087	0.081	0.112	0.078	0.069	0.061	0.064	0.339	0.000	0.000	0.045	0.022
tan a	0.088	0.093	0.101	0.109	0.118	0.131	0.145	0.141	0.125	0.107	0.018	0.095	0.095	0.090	0.088	0.085	0.084	0.116	0.130	0.146	0.157	0.143	0.121	0.113	0.113	0.111	0.107	0.110	0.102	0.099	0.097	0.099	0.162	0.089	0.085	0.091	0.084
tan b	0.075	0.077	0.080	0.082	0.085	0.088	0.091	0.094	0.091	0.089	0.089	0.085	0.082	0.079	0.075	0.073	0.073	0.087	0.091	0.094	0.097	0.098	0.096	0.092	0.091	0.088	0.085	0.083	0.080	0.080	0.079	0.081	0.094	0.088	0.086	0.075	0.073
shadow or illuminated zone (S or I)	S	S	S	S	S	S	S	S	S	S	I	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	I	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	1.69	2.69	3.69	4.69
Kmet	0.00	0.00	0.01	0.02	0.05	0.09	0.15	0.13	0.06	0.01	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.08	0.14	0.18	0.12	0.03	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.00	0.01	0.22	0.00	1.00	0.00	0.00
20/0.69*z*Kmet	0.00	0.00	0.02	0.06	0.18	0.48	1.05	0.77	0.22	0.01	-27.71	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.42	1.12	1.79	0.79	0.08	0.03	0.04	0.05	0.03	0.07	0.02	0.01	0.01	0.01	2.15	0.00	0.00	0.00	0.00
Dz	4.77	4.77	4.79	4.86	5.02	5.42	6.08	5.76	5.08	4.79	0.00	4.77	4.77	4.77	4.77	4.77	4.77	4.95	5.34	6.15	6.81	5.79	4.89	4.81	4.83	4.84	4.82	4.87	4.80	4.79	4.78	4.78	7.12	4.77	4.77	4.77	4.77

NSR XC

	LS1	LS2	LS3	LS4	LS5	LS6	LS7	LS8	LS9	LS10	LS11	LS12	LS13	LS14	LS15	LS16	LS17	PS1	PS2	PS3	PS4	PS5	PS6	PS7	PS8	PS9	PS10	PS11	PS12	PS13	PS14	PS15	AP1	AP2	AP3	AP4	AP5
Source H =	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	18.8	18.8	18.8	18.8	18.8
Rec Ht =	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
SB =	182	173	180	175	165	190	180	168	178	190	195	205	215	230	245	255	270	185	170	195	185	182	192	205	205	218	230	240	248	254	258	213	165	200	210	245	215
RB =	242	239	219	211	210	172	171	172	169	163	152	163	165	166	170	173	161	213	211	172	172	170	162	161	167	168	168	169	174	172	171	211	176	153	150	173	214
SR =	424	412	399	386	375	362	351	340	347	353	347	368	380	396	415	428	431	398	381	367	357	352	354	366	372	386	398	409	422	426	429	424	341	353	360	418	429
Barrier Ht =	35.0	35.0	35.0	35.0	35.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	35.0	35.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	35.0	22.0	22.0	22.0	22.0	35.0
dss =	183	174	181	176	166	190	180	168	178	190	195	205	215	230	245	255	270	186	171	195	185	182	192	205	205	218	230	240	248	254	258	214	165	200	210	245	216
dsr =	242	239	219	211	210	172	171	172	169	163	153	163	165	167	170	173	161	213	211	172	173	171	163	161	168	169	168	169	174	172	172	211	176	154	151	174	214
d =	424	413	399	387	376	362	351	340	347	353	347	368	380	397	415	428	431	398	381	367	358	353	355	366	373	387	398	409	422	426	430	425	341	354	361	419	429
z =	0.410	0.439	0.399	0.409	0.444	0.156	0.149	0.136	0.151	0.174	0.203	0.187	0.190	0.198	0.201	0.202	0.239	0.504	0.567	0.098	0.089	0.089	0.111	0.126	0.114	0.123	0.135	0.140	0.137	0.145	0.149	0.408	0.126	0.205	0.221	0.194	0.304
	0.410	0.439	0.399	0.409	0.444	-0.156	-0.149	-0.136	-0.151	-0.174	-0.203	-0.187	-0.190	-0.198	-0.201	-0.202	-0.239	0.504	0.567	-0.098	-0.089	-0.089	-0.111	-0.126	-0.114	-0.123	-0.135	-0.140	-0.137	-0.145	-0.149	0.408	-0.126	-0.205	-0.221	-0.194	0.304
tan a	0.089	0.094	0.090	0.093	0.098	0.017	0.018	0.019	0.018	0.017	0.016	0.016	0.015	0.014	0.013	0.013	0.012	0.101	0.110	0.029	0.031	0.031	0.030	0.028	0.028	0.026	0.025	0.024	0.023	0.022	0.022	0.088	0.019	0.016	0.015	0.013	0.075
tan b	0.038	0.039	0.041	0.042	0.043	0.045	0.046	0.048	0.047	0.046	0.047	0.044	0.043	0.041	0.039	0.038	0.038	0.047	0.049	0.051	0.052	0.053	0.053	0.051	0.050	0.048	0.047	0.046	0.044	0.044	0.044	0.044	0.048	0.046	0.045	0.039	0.038
shadow or illuminated zone (S or I)	S	S	S	S	S	I	I	I	I	I	I	I	I	I	I	I	I	S	S	I	I	I	I	I	I	I	I	I	I	I	I	S	I	I	I	I	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	1.69	2.69	3.69	4.69
Kmet	0.09	0.11	0.11	0.12	0.15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.14	0.18	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.09	1.00	1.00	1.00	1.00	0.06
20/0.69*z*Kmet	1.09	1.39	1.25	1.46	1.89	-4.51	-4.32	-3.94	-4.37	-5.04	-5.89	-5.43	-5.52	-5.75	-5.84	-5.85	-6.94	2.02	2.88	-2.85	-2.57	-2.58	-3.22	-3.65	-3.32	-3.57	-3.90	-4.05	-3.98	-4.20	-4.31	1.04	-3.66	-5.93	-6.41	-5.62	0.51
Dz	6.12	6.43	6.28	6.49	6.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.01	7.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.07	0.00	0.00	0.00	0.00	5.45

NSR IV1

	LS1	LS2	LS3	LS4	LS5	LS6	LS7	LS8	LS9	LS10	LS11	LS12	LS13	LS14	LS15	LS16	LS17	PS1	PS2	PS3	PS4	PS5	PS6	PS7	PS8	PS9	PS10	PS11	PS12	PS13	PS14	PS15	AP1	AP2	AP3	AP4	AP5
Source H =	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	18.8	18.8	18.8	18.8	18.8
Rec Ht =	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7
SB =	438	429	413	398	390	373	364	345	348	345	332	358	376	392	410	426	436	413	394	373	366	350	345	358	366	384	393	403	414	426	433	434	350	340	343	413	440
RB =	43	42	42	43	41	42	41	44	46	48	49	48	46	46	47	47	46	40	42	46	43	49	50	47	48	46	48	51	52	47	46	44	44	50	53	50	44
SR =	481	471	455	441	431	415	405	389	394	393	381	406	422	438	457	473	482	453	436	419	409	399	395	405	414	430	441	454	466	473	479	478	394	390	396	463	484
Barrier Ht =	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6
dss =	438	429	413	398	390	373	364	345	348	345	332	358	376	392	410	426	436	413	394	373	366	350	345	358	366	384	393	403	414	426	433	434	350	340	343	413	440
dsr =	43	42	43	43	41	42	41	44	46	48	49	48	46	47	47	47	46	41	42	46	43	49	50	47	48	46	48	51	52	47	46	45	44	50	53	50	44
d =	481	471	456	441	431	415	405	389	394	393	381	406	422	439	457	473	482	454	436	419	409	399	395	405	414	430	441	454	466	473	479	479	394	390	396	463	484
z =	0.074	0.076	0.072	0.069	0.073	0.069	0.071	0.062	0.059	0.053	0.051	0.055	0.061	0.062	0.061	0.062	0.066	0.064	0.058	0.047	0.052	0.038	0.037	0.044	0.042	0.049	0.045	0.042	0.040	0.050	0.053	0.056	0.063	0.050	0.045	0.056	0.072
	-0.074	-0.076	-0.072	-0.069	-0.073	-0.069	-0.071	-0.062	-0.059	-0.053	-0.051	-0.055	-0.061	-0.062	-0.061	-0.062	-0.066	-0.064	-0.058	-0.047	-0.052	-0.038	-0.037	-0.044	-0.042	-0.049	-0.045	-0.042	-0.040	-0.050	-0.053	-0.056	-0.063	-0.050	-0.045	-0.056	-0.072
tan a	0.011	0.011	0.012	0.012	0.012	0.013	0.013	0.014	0.014	0.014	0.014	0.013	0.013	0.012	0.012	0.011	0.011	0.018	0.019	0.020	0.020	0.021	0.021	0.020	0.020	0.019	0.019	0.018	0.018	0.017	0.017	0.017	0.014	0.014	0.014	0.012	0.011
tan b	0.016	0.017	0.017	0.018	0.018	0.019	0.019	0.020	0.020	0.020	0.021	0.019	0.019	0.018	0.017	0.017	0.016	0.023	0.024	0.025	0.025	0.026	0.026	0.026	0.025	0.024	0.024	0.023	0.022	0.022	0.022	0.022	0.020	0.020	0.020	0.017	0.016
shadow or illuminated zone (S or I)	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	1.69	2.69	3.69	4.69
Kmet	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20/0.69*z*Kmet	-2.15	-2.20	-2.10	-2.00	-2.12	-2.01	-2.06	-1.80	-1.72	-1.54	-1.47	-1.59	-1.77	-1.78	-1.78	-1.81	-1.93	-1.85	-1.68	-1.35	-1.50	-1.12	-1.06	-1.26	-1.22	-1.42	-1.32	-1.21	-1.16	-1.45	-1.55	-1.64	-1.82	-1.44	-1.31	-1.63	-2.08
Dz	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.79	1.08	1.63	1.85	1.50	0.91	0.85	0.86	0.76	0.31	0.61	1.20	2.18	1.77	2.75	2.88	2.40	2.50	1.99	2.26	2.53	2.64	1.90	1.62	1.35	0.72	1.94	2.29	1.36	0.00

NSR MV

	LS1	LS2	LS3	LS4	LS5	LS6	LS7	LS8	LS9	LS10	LS11	LS12	LS13	LS14	LS15	LS16	LS17	PS1	PS2	PS3	PS4	PS5	PS6	PS7	PS8	PS9	PS10	PS11	PS12	PS13	PS14	PS15	AP1	AP2	AP3	AP4	AP5
Source H =	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	18.8	18.8	18.8	18.8	18.8
Rec Ht =	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2
SB =	160	155	142	132	130	118	50	50	90	68	46	66	84	50	50	50	50	142	128	115	112	92	68	66	80	92	50	50	50	50	50	148	50	56	56	115	160
RB =	315	315	313	310	307	302	366	345	304	314	316	321	320	365	379	397	414	310	310	307	302	306	315	320	318	319	370	382	391	401	410	320	356	317	319	323	312
SR =	475	470	455	442	437	420	416	395	394	382	362	387	404	415	429	447	464	452	438	422	414	398	383	386	398	411	420	432	441	451	460	468	406	373	375	438	472
Barrier Ht =	40.5	40.5	40.5	40.5	40.5	40.5	15.3	15.3	40.5	40.5	40.5	40.5	40.5	15.3	15.3	15.3	15.3	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	15.3	15.3	15.3	15.3	15.3	40.5	15.3	40.5	40.5	40.5	40.5
dss =	161	157	144	134	132	120	50	50	93	71	51	69	87	50	50	50	50	144	130	118	115	95	72	70	84	95	50	50	50	50	50	150	50	60	60	117	161
dsr =	322	322	320	317	314	310	377	357	311	321	323	328	327	376	390	408	424	318	318	314	310	313	322	327	325	326	381	393	402	412	420	327	368	324	325	330	319
d =	483	478	463	451	446	430	425	405	403	392	372	397	413	424	438	456	473	461	448	432	424	408	394	397	409	421	430	441	450	461	469	477	415	383	385	447	481
z =	0.293	0.257	0.169	0.113	0.110	0.053	2.197	2.380	0.015	0.290	1.185	0.364	0.076	2.203	2.091	1.960	1.852	0.091	0.028	0.002	0.001	0.066	0.523	0.618	0.253	0.097	1.530	1.451	1.393	1.334	1.290	0.097	2.282	0.665	0.675	0.013	0.307
	-0.293	-0.257	-0.169	-0.113	-0.110	-0.053	-2.197	-2.380	0.015	0.290	1.185	0.364	0.076	-2.203	-2.091	-1.960	-1.852	-0.091	-0.028	-0.002	-0.001	0.066	0.523	0.618	0.253	0.097	-1.530	-1.451	-1.393	-1.334	-1.290	-0.097	-2.282	0.665	0.675	-0.013	-0.307
tan a	0.136	0.140	0.153	0.164	0.167	0.184	-0.070	-0.070	0.241	0.319	0.472	0.329	0.258	-0.070	-0.070	-0.070	-0.070	0.170	0.189	0.210	0.216	0.263	0.356	0.367	0.303	0.263	-0.020	-0.020	-0.020	-0.020	-0.020	0.164	-0.070	0.388	0.388	0.189	0.136
tan b	0.186	0.188	0.194	0.200	0.202	0.210	0.213	0.224	0.225	0.231	0.244	0.229	0.219	0.213	0.206	0.198	0.190	0.201	0.207	0.215	0.219	0.228	0.237	0.235	0.228	0.221	0.217	0.211	0.206	0.201	0.198	0.194	0.218	0.237	0.236	0.202	0.187
shadow or illuminated zone (S or I)	I	I	I	I	I	I	I	I	S	S	S	S	S	I	I	I	I	I	I	I	I	S	S	S	S	S	I	I	I	I	I	I	I	S	S	I	I
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	1.69	2.69	3.69	4.69
Kmet	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.14	0.45	0.17	0.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.01	0.23	0.26	0.10	0.02	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.31	0.31	1.00	1.00
20/0.69*z*Kmet	-8.48	-7.44	-4.89	-3.28	-3.18	-1.55	-63.68	-68.98	0.00	1.17	15.39	1.81	0.03	-63.85	-60.62	-56.82	-53.68	-2.64	-0.82	-0.05	-0.02	0.02	3.46	4.60	0.71	0.05	-44.34	-42.07	-40.39	-38.66	-37.38	-2.80	-66.13	5.90	6.01	-0.37	-8.88
Dz	0.00	0.00	0.00	0.00	0.00	1.61	0.00	0.00	4.77	6.21	12.65	6.82	4.81	0.00	0.00	0.00	0.00	0.00	3.38	4.69	4.74	4.79	8.10	8.81	5.69	4.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.50	9.55	4.20	0.00

Annex B-4

Sound Power Levels of Fixed Plant Noise Sources (Other Fixed Plant in Ocean Park)

Items	Sound Power Level (SWL) of each item, dB(A)	No. of item	Total Sound Power Level (SWL), dB(A)
Chiller1 (1)	81.0	4	**87.0**
Chiller2 (1)	96.5	4	**102.5**
CT1 (2)	90.5	3	**95.3**
ST1 (2)	66.5	3	**71.3**
ST2 (2)	66.5	1	**66.5**
ST3 (2)	66.5	4	**72.6**
VRV1 (2)	77.5	3	**82.3**
VRV2 (2)	79.5	3	**84.3**
VRV3 (2)	79.5	11	**90.0**
VRV4 (2)	79.5	3	**84.3**
VRV5 (2)	77.5	2	**80.6**
VRV6 (2)	77.5	5	**84.5**
VRV7 (2)	77.5	4	**83.6**
VRV8 (2)	79.5	6	**87.3**
VRV9 (2)	87.5	4	**93.6**
VRV10 (2)	82.5	14	**94.0**
VRV11 (2)	79.5	4	**85.6**
All rides (3)	98.7	1	**98.7**
Sea Horse Carousel (3)	94.0	1	**94.0**
PA1 (3)	83.0	30	**97.8**
PA2 (3)	83.0	15	**94.8**
PA3 (3)	83.0	10	**93.0**
PA4 (3)	83.0	15	**94.8**

Notes:

ST	Split Type Unit
VRV	Variable Refrigerant Volume
Chiller	Chiller
CT	Cooling Tower
PA1	PA system at Aqua City
PA2	PA System at Birds of Paradise
PA3	PA System at Whisker's Harbour
PA4	PA System at Entry Plaza

(1) SWL of Chillers refers to noise data provided by the supplier.
(2) SWL of CT, ST and VRV refers to noise data provided by the Engineer.
(3) SWL of rides, Sea Horse Carousel and PA system refers to the noise data presented in the Approved EIA (confirmed no change by the Engineer).

Annex B-5

Fixed Plant Noise Prediction (Other Fixed Plant in Ocean Park)

NSR PTS1

Noise Source	Soud Power Level (SWL), dB(A)	Slant Distance (m)	Correction, dB(A)				Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Acoustic Treatment	Façade	
Chiller1	87.0	388	-60	0	0	3	30
Chiller2 (1) (2)	102.5	189	-54	-10	-3	3	39
CT1 (2)	95.3	184	-53	0	-10	3	35
ST1	71.3	188	-53	0	0	3	21
ST2	66.5	171	-53	0	0	3	17
ST3	72.6	199	-54	0	0	3	22
VRV1	82.3	209	-54	0	0	3	31
VRV2	84.3	171	-53	0	0	3	35
VRV3	90.0	185	-53	0	0	3	40
VRV4	84.3	216	-55	0	0	3	33
VRV5	80.6	312	-58	0	0	3	26
VRV6	84.5	186	-53	0	0	3	34
VRV7	83.6	163	-52	0	0	3	34
VRV8	87.3	94	-47	0	0	3	43
VRV9 (2)	93.6	93	-47	0	-10	3	39
VRV10 (2)	94.0	108	-49	0	-10	3	38
VRV11	85.6	140	-51	0	0	3	38
All rides	98.7	500.0	-62	0	0	3	40
Sea Horse Carousel	94.0	250.0	-56	0	0	3	41
PA1	97.8	250.0	-56	0	0	3	45
PA2	94.8	380.0	-60	0	0	3	38
PA3	93.0	500.0	-62	0	0	3	34
PA4	94.8	180.0	-53	0	0	3	45
						Total SPL	**52**

Notes:

(1) Chiller2 was installed within a concrete building structures with opening on top and lourve at the wall side facing hillside, ie faced away from any NSRs. Reference was made from IND-TM, a negative correction of 10dB(A) is applied for noise source totally screened by barrier or building such that none will be visible when viewed from any window, door or other opening of the NSR.

(2) Appropriate acoustic treatments such as acoustic enclosures for the VRV compressors and silencers for the fan discharge of the cooling towers will be installed by the supplier/the Engineer such that a minimum of 10dB(A) noise reduction will be provided, and silencers will also be installed by the supplier/the Engineer for the Chiller2 at the intake area to provide a minimum of 3dB(A) noise reduction.

NSR	SW2						
Noise Source	Soud Power Level (SWL), dB(A)	Slant Distance (m)	Correction, dB(A)				Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Acoustic Treatment	Façade	
Chiller1	87.0	351	-59	0	0	3	31
Chiller2 (1) (2)	102.5	389	-60	-10	-3	3	33
CT1 (2)	95.3	381	-60	0	-10	3	29
ST1	71.3	219	-55	0	0	3	20
ST2	66.5	237	-55	0	0	3	14
ST3	72.6	196	-54	0	0	3	22
VRV1	82.3	184	-53	0	0	3	32
VRV2	84.3	226	-55	0	0	3	32
VRV3	90.0	249	-56	0	0	3	37
VRV4	84.3	250	-56	0	0	3	31
VRV5	80.6	299	-58	0	0	3	26
VRV6	84.5	363	-59	0	0	3	28
VRV7	83.6	368	-59	0	0	3	27
VRV8	87.3	341	-59	0	0	3	32
VRV9 (2)	93.6	328	-58	0	-10	3	28
VRV10 (2)	94.0	292	-57	0	-10	3	30
VRV11	85.6	252	-56	0	0	3	33
All rides	98.7	550.0	-63	0	0	3	39
Sea Horse Carousel	94.0	300.0	-58	0	0	3	39
PA1	97.8	300.0	-58	0	0	3	43
PA2	94.8	450.0	-61	0	0	3	37
PA3	93.0	550.0	-63	0	0	3	33
PA4	94.8	205.0	-54	0	0	3	44
						Total SPL	49

Notes:

(1) Chiller2 was installed within a concrete building structures with opening on top and lourve at the wall side facing hillside, ie faced away from any NSRs. Reference was made from IND-TM, a negative correction of 10dB(A) is applied for noise source totally screened by barrier or building such that none will be visible when viewed from any window, door or other opening of the NSR.

(2) Appropriate acoustic treatments such as acoustic enclosures for the VRV compressors and silencers for the fan discharge of the cooling towers will be installed by the supplier/the Engineer such that a minimum of 10dB(A) noise reduction will be provided, and silencers will also be installed by the supplier/the Engineer for the Chiller2 at the intake area to provide a minimum of 3dB(A) noise reduction.

NSR	HA						
Noise Source	Soud Power Level (SWL), dB(A)	Slant Distance (m)	Correction, dB(A)				Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Acoustic Treatment	Façade	
Chiller1	87.0	209	-54	0	0	3	36
Chiller2 (1) (2)	102.5	322	-58	-10	-3	3	34
CT1 (2)	95.3	317	-58	0	-10	3	30
ST1	71.3	284	-57	0	0	3	17
ST2	66.5	298	-57	0	0	3	12
ST3	72.6	213	-55	0	0	3	21
VRV1	82.3	212	-55	0	0	3	31
VRV2	84.3	236	-55	0	0	3	32
VRV3	90.0	218	-55	0	0	3	38
VRV4	84.3	196	-54	0	0	3	33
VRV5	80.6	182	-53	0	0	3	30
VRV6	84.5	298	-57	0	0	3	30
VRV7	83.6	313	-58	0	0	3	29
VRV8	87.3	322	-58	0	0	3	32
VRV9 (2)	93.6	315	-58	0	-10	3	29
VRV10 (2)	94.0	293	-57	0	-10	3	30
VRV11	85.6	269	-57	0	0	3	32
All rides	98.7	360.0	-59	0	0	3	43
Sea Horse Carousel	94.0	210.0	-54	0	0	3	43
PA1	97.8	210.0	-54	0	0	3	46
PA2	94.8	320.0	-58	0	0	3	40
PA3	93.0	360.0	-59	0	0	3	37
PA4	94.8	240.0	-56	0	0	3	42
						Total SPL	51

Notes:

(1) Chiller2 was installed within a concrete building structures with opening on top and lourve at the wall side facing hillside, ie faced away from any NSRs. Reference was made from IND-TM, a negative correction of 10dB(A) is applied for noise source totally screened by barrier or building such that none will be visible when viewed from any window, door or other opening of the NSR.

(2) Appropriate acoustic treatments such as acoustic enclosures for the VRV compressors and silencers for the fan discharge of the cooling towers will be installed by the supplier/the Engineer such that a minimum of 10dB(A) noise reduction will be provided, and silencers will also be installed by the supplier/the Engineer for the Chiller2 at the intake area to provide a minimum of 3dB(A) noise reduction.

NSR	OR						
Noise Source	Soud Power Level (SWL), dB(A)	Slant Distance (m)	Correction, dB(A)				Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Acoustic Treatment	Façade	
Chiller1	87.0	198	-54	0	0	3	36
Chiller2 (1) (2)	102.5	364	-59	-10	-3	3	33
CT1 (2)	95.3	361	-59	0	-10	3	29
ST1	71.3	367	-59	0	0	3	15
ST2	66.5	380	-60	0	0	3	10
ST3	72.6	292	-57	0	0	3	18
VRV1	82.3	293	-57	0	0	3	28
VRV2	84.3	312	-58	0	0	3	29
VRV3	90.0	285	-57	0	0	3	36
VRV4	84.3	256	-56	0	0	3	31
VRV5	80.6	205	-54	0	0	3	29
VRV6	84.5	343	-59	0	0	3	29
VRV7	83.6	362	-59	0	0	3	27
VRV8	87.3	385	-60	0	0	3	31
VRV9 (2)	93.6	380	-60	0	-10	3	27
VRV10 (2)	94.0	364	-59	0	-10	3	28
VRV11	85.6	345	-59	0	0	3	30
All rides	98.7	325.0	-58	0	0	3	43
Sea Horse Carousel	94.0	250.0	-56	0	0	3	41
PA1	97.8	250.0	-56	0	0	3	45
PA2	94.8	315.0	-58	0	0	3	40
PA3	93.0	320.0	-58	0	0	3	38
PA4	94.8	325.0	-58	0	0	3	40
						Total SPL	50

Notes:

(1) Chiller2 was installed within a concrete building structures with opening on top and lourve at the wall side facing hillside, ie faced away from any NSRs. Reference was made from IND-TM, a negative correction of 10dB(A) is applied for noise source totally screened by barrier or building such that none will be visible when viewed from any window, door or other opening of the NSR.

(2) Appropriate acoustic treatments such as acoustic enclosures for the VRV compressors and silencers for the fan discharge of the cooling towers will be installed by the supplier/the Engineer such that a minimum of 10dB(A) noise reduction will be provided, and silencers will also be installed by the supplier/the Engineer for the Chiller2 at the intake area to provide a minimum of 3dB(A) noise reduction.

NSR	CV2						
Noise Source	Soud Power Level (SWL), dB(A)	Slant Distance (m)	Correction, dB(A)				Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Acoustic Treatment	Façade	
Chiller1	87.0	116	-49	0	0	3	41
Chiller2 (1) (2)	102.5	309	-58	-10	-3	3	35
CT1 (2)	95.3	307	-58	0	-10	3	31
ST1	71.3	371	-59	0	0	3	15
ST2	66.5	381	-60	0	0	3	10
ST3	72.6	287	-57	0	0	3	18
VRV1	82.3	293	-57	0	0	3	28
VRV2	84.3	300	-58	0	0	3	30
VRV3	90.0	260	-56	0	0	3	37
VRV4	84.3	226	-55	0	0	3	32
VRV5	80.6	143	-51	0	0	3	32
VRV6	84.5	291	-57	0	0	3	30
VRV7	83.6	313	-58	0	0	3	29
VRV8	87.3	350	-59	0	0	3	31
VRV9 (2)	93.6	349	-59	0	-10	3	28
VRV10 (2)	94.0	340	-59	0	-10	3	28
VRV11	85.6	331	-58	0	0	3	30
All rides	98.7	245.0	-56	0	0	3	46
Sea Horse Carousel	94.0	195.0	-54	0	0	3	43
PA1	97.8	195.0	-54	0	0	3	47
PA2	94.8	240.0	-56	0	0	3	42
PA3	93.0	245.0	-56	0	0	3	40
PA4	94.8	310.0	-58	0	0	3	40
						Total SPL	52

Notes:

(1) Chiller2 was installed within a concrete building structures with opening on top and lourve at the wall side facing hillside, ie faced away from any NSRs. Reference was made from IND-TM, a negative correction of 10dB(A) is applied for noise source totally screened by barrier or building such that none will be visible when viewed from any window, door or other opening of the NSR.

(2) Appropriate acoustic treatments such as acoustic enclosures for the VRV compressors and silencers for the fan discharge of the cooling towers will be installed by the supplier/the Engineer such that a minimum of 10dB(A) noise reduction will be provided, and silencers will also be installed by the supplier/the Engineer for the Chiller2 at the intake area to provide a minimum of 3dB(A) noise reduction.

NSR HY

Noise Source	Soud Power Level (SWL), dB(A)	Slant Distance (m)	Correction, dB(A)				Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Acoustic Treatment	Façade	
Chiller1	87.0	161	-52	0	0	3	38
Chiller2 (1) (2)	102.5	371	-59	-10	-3	3	33
CT1 (2)	95.3	370	-59	0	-10	3	29
ST1	71.3	437	-61	0	0	3	14
ST2	66.5	448	-61	0	0	3	9
ST3	72.6	354	-59	0	0	3	17
VRV1	82.3	359	-59	0	0	3	26
VRV2	84.3	368	-59	0	0	3	28
VRV3	90.0	328	-58	0	0	3	35
VRV4	84.3	294	-57	0	0	3	30
VRV5	80.6	207	-54	0	0	3	29
VRV6	84.5	355	-59	0	0	3	29
VRV7	83.6	377	-60	0	0	3	27
VRV8	87.3	418	-60	0	0	3	30
VRV9 (2)	93.6	417	-60	0	-10	3	26
VRV10 (2)	94.0	409	-60	0	-10	3	27
VRV11	85.6	400	-60	0	0	3	29
All rides	98.7	245.0	-56	0	0	3	46
Sea Horse Carousel	94.0	262.0	-56	0	0	3	41
PA1	97.8	262.0	-56	0	0	3	44
PA2	94.8	265.0	-56	0	0	3	41
PA3	93.0	245.0	-56	0	0	3	40
PA4	94.8	377.0	-60	0	0	3	38
						Total SPL	**51**

Notes:

(1) Chiller2 was installed within a concrete building structures with opening on top and lourve at the wall side facing hillside, ie faced away from any NSRs. Reference was made from IND-TM, a negative correction of 10dB(A) is applied for noise source totally screened by barrier or building such that none will be visible when viewed from any window, door or other opening of the NSR.

(2) Appropriate acoustic treatments such as acoustic enclosures for the VRV compressors and silencers for the fan discharge of the cooling towers will be installed by the supplier/the Engineer such that a minimum of 10dB(A) noise reduction will be provided, and silencers will also be installed by the supplier/the Engineer for the Chiller2 at the intake area to provide a minimum of 3dB(A) noise reduction.

NSR	XC						
Noise Source	Soud Power Level (SWL), dB(A)	Slant Distance (m)	Correction, dB(A)				Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Acoustic Treatment	Façade	
Chiller1	87.0	173	-53	0	0	3	37
Chiller2 (1) (2)	102.5	396	-60	-10	-3	3	33
CT1 (2)	95.3	396	-60	0	-10	3	28
ST1	71.3	494	-62	0	0	3	12
ST2	66.5	503	-62	0	0	3	8
ST3	72.6	409	-60	0	0	3	15
VRV1	82.3	415	-60	0	0	3	25
VRV2	84.3	420	-60	0	0	3	27
VRV3	90.0	375	-59	0	0	3	33
VRV4	84.3	339	-59	0	0	3	29
VRV5	80.6	239	-56	0	0	3	28
VRV6	84.5	384	-60	0	0	3	28
VRV7	83.6	407	-60	0	0	3	26
VRV8	87.3	456	-61	0	0	3	29
VRV9 (2)	93.6	457	-61	0	-10	3	25
VRV10 (2)	94.0	455	-61	0	-10	3	26
VRV11	85.6	450	-61	0	0	3	28
All rides	98.7	210.0	-54	0	0	3	47
Sea Horse Carousel	94.0	300.0	-58	0	0	3	39
PA1	97.8	300.0	-58	0	0	3	43
PA2	94.8	265.0	-56	0	0	3	41
PA3	93.0	210.0	-54	0	0	3	42
PA4	94.8	450.0	-61	0	0	3	37
						Total SPL	**51**

Notes:

(1) Chiller2 was installed within a concrete building structures with opening on top and lourve at the wall side facing hillside, ie faced away from any NSRs. Reference was made from IND-TM, a negative correction of 10dB(A) is applied for noise source totally screened by barrier or building such that none will be visible when viewed from any window, door or other opening of the NSR.

(2) Appropriate acoustic treatments such as acoustic enclosures for the VRV compressors and silencers for the fan discharge of the cooling towers will be installed by the supplier/the Engineer such that a minimum of 10dB(A) noise reduction will be provided, and silencers will also be installed by the supplier/the Engineer for the Chiller2 at the intake area to provide a minimum of 3dB(A) noise reduction.

NSR	IV1						
Noise Source	Soud Power Level (SWL), dB(A)	Slant Distance (m)	Correction, dB(A)				Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Acoustic Treatment	Façade	
Chiller1	87.0	213	-55	0	0	3	35
Chiller2 (1) (2)	102.5	421	-60	-10	-3	3	32
CT1 (2)	95.3	423	-61	0	-10	3	28
ST1	71.3	579	-63	0	0	3	11
ST2	66.5	585	-63	0	0	3	6
ST3	72.6	491	-62	0	0	3	14
VRV1	82.3	501	-62	0	0	3	23
VRV2	84.3	496	-62	0	0	3	25
VRV3	90.0	443	-61	0	0	3	32
VRV4	84.3	406	-60	0	0	3	27
VRV5	80.6	294	-57	0	0	3	26
VRV6	84.5	416	-60	0	0	3	27
VRV7	83.6	440	-61	0	0	3	26
VRV8	87.3	503	-62	0	0	3	28
VRV9 (2)	93.6	509	-62	0	-10	3	24
VRV10 (2)	94.0	516	-62	0	-10	3	25
VRV11	85.6	521	-62	0	0	3	26
All rides	98.7	135.0	-51	0	0	3	51
Sea Horse Carousel	94.0	350.0	-59	0	0	3	38
PA1	97.8	350.0	-59	0	0	3	42
PA2	94.8	235.0	-55	0	0	3	42
PA3	93.0	135.0	-51	0	0	3	45
PA4	94.8	525.0	-62	0	0	3	35
						Total SPL	53

Notes:

(1) Chiller2 was installed within a concrete building structures with opening on top and lourve at the wall side facing hillside, ie faced away from any NSRs. Reference was made from IND-TM, a negative correction of 10dB(A) is applied for noise source totally screened by barrier or building such that none will be visible when viewed from any window, door or other opening of the NSR.

(2) Appropriate acoustic treatments such as acoustic enclosures for the VRV compressors and silencers for the fan discharge of the cooling towers will be installed by the supplier/the Engineer such that a minimum of 10dB(A) noise reduction will be provided, and silencers will also be installed by the supplier/the Engineer for the Chiller2 at the intake area to provide a minimum of 3dB(A) noise reduction.

NSR	MV						
Noise Source	Soud Power Level (SWL), dB(A)	Slant Distance (m)	Correction, dB(A)				Corrected Sound Pressure Level, SPL, dB(A)
			Distance	Barrier	Acoustic Treatment	Façade	
Chiller1	87.0	297	-57	0	0	3	33
Chiller2 (1) (2)	102.5	364	-59	-10	-3	3	33
CT1 (2)	95.3	371	-59	0	-10	3	29
ST1	71.3	613	-64	0	0	3	11
ST2	66.5	613	-64	0	0	3	6
ST3	72.6	535	-63	0	0	3	13
VRV1	82.3	550	-63	0	0	3	23
VRV2	84.3	525	-62	0	0	3	25
VRV3	90.0	466	-61	0	0	3	32
VRV4	84.3	438	-61	0	0	3	26
VRV5	80.6	351	-59	0	0	3	25
VRV6	84.5	376	-59	0	0	3	28
VRV7	83.6	394	-60	0	0	3	27
VRV8	87.3	473	-62	0	0	3	29
VRV9 (2)	93.6	485	-62	0	-10	3	25
VRV10 (2)	94.0	511	-62	0	-10	3	25
VRV11	85.6	537	-63	0	0	3	26
All rides	98.7	145.0	-51	0	0	3	50
Sea Horse Carousel	94.0	350.0	-59	0	0	3	38
PA1	97.8	350.0	-59	0	0	3	42
PA2	94.8	180.0	-53	0	0	3	45
PA3	93.0	145.0	-51	0	0	3	45
PA4	94.8	540.0	-63	0	0	3	35
						Total SPL	53

Notes:

(1) Chiller2 was installed within a concrete building structures with opening on top and lourve at the wall side facing hillside, ie faced away from any NSRs. Reference was made from IND-TM, a negative correction of 10dB(A) is applied for noise source totally screened by barrier or building such that none will be visible when viewed from any window, door or other opening of the NSR.

(2) Appropriate acoustic treatments such as acoustic enclosures for the VRV compressors and silencers for the fan discharge of the cooling towers will be installed by the supplier/the Engineer such that a minimum of 10dB(A) noise reduction will be provided, and silencers will also be installed by the supplier/the Engineer for the Chiller2 at the intake area to provide a minimum of 3dB(A) noise reduction.

Annex C

PSEM Noise Impact Assessment

Annex C-1

Total Maximum Sound Exposure Level (SEL) from all PSEM

To obtain $L_{Aeq, 15min}$ 55 dB at the NSR, from the PSEM display, the total maximum SEL from all PSEM will be:

$SEL_{Total} = L_{Aeq, 15\,min}$ 55 dB + 10 log (15 x 60 sec / 1 sec)

= 55 + 10 log (900 sec / 1 sec)

= 85dB(A) at the nearest NSR

Annex C-2

Measured SEL for PSEM - Based on 30 April 2010 Measurement

Type	PSEM	Measured Maximum SEL, dB(A)	Measurement Distance, m
1	Mines	95	10
2	Mines, crackle/crackling	93	31.6
3	Comets	93	10
4	1 sec, gerbs	86	10
5	5 sec, gerbs	89	10

Time	PSEM Item	Type of PSEM	Position	Measured SEL, dB(A) Locations of PSEM-launching Lily Pad PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12	Measurement Distance (d1), m
0:18	10 x 1 sec x 5M gold gerbs	4	2-3-4-5-6-7-8-9-10-11		86	86	86	86	86	86	86	86	86	86		10
	4 x 1" comets, gold glittering	3	2-4-7-9		93		93			93		93				10
5:10	6 x 1" mines, red	1	1-3-5-7-9-11	95		95		95		95		95		95		10
5:20	6 x 1" mines, blue and green	1	2-4-6-8-10-12		95		95		95		95		95		95	10
5:25	6 x 1" mines, red	1	2-4-7-9		95		95			95		95				10
	4 x 1" mines, blue and green	1	1-3-8-10	95		95					95		95			10
6:26	4 x 1" mines, blue	1	1-5-7-11	95				95		95				95		10
6:40	6 x 1" comets, silver glittering	3	1-3-5-7-9-11	93		93		93		93		93		93		10
7:52	6 x 1" comets, aqua with silver tail	3	1-3-6-8-10-12	93		93			93		93		93		93	10
8:14	4 x 1" mines, red	1	2-5-7-10		95			95		95			95			10
	2 x 1" mines, gold glittering	1	6-12						95						95	10
9:25	4 x 1" comets, red with silver tail (alternating)	3	1-4-6-10	93			93		93				93			10
	4 x 1" comets, blue with silver tail (alternating)	3	2-5-8-12		93			93			93				93	10
10:27	6 x 1" mines, varigated (blue, red, orange, purple, green, lemon)	1	1-3-5-7-9-11	95		95		95		95		95		95		10
10:51	8 x 5 sec x 5M gold gerbs (on "Symbio!")	5	1-2-4-5-7-9-11-12	89	89		89	89		89		89		89	89	10
	8 x 1" comets, gold glittering (on final note)	3	1-2-4-5-7-9-11-12	93	93		93	93		93		93		93	93	10
	4 x 1" mines, crackling (on final note)	2	1-6-9-12	93					93			93			93	31.6

Annex C-3

Summary of Predicted SEL at NSRs

NSR	Predicted SEL at NSRs, dB(A)	Noise Criteria, SEL_{Total}, dB(A) [1]
CV2	79	85
HA	84	85
HY	82	85
IV1	82	85
MV	85	85
OR	85	85
PTS1	81	85
SW2	76	85
XC	83	85

Notes:

[1] Refer to Annex C-1 for the total maximum SEL from all PSEM.

Annex C-4.1

Calculation of SEL at Noise Sensitive Receiver

NSR: CV2

PSEM Item	Type of PSEM	Position	Corrected SEL [1], dB(A) Locations of PSEM-launching Lily Pad											
			PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Slant Distance between NSR and Lily Pad (d2), m			290	273	267	258	253	257	271	284	296	303	315	319
Barrier Attenuation (Dz)[2], dB(A)			-14	-15	-16	-16	-16	-16	-15	-15	-14	-14	-13	-13
Barrier Attenuation (Dz)[3], dB(A)			-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
10 x 1 sec x 5M gold gerbs	4	2-3-4-5-6-7-8-9-10-11		45.2	44.9	44.6	44.4	44.6	45.0	45.2	45.6	45.8	46.0	
4 x 1" comets, gold glittering	3	2-4-7-9		52.2		51.6			52.0		52.6			
6 x 1" mines, red	1	1-3-5-7-9-11	54.7		53.9		53.4		54.0		54.6		55.0	
6 x 1" mines, blue and green	1	2-4-6-8-10-12		54.2		53.6		53.6		54.2		54.8		55.1
6 x 1" mines, red	1	2-4-7-9		54.2		53.6			54.0		54.6			
4 x 1" mines, blue and green	1	1-3-8-10	54.7		53.9					54.2		54.8		
4 x 1" mines, blue	1	1-5-7-11	54.7				53.4		54.0				55.0	
6 x 1" comets, silver glittering	3	1-3-5-7-9-11	52.7		51.9		51.4		52.0		52.6		53.0	
6 x 1" comets, aqua with silver tail	3	1-3-6-8-10-12	52.7		51.9			51.6		52.2		52.8		53.1
4 x 1" mines, red	1	2-5-7-10		54.2			53.4		54.0			54.8		
2 x 1" mines, gold glittering	1	6-12						53.6						55.1
4 x 1" comets, red with silver tail (alternating)	3	1-4-6-10	52.7			51.6		51.6				52.8		
4 x 1" comets, blue with silver tail (alternating)	3	2-5-8-12		52.2			51.4			52.2				53.1
6 x 1" mines, varigated (blue, red, orange, purple, green, lemon)	1	1-3-5-7-9-11	54.7		53.9		53.4		54.0		54.6		55.0	
8 x 5 sec x 5M gold gerbs (on "Symbio!")	5	1-2-4-5-7-9-11-12	48.7	48.2		47.6	47.4		48.0		48.6		49.0	49.1
8 x 1" comets, gold glittering (on final note)	3	1-2-4-5-7-9-11-12	52.7	52.2		51.6	51.4		52.0		52.6		53.0	53.1
4 x 1" mines, crackling (on final note)	2	1-6-9-12	71.7					72.6			71.6			71.0
SEL from each Lily Pad, dB(A)			**72**	**61**	**60**	**60**	**61**	**73**	**63**	**59**	**72**	**61**	**62**	**71**
Total SEL, dB(A)			**79**											

Notes:

[1] Corrected SEL = Sub-total SEL + distance correction + façade correction + barrier attenuation
= Sub-total SEL + 20log(d1/d2) + 3 + Dz

[2] Calculation of barrier attenuation is presented in *Annex C-5.1* for all types of PSEM except Type 2.

[3] Calculation of barrier attenuation is presented in *Annex C-5.2* for mines with crackle/crackling, ie Type 2 PSEM.

Annex C-4.2

Calculation of SEL at Noise Sensitive Receiver

NSR: HA

PSEM Item	Type of PSEM	Position	Corrected SEL [1], dB(A) Locations of PSEM-launching Lily Pad PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Slant Distance between NSR and Lily Pad (d2), m			264	253	250	247	249	258	267	275	283	287	295	294
Barrier Attenuation (Dz)[2], dB(A)			-17	-18	-18	-18	-7	-6	-5	-5	-13	-13	-12	-13
Barrier Attenuation (Dz)[3], dB(A)			0	0	0	0	0	0	0	0	0	0	0	0
10 x 1 sec x 5M gold gerbs	4	2-3-4-5-6-7-8-9-10-11		43.4	42.7	42.8	53.8	54.7	55.1	55.5	46.5	47.0	47.9	
4 x 1" comets, gold glittering	3	2-4-7-9		50.4		49.8			62.1		53.5			
6 x 1" mines, red	1	1-3-5-7-9-11	52.8		51.7		62.8		64.1		55.5		56.9	
6 x 1" mines, blue and green	1	2-4-6-8-10-12		52.4		51.8		63.7		64.5		56.0		55.8
6 x 1" mines, red	1	2-4-7-9		52.4		51.8			64.1		55.5			
4 x 1" mines, blue and green	1	1-3-8-10	52.8		51.7					64.5		56.0		
4 x 1" mines, blue	1	1-5-7-11	52.8				62.8		64.1				56.9	
6 x 1" comets, silver glittering	3	1-3-5-7-9-11	50.8		49.7		60.8		62.1		53.5		54.9	
6 x 1" comets, aqua with silver tail	3	1-3-6-8-10-12	50.8		49.7			61.7		62.5		54.0		53.8
4 x 1" mines, red	1	2-5-7-10		52.4			62.8		64.1			56.0		
2 x 1" mines, gold glittering	1	6-12						63.7						55.8
4 x 1" comets, red with silver tail (alternating)	3	1-4-6-10	50.8			49.8		61.7				54.0		
4 x 1" comets, blue with silver tail (alternating)	3	2-5-8-12		50.4			60.8			62.5				53.8
6 x 1" mines, varigated (blue, red, orange, purple, green, lemon)	1	1-3-5-7-9-11	52.8		51.7		62.8		64.1		55.5		56.9	
8 x 5 sec x 5M gold gerbs (on "Symbio!")	5	1-2-4-5-7-9-11-12	46.8	46.4		45.8	56.8		58.1		49.5		50.9	49.8
8 x 1" comets, gold glittering (on final note)	3	1-2-4-5-7-9-11-12	50.8	50.4		49.8	60.8		62.1		53.5		54.9	53.8
4 x 1" mines, crackling (on final note)	2	1-6-9-12	77.6					77.8			77.0			76.6
SEL from each Lily Pad, dB(A)			**78**	**60**	**58**	**58**	**71**	**78**	**73**	**70**	**77**	**62**	**64**	**77**
Total SEL, dB(A)			**84**											

Notes:

[1] Corrected SEL = Sub-total SEL + distance correction + façade correction + barrier attenuation
= Sub-total SEL + 20log(d1/d2) + 3 + Dz

[2] Calculation of barrier attenuation is presented in *Annex C-5.1* for all types of PSEM except Type 2.

[3] Calculation of barrier attenuation is presented in *Annex C-5.2* for mines with crackle/crackling, ie Type 2 PSEM.

Annex C-4.3

Calculation of SEL at Noise Sensitive Receiver

NSR: HY

PSEM Item	Type of PSEM	Position	Corrected SEL [1], dB(A) Locations of PSEM-launching Lily Pad											
			PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Slant Distance between NSR and Lily Pad (d2), m			359	342	335	326	321	324	338	351	363	371	383	387
Barrier Attenuation (Dz)[2], dB(A)			-7	-9	-10	-11	-11	-8	-7	-7	-8	-7	-6	-6
Barrier Attenuation (Dz)[3], dB(A)			0	0	0	0	0	0	0	0	0	0	0	0
10 x 1 sec x 5M gold gerbs	4	2-3-4-5-6-7-8-9-10-11		49.1	48.2	47.4	47.6	51.0	51.3	50.7	50.2	50.8	51.1	
4 x 1" comets, gold glittering	3	2-4-7-9		56.1		54.4			58.3		57.2			
6 x 1" mines, red	1	1-3-5-7-9-11	59.4		57.2		56.6		60.3		59.2		60.1	
6 x 1" mines, blue and green	1	2-4-6-8-10-12		58.1		56.4		60.0		59.7		59.8		60.2
6 x 1" mines, red	1	2-4-7-9		58.1		56.4			60.3		59.2			
4 x 1" mines, blue and green	1	1-3-8-10	59.4		57.2					59.7		59.8		
4 x 1" mines, blue	1	1-5-7-11	59.4				56.6		60.3				60.1	
6 x 1" comets, silver glittering	3	1-3-5-7-9-11	57.4		55.2		54.6		58.3		57.2		58.1	
6 x 1" comets, aqua with silver tail	3	1-3-6-8-10-12	57.4		55.2			58.0		57.7		57.8		58.2
4 x 1" mines, red	1	2-5-7-10		58.1			56.6		60.3			59.8		
2 x 1" mines, gold glittering	1	6-12						60.0						60.2
4 x 1" comets, red with silver tail (alternating)	3	1-4-6-10	57.4			54.4		58.0				57.8		
4 x 1" comets, blue with silver tail (alternating)	3	2-5-8-12		56.1			54.6			57.7				58.2
6 x 1" mines, varigated (blue, red, orange, purple, green, lemon)	1	1-3-5-7-9-11	59.4		57.2		56.6		60.3		59.2		60.1	
8 x 5 sec x 5M gold gerbs (on "Symbio!")	5	1-2-4-5-7-9-11-12	53.4	52.1		50.4	50.6		54.3		53.2		54.1	54.2
8 x 1" comets, gold glittering (on final note)	3	1-2-4-5-7-9-11-12	57.4	56.1		54.4	54.6		58.3		57.2		58.1	58.2
4 x 1" mines, crackling (on final note)	2	1-6-9-12	74.9					75.8			74.8			74.2
SEL from each Lily Pad, dB(A)			76	65	64	63	65	76	69	65	75	66	67	75
Total SEL, dB(A)			82											

Notes:

[1] Corrected SEL = Sub-total SEL + distance correction + façade correction + barrier attenuation
= Sub-total SEL + 20log(d1/d2) + 3 + Dz

[2] Calculation of barrier attenuation is presented in *Annex C-5.1* for all types of PSEM except Type 2.

[3] Calculation of barrier attenuation is presented in *Annex C-5.2* for mines with crackle/crackling, ie Type 2 PSEM.

Annex C-4.4

Calculation of SEL at Noise Sensitive Receiver

NSR: IV1

PSEM Item	Type of PSEM	Position	Corrected SEL [1], dB(A) Locations of PSEM-launching Lily Pad PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Slant Distance between NSR and Lily Pad (d2), m			452	434	424	412	402	399	414	430	442	453	466	475
Barrier Attenuation (Dz)[2], dB(A)			-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
Barrier Attenuation (Dz)[3], dB(A)			0	0	0	0	0	0	0	0	0	0	0	0
10 x 1 sec x 5M gold gerbs	4	2-3-4-5-6-7-8-9-10-11		51.2	51.4	51.6	51.8	51.9	51.6	51.3	51.0	50.8	50.6	
4 x 1" comets, gold glittering	3	2-4-7-9		58.2		58.6			58.6		58.0			
6 x 1" mines, red	1	1-3-5-7-9-11	59.8		60.4		60.8		60.6		60.0		59.6	
6 x 1" mines, blue and green	1	2-4-6-8-10-12		60.2		60.6		60.9		60.3		59.8		59.4
6 x 1" mines, red	1	2-4-7-9		60.2		60.6			60.6		60.0			
4 x 1" mines, blue and green	1	1-3-8-10	59.8		60.4					60.3		59.8		
4 x 1" mines, blue	1	1-5-7-11	59.8				60.8		60.6				59.6	
6 x 1" comets, silver glittering	3	1-3-5-7-9-11	57.8		58.4		58.8		58.6		58.0		57.6	
6 x 1" comets, aqua with silver tail	3	1-3-6-8-10-12	57.8		58.4			58.9		58.3		57.8		57.4
4 x 1" mines, red	1	2-5-7-10		60.2			60.8		60.6			59.8		
2 x 1" mines, gold glittering	1	6-12						60.9						59.4
4 x 1" comets, red with silver tail (alternating)	3	1-4-6-10	57.8			58.6		58.9				57.8		
4 x 1" comets, blue with silver tail (alternating)	3	2-5-8-12		58.2			58.8			58.3				57.4
6 x 1" mines, varigated (blue, red, orange, purple, green, lemon)	1	1-3-5-7-9-11	59.8		60.4		60.8		60.6		60.0		59.6	
8 x 5 sec x 5M gold gerbs (on "Symbio!")	5	1-2-4-5-7-9-11-12	53.8	54.2		54.6	54.8		54.6		54.0		53.6	53.4
8 x 1" comets, gold glittering (on final note)	3	1-2-4-5-7-9-11-12	57.8	58.2		58.6	58.8		58.6		58.0		57.6	57.4
4 x 1" mines, crackling (on final note)	2	1-6-9-12	72.9					74.0			73.1			72.5
SEL from each Lily Pad, dB(A)			74	67	67	67	69	75	69	66	74	66	66	73
Total SEL, dB(A)			82											

Notes:

[1] Corrected SEL = Sub-total SEL + distance correction + façade correction + barrier attenuation
= Sub-total SEL + 20log(d1/d2) + 3 + Dz

[2] Calculation of barrier attenuation is presented in *Annex C-5.1* for all types of PSEM except Type 2.

[3] Calculation of barrier attenuation is presented in *Annex C-5.2* for mines with crackle/crackling, ie Type 2 PSEM.

Annex C-4.5

Calculation of SEL at Noise Sensitive Receiver

NSR: MV

PSEM Item	Type of PSEM	Position	Corrected SEL [1], dB(A) Locations of PSEM-launching Lily Pad											
			PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Slant Distance between NSR and Lily Pad (d2), m			450	435	426	414	402	393	402	415	425	435	446	458
Barrier Attenuation (Dz)[2], dB(A)			0	0	0	0	0	0	0	0	0	0	0	0
Barrier Attenuation (Dz)[3], dB(A)			0	0	0	0	0	0	0	0	0	0	0	0
10 x 1 sec x 5M gold gerbs	4	2-3-4-5-6-7-8-9-10-11		56.2	56.4	56.7	56.9	57.1	56.9	56.6	56.4	56.2	56.0	
4 x 1" comets, gold glittering	3	2-4-7-9		63.2		63.7			63.9		63.4			
6 x 1" mines, red	1	1-3-5-7-9-11	64.9		65.4		65.9		65.9		65.4		65.0	
6 x 1" mines, blue and green	1	2-4-6-8-10-12		65.2		65.7		66.1		65.6		65.2		64.8
6 x 1" mines, red	1	2-4-7-9		65.2		65.7			65.9		65.4			
4 x 1" mines, blue and green	1	1-3-8-10	64.9		65.4					65.6		65.2		
4 x 1" mines, blue	1	1-5-7-11	64.9				65.9		65.9				65.0	
6 x 1" comets, silver glittering	3	1-3-5-7-9-11	62.9		63.4		63.9		63.9		63.4		63.0	
6 x 1" comets, aqua with silver tail	3	1-3-6-8-10-12	62.9		63.4			64.1		63.6		63.2		62.8
4 x 1" mines, red	1	2-5-7-10		65.2			65.9		65.9			65.2		
2 x 1" mines, gold glittering	1	6-12						66.1						64.8
4 x 1" comets, red with silver tail (alternating)	3	1-4-6-10	62.9			63.7		64.1				63.2		
4 x 1" comets, blue with silver tail (alternating)	3	2-5-8-12		63.2			63.9			63.6				62.8
6 x 1" mines, varigated (blue, red, orange, purple, green, lemon)	1	1-3-5-7-9-11	64.9		65.4		65.9		65.9		65.4		65.0	
8 x 5 sec x 5M gold gerbs (on "Symbio!")	5	1-2-4-5-7-9-11-12	58.9	59.2		59.7	59.9		59.9		59.4		59.0	58.8
8 x 1" comets, gold glittering (on final note)	3	1-2-4-5-7-9-11-12	62.9	63.2		63.7	63.9		63.9		63.4		63.0	62.8
4 x 1" mines, crackling (on final note)	2	1-6-9-12	72.9					74.1			73.4			72.8
SEL from each Lily Pad, dB(A)			76	72	72	72	74	76	75	71	76	72	72	75
Total SEL, dB(A)			85											

Notes:

[1] Corrected SEL = Sub-total SEL + distance correction + façade correction + barrier attenuation
= Sub-total SEL + 20log(d1/d2) + 3 + Dz

[2] Calculation of barrier attenuation is presented in *Annex C-5.1* for all types of PSEM except Type 2.

[3] Calculation of barrier attenuation is presented in *Annex C-5.2* for mines with crackle/crackling, ie Type 2 PSEM.

Annex C-4.6

Calculation of SEL at Noise Sensitive Receiver

NSR: OR

PSEM Item	Type of PSEM	Position	Corrected SEL [1], dB(A) Locations of PSEM-launching Lily Pad PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Slant Distance between NSR and Lily Pad (d2), m			325	312	307	301	299	306	318	328	339	344	354	356
Barrier Attenuation (Dz)[2], dB(A)			0	0	-6	-8	-8	-14	-6	-6	-5	-5	0	0
Barrier Attenuation (Dz)[3], dB(A)			0	0	0	0	0	-4	0	0	0	0	0	0
10 x 1 sec x 5M gold gerbs	4	2-3-4-5-6-7-8-9-10-11		59.1	53.6	51.7	51.0	45.7	53.1	53.0	53.2	53.4	58.0	
4 x 1" comets, gold glittering	3	2-4-7-9		66.1		58.7			60.1		60.2			
6 x 1" mines, red	1	1-3-5-7-9-11	67.8		62.6		60.0		62.1		62.2		67.0	
6 x 1" mines, blue and green	1	2-4-6-8-10-12		68.1		60.7		54.7		62.0		62.4		67.0
6 x 1" mines, red	1	2-4-7-9		68.1		60.7			62.1		62.2			
4 x 1" mines, blue and green	1	1-3-8-10	67.8		62.6					62.0		62.4		
4 x 1" mines, blue	1	1-5-7-11	67.8				60.0		62.1				67.0	
6 x 1" comets, silver glittering	3	1-3-5-7-9-11	65.8		60.6		58.0		60.1		60.2		65.0	
6 x 1" comets, aqua with silver tail	3	1-3-6-8-10-12	65.8		60.6			52.7		60.0		60.4		65.0
4 x 1" mines, red	1	2-5-7-10		68.1			60.0		62.1			62.4		
2 x 1" mines, gold glittering	1	6-12						54.7						67.0
4 x 1" comets, red with silver tail (alternating)	3	1-4-6-10	65.8			58.7		52.7				60.4		
4 x 1" comets, blue with silver tail (alternating)	3	2-5-8-12		66.1			58.0			60.0				65.0
6 x 1" mines, varigated (blue, red, orange, purple, green, lemon)	1	1-3-5-7-9-11	67.8		62.6		60.0		62.1		62.2		67.0	
8 x 5 sec x 5M gold gerbs (on "Symbio!")	5	1-2-4-5-7-9-11-12	61.8	62.1		54.7	54.0		56.1		56.2		61.0	61.0
8 x 1" comets, gold glittering (on final note)	3	1-2-4-5-7-9-11-12	65.8	66.1		58.7	58.0		60.1		60.2		65.0	65.0
4 x 1" mines, crackling (on final note)	2	1-6-9-12	75.8					72.2			75.4			75.0
SEL from each Lily Pad, dB(A)			79	75	69	67	68	72	71	67	76	69	74	77
Total SEL, dB(A)			85											

Notes:

[1] Corrected SEL = Sub-total SEL + distance correction + façade correction + barrier attenuation
= Sub-total SEL + 20log(d1/d2) + 3 + Dz

[2] Calculation of barrier attenuation is presented in *Annex C-5.1* for all types of PSEM except Type 2.

[3] Calculation of barrier attenuation is presented in *Annex C-5.2* for mines with crackle/crackling, ie Type 2 PSEM.

Annex C-4.7

Calculation of SEL at Noise Sensitive Receiver

NSR: PTS1

PSEM Item	Type of PSEM	Position	Corrected SEL [1], dB(A) Locations of PSEM-launching Lily Pad PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Slant Distance between NSR and Lily Pad (d2), m			152	170	178	189	197	199	184	168	155	145	132	125
Barrier Attenuation (Dz)[2], dB(A)			-19	-17	-17	-12	-12	-12	-13	-14	-16	-17	-18	-20
Barrier Attenuation (Dz)[3], dB(A)			-6	-5	-5	-7	-7	-7	-8	-10	-12	-14	-16	-18
10 x 1 sec x 5M gold gerbs	4	2-3-4-5-6-7-8-9-10-11		47.3	47.5	51.0	51.0	51.0	50.6	50.3	49.6	49.0	48.2	
4 x 1" comets, gold glittering	3	2-4-7-9		54.3		58.0			57.6		56.6			
6 x 1" mines, red	1	1-3-5-7-9-11	55.7		56.5		60.0		59.6		58.6		57.2	
6 x 1" mines, blue and green	1	2-4-6-8-10-12		56.3		60.0		60.0		59.3		58.0		56.2
6 x 1" mines, red	1	2-4-7-9		56.3		60.0			59.6		58.6			
4 x 1" mines, blue and green	1	1-3-8-10	55.7		56.5					59.3		58.0		
4 x 1" mines, blue	1	1-5-7-11	55.7				60.0		59.6				57.2	
6 x 1" comets, silver glittering	3	1-3-5-7-9-11	53.7		54.5		58.0		57.6		56.6		55.2	
6 x 1" comets, aqua with silver tail	3	1-3-6-8-10-12	53.7		54.5			58.0		57.3		56.0		54.2
4 x 1" mines, red	1	2-5-7-10		56.3			60.0		59.6			58.0		
2 x 1" mines, gold glittering	1	6-12						60.0						56.2
4 x 1" comets, red with silver tail (alternating)	3	1-4-6-10	53.7			58.0		58.0				56.0		
4 x 1" comets, blue with silver tail (alternating)	3	2-5-8-12		54.3			58.0			57.3				54.2
6 x 1" mines, varigated (blue, red, orange, purple, green, lemon)	1	1-3-5-7-9-11	55.7		56.5		60.0		59.6		58.6		57.2	
8 x 5 sec x 5M gold gerbs (on "Symbio!")	5	1-2-4-5-7-9-11-12	49.7	50.3		54.0	54.0		53.6		52.6		51.2	50.2
8 x 1" comets, gold glittering (on final note)	3	1-2-4-5-7-9-11-12	53.7	54.3		58.0	58.0		57.6		56.6		55.2	54.2
4 x 1" mines, crackling (on final note)	2	1-6-9-12	76.3					73.5			70.2			66.0
SEL from each Lily Pad, dB(A)			77	63	63	66	68	74	68	65	72	64	64	68
Total SEL, dB(A)			81											

Notes:

[1] Corrected SEL = Sub-total SEL + distance correction + façade correction + barrier attenuation
= Sub-total SEL + 20log(d1/d2) + 3 + Dz

[2] Calculation of barrier attenuation is presented in *Annex C-5.1* for all types of PSEM except Type 2.

[3] Calculation of barrier attenuation is presented in *Annex C-5.2* for mines with crackle/crackling, ie Type 2 PSEM.

Annex C-4.8

Calculation of SEL at Noise Sensitive Receiver

NSR: SW2

PSEM Item	Type of PSEM	Position	Corrected SEL [1], dB(A) Locations of PSEM-launching Lily Pad PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Slant Distance between NSR and Lily Pad (d2), m			298	297	300	303	311	323	326	326	328	327	328	322
Barrier Attenuation (Dz)[2], dB(A)			-19	-19	-19	-19	-19	-18	-16	-16	-16	-16	-16	-17
Barrier Attenuation (Dz)[3], dB(A)			-9	-9	-8	-8	-8	-7	-5	-5	-5	-5	-5	-6
10 x 1 sec x 5M gold gerbs	4	2-3-4-5-6-7-8-9-10-11		40.2	40.4	40.5	40.1	40.9	42.5	42.4	42.5	42.5	42.5	
4 x 1" comets, gold glittering	3	2-4-7-9		47.2		47.5			49.5		49.5			
6 x 1" mines, red	1	1-3-5-7-9-11	49.2		49.4		49.1		51.5		51.5		51.5	
6 x 1" mines, blue and green	1	2-4-6-8-10-12		49.2		49.5		49.9		51.4		51.5		50.8
6 x 1" mines, red	1	2-4-7-9		49.2		49.5			51.5		51.5			
4 x 1" mines, blue and green	1	1-3-8-10	49.2		49.4					51.4		51.5		
4 x 1" mines, blue	1	1-5-7-11	49.2				49.1		51.5				51.5	
6 x 1" comets, silver glittering	3	1-3-5-7-9-11	47.2		47.4		47.1		49.5		49.5		49.5	
6 x 1" comets, aqua with silver tail	3	1-3-6-8-10-12	47.2		47.4			47.9		49.4		49.5		48.8
4 x 1" mines, red	1	2-5-7-10		49.2			49.1		51.5			51.5		
2 x 1" mines, gold glittering	1	6-12						49.9						50.8
4 x 1" comets, red with silver tail (alternating)	3	1-4-6-10	47.2			47.5		47.9				49.5		
4 x 1" comets, blue with silver tail (alternating)	3	2-5-8-12		47.2			47.1			49.4				48.8
6 x 1" mines, varigated (blue, red, orange, purple, green, lemon)	1	1-3-5-7-9-11	49.2		49.4		49.1		51.5		51.5		51.5	
8 x 5 sec x 5M gold gerbs (on "Symbio!")	5	1-2-4-5-7-9-11-12	43.2	43.2		43.5	43.1		45.5		45.5		45.5	44.8
8 x 1" comets, gold glittering (on final note)	3	1-2-4-5-7-9-11-12	47.2	47.2		47.5	47.1		49.5		49.5		49.5	48.8
4 x 1" mines, crackling (on final note)	2	1-6-9-12	67.7					69.1			70.6			70.2
SEL from each Lily Pad, dB(A)			**68**	**56**	**56**	**56**	**57**	**69**	**60**	**57**	**71**	**58**	**58**	**70**
Total SEL, dB(A)			**76**											

Notes:

[1] Corrected SEL = Sub-total SEL + distance correction + façade correction + barrier attenuation
= Sub-total SEL + 20log(d1/d2) + 3 + Dz

[2] Calculation of barrier attenuation is presented in *Annex C-5.1* for all types of PSEM except Type 2.

[3] Calculation of barrier attenuation is presented in *Annex C-5.2* for mines with crackle/crackling, ie Type 2 PSEM.

Annex C-4.9

Calculation of SEL at Noise Sensitive Receiver

NSR: XC

PSEM Item	Type of PSEM	Position	Corrected SEL [1], dB(A) Locations of PSEM-launching Lily Pad											
			PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Slant Distance between NSR and Lily Pad (d2), m			398	381	373	362	355	356	371	385	398	407	420	426
Barrier Attenuation (Dz)[2], dB(A)			-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
Barrier Attenuation (Dz)[3], dB(A)			0	0	0	0	0	0	0	0	0	0	0	0
10 x 1 sec x 5M gold gerbs	4	2-3-4-5-6-7-8-9-10-11		52.6	52.8	53.1	53.2	53.2	52.8	52.5	52.2	52.0	51.8	
4 x 1" comets, gold glittering	3	2-4-7-9		59.6		60.1			59.8		59.2			
6 x 1" mines, red	1	1-3-5-7-9-11	61.2		61.8		62.2		61.8		61.2		60.8	
6 x 1" mines, blue and green	1	2-4-6-8-10-12		61.6		62.1		62.2		61.5		61.0		60.6
6 x 1" mines, red	1	2-4-7-9		61.6		62.1			61.8		61.2			
4 x 1" mines, blue and green	1	1-3-8-10	61.2		61.8					61.5		61.0		
4 x 1" mines, blue	1	1-5-7-11	61.2				62.2		61.8				60.8	
6 x 1" comets, silver glittering	3	1-3-5-7-9-11	59.2		59.8		60.2		59.8		59.2		58.8	
6 x 1" comets, aqua with silver tail	3	1-3-6-8-10-12	59.2		59.8			60.2		59.5		59.0		58.6
4 x 1" mines, red	1	2-5-7-10		61.6			62.2		61.8			61.0		
2 x 1" mines, gold glittering	1	6-12						62.2						60.6
4 x 1" comets, red with silver tail (alternating)	3	1-4-6-10	59.2			60.1		60.2				59.0		
4 x 1" comets, blue with silver tail (alternating)	3	2-5-8-12		59.6			60.2			59.5				58.6
6 x 1" mines, varigated (blue, red, orange, purple, green, lemon)	1	1-3-5-7-9-11	61.2		61.8		62.2		61.8		61.2		60.8	
8 x 5 sec x 5M gold gerbs (on "Symbio!")	5	1-2-4-5-7-9-11-12	55.2	55.6		56.1	56.2		55.8		55.2		54.8	54.6
8 x 1" comets, gold glittering (on final note)	3	1-2-4-5-7-9-11-12	59.2	59.6		60.1	60.2		59.8		59.2		58.8	58.6
4 x 1" mines, crackling (on final note)	2	1-6-9-12	74.0					75.0			74.0			73.4
SEL from each Lily Pad, dB(A)			**75**	**69**	**68**	**68**	**70**	**76**	**70**	**67**	**75**	**67**	**67**	**74**
Total SEL, dB(A)			**83**											

Notes:

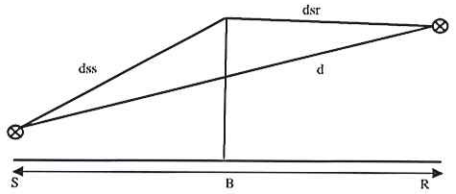
[1] Corrected SEL = Sub-total SEL + distance correction + façade correction + barrier attenuation
= Sub-total SEL + 20log(d1/d2) + 3 + Dz

[2] Calculation of barrier attenuation is presented in *Annex C-5.1* for all types of PSEM except Type 2.

[3] Calculation of barrier attenuation is presented in *Annex C-5.2* for mines with crackle/crackling, ie Type 2 PSEM.

Annex C-5.1
Calculation of Barrier Attenuation for PSEM Types 1, 3, 4 & 5

The noise levels at the identified NSRs were predicted based on equation 1 below:



$SPL = SWL - 20 \log (D) - 8 + 3 + D_z$ ------- equation 1

Where
SPL = Sound Pressure Level
SWL = Sound Power Level
D = Distance between the noise sources and identified NSRs
D_z = Barrier Attenuation, in accordance with ISO 9613-2 (see equation 2)

$D_z = 10 \log [3 + C_2/\lambda\ C_3\ z\ K_{met}]$ ------- equation 2

Where
C_2 = 20, includes effects of ground reflection
λ = wavelength, λ_{500Hz} = 0.69m
C_3 = 1, for single diffraction
z = path length difference = dss + dsr – d
$K_{met} = \exp [-(1/2000)\ (dss\ dsr\ d/2z)^{1/2}]$ for z>0
K_{met} = 1 for z<0

NSR CV2

	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Source H =	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Rec Ht =	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7
SB =	160	140	130	120	115	120	135	145	160	170	180	185
RB =	130	133	137	138	138	137	136	139	136	133	135	134
SR =	290	273	267	258	253	257	271	284	296	303	315	319
Barrier Ht =	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
dss =	162	143	133	123	118	123	138	147	162	172	182	187
dsr =	130	134	137	138	138	137	136	139	136	133	135	134
d =	291	274	268	259	254	258	272	285	296	304	316	320
z =	1.559	1.825	1.995	2.190	2.301	2.188	1.910	1.765	1.570	1.461	1.371	1.327
	1.559	1.825	1.995	2.190	2.301	2.188	1.910	1.765	1.570	1.461	1.371	1.327
tan a	0.169	0.193	0.208	0.225	0.235	0.225	0.200	0.186	0.169	0.159	0.150	0.146
tan b	0.075	0.079	0.081	0.084	0.086	0.084	0.080	0.076	0.073	0.072	0.069	0.068
shadow or illuminatec	S	S	S	S	S	S	S	S	S	S	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	0.50	0.55	0.58	0.61	0.62	0.61	0.56	0.53	0.49	0.46	0.43	0.42
20/0.69*z*Kmet	22.42	29.09	33.32	38.49	41.46	38.52	31.06	26.90	22.14	19.55	17.15	16.14
Dz	14.05	15.06	15.60	16.18	16.48	16.18	15.32	14.76	14.00	13.53	13.04	12.82
	-14	-15	-16	-16	-16	-16	-15	-15	-14	-14	-13	-13

NSR HA

	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Source H =	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Rec Ht =	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2
SB =	45	40	35	35	60	70	80	110	70	75	85	75
RB =	219	213	215	212	189	188	187	165	213	212	210	219
SR =	264	253	250	247	249	258	267	275	283	287	295	294
Barrier Ht =	24.9	24.9	24.9	24.9	18.0	18.0	18.0	18.0	24.9	24.9	24.9	24.9
dss =	48	43	39	39	61	71	81	110	72	77	87	77
dsr =	219	213	215	212	189	188	188	165	213	212	210	219
d =	265	254	251	248	250	259	268	276	284	287	295	295
z =	2.261	2.580	3.014	3.002	0.258	0.174	0.118	0.017	1.262	1.141	0.946	1.159
	2.261	2.580	3.014	3.002	0.258	0.174	0.118	0.017	1.262	1.141	0.946	1.159
tan a	0.376	0.423	0.483	0.483	0.167	0.143	0.125	0.091	0.241	0.225	0.199	0.225
tan b	0.080	0.084	0.085	0.086	0.085	0.082	0.079	0.077	0.075	0.074	0.072	0.072
shadow or illuminatec	S	S	S	S	S	S	S	S	S	S	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	0.68	0.71	0.74	0.75	0.31	0.21	0.13	0.00	0.52	0.49	0.43	0.48
20/0.69*z*Kmet	44.26	53.38	65.01	65.00	2.30	1.05	0.43	0.00	18.96	16.17	11.81	16.17
Dz	16.74	17.51	18.33	18.33	7.24	6.07	5.35	4.77	13.42	12.83	11.71	12.83
	-17	-18	-18	-18	-7	-6	-5	-5	-13	-13	-12	-13

NSR HY

	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Source H =	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Rec Ht =	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3
SB =	160	140	130	120	120	150	160	160	160	170	180	185
RB =	199	202	205	206	201	174	178	191	203	201	203	202
SR =	359	342	335	326	321	324	338	351	363	371	383	387
Barrier Ht =	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
dss =	162	143	133	123	123	152	162	162	162	172	182	187
dsr =	199	203	205	206	201	174	178	192	204	201	203	203
d =	361	344	337	328	323	326	340	353	365	373	385	389
z =	0.496	0.704	0.846	1.005	0.978	0.469	0.410	0.466	0.514	0.431	0.375	0.345
	0.496	0.704	0.846	1.005	0.978	0.469	0.410	0.466	0.514	0.431	0.375	0.345
tan a	0.169	0.193	0.208	0.225	0.225	0.180	0.169	0.169	0.169	0.159	0.150	0.146
tan b	0.110	0.115	0.117	0.121	0.123	0.121	0.116	0.112	0.108	0.106	0.103	0.101
shadow or illuminatec	S	S	S	S	S	S	S	S	S	S	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	0.18	0.26	0.31	0.36	0.36	0.22	0.18	0.18	0.18	0.14	0.11	0.10
20/0.69*z*Kmet	2.59	5.40	7.64	10.54	10.32	2.98	2.10	2.42	2.69	1.80	1.23	0.99
Dz	7.47	9.24	10.27	11.32	11.24	7.76	7.07	7.34	7.55	6.81	6.26	6.01
	-7	-9	-10	-11	-11	-8	-7	-7	-8	-7	-6	-6

NSR IV1

	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Source H =	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Rec Ht =	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7
SB =	200	200	200	200	200	200	200	200	200	200	200	200
RB =	252	234	224	212	202	199	214	230	242	253	266	275
SR =	452	434	424	412	402	399	414	430	442	453	466	475
Barrier Ht =	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6
dss =	201	201	201	201	201	201	201	201	201	201	201	201
dsr =	252	234	224	212	202	199	214	230	242	253	266	275
d =	452	434	425	412	403	399	414	430	443	453	466	475
z =	0.240	0.225	0.217	0.206	0.197	0.194	0.207	0.222	0.232	0.240	0.251	0.257
	0.240	0.225	0.217	0.206	0.197	0.194	0.207	0.222	0.232	0.240	0.251	0.257
tan a	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078
tan b	0.041	0.043	0.044	0.045	0.047	0.047	0.045	0.044	0.042	0.041	0.040	0.039
shadow or illuminatec	S	S	S	S	S	S	S	S	S	S	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
20/0.69*z*Kmet	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.21	0.21
Dz	5.08	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.08	5.08	5.07	5.06
	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5

NSR MV

	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Source H =	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Rec Ht =	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2
SB =	250	230	210	200	190	180	190	200	210	220	230	250
RB =	200	205	216	214	212	213	212	215	215	215	216	208
SR =	450	435	426	414	402	393	402	415	425	435	446	458
Barrier Ht =	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5
dss =	252	232	213	203	193	183	193	203	213	222	232	252
dsr =	211	216	226	224	222	223	222	226	225	225	226	218
d =	461	447	437	426	414	405	414	427	436	446	457	468
z =	2.129	1.683	1.169	1.057	0.943	0.789	0.944	1.033	1.189	1.329	1.447	1.924
	-2.129	-1.683	-1.169	-1.057	-0.943	-0.789	-0.944	-1.033	-1.189	-1.329	-1.447	-1.924
tan a	0.130	0.141	0.155	0.163	0.171	0.181	0.171	0.163	0.155	0.148	0.141	0.130
tan b	0.220	0.228	0.233	0.240	0.247	0.253	0.247	0.239	0.234	0.228	0.222	0.217
shadow or illuminatec	I	I	I	I	I	I	I	I	I	I	I	I
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20/0.69*z*Kmet	-61.72	-48.79	-33.87	-30.63	-27.32	-22.87	-27.36	-29.95	-34.45	-38.52	-41.95	-55.76
Dz	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0	0	0	0	0	0	0	0	0	0	0	0

NSR OR

	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Source H =	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Rec Ht =	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7
SB =	140	130	120	100	95	110	120	125	135	150	160	160
RB =	185	182	187	201	204	196	198	203	204	194	194	196
SR =	325	312	307	301	299	306	318	328	339	344	354	356
Barrier Ht =	18.0	18.0	27.0	27.0	27.0	35.0	27.0	27.0	27.0	27.0	18.0	18.0
dss =	140	130	121	102	97	113	121	126	136	151	160	160
dsr =	187	183	188	201	205	196	199	204	204	195	196	197
d =	327	313	309	303	301	308	320	330	340	346	356	357
z =	0.150	0.130	0.198	0.407	0.479	1.455	0.229	0.212	0.161	0.087	0.182	0.177
	-0.150	-0.130	0.198	0.407	0.479	1.455	0.229	0.212	0.161	0.087	-0.182	-0.177
tan a	0.071	0.077	0.158	0.190	0.200	0.245	0.158	0.152	0.141	0.127	0.063	0.063
tan b	0.107	0.111	0.113	0.115	0.116	0.113	0.109	0.106	0.102	0.101	0.098	0.098
shadow or illuminatec	I	I	S	S	S	S	S	S	S	S	I	I
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	1.00	1.00	0.12	0.25	0.29	0.46	0.13	0.11	0.07	0.02	1.00	1.00
20/0.69*z*Kmet	-4.36	-3.77	0.69	2.96	3.98	19.59	0.85	0.66	0.31	0.06	-5.27	-5.12
Dz	0.00	0.00	5.68	7.75	8.44	13.54	5.86	5.63	5.20	4.85	0.00	0.00
	0	0	-6	-8	-8	-14	-6	-6	-5	-5	0	0

NSR PTS1

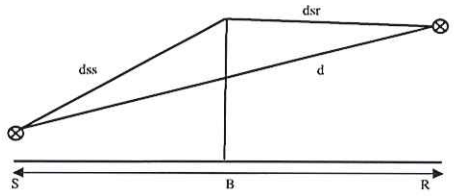
	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Source H =	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Rec Ht =	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2
SB =	50	70	80	90	95	95	80	65	50	40	28	20
RB =	102	100	98	99	102	104	104	103	105	105	104	105
SR =	152	170	178	189	197	199	184	168	155	145	132	125
Barrier Ht =	24.9	24.9	24.9	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8
dss =	53	72	82	91	96	96	81	66	52	42	31	24
dsr =	103	100	98	99	102	104	104	103	106	106	104	105
d =	153	170	178	189	197	199	184	168	156	146	132	125
z =	2.927	2.192	1.962	0.835	0.792	0.791	0.937	1.151	1.497	1.867	2.634	3.577
	2.927	2.192	1.962	0.835	0.792	0.791	0.937	1.151	1.497	1.867	2.634	3.577
tan a	0.338	0.241	0.211	0.142	0.135	0.135	0.160	0.197	0.256	0.320	0.457	0.640
tan b	0.054	0.048	0.046	0.043	0.042	0.041	0.045	0.049	0.053	0.056	0.062	0.066
shadow or illuminatec	S	S	S	S	S	S	S	S	S	S	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	0.83	0.77	0.74	0.60	0.58	0.57	0.63	0.70	0.77	0.81	0.87	0.90
20/0.69*z*Kmet	70.29	48.78	42.05	14.59	13.20	13.10	17.22	23.42	33.24	43.97	66.25	93.40
Dz	18.65	17.14	16.54	12.45	12.10	12.07	13.06	14.22	15.59	16.72	18.40	19.84
	-19	-17	-17	-12	-12	-12	-13	-14	-16	-17	-18	-20

NSR	SW2											
	PY1	**PY2**	**PY3**	**PY4**	**PY5**	**PY6**	**PY7**	**PY8**	**PY9**	**PY10**	**PY11**	**PY12**
Source H =	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Rec Ht =	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2
SB =	38	38	40	42	40	50	70	68	70	70	70	60
RB =	260	259	260	261	271	273	256	258	258	257	258	262
SR =	298	297	300	303	311	323	326	326	328	327	328	322
Barrier Ht =	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9
dss =	42	42	43	45	43	53	72	70	72	72	72	62
dsr =	261	259	260	262	271	273	257	258	259	257	259	262
d =	298	297	300	303	311	323	326	326	328	327	328	322
z =	3.932	3.934	3.768	3.615	3.753	3.107	2.362	2.417	2.359	2.361	2.359	2.677
	3.932	3.934	3.768	3.615	3.753	3.107	2.362	2.417	2.359	2.361	2.359	2.677
tan a	0.445	0.445	0.423	0.402	0.423	0.338	0.241	0.249	0.241	0.241	0.241	0.282
tan b	0.011	0.011	0.011	0.011	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
shadow or illuminatec	S	S	S	S	S	S	S	S	S	S	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	0.73	0.73	0.72	0.70	0.71	0.65	0.57	0.58	0.57	0.57	0.57	0.61
20/0.69*z*Kmet	82.70	82.92	78.11	73.64	76.72	58.41	38.92	40.35	38.69	38.88	38.69	47.26
Dz	19.33	19.34	19.09	18.84	19.02	17.88	16.22	16.37	16.20	16.22	16.20	17.01
	-19	-19	-19	-19	-19	-18	-16	-16	-16	-16	-16	-17

NSR	XC											
	PY1	**PY2**	**PY3**	**PY4**	**PY5**	**PY6**	**PY7**	**PY8**	**PY9**	**PY10**	**PY11**	**PY12**
Source H =	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Rec Ht =	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
SB =	200	190	180	170	160	160	170	180	190	200	210	220
RB =	198	191	193	192	195	196	201	205	208	207	210	206
SR =	398	381	373	362	355	356	371	385	398	407	420	426
Barrier Ht =	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
dss =	200	191	181	171	161	161	171	181	191	200	210	220
dsr =	199	191	193	192	196	196	201	206	208	207	210	206
d =	399	382	374	363	356	357	372	386	399	408	420	426
z =	0.001	0.001	0.005	0.010	0.019	0.020	0.014	0.010	0.006	0.003	0.001	0.000
	0.001	0.001	0.005	0.010	0.019	0.020	0.014	0.010	0.006	0.003	0.001	0.000
tan a	0.070	0.074	0.078	0.082	0.088	0.088	0.082	0.078	0.074	0.070	0.067	0.064
tan b	0.068	0.071	0.072	0.075	0.076	0.076	0.073	0.070	0.068	0.066	0.064	0.063
shadow or illuminatec	S	S	S	S	S	S	S	S	S	S	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20/0.69*z*Kmet	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dz	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77
	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5

Annex C-5.2
Calculation of Barrier Attenuation for PSEM Type 2

The noise levels at the identified NSRs were predicted based on equation 1 below:



SPL = SWL - 20 log (D) – 8 +3 + D_z ------ equation 1

Where
SPL = Sound Pressure Level
SWL = Sound Power Level
D = Distance between the noise sources and identified NSRs
D_z = Barrier Attenuation, in accordance with ISO 9613-2 (see equation 2)

D_z = 10 log [3+C_2/λ C_3 z K_{met}] ------ equation 2

Where
C_2 = 20, includes effects of ground reflection
λ = wavelength, λ_{500Hz} = 0.69m
C_3 = 1, for single diffraction
z = path length difference = dss + dsr – d
K_{met} = exp [-(1/2000) (dss dsr d/2z)$^{1/2}$] for z>0
K_{met} = 1 for z<0

NSR CV2

	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Source H =	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
Rec Ht =	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7
SB =	160	140	130	120	115	120	135	145	160	170	180	185
RB =	130	133	137	138	138	137	136	139	136	133	135	134
SR =	290	273	267	258	253	257	271	284	296	303	315	319
Barrier Ht =	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
dss =	160	140	130	120	115	120	135	145	160	170	180	185
dsr =	130	134	137	138	138	137	136	139	136	133	135	134
d =	290	273	267	258	253	257	271	284	296	303	315	319
z =	0.102	0.100	0.098	0.097	0.097	0.098	0.098	0.096	0.098	0.099	0.098	0.099
	0.102	0.100	0.098	0.097	0.097	0.098	0.098	0.096	0.098	0.099	0.098	0.099
tan a	0.013	0.014	0.015	0.017	0.017	0.017	0.015	0.014	0.013	0.012	0.011	0.011
tan b	0.011	0.012	0.012	0.013	0.013	0.013	0.012	0.012	0.011	0.011	0.010	0.010
shadow or illuminatec	S	S	S	S	S	S	S	S	S	S	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	0.07	0.08	0.09	0.10	0.10	0.10	0.08	0.06	0.06	0.05	0.04	0.04
20/0.69*z*Kmet	0.20	0.23	0.24	0.27	0.29	0.28	0.23	0.18	0.16	0.15	0.13	0.12
Dz	5.04	5.09	5.11	5.15	5.17	5.15	5.09	5.02	5.00	4.99	4.95	4.94
	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5

NSR HA

	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Source H =	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
Rec Ht =	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2
SB =	45	40	35	35	60	70	80	110	70	75	85	75
RB =	219	213	215	212	189	188	187	165	213	212	210	219
SR =	264	253	250	247	249	258	267	275	283	287	295	294
Barrier Ht =	24.9	24.9	24.9	24.9	18.0	18.0	18.0	18.0	24.9	24.9	24.9	24.9
dss =	46	41	36	36	62	72	81	111	70	75	85	75
dsr =	219	213	215	212	189	188	188	165	213	212	210	219
d =	264	253	250	247	249	258	268	275	283	287	295	294
z =	0.738	0.827	0.939	0.939	2.150	1.895	1.701	1.372	0.485	0.455	0.405	0.454
	-0.738	-0.827	-0.939	-0.939	-2.150	-1.895	-1.701	-1.372	-0.485	-0.455	-0.405	-0.454
tan a	-0.180	-0.203	-0.231	-0.231	-0.250	-0.214	-0.188	-0.136	-0.116	-0.108	-0.095	-0.108
tan b	0.014	0.015	0.015	0.015	0.015	0.015	0.014	0.014	0.013	0.013	0.013	0.013
shadow or illuminatec	I	I	I	I	I	I	I	I	I	I	I	I
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20/0.69*z*Kmet	-21.39	-23.96	-27.22	-27.23	-62.31	-54.93	-49.31	-39.77	-14.06	-13.18	-11.73	-13.15
Dz	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0	0	0	0	0	0	0	0	0	0	0	0

NSR HY

	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Source H =	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
Rec Ht =	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3
SB =	160	140	130	120	120	150	160	160	160	170	180	185
RB =	199	202	205	206	201	174	178	191	203	201	203	202
SR =	359	342	335	326	321	324	338	351	363	371	383	387
Barrier Ht =	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
dss =	160	140	130	120	120	150	160	160	160	170	180	185
dsr =	199	203	205	206	201	174	178	192	204	201	203	203
d =	359	342	335	326	321	324	338	352	364	371	383	388
z =	0.108	0.089	0.079	0.070	0.074	0.132	0.135	0.117	0.103	0.112	0.117	0.120
	-0.108	-0.089	-0.079	-0.070	-0.074	-0.132	-0.135	-0.117	-0.103	-0.112	-0.117	-0.120
tan a	0.013	0.014	0.015	0.017	0.017	0.013	0.013	0.013	0.013	0.012	0.011	0.011
tan b	0.040	0.042	0.043	0.044	0.045	0.044	0.042	0.041	0.039	0.039	0.037	0.037
shadow or illuminatec	I	I	I	I	I	I	I	I	I	I	I	I
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20/0.69*z*Kmet	-3.13	-2.59	-2.29	-2.04	-2.16	-3.84	-3.90	-3.38	-2.99	-3.25	-3.38	-3.49
Dz	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0	0	0	0	0	0	0	0	0	0	0	0

NSR IV1

	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Source H =	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
Rec Ht =	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7
SB =	200	200	200	200	200	200	200	200	200	200	200	200
RB =	252	234	224	212	202	199	214	230	242	253	266	275
SR =	452	434	424	412	402	399	414	430	442	453	466	475
Barrier Ht =	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6
dss =	200	200	200	200	200	200	200	200	200	200	200	200
dsr =	252	234	224	212	202	199	214	230	242	253	266	275
d =	452	434	424	412	402	399	414	430	442	453	466	475
z =	0.196	0.196	0.195	0.195	0.195	0.195	0.195	0.196	0.196	0.196	0.196	0.196
	-0.196	-0.196	-0.195	-0.195	-0.195	-0.195	-0.195	-0.196	-0.196	-0.196	-0.196	-0.196
tan a	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047	-0.047
tan b	0.014	0.015	0.015	0.015	0.016	0.016	0.015	0.015	0.014	0.014	0.014	0.013
shadow or illuminatec	I	I	I	I	I	I	I	I	I	I	I	I
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20/0.69*z*Kmet	-5.68	-5.67	-5.66	-5.66	-5.66	-5.66	-5.66	-5.67	-5.67	-5.68	-5.69	-5.69
Dz	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0	0	0	0	0	0	0	0	0	0	0	0

NSR MV

	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Source H =	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
Rec Ht =	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2	107.2
SB =	250	230	210	200	190	180	190	200	210	220	230	250
RB =	200	205	216	214	212	213	212	215	215	215	216	208
SR =	450	435	426	414	402	393	402	415	425	435	446	458
Barrier Ht =	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5
dss =	250	230	210	200	190	180	190	200	210	220	230	250
dsr =	211	216	226	224	222	223	222	226	225	225	226	218
d =	456	442	432	421	409	400	409	422	431	441	452	464
z =	4.867	4.400	3.788	3.695	3.597	3.423	3.599	3.656	3.820	3.954	4.052	4.584
	-4.867	-4.400	-3.788	-3.695	-3.597	-3.423	-3.599	-3.656	-3.820	-3.954	-4.052	-4.584
tan a	0.030	0.033	0.036	0.038	0.039	0.042	0.039	0.038	0.036	0.034	0.033	0.030
tan b	0.165	0.170	0.174	0.179	0.184	0.189	0.185	0.179	0.175	0.171	0.166	0.162
shadow or illuminatec	I	I	I	I	I	I	I	I	I	I	I	I
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20/0.69*z*Kmet	-141.06	-127.54	-109.79	-107.11	-104.25	-99.22	-104.33	-105.97	-110.71	-114.61	-117.46	-132.86
Dz	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0	0	0	0	0	0	0	0	0	0	0	0

NSR OR

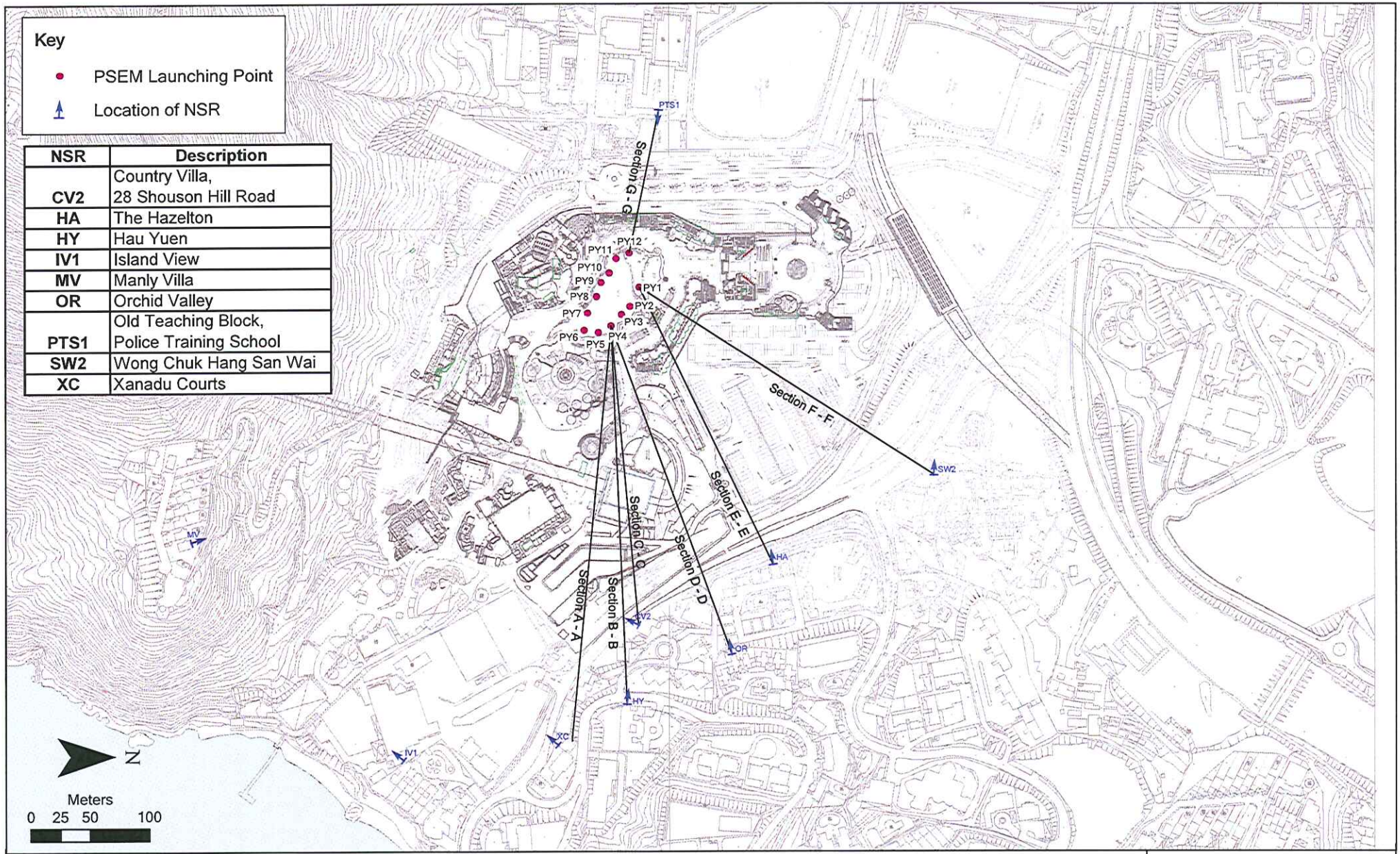
	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Source H =	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
Rec Ht =	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7
SB =	140	130	120	100	95	110	120	125	135	150	160	160
RB =	185	182	187	201	204	196	198	203	204	194	194	196
SR =	325	312	307	301	299	306	318	328	339	344	354	356
Barrier Ht =	18.0	18.0	27.0	27.0	27.0	35.0	27.0	27.0	27.0	27.0	18.0	18.0
dss =	141	131	120	100	95	110	120	125	135	150	161	161
dsr =	187	183	188	201	205	196	199	204	204	195	196	197
d =	325	312	307	301	300	306	318	328	339	344	354	356
z =	2.296	2.384	0.655	0.637	0.634	0.016	0.623	0.606	0.599	0.617	2.135	2.123
	-2.296	-2.384	-0.655	-0.637	-0.634	-0.016	-0.623	-0.606	-0.599	-0.617	-2.135	-2.123
tan a	-0.107	-0.115	-0.050	-0.060	-0.063	0.018	-0.050	-0.048	-0.044	-0.040	-0.094	-0.094
tan b	0.030	0.031	0.032	0.032	0.032	0.032	0.030	0.030	0.029	0.028	0.027	0.027
shadow or illuminatec	I	I	I	I	I	I	I	I	I	I	I	I
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20/0.69*z*Kmet	-66.55	-69.10	-18.98	-18.45	-18.38	-0.45	-18.06	-17.56	-17.36	-17.89	-61.89	-61.54
Dz	0.00	0.00	0.00	0.00	0.00	4.06	0.00	0.00	0.00	0.00	0.00	0.00
	0	0	0	0	0	-4	0	0	0	0	0	0

NSR PTS1

	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11	PY12
Source H =	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
Rec Ht =	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2
SB =	50	70	80	90	95	95	80	65	50	40	28	20
RB =	102	100	98	99	102	104	104	103	105	105	104	105
SR =	152	170	178	189	197	199	184	168	155	145	132	125
Barrier Ht =	24.9	24.9	24.9	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8
dss =	51	70	80	91	96	96	81	66	51	42	31	23
dsr =	103	100	98	99	102	104	104	103	106	106	104	105
d =	153	171	179	190	198	200	185	169	156	146	133	126
z =	0.098	0.016	0.003	0.185	0.169	0.174	0.261	0.401	0.662	0.952	1.581	2.404
	0.098	0.016	0.003	0.185	0.169	0.174	0.261	0.401	0.662	0.952	1.581	2.404
tan a	-0.162	-0.116	-0.101	-0.136	-0.128	-0.128	-0.153	-0.188	-0.244	-0.305	-0.436	-0.610
tan b	0.110	0.099	0.094	0.089	0.085	0.084	0.091	0.100	0.108	0.116	0.127	0.134
shadow or illuminatec	S	S	S	S	S	S	S	S	S	S	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	0.36	0.05	0.00	0.34	0.30	0.30	0.42	0.55	0.67	0.75	0.83	0.88
20/0.69*z*Kmet	1.03	0.02	0.00	1.83	1.48	1.52	3.19	6.37	12.86	20.63	38.15	61.37
Dz	6.05	4.80	4.77	6.84	6.51	6.55	7.92	9.72	12.00	13.73	16.14	18.09
	-6	-5	-5	-7	-7	-7	-8	-10	-12	-14	-16	-18

NSR	SW2											
	PY1	**PY2**	**PY3**	**PY4**	**PY5**	**PY6**	**PY7**	**PY8**	**PY9**	**PY10**	**PY11**	**PY12**
Source H =	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
Rec Ht =	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2
SB =	38	38	40	42	40	50	70	68	70	70	70	60
RB =	260	259	260	261	271	273	256	258	258	257	258	262
SR =	298	297	300	303	311	323	326	326	328	327	328	322
Barrier Ht =	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9
dss =	39	39	41	43	41	51	70	68	70	70	70	61
dsr =	261	259	260	262	271	273	257	258	259	257	259	262
d =	299	297	301	304	312	324	327	326	329	327	329	323
z =	0.418	0.416	0.381	0.350	0.395	0.260	0.105	0.116	0.107	0.106	0.107	0.165
	0.418	0.416	0.381	0.350	0.395	0.260	0.105	0.116	0.107	0.106	0.107	0.165
tan a	-0.213	-0.213	-0.203	-0.193	-0.203	-0.162	-0.116	-0.119	-0.116	-0.116	-0.116	-0.135
tan b	0.073	0.073	0.073	0.072	0.070	0.068	0.067	0.067	0.066	0.067	0.066	0.068
shadow or illuminatec	S	S	S	S	S	S	S	S	S	S	S	S
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	0.39	0.39	0.36	0.33	0.35	0.23	0.07	0.08	0.07	0.07	0.07	0.14
20/0.69*z*Kmet	4.68	4.68	3.97	3.37	4.02	1.74	0.22	0.28	0.22	0.22	0.22	0.67
Dz	8.86	8.85	8.43	8.04	8.47	6.76	5.07	5.15	5.08	5.07	5.08	5.64
	-9	-9	-8	-8	-8	-7	-5	-5	-5	-5	-5	-6

NSR	XC											
	PY1	**PY2**	**PY3**	**PY4**	**PY5**	**PY6**	**PY7**	**PY8**	**PY9**	**PY10**	**PY11**	**PY12**
Source H =	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
Rec Ht =	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
SB =	200	190	180	170	160	160	170	180	190	200	210	220
RB =	198	191	193	192	195	196	201	205	208	207	210	206
SR =	398	381	373	362	355	356	371	385	398	407	420	426
Barrier Ht =	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
dss =	200	190	180	170	160	160	170	180	190	200	210	220
dsr =	199	191	193	192	196	196	201	206	208	207	210	206
d =	398	381	373	362	355	356	371	385	398	407	420	426
z =	0.723	0.755	0.769	0.790	0.805	0.803	0.770	0.742	0.719	0.705	0.686	0.681
	-0.723	-0.755	-0.769	-0.790	-0.805	-0.803	-0.770	-0.742	-0.719	-0.705	-0.686	-0.681
tan a	-0.055	-0.058	-0.061	-0.065	-0.069	-0.069	-0.065	-0.061	-0.058	-0.055	-0.052	-0.050
tan b	0.005	0.005	0.005	0.006	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005
shadow or illuminatec	I	I	I	I	I	I	I	I	I	I	I	I
Wavelength, 500Hz	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Kmet	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20/0.69*z*Kmet	-20.96	-21.89	-22.28	-22.89	-23.32	-23.27	-22.33	-21.49	-20.84	-20.45	-19.89	-19.73
Dz	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0	0	0	0	0	0	0	0	0	0	0	0



Annex C-5.3 (1 of 3)

Lagoon Show PSEM Launching Points

File: 0111415_Cross Section.mxd
Date: 17/09/2010

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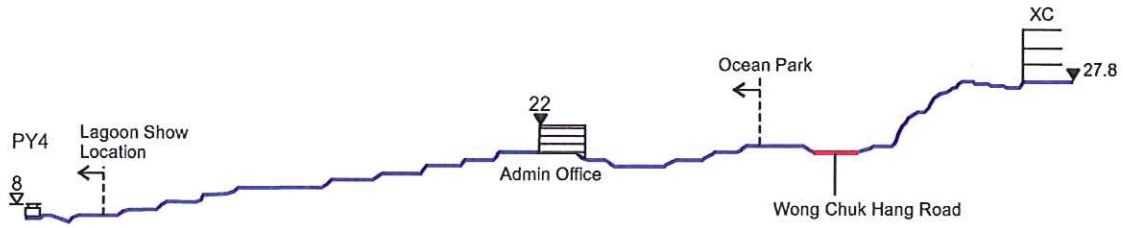
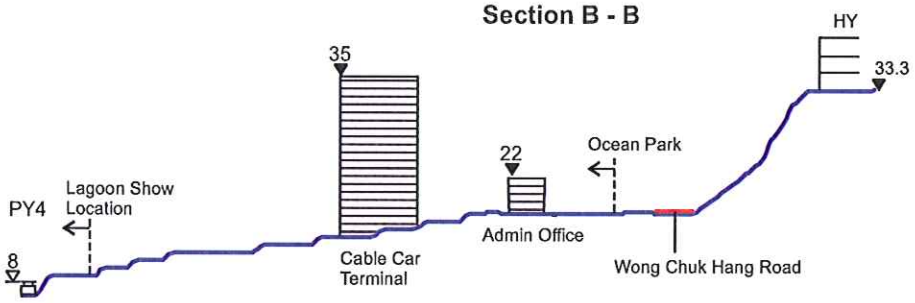
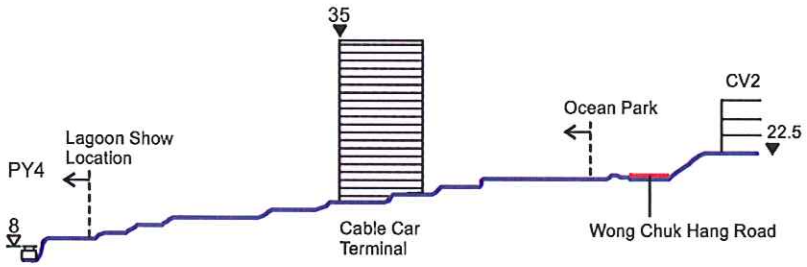
Section A - A



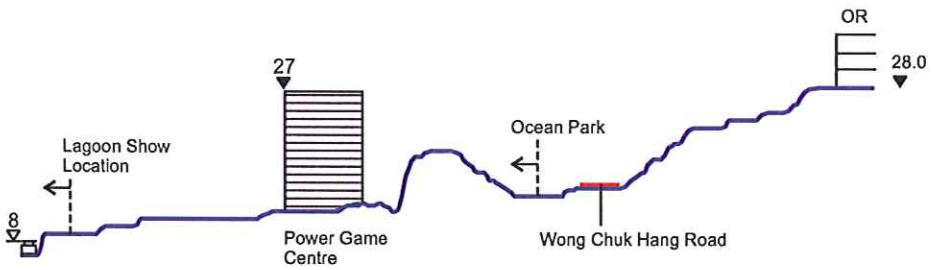
Section B - B



Section C - C



Section D - D



Annex C-5.3 (2 of 3)

Cross Section (PSEM Launching Point)

FILE: 0111415a
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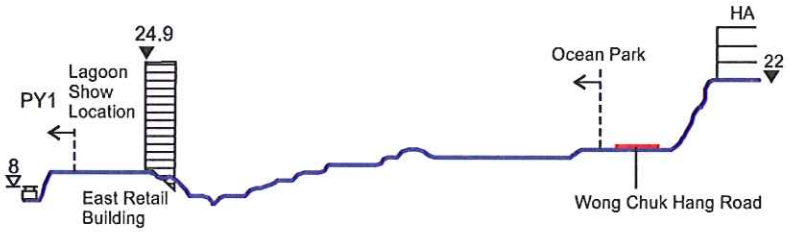
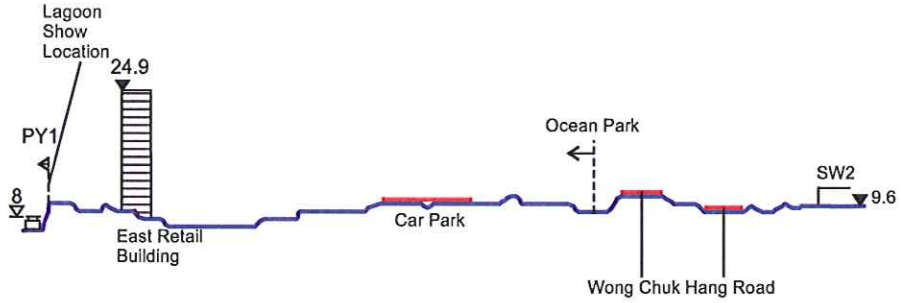
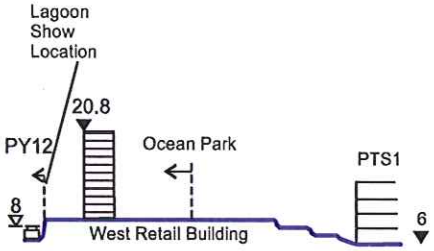
Section E - E



Section F - F



Section G - G



Annex C-5.3 (3 of 3)

Cross Section (PSEM Launching Points)

FILE: 0111415b
DATE: 05/08/2010

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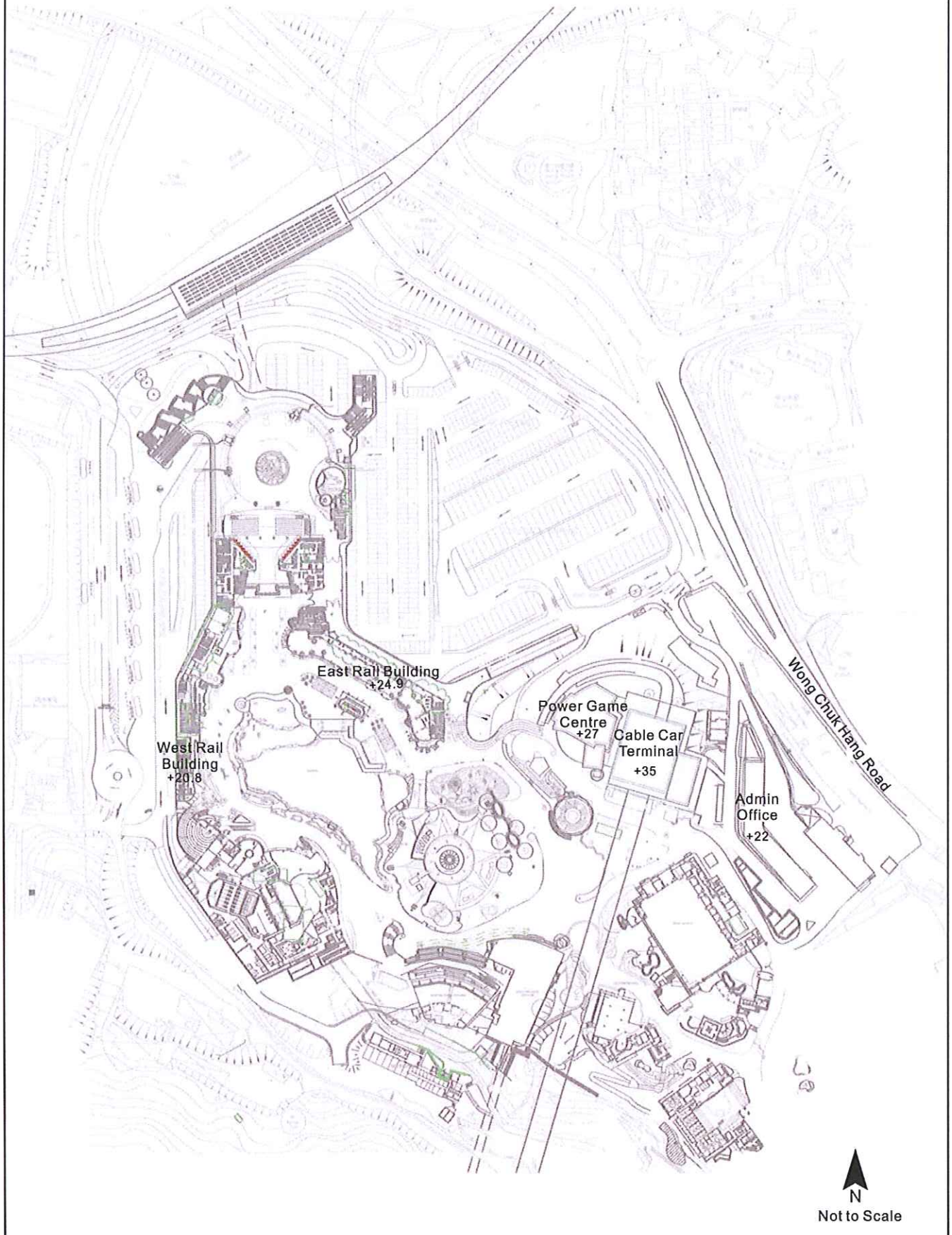
Management

ERM



Annex C-5.4

Layout Plan of the Lagoon and the nearby Buildings

FILE: 0111415c
DATE: 17/09/2010

Environmental
Resources
Management

ERM

Annex D

Cumulative Noise Impact – Fixed Plant Noise (Lagoon Night Show and Other Fixed Plant Noise from Ocean Park) and PSEM Noise

Annex D

Summary of Cumulative Noise Levels at NSRs

Fixed plant noise (Lagoon Night Show and Other Fixed Plant Noise in Ocean Park) + PSEM noise

NSR	PSEM Noise		Fixed plant noise + Entertainment noise (loudspeaker noise only)	Fixed plant noise + Entertainment noise (loudspeaker & PSEM noise)	Noise Criteria, LAeq, 30min, dB(A) [1]
	Predicted SEL, dB(A)	Calculated $L_{Aeq, 30min}$, dB(A)			
PTS1	81	48	54	55	60
SW2	76	44	50	51	60
HA	84	52	55	57	60
CV2	79	46	53	54	60
XC	83	50	54	55	60
IV1	82	49	55	56	60
OR	85	52	53	55	55
HY	82	50	53	54	55
MV	85	52	54	56	56