

# Memorandum

**Date:** 16/03/2012

**To:** Peter Baldwin – Department of State Development - General Manager, Project Approvals Strategy

**SUBJECT: BROWSE LNG DEVELOPMENT – UNDERWATER NOISE MODELLING ASSESSMENT**

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## 1. Background

Since submission of the SAR and given the progress of the FEED process, additional information became available for input to the underwater noise modelling which warranted a re-assessment of the potential impacts from the proposed piling activities for Woodside's Downstream Development. The additional information includes updated bathymetry data of higher resolution and a revised pile hammer source level based on a more extensive literature review.

The results from the underwater noise modelling completed for the Derived Proposal (DP) show that the updated bathymetry data and the revised piling hammer source level do not have a significant impact on the underwater noise impacts associated with the pile driving scenario modelled for the SAR and the DP.

However, the updated modelling for the DP has resulted in the identification of two errors (discussed below) which has resulted in higher noise levels when compared to the SAR for the comparable piling scenario of three simultaneously operating piling barges. The two errors identified which affect the SAR modelling results include:

1. A human error when inputting the source level in the SAR modelling, a source level of 192 dB re 1  $\mu\text{Pa}^2\cdot\text{s}$  was actually used (as opposed to a source level of 205 dB re 1  $\mu\text{Pa}^2\cdot\text{s}$ ), which is 17 dB re 1  $\mu\text{Pa}^2\cdot\text{s}$  lower than the source level used in the modelling for the DP (the DP used a source level of 209 dB re 1  $\mu\text{Pa}^2\cdot\text{s}$ ). This resulted in considerably lower predicted received levels in the SAR compared to the DP modelling outputs.
2. The sound transmission calculations were incorrect due to a curve fitting error in the SAR modelling. This caused the outputs to overestimate the noise levels in the nearfield (<100 m) and underestimated levels at greater than 100 m from source.

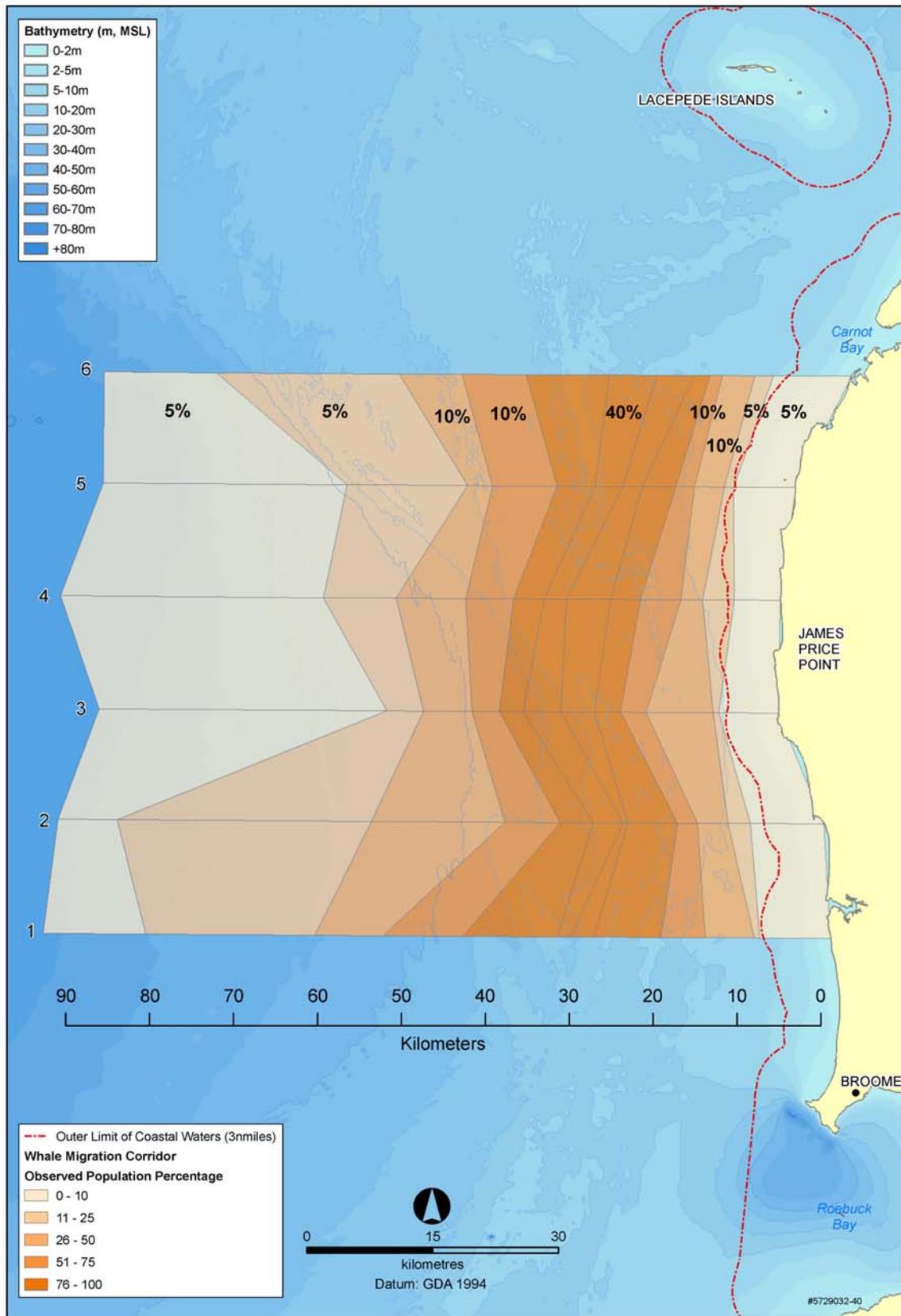
As a result of the errors identified during the re-assessment of the potential impacts from the proposed piling activities, the pile driving modelling results presented in the SAR are inaccurate. The results from the SAR modelling generally underestimate the underwater noise levels compared to the updated DP modelling.

## 2. Strategic Assessment Report Impact Conclusions

Within the Strategic Assessment Report (**Part 3, Section 2.6.3.1**) the predicted impacts of the piling activities (based on an Sound Exposure Level of 10 seconds) stated that "High intensity impulsive noise emitted during blasting and piling would overlap the frequency range of hearing in humpback whales and has the potential to cause physiological injuries (PTS) at close ranges."

While it was acknowledged that humpback whales would be present off the Dampier Peninsula during the northerly and southerly migration periods, it was determined that the majority of animals (95%) were migrating at a distance of at least 8 km off the coast (**Figure 1**). With the data available at the time (i.e. 1 year worth of aerial surveys) the mean distance offshore during the migration for adults and calves was determined to be 27 km and 24 km respectively. Therefore, the data (RPS, 2010, **Appendix C-8**) indicated that approximately 5 % of the Group IV humpback whale population may migrate through the James Price Point coastal area (i.e. Coulomb Point to Quondong Point) during the migration season.

In addition, it was noted (RPS, 2010, **Appendix C-8**) that demonstrably fewer humpback whales were seen to travel along the coastal migration corridor on the southbound migration when the more vulnerable cow-calf groups would be present (**Figure 2**) (RPS, 2010; **Appendix C-8**). Consequently, it was concluded that the construction activities were unlikely to have a significant impact on the broader humpback whale population.



**Figure 1. Distribution and Abundance of Humpback Whales within the James Price Point Migration Corridor Survey Area. Note - Data from the entire Migration Corridor Survey was used to calculate percentage bands for all groups sighted. Therefore data is not representative of any one day of surveying, but provides an indication of the location of the main migration corridor (RPS 2010).**

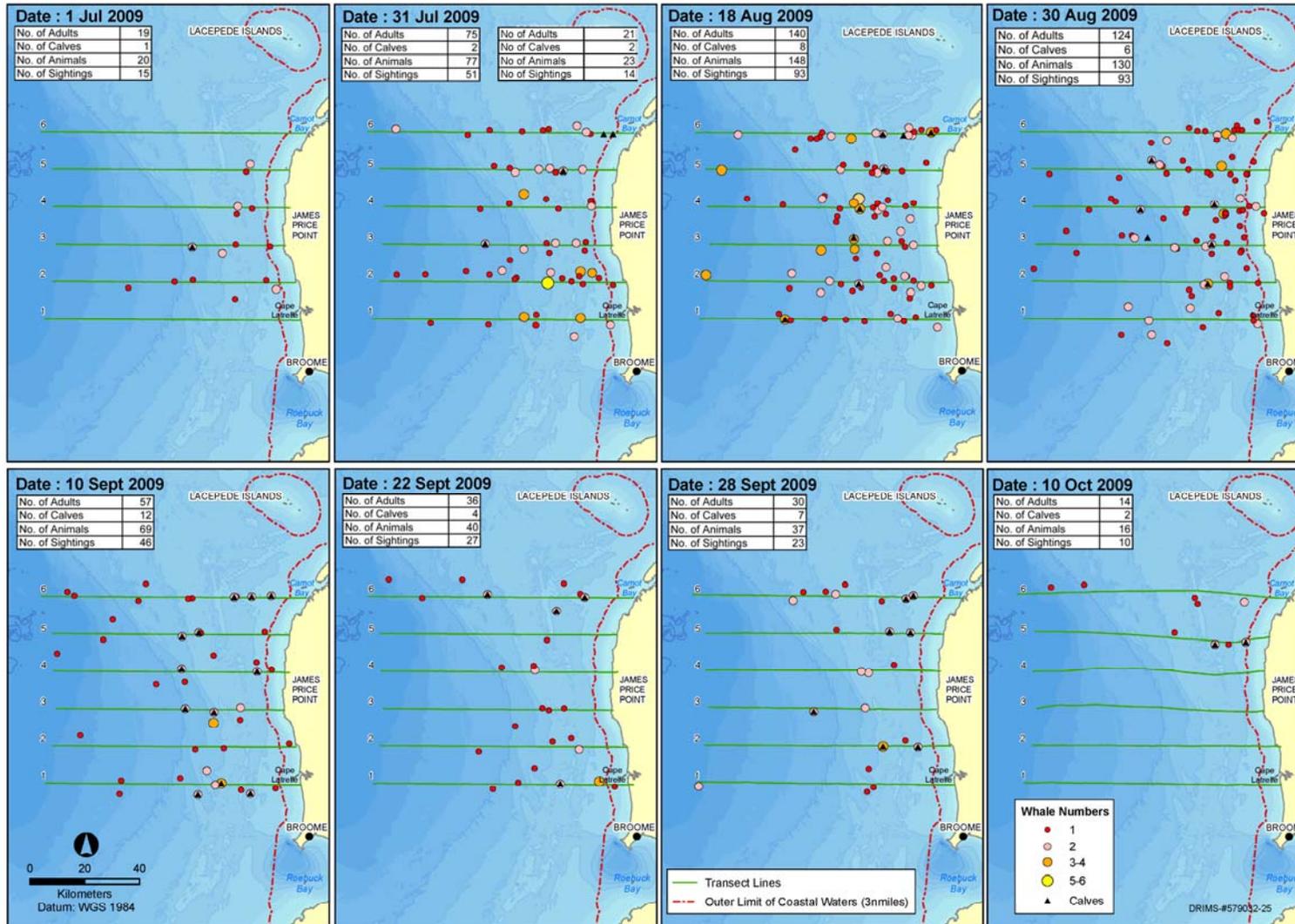


Figure 2. Total Number of Humpback Whales Recorded during the James Price Point Migration Corridor Survey 2009 (RPS 2010).

### 3. Derived Proposal (DP) Modelling Results

The preliminary results from the DP modelling identify higher underwater noise levels (beyond 100 m from the piling source) associated with concurrently driving three piles compared to the comparable SAR scenario. These higher noise levels subsequently affect the extent of the zones of potential behaviour disturbance (Table 1).

It should be noted that both assessments (SAR and DP) utilise thresholds (criteria) defined in Southall *et al.* (2007) for physical injury to predict potential impacts to marine mammals from noise related to piling activities. Practical, ethical, and legal considerations limit the level of scientific information that is available for deriving robust quantitative criteria for assessing behavioural impacts to whales from pulse and non-pulse sounds. “The inability to identify broadly applicable, quantitative criteria for behavioural disturbance in response to multiple-pulse and non-pulse sounds is an acknowledged limitation” in this field (Southall *et al.* 2007). Therefore, the noise assessment thresholds used for modelling potential behavioural disturbance in the SAR and DP is based on the guidance given within EPBC Act Policy Statement 2.1 for the assessment of underwater noise impacts from seismic activities (DEWHA 2008).

**Table 1. Furthest distance to zones of potential physical injury and possible behavioural disturbance for the SAR and DP pile driving scenarios.**

Piling Scenario: three simultaneously driven piles	Zone of potential physical injury (m) (198 dB re 1 $\mu\text{Pa}^2\cdot\text{s}$ )	Zone of potential behavioural disturbance (m) (160 dB re 1 $\mu\text{Pa}^2\cdot\text{s}$ )
	SEL for a single pile strike	SEL for 10sec period
SAR	60*	250*
DP	12**	4500**

\* These results are presented in the SAR. Due to the errors discussed earlier in this memo, the SAR results should not be used as a comparative tool for assessment because they are based on incorrect calculations and do not represent accurate zones of impact from the described piling Scenario.

\*\* These results represent the accurate results for the comparable piling scenario and should form the basis of the assessment of the zones of impact based on a 10 second exposure period for the described piling scenario.

Received sound levels are variable dependent on environmental conditions. Depth has a strong influence over sound transmission and modelling results are conservatively based on highest astronomical tide (HAT) which only occurs very infrequently (approximately 1 in every 18 years).

It is important to note that the zone of potential behavioural disturbance demonstrated in the DP modelling is comparable with zones of potential behavioural disturbance identified for other recent developments within North-Western Australia. For example the recently approved Port Hedland Outer Harbour Development (Ministerial Statement No. 890) identified that potential behavioural disturbance can occur at ranges up to tens of kilometres, based on the results of a literature survey (BHP Billiton 2011).

## 4. Comparison of Environmental Outcomes between SAR and DP

In terms of a comparison of the impact assessment conclusions and environmental outcomes of the differing SAR and DP results, it is worth noting how the initial impact assessment conclusion for the SAR was determined. The primary reason for the determination of a 'low' Significance of Residual Impact for underwater noise impacts was due to the relatively small proportion of the total migratory Group IV population (i.e. ~5 % of the total migrating population) likely to be exposed to the predicted elevated noise levels for which physical injury and/or behavioural disturbance could occur. The assessment was based on the application of noise thresholds for both physical injury (198 dB re 1  $\mu\text{Pa}^2\cdot\text{s}$  for a single piling strike (Southall *et al* 2007)) and behavioural disturbance (160 dB re 1  $\mu\text{Pa}^2\cdot\text{s}$  for a 10 sec exposure (DEWHA 2008)).

As stated in Section 2 of this memo, 95% of the total migratory humpback whale population were estimated to travel at a distance of at least 8 km off the coast (**Figure 1**). Data from the 2010 and 2011 megafauna surveys (RPS 2012) demonstrates the consistency in relative abundance of humpback whales in the migration corridor survey area between the survey years and confirms that the general spatial distribution of the humpback migration population is concentrated between 9 and 46 km offshore from the Dampier Peninsula coastline (Figure 2).

Over the three years, the median distance from shore that humpback whale adults and calves were sighted was 20-23 km (RPS 2012). Therefore, although the Derived Proposal modelling has demonstrated that the predicted noise levels and area of impact exceed those determined for the SAR (for the 160 dB re 1  $\mu\text{Pa}^2\cdot\text{s}$  for a 10 sec exposure criteria), the predicted underwater noise is still expected to impact a similar proportion of the total Group IV migratory population as demonstrated in the SAR (**Table 1**). In regards to the threshold criteria for physical injury (198 dB re 1  $\mu\text{Pa}^2\cdot\text{s}$  for a single piling strike), the predicted impacts do not exceed that predicted in the SAR.

On the basis of the assessment thresholds presented in **Table 1** and the SAR, the SAR concluded that noise associated with the construction activities is likely to result in only the localised displacement of humpback whales from the BLNG Precinct Port area (**SAR Part 3, Section 2.6.3.1**). Based on the comparative assessment presented in this memo, this statement holds true.

With regards to other marine mammals (specifically dugongs), The BLNG Precinct Port area is not considered regionally significant for dugongs (**SAR Part 3, Section 1.1**), and the wider Dampier Peninsula supports established populations. Therefore, it is likely that any dugongs displaced from the BLNG Precinct Port area would find suitable habitats within the wider Kimberley region during the construction period, and that this displacement would not have a significant impact on the dugong population on a regional level (**SAR Part 3, Section 2.6.3.1**).

## 5. Proposed Course of Action

Considering the fact that the results from the SAR modelling generally underestimate the underwater noise levels compared to the updated DP modelling results. It is thought that the appropriate course of action is to seek an amendment to the SAR proposal prior to formal assessment by the EPA in the form of a Section 43a under the Environmental Protection Amendment Act 2003. Preparation of support documentation for the Section 43a submission would include a briefing document summarising the updated information and a modification to the SAR Responses to Submissions Summary Report in light of the these results.

## 6. References

BHP Billiton 2011. Outer Harbour Development – Public Environmental Review.

DEWHA 2008. EPBC Act Policy Statement 2.1 - Interaction between offshore seismic exploration and whales

RPS. 2010. Humpback Whale Survey Report, Browse MMFS 2009. Prepared for Woodside Energy Ltd.

RPS 2012. Browse Project Humpback Whale Survey Report: Marine Megafauna Study 2011. Report produced for Woodside Energy Limited. 43 pp.

Southall *et al* 2007. Marine mammal noise exposure criteria: initial scientific recommendations. Aquatic Mammals: Vol 33 (4)