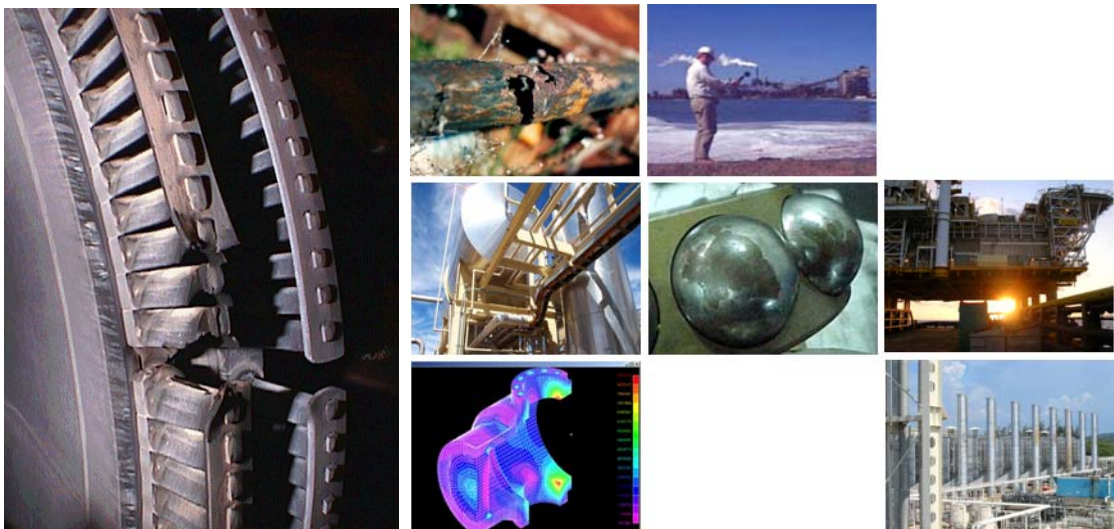


PORT HEDLAND DREDGING AND SPOIL MANAGEMENT NOISE ASSESSMENT REPORT



BHP BILLITON

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EXECUTIVE SUMMARY

Overview

SVT were commissioned by BHP Billiton to undertake an environmental noise impact assessment of the present and proposed expansion of BHP Billiton Iron Ore's (BHPBIO) Port Hedland facilities in Western Australia. The objectives of the study are to determine current noise emission levels and to assess:

- the noise impacts of the proposed port upgrade for RPG4 and 5;
- the noise impacts of the proposed dredging and dredge spoil activities;
- the noise impacts of rail operations; and,
- where appropriate, to suggest methods to mitigate excessive noise emissions to achieve compliance with noise limits imposed under the regulations (Environmental Protection (Noise) Regulations 1997).

This report addresses the noise impact due to dredging and spoil management activities.

Applicable Regulations

Dredging and Spoil Management

Dredging is considered as a construction activity. The Environmental Protection (Noise) Regulations 1997 gives requirements on how noise emission from construction sites is to be controlled. For construction work the noise regulations are the most stringent during nighttime hours and the following conditions apply:

- The construction work must be carried out in accordance with control of noise practices set out in Section 6 of Australian Standard 2436 "Guide to Noise Control on Construction, Maintenance and Demolition Sites"; and
- The equipment used for the construction must be the quietest reasonably available.
- The contractor must advise all nearby occupants or other sensitive receptors who are likely to receive noise levels which fail to comply with the standard under Regulation 7 of the Environmental Protection (Noise) Regulations 1997, of the work to be done at least 24 hours before it commences;
- The contractor must show that it was reasonably necessary for the work to be done out of hours; and
- The contractor must submit to the CEO a Noise Management Plan at least seven days before the work starts, and the plan must be approved by the CEO. The plan must include details of:
 - Need for the work to be done out of hours;
 - Types of activities which could be noisy;
 - Predictions of the noise levels;

- Control measures for noise and vibration;
- Procedures to be adopted for monitoring noise emissions; and,
- Complaint response procedures to be adopted.

Assigned Levels

The Regulations specify assigned noise levels, which are the highest noise levels that can be received at noise-sensitive premises, commercial and industrial premises. Assigned noise levels have been set differently for noise sensitive premises, commercial premises, and industrial premises. For noise sensitive premises, ie residences, an “influencing factor” is added to the assigned noise levels. Penalties are also applied for noise that has tonal characteristics. The assigned noise levels for the Port Hedland area are given in Table 1-1.

Table 1-1: Assigned noise levels for noise sensitive premises.

Position	Influencing Factor in dB	LA10 Assigned noise levels in dB(A)		
		Day	Evening	Night
1. Brearley St	2	47	42	37
2. Hospital	2	47	42	37
3. Laurentis Point	5	50	45	40
4. Police Station	17	62	57	52
5. Pretty Pool	0	45	40	35
6. South Hedland	0	45	40	35
7. Wedgefield Industrial Estate	NA	65	65	65

Modelling

The dredging and spoil management noise sources included a Backhoe, a Cutter Suction dredger and mobile equipment. The following three different situations were modelled:

- Dredging Activities in Harriet Point area and spoil management in area B1 (see Figure 5-1 page 14).
- Dredging Activities in Harriet Point area and spoil management in area B2 (Figure 5-3 page 15).
- Dredging Activities in Harriet Point area and spoil management in area A (Figure 5-5 page 17).

Dredging Compliance and Noise Control

The modelling showed that for all dredging operations there are only 3 noise sensitive receivers that were affected by the dredging operations. These are the hospital, Laurentis Point and the police station. Noise received at the police station was found to exceed the assigned levels for Harriet Point and dredge spoil operations in areas B1 and B2 at night time. The hospitals noise levels were found to be above the assigned levels for all dredging operations during night and evening operations.

The cumulative effect of port facility operations (RGP3, RGP4(a) and RGP4(b)) and dredging operations is given in Table 6-2. As can be seen from the table the impact of the dredging noise on the sensitive receivers is between 0 and 0.8 dB for the receivers within Port Hedland. Dredging noise has the largest impact on Wedgefield with a maximum increase of 5 dB.

As a result of the analysis it is suggested that the following noise control measures be considered:

- 1) **Cutter Suction Dredge Cutter**. The cutter primary noise sources are the motor and a gear drive. It is recommended that the cutter's motor and gear drive be acoustically enclosed.
- 2) **Booster Pump**. It is recommended that the Booster Pump's pumps and generator be acoustically enclosed, or where possible lagged.
- 3) **Backhoe Dredge**. It is recommended that a quiet as possible backhoe be used.
- 4) **Mobile Equipment**. It is recommended that noise from mobile equipment should not exceed the levels given in Australian Standard 2436-1981.

A noise management plan has also been included that recommends the following activities:

- 5) Noise loggers be placed at the Police Station, Hospital and Laurentis Point for the duration of the dredging and spoil management activities.
- 6) Stakeholder awareness;
- 7) Complaint Registration;
- 8) Noise Monitoring and analysis; and,
- 9) Noise control plan and implementation.

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1. INTRODUCTION

SVT were commissioned by BHP Billiton to undertake an environmental noise impact assessment of the present and proposed expansion of BHP Billiton Iron Ore's (BHPBIO) Port Hedland facilities in Western Australia. The objectives of the study are to determine current noise emission levels, to assess the noise impacts of:

- the proposed port upgrade for Rapid Growth Project 4 and Rapid Growth Project 5;
- the proposed dredging and dredge spoil activities;
- the proposed rail operations; and,
- where appropriate, to suggest methods to mitigate excessive noise emissions to achieve compliance with noise limits imposed under the Environmental Protection (Noise) Regulations 1997.

This report addresses the noise assessment of the proposed dredging and spoil management activities planned for the RGP 5 development at Port Hedland.

1.1 Applicable Documents

The following lists the applicable documents.

- BHBIO Doc: Noise Reduction Management Plan – Port Hedland Rev 0 22/11/2006
- SVT Doc: Port Hedland noise assessment report for RGP3/4 and 5 - Rpt02 075063 Noise Assessment report Rev 0

1.2 Scope of Work

The major activities undertaken for this report included the modelling of dredging operations and spoil management using equivalent noise sources from the SVT acoustics database or from similar equipment already in operation at Port Hedland.

2. PORT HEDLAND AND SURROUNDING AREA

2.1 Port Hedland

Within Port Hedland there are industrial, commercial and residential areas as shown in Figure 2-1. The industrial areas are concentrated at Nelson Point and Finucane Island, the commercial area is located at the town centre of Port Hedland and the residential area is located along northern shore of Nelson Point.

The industrial activities in Port Hedland are primarily due to port operations associated with fishing and the shipping of iron ore and salt. Of these activities the BHPBIO facilities at Nelson Point and Finucane Island dominate noise impacts within the town of Port Hedland.

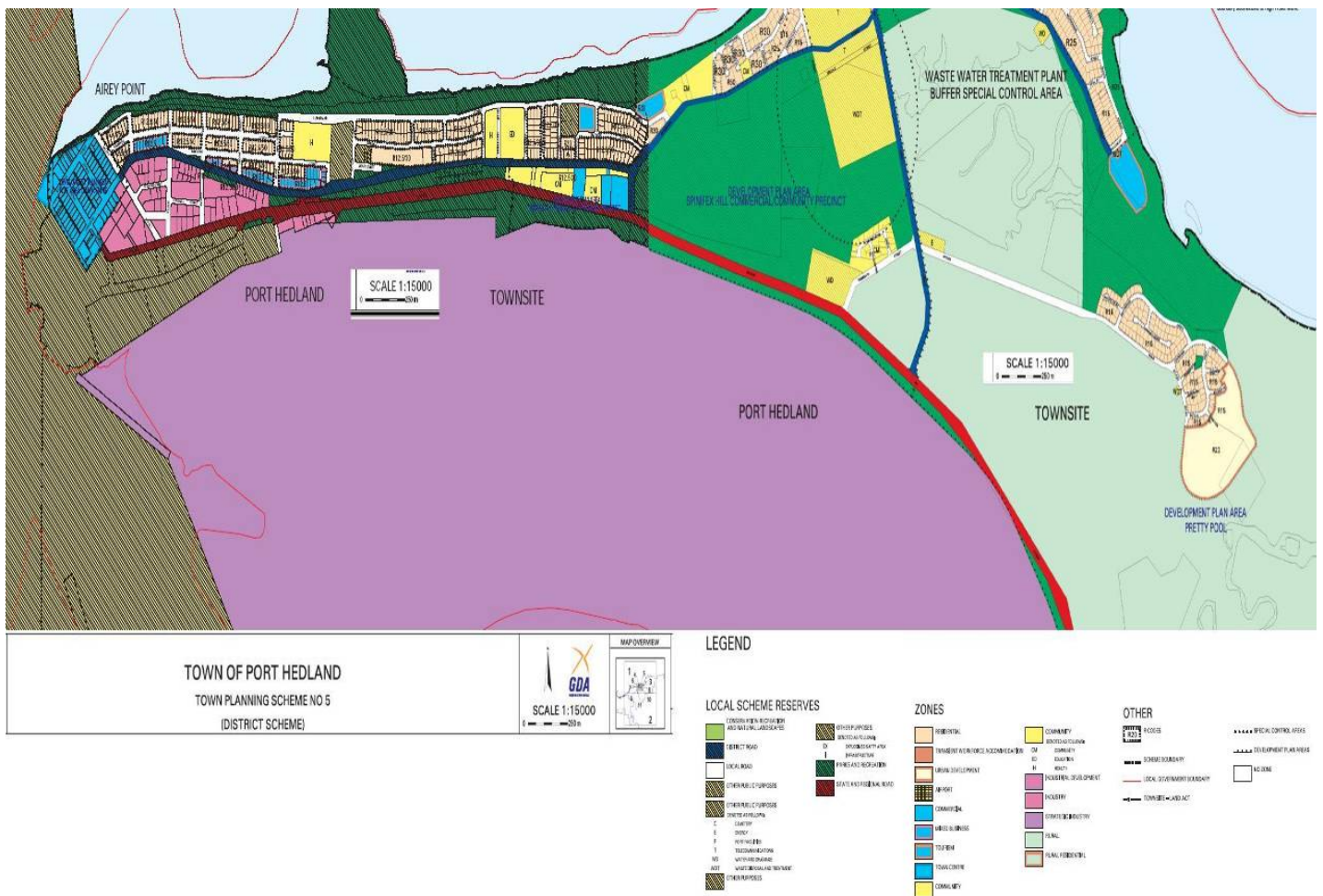


Figure 2-1 Port Hedland Town Zoning

2.2 Wedgefield Industrial area

The industrial area of Wedgefield is some 5.5 km from the BHPBIO operations at Port Hedland as shown in Figure 2-2. Wedgefield field is zoned as an industrial area.

2.3 South Hedland

South Hedland is a small town, consisting of a residential area with a small shopping and office area which is zoned as a commercial area. South Hedland is some 9 km away from Port Hedland as shown in Figure 2-2.



Figure 2-2 Port Hedland and surrounding area.

3. APPLICABLE REGULATIONS AND ASSIGNED LEVELS

3.1 Regulation Applicable to Dredging Operations

Dredging activities are typically a continuous operation running 24 hours a day 7 days a week. Dredging is considered as a construction activity and therefore has noise criteria and noise control requirements that need to be met under the Environmental Protection (Noise) Regulations 1997.

3.1.1 Daytime Construction Activities

The Environmental Protection Noise Regulations 1997 state that for construction work carried out between 7am and 7pm on any day, which is not a Sunday or public holiday the assigned noise levels do not apply provided that:

- The construction work is carried out in accordance with control of noise practices set out in Section 6 of Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites"; and,
- The equipment used for the construction is the quietest reasonably available.

The Chief Executive Officer (CEO) may request that a noise management plan be submitted for the construction work carried out.

3.1.2 Night-time Construction Activities

The following applies for construction work undertaken outside daytime hours:

- The construction work must be carried out in accordance with control of noise practices set out in Section 6 of Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites"; and,
- The equipment used for the construction must be the quietest reasonably available.

Furthermore, if noise emissions are likely to exceed the assigned noise levels then the following must be undertaken.

- The contractor must advise all nearby occupants or other sensitive receptors who are likely to receive noise levels which fail to comply with the standard under Regulation 7, of the work to be done at least 24 hours before it commences.
- The contractor must show that it was reasonably necessary for the work to be done out of hours.
- The contractor must submit to the CEO a Noise Management Plan at least seven days before the work starts, and the plan must be approved by the CEO. The plan must include details of:
 - Need for the work to be done out of hours;
 - Types of activities which could be noisy;
 - Predictions of the noise levels;
 - Control measures for noise and vibration;
 - Procedures to be adopted for monitoring noise emissions; and

- o Complaint response procedures to be adopted.

3.1.3 Construction Traffic

Where construction traffic (particularly from heavy vehicles associated with earthworks) is likely to pass close to residential streets or along quiet country roads then traffic noise impacts should be assessed in accordance with the draft EPA Guidance for EIA No.14 – Road and Rail Transportation Noise. If it is assumed that the mobile equipment used in the spoil management moves infrequently between spoil management areas then the dredging activities will have to be evaluated for daytime activities and for night time activities only.

3.2 Summary of Assigned Levels

Noise management in Western Australia is implemented through the Environmental Protection (Noise) Regulations 1997 which operate under the *Environmental Protection Act 1986*. The Regulations specify maximum noise levels (assigned levels), which are the highest noise levels that can be received at noise-sensitive premises, commercial and industrial premises.

Assigned noise levels have been set differently for noise sensitive premises, commercial premises, and industrial premises. For noise sensitive premises, ie residences, an “influencing factor” is incorporated into the assigned noise levels.

The regulations define three types of assigned noise level:

- L_{Amax} assigned noise level means a noise level which is not to be exceeded at any time;
- L_{A1} assigned noise level which is not to be exceeded for more than 1% of the time;
- L_{A10} assigned noise level which is not to be exceeded for more than 10% of the time.

The L_{A10} noise limit is the most significant for this study since this is representative of continuous noise emissions from the port facility.

Table 3-1 shows the assigned noise levels for noise sensitive premises. As can be seen from the table the time of day also affects the assigned levels for noise sensitive residences.

Table 3-1: Assigned noise levels for noise sensitive premises.

Type of premises receiving noise	Time of day	Assigned Level dB(A)		
		LA 10	LA 1	LA max
Locations within 15m of a building directly associated with a noise sensitive use.	0700 to 1900 hours Monday to Saturday	45+ influencing factor	55+ influencing factor	65+ influencing factor
	0900 to 1900 hours Sundays and public holidays	40+ influencing factor	50+ influencing factor	65+ influencing factor
	1900 to 2200 hours all days	40+ influencing factor	50+ influencing factor	55+ influencing factor

Type of premises receiving noise	Time of day	Assigned Level dB(A)		
		LA 10	LA 1	LA max
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35+ influencing factor	45+ influencing factor	55+ influencing factor
Locations further than 15m from a building directly associated with a noise sensitive use.	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial and utility premises	All hours	65	80	90

Table 3-2: Assigned penalties for intrusive or dominant noise characteristics.

Adjustment where noise emission is not music these adjustments are cumulative to a maximum of 15 dB		
Where tonality is present	Where modulation is present	Where impulsiveness is present
+5 dB	+5 dB	+10 dB

Noise levels at the receiver are subject to penalty corrections if the noise exhibits intrusive or dominant characteristics, ie if the noise is impulsive, tonal, or modulated. That is, the measured or predicted noise levels are increased by the applicable penalties, and the adjusted noise levels must comply with the assigned noise levels. Regulation 9 sets out objective tests to assess whether the noise is taken to be free of these characteristics.

Since the port facilities operates 24 hours a day the most stringent noise limit that would apply to noise emissions will occur during the night time hours.

3.2.1 Assigned Level Evaluation for Port Hedland

As the assessment is for a multitude of different premises, different assigned noise levels will be applicable to different areas of the town. As can be seen from Table 3-1 different premises zoning classifications have different assigned levels. So industrial premises have an assigned L_{A10} value of 65dB(A), commercial premises have an assigned L_{A10} value of 60dB(A) while residential premises have different assigned levels depending on the day of the week and the time of the day and surrounding land use. The relevant zone to each noise assessment positions is shown in Table 3-3.

Table 3-3 Zones relevant to each logging position

Residential	Commercial (60dB(A))	Industrial (65dB(A))
Darlot Street		
Hospital		
Rural Village	Police Station (Influencing Factor = 17dB for residents at police station)	Wedgefield
Pretty Pool	Port Hedland Shopping Centre	HBI
South Hedland Golf Course	South Hedland Telstra Building	
Cook Point		
Brearley Avenue		

The most stringent assigned levels are applicable to residential areas at night time (22:00 to 07:00), on weekends from 09:00 and public holidays. Residential areas will therefore be the focus of the assessment undertaken here.

3.2.2 Influencing Factors

The influencing factor is calculated at the noise sensitive premises and the calculated value is added to the assigned noise levels as shown in Table 3-1. The influencing factor depends on land use zonings within circles of 100 metres and 450 metres radius from the noise receiver. The value is dependent on:

- the proportion of industrial land use zonings;
- the proportion of commercial zonings; and
- the presence of major roads within the circles.

Due to the large number of noise sensitive premises an influencing factor has not been calculated for each premises, but rather an influencing factor has been calculated for specific areas as shown in Figure 3-1 and Table 3-4, which is considered representative of the area. As can be seen from the figure, and as expected the influencing factor and therefore the assigned noise level varies within the town area.

Table 3-4 Influencing Factor for various locations in Port Hedland.

Residential Area	Influencing Factor
Police Station	17dB
Hospital	2dB
Darlot St	2 to 3dB
Brearley Avenue	1 to 2 dB
Pretty Pool	0

Residential Area	Influencing Factor
Cook Point	0
Rural Village	0
South Hedland Golf Course	0



Figure 3-1 Influencing factors that can be applied to different areas of Port Hedland.

3.2.3 Corrections for Characteristic of Noise

Noise levels at the receiver are subject to penalty corrections if the noise exhibits intrusive or dominant characteristics, i.e. if the noise is impulsive, tonal, or modulating. Table 3-2 presents the penalties incurred for noise that exhibits intrusive or dominant characteristics (i.e. if it has tonal, modulating or impulsive characteristics). As the existing ambient noise levels are so high for the Port Hedland area it is not expected that any tonality from dredging activities will protrude above the ambient noise levels.

3.3 Assigned Level Evaluation for Wedgefield

Wedgefield is classified as an industrial area with no known premises that can be classed as sensitive¹ premises as per the regulations. This implies that Wedgefield has an assigned LA10 value of 65dB(A).

¹ Sensitive premises are defined as premises occupied solely or mainly for residential or accommodation purposes; rural premises; caravan parks and camping grounds; hospitals with less than 150 beds; rehabilitation centres, care institutions; educational institutions; premises used for public worship; hotels; premises for aged and child care; prisons and detention centres.

3.3.1 Influencing Factors

As Wedgefield is an industrial area there are no influencing factors that are applicable.

3.3.2 Corrections for Characteristic of Noise

As Wedgefield is approximately 5.5km from Port Hedland it is expected that there will be no tonality in the received noise from the Port facility due to absorption in the atmosphere. No penalty will therefore be applicable to Wedgfield.

3.3.3 Assigned Noise Levels

The assigned levels for Wedgefield will therefore be the same as per the regulations for industrial areas.

3.4 Assigned Level Evaluation for South Hedland

South Hedland can be classified as predominately residential. For the purposes of this report and for evaluation purposes the commercial area of South Hedland will not be considered since the most restrictive assigned noise levels for the town apply at noise sensitive premises. Therefore, South Hedland will be subject to assigned levels as per the regulation for noise sensitive premises.

3.4.1 Influencing Factors

Since there are large areas of South Hedland which are zoned residential, the influencing factor has been assumed to be 0. The limits as per the regulation for noise sensitive areas will be used as a worst case scenario for all areas in South Hedland.

3.4.2 Corrections for Characteristic of Noise

As South Hedland is approximately 9km from Port Hedland it is expected that there will be no tonality in the received noise from the Port facility due to absorption in the atmosphere. No penalty will therefore be applicable to South Hedland.

3.4.3 Assigned Noise Levels

The assigned levels for South Hedland will therefore remain as per the regulations.

3.5 Assigned and Maximum Allowable Noise Levels for Port Hedland, South Hedland and Wedgefield.

The assigned noise levels that are applicable for the assessment of the Port Hedland dredging operations and spoil management activities are given in Table 3-5.

Table 3-5: Assigned noise levels for noise sensitive premises including 5dB penalty for tonality.

Position	Influencing Factor in dB	LA10 Assigned noise levels in dB(A)		
		Day	Evening	Night
1. Brearley St	2	47	42	37
2. Hospital	2	47	42	37
3. Laurentis Point	5	50	45	40
4. Police Station	17	62	57	52
5. Pretty Pool	0	45	40	35
6. South Hedland	0	45	40	35
7. Wedgefield Industrial Estate	NA	65	65	65

4. NOISE MODELLING – METHODOLOGY AND OVERVIEW

A noise model has been developed for three different scenarios, with each scenario covering a different dredging or spoils management area. The noise sources in the model were arranged so that they would provide the worst case noise impacts for either Port Hedland or for Wedgefield. The sound power levels for each noise source were obtained from the SVT database and are therefore based on measured data for similar equipment.

The noise modelling calculates noise levels at different receivers, and can also be used to assess noise control recommendations. This information can be used in the Noise Management Plan that is required by regulation for night time operations.

4.1 Noise Model Software

An acoustic model has been developed using the SoundPlan noise modelling program developed by SoundPlan LLC. The SoundPlan software calculates sound pressure levels at nominated receiver locations or produces noise contours over a defined area of interest around the noise sources. The inputs required are noise source data, ground topographical data, meteorological data and receiver locations.

The model has been used to generate noise contours and predict noise levels at noise sensitive locations for the area around Port Hedland, South Hedland and Wedgefield.

4.2 Input Data

4.2.1 Source Sound Power Levels

The sound power levels for dredging activities were obtained from the SVT database and are therefore based on measured noise data for similar equipment (refer section 5.1).

4.2.2 Topography and Ground Types

Topographical information for the noise model was provided in .dxf format files, which were imported into the noise model directly. Ground absorption for hard and soft surfaces is as specified by the CONCAWE propagation algorithms. The ground absorption for the sea surface has been set to zero (perfectly reflecting), representing a realistic worst-case condition at the frequencies of interest.

Buildings within the Port Hedland facility have also been incorporated in the noise model.

4.2.3 Receiving Locations

The noise model has been used to predict noise levels at the seven locations at which baseline noise levels have been previously established². Those locations are as indicated in Table 4-1

² BHBIO Doc: Noise Reduction Management Plan – Port Hedland Rev 0 22/11/2006

Table 4-1 Co-ordinates of receiving locations

Receiver	Location	GPS co-ordinates (GDA-95)
R1	Brearley St , Port Hedland	7753338 N, 667699 E
R2	Hospital 7753, Port Hedland	7753424 N, 665799 E
R3	Laurentis Point, Port Hedland	7753342 N, 664415 E
R4	Police Station, Port Hedland	7753117 N, 664652 E
R5	Pretty Pool, Port Hedland	7752609 N, 671261 E
R6	South Hedland	7742771 N, 667852 E
R7	Wedgfield Industrial Estate	7746567 N, 666048 E

4.2.4 Meteorology

Certain meteorological conditions can increase noise levels at a receiving location by a process known as refraction. When refraction occurs, sound waves that would normally propagate directly outwards from a source can be bent downwards causing an increase in noise levels. Such refraction occurs during temperature inversions and where there is a wind gradient. These meteorological effects can increase noise levels by as much as 5 to 10 dB depending on the source – receiver geometry and intervening topography.

The SoundPlan noise model calculates noise levels for user defined meteorological conditions. In particular, temperature, relative humidity, wind speed and direction data, and temperature inversion rates are required as input to the SoundPlan model.

The noise model has been used to predict noise levels and produce noise contours for the worst case. In all cases the temperature and relative humidity values used were 15°C and 50% respectively. A worst-case scenario with wind speed of 3m/s winds combined with a 2°C/100m thermal inversion has been considered for night time noise propagation. (Wind speeds of 3m/s combined with a thermal inversion rate of 2°C/100m or pasquil stability Fare consistent with the default worst case night-time conditions for sound propagations defined in the EPA's draft guidance note – "Guidance for the Assessment of Environmental Factors (in accordance with the Environmental Protection Act 1986) – Environmental Noise – No.8 Draft".)

4.3 Noise model configurations

The dredging and spoil management noise sources included a Backhoe, a Cutter Suction dredger and mobile equipment. The following three situations were modelled:

- Dredging Activities in Harriet Point area and spoil management in area B1 (Figure 5-1).
- Dredging Activities in Harriet Point area and spoil management in area B2 (Figure 5-3).
- Dredging Activities in Harriet Point area and spoil management in area A (Figure 5-5).

5. NOISE MODELLING DREDGING AND SPOIL MANAGEMENT

Three different dredging configurations were modelled and evaluated. The results for the different modelling configurations or situations are given below. A summary of the point receiver predicted noise levels is given at the end of the section. Each model situation was run for the worst case conditions (i.e. a wind of 3m/s and pasquil stability F).

5.1 Noise Sources

Table 5-1 shows the sound power levels for the noise sources associated with the dredging activities.

Table 5-1 Dredging Noise Source Sound Power Levels

Dredgers	dB(Z)									dB(Z)	dB(A)
	31Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz		
Cutter Suction Dredge - Pump Motor Drive	108.7	107.3	102.7	100.1	104.9	100.4	104.3	94.3	85.8	113.6	108.2
Cutter Suction Dredge - Cutter	100.1	109.0	109.8	116.9	113.9	112.1	111.7	103.4	85.3	121.0	117.5
Cutter Suction Dredge - Booster Pump	108.7	107.3	102.7	100.1	104.9	100.4	104.3	94.3	85.8	113.6	108.2
Backhoe Dredge	112.4	113.6	120.5	115.2	112.4	107.9	103.9	95.6	88.8	123.3	114.1
Mobile Equipment											
Komatsu Excavator PC1250	106.4	109.3	116.3	110.9	107.5	103.6	103.8	91.3	84.6	118.9	110.4
CAT Dozer D7H	103.4	107.2	113.6	111.0	106.9	107.7	104.0	97.6	93.6	117.2	110.8
Pipe Layer		106.4	114.8	104.9	100.1	106.3	101.5	98.7	93.6	116.3	108.1

5.2 Dredging Activities in Harriet Point area and spoil management in area B1.

5.2.1 Distribution of Noise Sources

Figure 5-1 shows the arrangement of the dredging and mobile equipment for the modelling done for Harriet Point and spoil management area B1. For this modelling situation the dredging activities have been located on the northern end of Harriet Point with the dredge spoil management mobile equipment being located on the eastern side of area B1. This is the worst case scenario for noise impacts in Port Hedland.

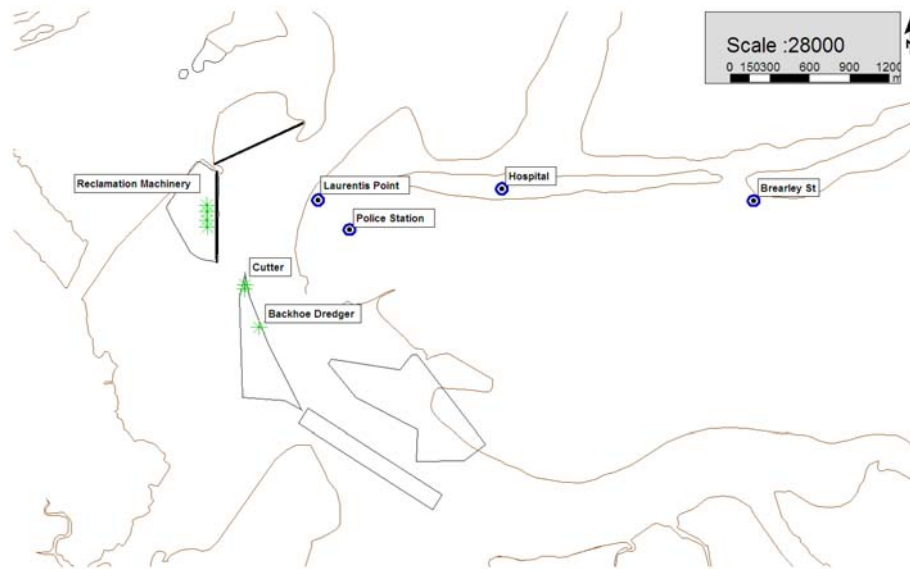


Figure 5-1 Dredger and mobile equipment locations for Harriet Point and dredge spoil area B1.

5.2.2 Noise Contours

The noise contours for the modelling done for Harriet Point and spoil management area B1 are shown in Figure 5-2.

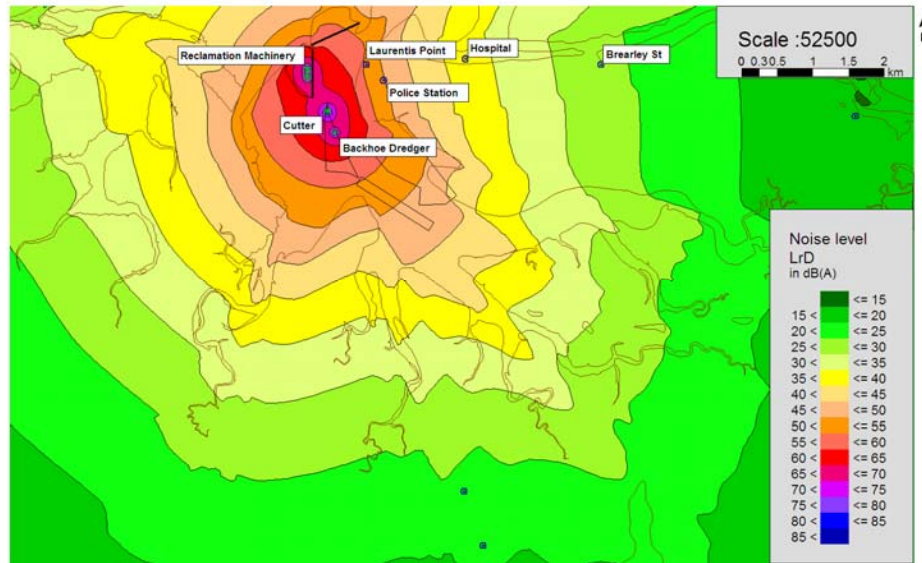


Figure 5-2 Noise Contours for Harriet Point and Area B1

5.3 Dredging Activities in Harriet Point area and spoil management in area B2.

5.3.1 Distribution of Noise Sources

Figure 5-3 shows the arrangement of the dredging and mobile equipment for the modelling done for Harriet Point and spoil management area B2. As for area B1, this modelling situation has the dredging activities located on the northern end of Harriet Point with the dredge spoil management mobile equipment being located on the eastern side of area B2. This is the worst case scenario for noise impacts in Port Hedland.

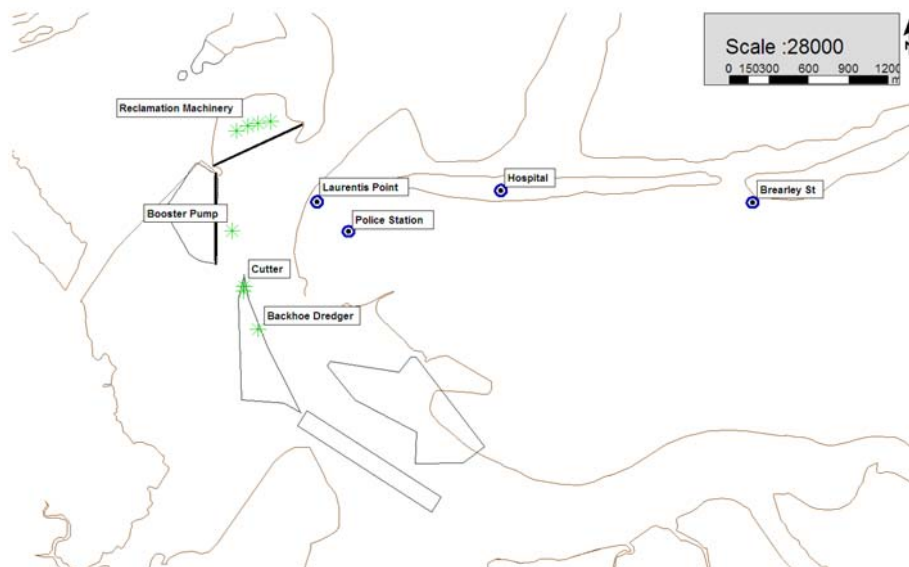


Figure 5-3 Dredger and mobile equipment locations for Harriet Point and dredge spoil area B2.

5.3.2 Noise Contours

The noise contours for the modelling done for Harriet Point and spoil management area B2 are shown in Figure 5-4.

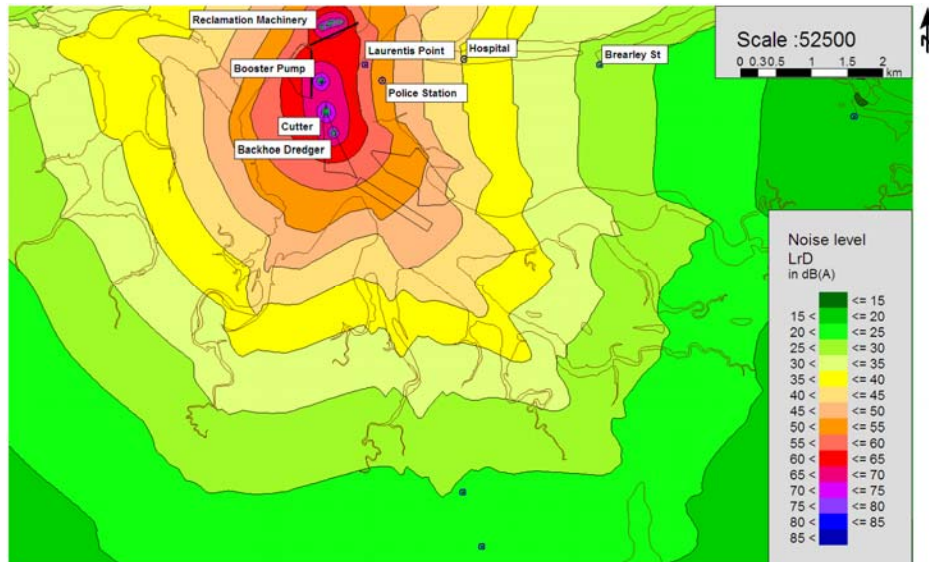


Figure 5-4 Noise Contours for Harriet Point and Area B2

5.4 Dredging Activities in Harriet Point area and spoil management in area A.

5.4.1 Distribution of Noise Sources

Figure 5-5 shows the arrangement of the dredging and mobile equipment for the modelling done for Harriet Point and spoil management area A. The dredging activities have been located on the southern end of Harriet Point and the mobile equipment has been located on the south eastern side of area H as this is the worst case scenario for noise impacts on Wedgefield.

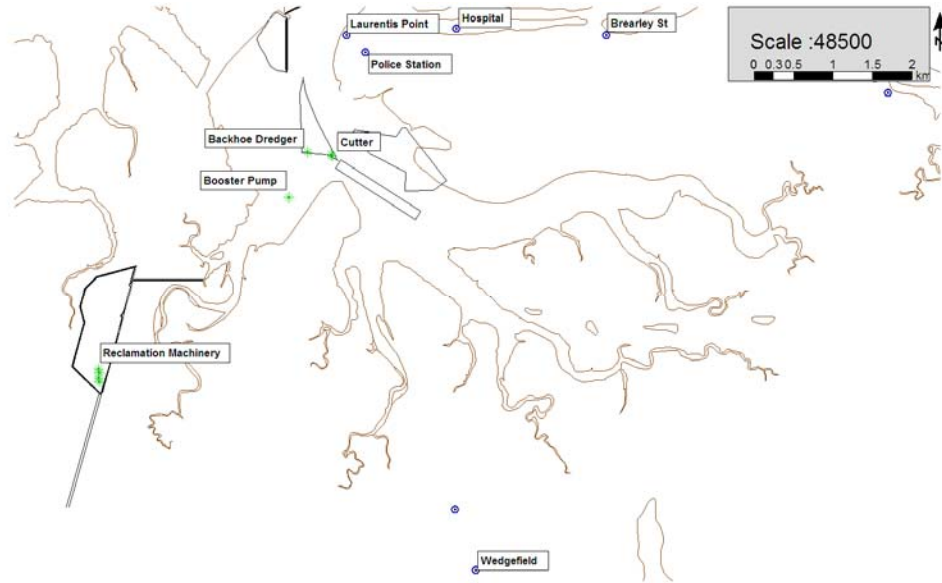


Figure 5-5 Dredger and mobile equipment locations for Harriet Point and dredge spoil area A.

5.4.2 Noise Contours

The noise contours for the modelling done for Harriet Point and spoil management area A are shown in Figure 5-2.

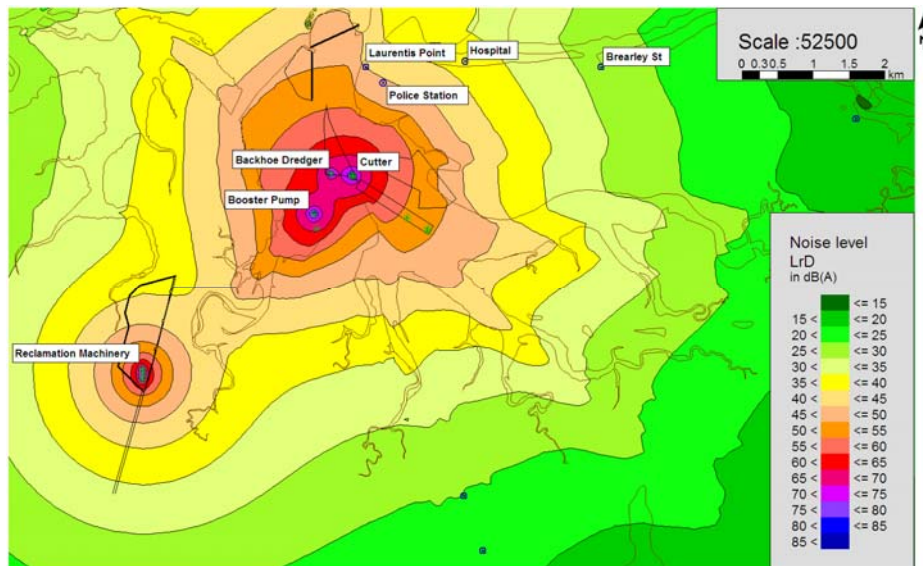


Figure 5-6 Noise Contours for Harriet Point and Area A

5.5 Summary of Dredging Noise Levels

A summary of the predicted noise levels at the point receivers due to dredging at Harriet Point and Nelson Point and spoil management activities in areas B1, B2 and A are given in Table 5-2. As can

be seen from the table Brearly Street, the rural village, Pretty Pool, South Hedland and Wedgefield³ predicted noise levels due to dredging activities are below the regulatory assigned noise levels, while the areas surrounding the hospital, police station and Laurentis Point are above the assigned levels.

Table 5-2 Summary of receiver noise levels (L_{A10} in dB(A)) as a result of dredging and spoil management

Dredging	Harriet	Harriet	Harriet
Spoil	Area A	Area B1	Area B2
Brearley St	28.4	26.7	28.3
Rural Village	11.1	11.3	11.6
Hospital	37.8	37.6	39.7
Laurentis Point	44.9	53.8	57
Police Station	45.8	50.3	52.2
Pretty Pool	17.8	16.3	16.9
South Hedland	13.5	14.1	14.4
Wedgefield	24.8	23.7	24.3

³ Wedgefield is zoned as an industrial area and therefore has an assigned level of 65dB(A).

6. DREDGING ASSESSMENT AND NOISE CONTROL REQUIREMENTS

6.1 Methodology

Dredging is considered a construction activity and as a result regulation 13 of the Environmental Protection (Noise) regulations is applicable. The regulations that have to be complied with can be summarised as follows:

- 1) **Daytime Construction Activities.** Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites" is applicable and the equipment used for the construction is the quietest reasonably available. A noise management plan may be required.
- 2) **Night time Construction Activities.** All the restrictions required for daytime activities are applicable for night time activities. In addition to the restrictions applicable for daytime activities, night time activities require that the affected community be notified, it must be demonstrated that night time activities is required and a noise management plan must be submitted and approved. The plan must include details of:
 - o Need for the work to be done out of hours;
 - o Types of activities which could be noisy;
 - o Predictions of the noise levels;
 - o Control measures for noise and vibration;
 - o Procedures to be adopted for monitoring noise emissions; and
 - o Complaint response procedures to be adopted.

As a result of the regulation 13 requirement for night time dredging operations this report will address the types of activities that could be noisy, the predictions of the noise levels, recommend any reasonable control measures and recommend procedures for monitoring noise emissions.

6.2 Predicted Noise Levels

Table 5-2 shows the predicted noise levels at the various noise sensitive receivers. As indicated in the last section the predicted noise levels are worst case for all the different BHPBI dredging and spoil management activities in the Port Hedland area.

6.3 Assessment

In order to determine which activities could be considered noisy the maximum allowable noise levels as calculated in Table 3-5 will be used as the baseline for acceptable noise levels.

Table 6-1 shows which sensitive receivers are above or below the maximum allowable (see Table 3-5) noise levels for dredging operations. As can be seen from the table there are only 3 sensitive receivers that will be affected by the dredging operations. These are the hospital, Laurentis Point and the police station. The police station is only above the maximum allowable limit for Harriet Point and dredge spoil operations in areas B1 and B2 at night time. The hospital is above the maximum allowable level for all dredging operations during night and evening operations.

Table 6-1 Compliancy of sensitive receivers during dredging operations.

	Below Assigned Level for Night (Y/N)	Below Assigned Level for Evening (Y/N)	Below Assigned Level for Day (Y/N)
Brearley St	Y	Y	Y
Rural Village	Y	Y	Y
Hospital	N	Y	Y
Laurentis Point	N	N	N
Police Station	N (except for area A)	Y	Y
Pretty Pool	Y	Y	Y
South Hedland	Y	Y	Y
Wedgfield South	Y	Y	Y
Wedgfield North	Y	Y	Y

6.4 Cumulative Impact with Port Hedland RGP3, 4(a) and 4(b)

The cumulative effect of port facility operations and dredging operations is given in Table 6-2. as can be seen from the table the impact of the dredging noise on the sensitive receivers is between 0 and 0.8 dB for the receivers within Port Hedland. Dredging noise has the largest impact on Wedgfield with a maximum of 5 dB's increase.

Table 6-2 Cumulative noise from port facility and dredging operations.

	Cumulative Noise Levels (L_{A10} in dB(A))			Increase In Noise in dB		
	RGP 3	RGP 4A	RGP 4B	RGP 3	RGP 4A	RGP 4B
Harriet Point and Area B1						
Bearley St	51.8	51.8	50.7	0.0	0.0	0.0
Rurtal Village	24.9	25.2	24.4	0.2	0.2	0.2
Hospital	61.5	61.5	58.6	0.0	0.0	0.0
Laurentis Point	64.7	64.9	64.7	0.8	0.7	0.8
Police Station	62.6	62.8	61.8	0.4	0.4	0.5
Pretty Pool	35.0	35.1	34.3	0.1	0.1	0.1
South Hedland	28.1	28.3	27.6	0.2	0.2	0.2

	Cumulative Noise Levels (L_{A10} in dB(A))			Increase In Noise in dB		
	RGP 3	RGP 4A	RGP 4B	RGP 3	RGP 4A	RGP 4B
Harriet Point and Area B1						
Wedgefield	36.8	36.9	36.2	0.1	0.1	0.2
Harriet Point and Area B2						
Bearley St	51.8	51.8	50.7	0.0	0.0	0.0
Rurtal Village	24.9	25.2	24.4	0.2	0.2	0.2
Hospital	61.5	61.5	58.7	0.0	0.0	0.1
Laurentis Point	64.7	65.0	64.7	0.8	0.8	0.8
Police Station	62.6	62.8	61.8	0.4	0.4	0.5
Pretty Pool	35.0	35.1	34.3	0.1	0.1	0.1
South Hedland	28.1	28.3	27.6	0.2	0.2	0.2
Wedgefield	36.8	36.9	36.2	0.1	0.1	0.2
Harriet Point and Area A						
Bearley St	51.8	51.8	50.7	0.0	0.0	0.0
Rurtal Village	24.9	25.2	24.4	0.2	0.2	0.2
Hospital	61.5	61.5	58.6	0.0	0.0	0.0
Laurentis Point	64.0	64.3	64.0	0.1	0.1	0.1
Police Station	62.3	62.5	61.4	0.1	0.1	0.1
Pretty Pool	35.0	35.1	34.3	0.1	0.1	0.1
South Hedland	28.1	28.2	27.6	0.2	0.1	0.2
Wedgefield	36.8	36.9	36.2	0.1	0.1	0.2

6.5 Analysis of noise control Measures.

6.5.1 Noise Source Contributions

In order to determine what noise control measures are required, an analysis of the chief noise source contributors at the receivers has been done. The analysis will be limited to the hospital, police station and Laurentis Point, as all the other receivers are within the maximum allowable noise level.

Table 6-3 shows the eight noise source contributions for the affected receivers at Port Hedland. A 1 ranking indicates that that receiver has the most significant impact at the receiver and an 8 indicates that that noise source had the least significant impact at the receiver. The weighting

factor is the summation of all the noise source rankings (in reverse order⁴) for the different receivers. The weighting factor provides an indication of the impact of a specific noise source on the different receivers. A high weighting factor therefore indicates that the noise source has a high impact on most, if not all, the receivers. As can be seen from the table the cutter suction dredge's cutter, the Booster Pump, and the backhoe dredge have the highest impact on the most receivers for all dredging and dredge spoil management activities. Therefore, it is these items that should receive the highest priority when it comes to noise control.

Table 6-3 Noise source contributions at each receiver and the weighting of each noise source. 1 is highest ranking, 8 is the lowest ranking for that receiver.

	Hospital	Laurent's Point	Police Station	Weighting Factor
Cutter Suction Dredge - Cutter				66
Harriet Area A1	1	1	1	24
Harriet Area B1	1	1	1	21
Harriet Area B2	2	2	2	21
Booster Pump				40
Harriet Area A1	3	3	3	18
Harriet Area B2	1	1	3	22
Backhoe Dredge				51
Harriet Area A1	2	2	2	21
Harriet Area B1	2	6	2	14
Harriet Area B2	3	7	1	16
D6 Bulldozer (2)				42
Harriet Area A1	5	5	5	12
Harriet Area B1	3	2	3	16
Harriet Area B2	4	3	6	14
Excavator				26
Harriet Area A1	7	7	7	6
Harriet Area B1	5	5	5	9

⁴ Reverse order implies that a ranking of 1 is equal to a weighting of 8 and a ranking of 8 is equal to a weighting of 1.

	Hospital	Laurent's Point	Police Station	Weighting Factor
Harriet Area B2	6	6	4	11
Cutter Suction Dredge - Pumps				21
Harriet Area A1	4	4	4	15
Harriet Area B1	7	7	7	3
Harriet Area B2	8	8	8	3
D6 Bulldozer (1)				30
Harriet Area A1	6	6	6	6
Harriet Area B1	4	4	4	12
Harriet Area B2	5	5	5	12
Pipelayer				17
Harriet Area A1	8	8	8	3
Harriet Area B1	6	3	6	7
Harriet Area B2	7	4	7	7

6.6 Proposed Noise Control Measures

As a result of the analysis it is suggested that the following noise control measures be considered:

- 1) **Cutter Suction Dredge Cutter**. The cutter's primary noise elements consist of a motor and a gear drive. It is recommended that the cutters motor and gear drive be acoustically enclosed.
- 2) **Booster Pump**. It is recommended that the booster pumps and generator be resilient mounted and acoustically enclosed.
- 3) **Backhoe Dredge**. It is recommended that a quiet as possible backhoe be used.
- 4) **Mobile Equipment**. It is recommended that all mobile equipment not exceed the levels given in Australian Standard 2436-1981 as a minimum.

6.7 Noise Control Management Plan Overview

The noise management plan is described in the following paragraphs. A flow diagram of the elements of the complaints registration action plan is given in appendix A. The plan should recommend that the following activities be followed:

- 1) Noise loggers be placed at the Police Station, Hospital and Laurentis Point for the duration of the dredging and spoil management activities.
- 2) Stakeholder awareness;
- 3) Complaint Registration;
- 4) Noise Monitoring and analysis; and,
- 5) Noise control plan and implementation.

6.7.1 Stakeholder Awareness.

BHPBIO must notify all affected residents of dredging operations. It is recommended that The following information be supplied to the residents:

- 1) Provide stakeholders with information on the dredging activities;
- 2) Provide stakeholders with information on complaint registration; and,
- 3) Inform stakeholders of the intended noise management plan.

6.7.2 Complaint Registration.

It is recommended that BHPBIO supply residents with a complaints hot-line. Once a complaint has been registered a noise monitoring and analysis process should be implemented.

6.7.3 Noise Monitoring and Data Analysis.

It is recommended that BHPBIO conduct noise monitoring at the noise sensitive sites that have been identified through complaints. The objective of the noise monitoring will be to determine, as best as possible, the impact of the dredging activities noise at the monitoring site. This will be done by measurement of the overall noise levels and, if necessary, the 1/3rd octave bands. Where possible the monitoring positions should be supplemented by subjective observations.

The monitoring programme shall be scheduled to coincide with similar operating conditions to those at the time of the complaint. The complainant shall also be asked to make notes of any noise impacts observed during the monitoring period (i.e. does the same operating condition elicit the same response from the complainant).

6.7.4 Noise Control Plan and Implementation.

Depending on the outcome of the noise monitoring and data analysis it is recommended that a feasibility study be executed. The output of the study will be to propose various noise control options based on the hierarchy of controls ALARP (As Low As Reasonably Practical) principal. The study will therefore consider all possibilities from engineering to administrative control.

APPENDIX A : DREDGING NOISE MANAGEMENT PROCESS FLOW DIAGRAM

