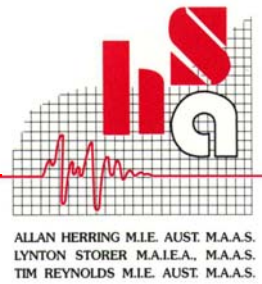
Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
HERRING STORER ACOUSTICS
Suite 34, 11 Preston Street, Como, W.A. 6152
P.O. Box 219, Como, W.A. 6952

Telephone: (08) 9367 6200
Facsimile: (08) 9474 2579
Email: hsa@hsacoustics.com.au



ALLAN HERRING M.I.E. AUST. M.A.A.S.
LYNTON STORER M.A.I.E.A., M.A.A.S.
TIM REYNOLDS M.I.E. AUST. M.A.A.S.

ACOUSTIC ASSESSMENT

GOLDEN PIKE DEVELOPMENT INCLUDING NOISE BUND CONSTRUCTION

FOR

KALGOORLIE CONSOLIDATED GOLD MINES

BY

HERRING STORER ACOUSTICS

JUNE 2005

REF: 4389-4-05033-01

CONTENTS

APPENDICIES

1.0 INTRODUCTION

Noise modelling has been carried out to assess the impact of noise bund construction and also initial Golden Pike mining operations with a 20m high noise bund in place. The bund construction will be considered as a "construction site" and therefore, in accordance with Regulation 13 of the *Environmental Protection (Noise) Regulations 1997*, the Assigned Noise Levels of Regulation 7 will not apply between 0700hrs and 1900hrs on any day which is not a Sunday or Public Holiday. Initial mining operations will be considered to take place on the existing ground level with the 20m high bund in place.

Equipment used in the model has been taken from KCGM forecast equipment inventories for each of the operations.

On the noise contour plots, the locations of plant included in the corresponding scenario are shown. Also shown are receiver locations comprising the existing noise monitoring sites at Boulder Primary School (BPS) and Kalgoorlie Technical School (KTS), and additionally on York Street between Lane and Hamilton Streets. The two existing noise monitoring sites have been included as they provide a comparison of modelled results to measured noise levels at each of these sites which have been used as the permanent noise monitoring sites for several years. The additional York Street location was chosen because of its close proximity to the proposed bund and Golden Pike Mining operations.

All related noise contour plots are included as appendices to this report and can be referred to accordingly. Proposed equipment inventories for bund construction and Golden Pike mining operations are detailed in Table 3.

2.0 SUMMARY

The results of modelling for commencement of the noise bund construction show that resultant noise levels to Lane Street are in the range 60 – 65 dB(A) and therefore are above the Assigned Noise Levels of the Regulations. As this would be classed as a construction site, then it is not required to meet the Assigned Noise Levels provided work is carried out only within certain hours, the machinery used is the quietest reasonably available, and all other requirements in Regulation 13 of the Noise Regulations are addressed which includes advising affected residences if work is essential outside of the designated hours.

As part of the planning for the new bund construction and also the Golden Pike mining operations, the existing noise bund has been re-assessed for its effectiveness in 2005 for the existing operation primarily in view of the deeper Super Pit. Based on current machinery numbers and location of operations, a model was undertaken with the existing bund in place and also totally removed as it may have to be to facilitate the Golden Pike mining proposals. The differences have been found to be negligible and therefore, the existing bund may be totally removed to construct the new noise bund if required. The actual process of removal should be considered as part of the new western bund construction and therefore any noise associated with this would come under Regulation 13 with the main factor impacting on this phase of the project being the restriction to the day time hours 0700hrs to 1900hrs and the other conditions of Regulation 13.

Results of the initial Golden Pike mining operations on existing ground levels, with a 20m high bund to the west between the mining operations and the residential areas, showed that noise levels approximately along the re-aligned (current) Eastern Bypass (Goldfields Highway), are in the range of 50 – 55 dB(A). Reference should be made to the noise contour plots for complete details however, for comparison, the following Assigned Noise Levels, measured noise levels, and modelled noise levels are shown at the existing permanent monitoring sites at BPS and KTS and also at the third "receiver" site east of the intersection of York and Lane Streets.

It is relevant to note that the results tabulated below are for all the equipment on the inventory provided by KCGM operating simultaneously, and for wind from all directions at the same time and therefore, any variations would be less than the above results dependant on the wind direction and the number of items of machinery operating.

TABLE 1 – COMPARISON OF ASSIGNED, MEASURED AND MODELLED NOISE LEVELS

Location	Assigned Noise Levels Ø		Measured Noise Levels ∞		Modelled Noise Levels	
	Day 0700 – 1900hrs	Night 2200 – 0700hrs	Day	Night	Bund Construction	Golden Pike Operation
KTS Logger Cnr Davidson / Wilson Stts	48	38	66	54	50 – 55	35 – 40* 30 – 35#
BPS Logger on the School Boundary Brookman Street	48	38	62	54	55 – 60	40 – 45* 35 – 40#
York St, between Lane & Hamilton Streets	51	41	54	52	60 - 65	45 – 50* 40 – 45#

Ø Ref Table 1 of the Environmental Protection (Noise) Regulations 1997

∞ Current measured noise levels include both mining and non-mining (i.e. traffic) related activities. These are the average L_{10} levels recorded at the KTS and BPS sites from January to December 2005, and the average L_{10} levels recorded from 6-14 April 05 at the York St location.

* Existing ground level at commencement

\# -20m – approximately 6 months after commencement

As seen from the above results, the existing noise levels measured at each of the measurement sites are for most part above the Assigned Noise Levels for the corresponding times of day. Modelled noise levels for the bund construction are generally within the current day time measured noise levels for the BPS and KTS sites but above the measured range at the nearest site to the proposed works on York Street between Lane and Hamilton Streets. This is not considered a serious consequence as the bund construction would be classed as a construction site under Regulation 13, and work would generally be carried out between the hours of 0700 to 1900hrs in accordance with Regulation 13(2).

As noted above, construction of the noise bund will be carried out in accordance with Regulation 13 of the *Environmental Protection (Noise) Regulations 1997*, primarily with respect to times of construction, the implementation of a Noise Management Plan, and consultation as required, with potentially affected property occupiers.

3.0 CRITERIA

The *Environmental Protection (Noise) Regulations 1997* are the enforceable regulations under the *Environmental Protection Act*, and in Table 1 and Schedule 3 of these Regulations, Assigned Noise Levels are determined for areas based on circles of 100 metres and 450 metres centered on a point of measurement. For this proposal, three locations have been selected to be representative of residential areas near to the proposed noise bund and Golden Pike mining activities. Two of these locations the Boulder Primary School (BPS) and Kalgoorlie Technical School (KTS), are the sites of continuous noise monitoring and this will enable a comparison of Assigned Noise Levels to the actual measured noise levels. A location closer to the proposed Golden Pike operations was also considered to be relevant and hence, a noise logger was placed on York Street between Lane and Hamilton Streets in order to monitor existing noise levels for comparison with the Assigned Noise Levels.

For each of these locations, the Assigned Noise Levels have been calculated for comparison to the modelled resultant noise levels. Assigned Noise Levels are different for different time periods during the day and night. There are three different time periods during any 24 hour period for determination of Assigned Noise Levels with the overnight period 2200hrs to 0700hrs having the lowest Assigned Noise Level. Also, the modes of measurement are different dependent on the time that a noise source is present. The L_{A10} Assigned Noise Levels are not to be exceeded for more than 10% of the representative assessment period, and the L_{A1} Assigned Noise Level, for not more than 1% of the representative assessment period. Unless noted otherwise, this assessment will use the L_{A10} criteria. For the noise bund construction, only the daytime Assigned Noise Level will be used for comparison even though it is not strictly applicable because it is a construction site, whereas for mining operations, the overnight Assigned Noise Level between 2200hrs and 0700hrs will be used for assessment purposes.

The following table provides all relevant Assigned Noise Levels for the above noted receiver locations used in this study.

TABLE 2 - ASSIGNED NOISE LEVELS AT RECEIVER LOCATIONS USED IN MODEL

Location	Time of Day	Assigned Noise Level		
		L_{A10}	L_{A1}	L_{Amax}
Corner of Davidson St & Wilson St (KTS logger site)	0700 – 1900 hours Monday to Saturday	48	58	68
	0900 – 1900 hours Sunday & public holidays	43	53	68
	1900 – 2200 hours all days	43	53	58
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	38	48	58
Brookman St west boundary of Boulder Primary School (BPS logger site)	0700 – 1900 hours Monday to Saturday	48	58	68
	0900 – 1900 hours Sunday & public holidays	43	53	68
	1900 – 2200 hours all days	43	53	58
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	38	48	58
York Street between Lane & Hamilton Sts	0700 – 1900 hours Monday to Saturday	51	61	71
	0900 – 1900 hours Sunday & public holidays	46	56	71
	1900 – 2200 hours all days	46	56	61
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	41	51	61

There could be small variations in the Assigned Noise Levels within the vicinity of each of these locations due to differences in land usage within each of the abovementioned circles relative to each location, however, these have not been shown in this instance and nor are they considered too important.

Other noise level standards have been written in relation to the KCGM Kalgoorlie Operations. The "Noise Level Standards for Kalgoorlie Consolidated Gold Mines Pty Ltd" (October 1991), Part D, "General Noise Level Standards" States in D1 that noise levels shall not exceed the ambient noise level present at the time by more than 5 $dBL_{A.}$ There are also other noise level standards for different times of day and night which are not based on the ambient noise levels.

Noise levels associated with this proposal will aim to comply with the *Environmental Protection (Noise) Regulations 1997* and also standards specific to KCGM Kalgoorlie Operations.

4.0 METHODOLOGY

Noise level contour predictions were modeled utilizing the computer modelling programme SoundPlan Version 6.1. Land contours were obtained from KCGM Mining Operations and imported into the SoundPlan programme. For modelling of the existing noise bund, the Super Pit, production stockpiles (Blendfinger), waste dumps to the east and associated haul roads were included; viz all current mining operations. For modelling the new bund construction and Golden Pike mining, only the area around the Golden Pike mining area was used and included significant residential areas in Kalgoorlie-Boulder which could be impacted upon by either the noise bund construction, or the subsequent Golden Pike mining operations. Weather conditions used were a temperature of 15°C and wind with velocity 3m/s in accordance with Department of Environment criteria for worst case conditions. The results depicted by the contours are for the above wind speed from all directions simultaneously in order to generate worst case results.

Equipment inventories for noise bund construction and for mining operations at Golden Pike were obtained from KCGM mine planning and sound power levels used were calculated from measurements of actual or representative machinery at the KCGM operations in Kalgoorlie. Equipment inventories and machine sound power levels are detailed in the following Table 3.

TABLE 3 – EQUIPMENT No's & SOUND POWER LEVELS

Equipment	Bund Construction	Golden Pike Cutback	Sound Power Level, dB(A)
PC-8000 Excavator	0	1	126
CAT 793 Truck	2	5 – 7	124
CAT 16G Grader	1	1	112
CAT D10R Dozer	1	1	126
CAT 783 Watertruck	1	1	113
Schramm RC Grade Control Rig	0	1	117
DM-45 Blasthole Rig	0	3	117
Roller / Whacker Packer	1	0	106

For the noise bund construction, the existing ground levels have been used with no barrier between these operations and the residential area to the west. Again, this would be a worst case representation of initial construction where there is no barrier. With advancing construction, every endeavor would be made to raise the western side first thus giving a small barrier behind which to carry out further construction to the next lift. This method was used in constructing the Croesus waste dump and the recent Southern Extension to the Environmental Noise Bund.

Initially for Golden Pike mining operations, ground levels used are the existing ground levels. A scenario has also been calculated for a pit RL of –20 below the existing ground level in order to quantify the reduction as mining deepens into the pit.

5.0 RESULTS

5.1 Bund Construction – Resultant predicted noise contours for the bund construction at the initial stage when there is no noise barrier at all, are shown on noise contour plot 1. For general information on predicted noise levels in the larger residential areas, reference should be made to this plot however, more specifically, at the three noted receiver locations, predicted noise levels are:

KTS logger site (corner of Davidson & Wilson Sts)	50-55 dB(A)
BPS logger site (on Brookman between Wittenoom & Moran Sts)	55-60 dB(A)
Intersection of York & Lane Sts	60-65 dB(A)

The two logger sites were chosen because there is ongoing monitoring at these locations which facilitates comparison to existing actual measured noise levels, whereas the latter was selected because of its close proximity to both the noise bund construction and the subsequent Golden Pike mining operations. The predicted noise levels are above the Assigned Noise Levels during the daytime for these locations and are within the range of the measured daytime noise environment at the two logger sites. However, since the noise bund construction would be classed as a construction site, Regulation 13(2) of the *Environmental Protection (Noise) Regulations 1997* is quite clear that the Assigned Noise Levels of Regulation 7 do not apply for construction work carried out *between 0700 hours and 1900 hours on any day which is not a Sunday or public holiday…….* provided that other conditions of this regulation are met, which would generally be covered under a Noise Management Plan. Regulation 13(3) has conditions for operation outside of these hours when Regulation 7 also does not apply, provided the conditions of the subsequent sub-clauses (3) to (6) are met.

5.2 Golden Pike Cutback - Resultant predicted noise levels for initial operations on ground level with the noise bund in place are shown on contour plot 2. This is for the noise bund constructed to the full 20 metre height and for initial mining operations at the existing ground level. This scenario would be a "worst case". For general information on predicted noise levels in the larger residential areas, reference should be made to this plot however, more specifically, at the three noted receiver locations, noise levels are:

KTS logger site (corner of Davidson & Wilson Sts)	35-40 dB(A)
BPS logger site (on Brookman between Wittenoom & Moran Sts)	40-45 dB(A)
Intersection of York & Lane Sts	45-50 dB(A)

The noise model was also run for mining operations at 20 metres below the existing ground level, a scenario anticipated to be reached approximately 6 months after commencement. For this scenario, predicted noise levels are shown on contour plot 3 and reference should be made to this plot accordingly. At the three noted receiver locations, noise levels are:

KTS logger site (corner of Davidson & Wilson Sts)	30-35 dB(A)
BPS logger site (on Brookman between Wittenoom & Moran Sts)	35-40 dB(A)
Intersection of York & Lane Sts	40-45 dB(A)

For initial mining at Golden Pike, predicted noise levels (dB(A)) range either side of the Assigned Noise Level between 2200hrs and 0700hrs for the KTS site and are above the Assigned Noise Levels for both BPS and York Street.

These modeled noise levels are less than the Assigned Noise Levels for all other times. An adjustment for tonality could be applicable as per the Regulations. If this was applied, then the result would be less than the daytime Assigned Noise Levels and marginal during the evening. However, it is relevant to note that the above results are for all the equipment on the inventory provided by KCGM operating simultaneously, and for wind from all directions at the same time and therefore, any variations would be less than the above results dependant on the wind direction and the number of items of machinery operating.

In terms of the existing night time noise environment at each of the targeted positions, the modelled results for initial mining are less than the existing levels at the KTS and BPS sites and marginally above for the York Street location. For day time, all modelled results are less than the noise levels measured in each of these areas.

For mining at the -20 metre level, approximately 6 months after commencement of mining in this area, the resultant predicted noise levels are approximately 5 dB(A) less than the initial operations on existing ground levels. In terms of the Assigned Noise Levels at the three identified receiver locations used as reference points in summary of the overall noise contour plots, this interprets to the lower end of the predicted range complying with night time Assigned Noise Levels and the upper end of the range being marginally above the night time Assigned Noise Levels.

In terms of the existing measured noise levels, all predicted results are less than the existing noise levels during the night and well within the daytime levels. As noted above, these results are a "worst case" scenario of all equipment operating simultaneously and wind blowing from the noise sources to the receiver locations at the velocity recommended by the Department of the Environment as representing the least attenuation with distance, or the most enhanced conditions for propagation.

5.3 Existing Noise Bund

Modelled results of the existing mining operations "with" and "without" the existing noise bund are shown on Contour Plots 4 & 5. Generally, the modelled results lie within the ranges measured at corresponding locations, the latter of which would also include other noise sources independent of mining operations and therefore would introduce some unknown variables. Contour Plot 6 shows the "*difference"* between plots 4 & 5, that is to say, the effect if the existing noise bund was to be totally removed as part of the planning for this proposal. As noted on this "*difference*" contour plot, there is no variation in the residential areas except for a couple of isolated spots where the increase is <1.5 dB(A).

5.4 Proposed Loopline Tourist Rail

A detailed assessment was carried out and reported in April 2003 in relation to the environmental noise impact of the proposal at that time. Based on a P Class locomotive of which noise data was available, the resulting calculated L_{Aeq} at 25 metres distance for the number of trips per day as predicted at that time, was 43 dB(A). The "P" class locomotive was noted as having noise levels higher than those types likely to run however this was considered sufficiently indicative at that time. It was also considered that for the proposed speed and track layout, there would be no impact from wheel squeal.

Even though the above initial review provided objective results to support there being no problems associated with the tourist rail (as proposed at that time), it is still considered prudent to assess any such proposal in association with the future bund and track layouts to confirm any impact on the residential areas. If specific locomotives are known to be intended for service on this proposed line, then noise measurements can be carried out on these locomotives in order to determine their appropriateness for this service; particularly in regard to diesel powered locomotives where efficient exhaust silencers would be expected to be fitted.

To draw comparisons, it could be said that diesel powered locomotives would have less impact on the surrounding environment than diesel powered trucks which frequent the eastern by-pass road in this vicinity.

6.0 NOISE MANAGEMENT

Although generally related to all operations a Noise Management Plan such as that previously developed and used for all operations including construction, is particularly important for the noise bund construction which does not meet, and does not have to meet the criteria of the regulations because it is a construction site. Nevertheless, it is relevant and important to emit the least possible noise from machinery under the circumstances and therefore, the following may be used as guidance in this Noise Management Plan which for some items, is specific to this project.

6.1 Ensure the "quietest reasonably available" equipment available is used on this site.

6.2 Monitoring of sound pressure levels should be carried out during construction. This will mainly be by way of the existing continuous monitoring at the two established logger sites as part of KCGM's ongoing noise monitoring program established in 1993. Other specific locations may be monitored from time to time on an 'as needs' basis.

6.3 Construction activities must be restricted to 0700 to 1900 hours on any day, except a Sunday or Public Holiday. If work outside these hours is required and it is reasonably necessary for the construction work to be carried out at that time, then the following procedures should be initiated:

i) A Noise Management Plan is prepared and given to the Chief Executive Officer (of Department of Environment) at least 7 days before construction commences and is approved by the Chief Executive Office (of Department of Environment).

ii) Written notice is given to the occupiers of all premises at which noise emissions received are likely to exceed those levels specified under Regulation 7 due to proposed construction work.

6.4 All mobile equipment used during construction to be fitted with 'Smart Alarms'.

6.5 Operator training in 'least noisy' operation of equipment and also awareness of proximity to residences.

6.6 Larger trucks to be utilised where feasible in order to reduce number of truck cycles.

6.7 If possible, commence construction of the noise bund on the western side with at least one lift to provide some noise barrier for other activities.

6.8 For the Golden Pike operations, in addition to the above items where applicable, consideration should be given to haul road layouts in order to maximize on the barrier effects of the noise bund or other more local earth barriers or screening which may be possible with planning. Direct lines-of-sight should be minimized wherever possible.

7.0 CONCLUSION

7.1 Construction of the new noise bund will be carried out between 0700 and 1900 hours on any day which is not a Sunday or public holiday in accordance with Regulation 13 (2) of the *Environmental Protection (Noise) Regulations 1997*. Other requirements of this regulation such as the implementation of a Noise Management Plan and use of the least noisy equipment reasonably available will be incorporated into the planning and construction programmes. Where any work outside of the above times may be necessary from time to time, then a consultation process shall be incorporated into the Noise Management Plan and implemented as and when needed.

7.2 The existing noise bund may be used for constructing the new noise bund if required, as it has been shown that the effective attenuation provided by this existing noise bund, of existing mining operations in 2005, is minimal.

7.3 Noise levels of mining operations will be reduced as the ground levels of mining operations become lower and the additional barrier of the pit itself also contributes to meaningful noise reductions.

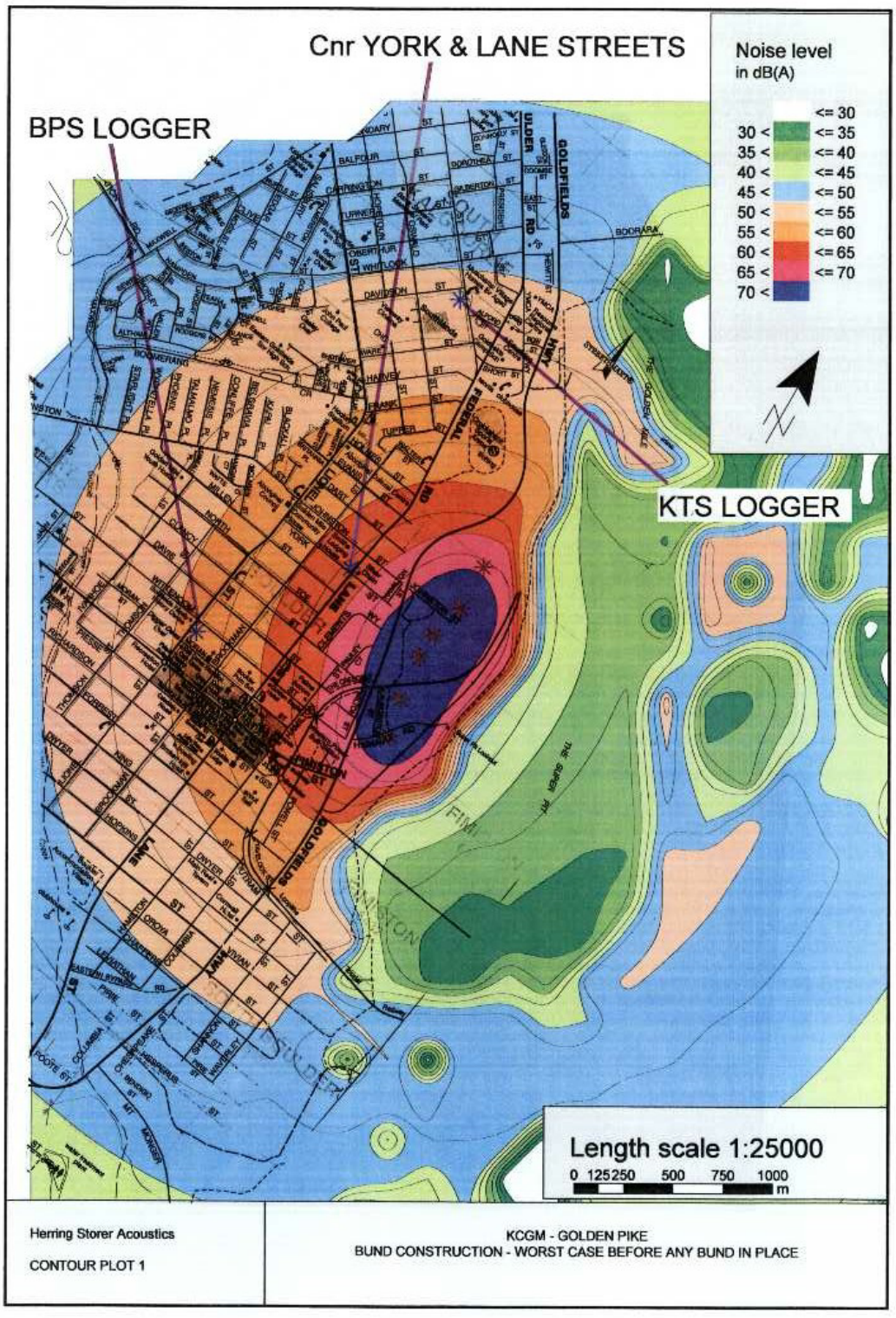
For: **HERRING STORER ACOUSTICS**

Allan Herring

22 June 2005

APPENDIX A

NOISE CONTOURS
GOLDEN PIKE MINING OPERATIONS



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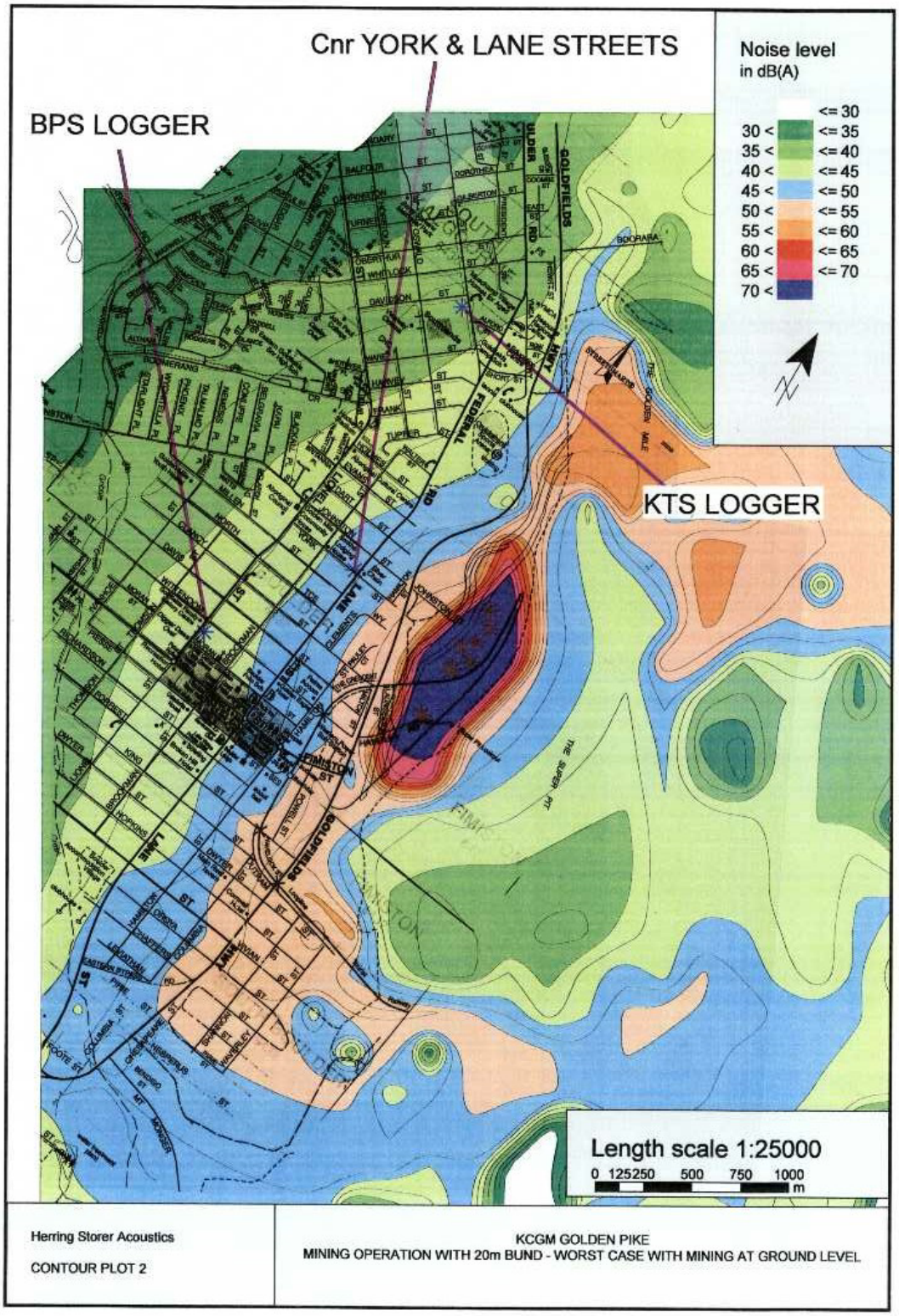
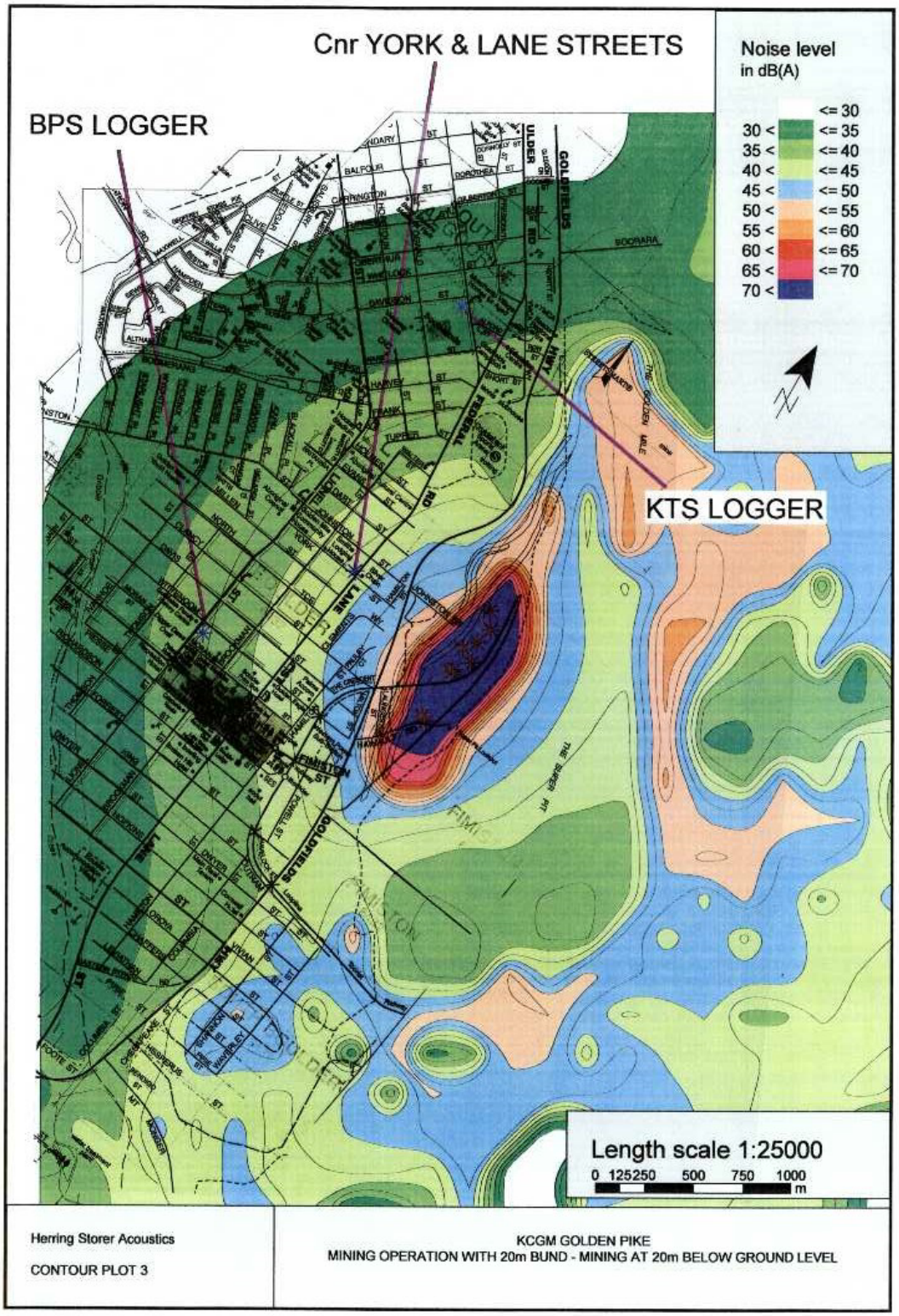
CONTOUR PLOT 1

KCGM - GOLDEN PIKE
BUND CONSTRUCTION - WORST CASE BEFORE ANY BUND IN PLACE


Cnr YORK & LANE STREETS
BPS LOGGER
KTS LOGGER
Noise level
in dB(A)
<= 30
30 < <= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 < <= 70
70 <
Length scale 1:25000
0 125250 500 750 1000
m
Herring Storer Acoustics
CONTOUR PLOT 2
KCGM GOLDEN PIKE
MINING OPERATION WITH 20m BUND - WORST CASE WITH MINING AT GROUND LEVEL


Cnr YORK & LANE STREETS
BPS LOGGER
KTS LOGGER
Noise level
in dB(A)
<= 30
30 < <= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 < <= 70
70 <
Length scale 1:25000
0 125250 500 750 1000
m
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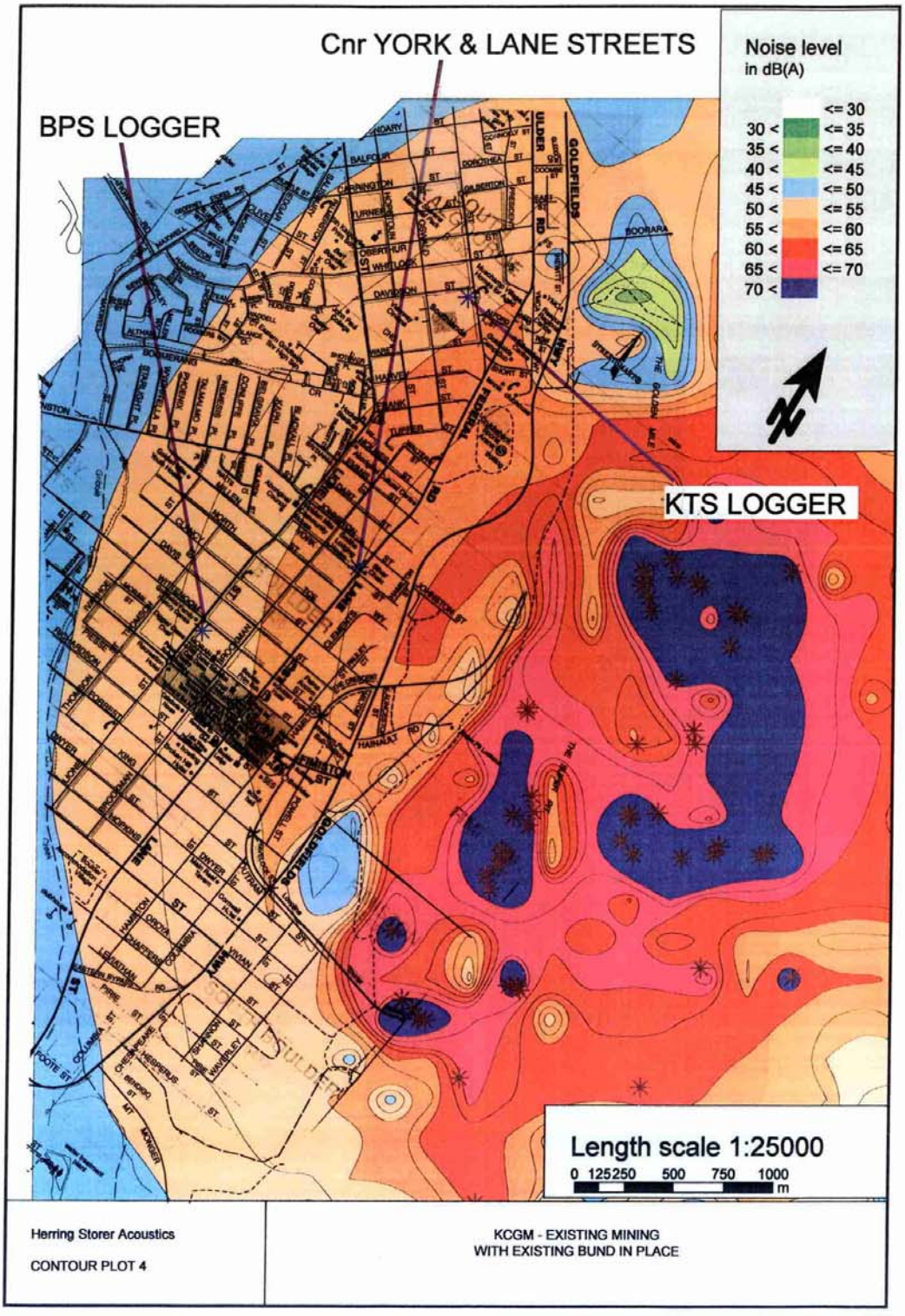
CONTOUR PLOT 3
KCGM GOLDEN PIKE
MINING OPERATION WITH 20m BUND - MINING AT 20m BELOW GROUND LEVEL

APPENDIX B

NOISE CONTOURS

EXISTING NOISE BUND

- IN PLACE (AS EXISTING)
- REMOVED


Cnr YORK & LANE STREETS
BPS LOGGER
KTS LOGGER
Noise level
in dB(A)
<= 30
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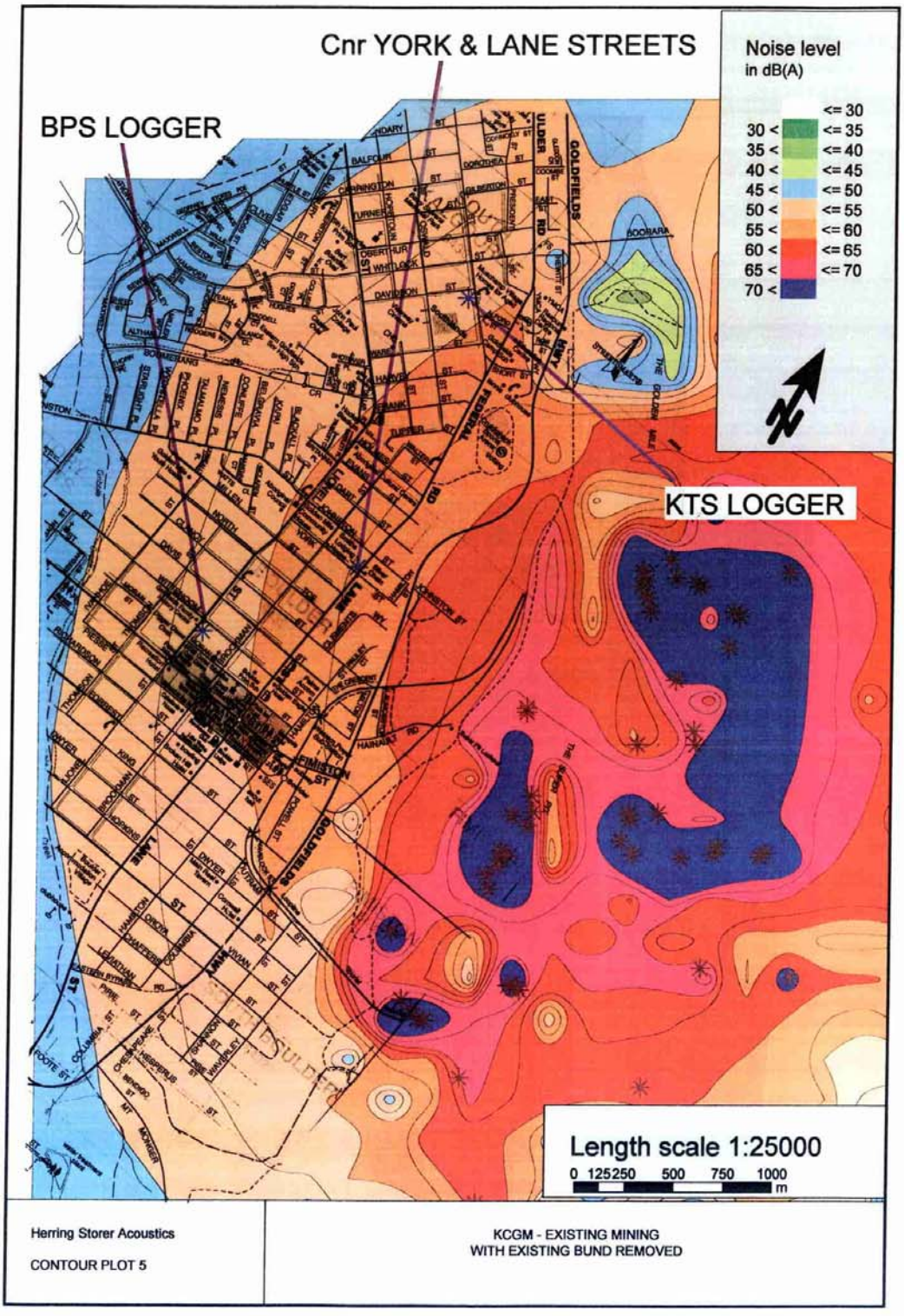
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 < <= 70
70 <
Length scale 1:25000
0 125250 500 750 1000
m
Herring Storer Acoustics
CONTOUR PLOT 4
KCGM - EXISTING MINING
WITH EXISTING BUND IN PLACE


Cnr YORK & LANE STREETS
BPS LOGGER
KTS LOGGER
Noise level
in dB(A)
<= 30
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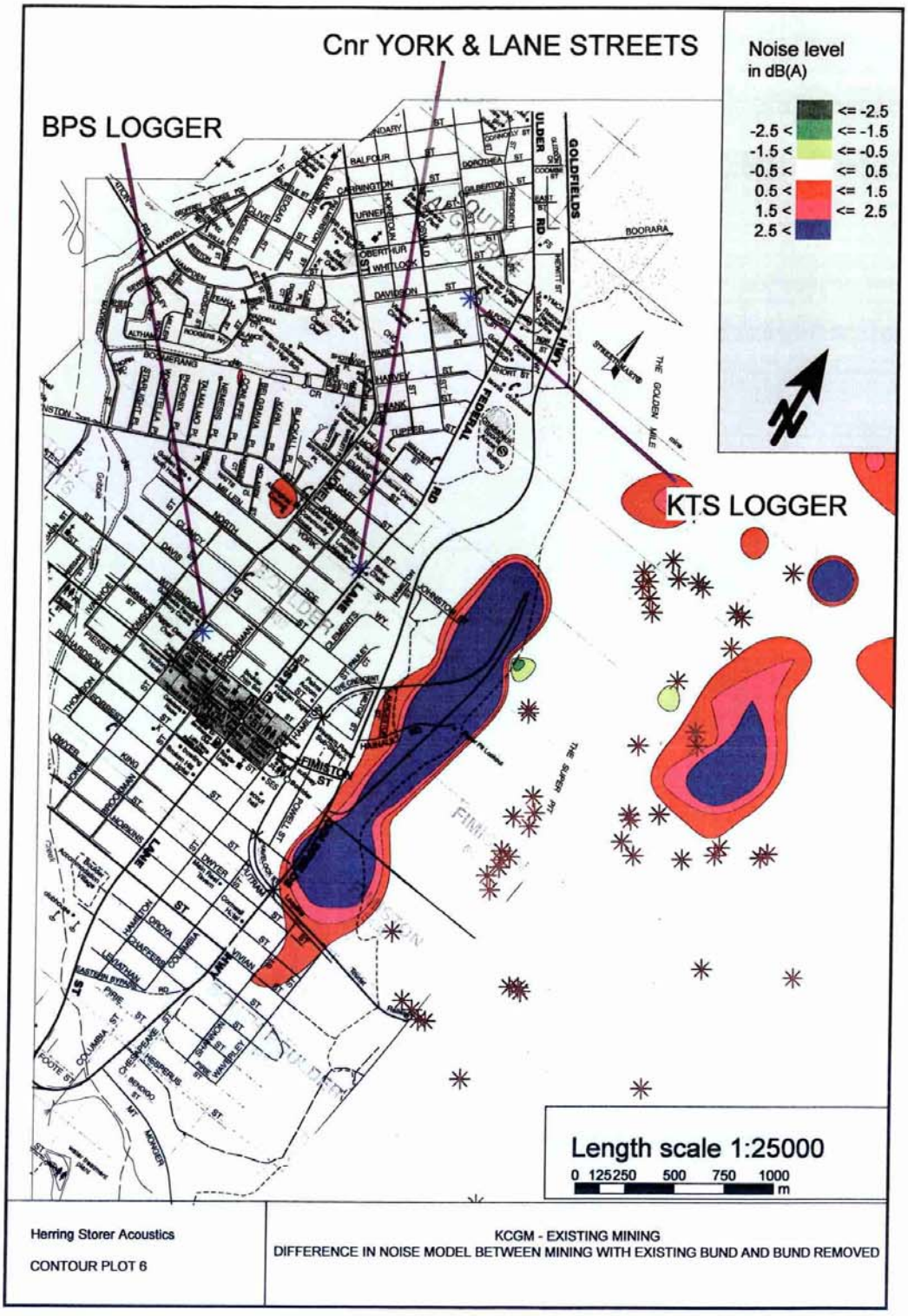
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 < <= 70
70 <
Length scale 1:25000
0 125250 500 750 1000
m
Herring Storer Acoustics
CONTOUR PLOT 5
KCGM - EXISTING MINING
WITH EXISTING BUND REMOVED


Cnr YORK & LANE STREETS
BPS LOGGER
KTS LOGGER
Noise level
in dB(A)
<= -2.5
-2.5 < <= -1.5
-1.5 < <= -0.5
-0.5 < <= 0.5
0.5 < <= 1.5
1.5 < <= 2.5
2.5 <
Length scale 1:25000
0 125250 500 750 1000
m
Herring Storer Acoustics
CONTOUR PLOT 6
KCGM - EXISTING MINING
DIFFERENCE IN NOISE MODEL BETWEEN MINING WITH EXISTING BUND AND BUND REMOVED