

20 January 2015

WM Project Number: 06159-WM
 Our Ref: AGL200115 RH_ComplianceResults
 Email: aclifton@agl.com.au

Mr Aaron Clifton
 AGL Upstream Investments Pty Ltd
 Lot 35 Energy Ltd
 MENANGLE NSW 2568

Dear Aaron

**Re: Camden Operating Gas Wells - Compliance Noise Monitoring
 (November 2014 & January 2015)**

INTRODUCTION

Noise monitoring of a selection of operational AGL gas well sites in Camden was carried out by Wilkinson Murray in order to assess compliance with the relevant noise criteria set by the Department of Planning and Environment *Conditions of Consent* (Project Approval No. 282-6-2003, 75-4-2005, 06_0137 and 06_0291).

The compliance assessment is based on noise monitoring conducted during the day, evening and night time on Thursday, 20 November 2014.

The well sites assessed include wells from Razorback (RB07, RB10), Elizabeth Macarthur Agricultural Institute or EMAI (EM20/38), Sugarloaf (SL02), Spring Farm (SF20) and Menangle Park (MP11/22, MP11/22 and MP03).

PROJECT APPROVAL CRITERIA

The day, evening and night time operational noise criteria set out in the Project Approvals for the relevant well sites are summarised in Table 1.

Table 1 Relevant Project Approval Noise Criteria

| Project | Well Site | Operational Noise Criteria (dBA) | | | |
|---------------|----------------------------------|-------------------------------------|------------------------|------------------------|----------------------|
| | | Day | Eve | Night | Night |
| | | L _{Aeq,15min} | L _{Aeq,15min} | L _{Aeq,15min} | L _{A1,1min} |
| Razorback | RB07, RB10 | 39 | 39 | 35 | 45 |
| EMAI | EM20 / EM38 | - | - | - | - |
| Sugarloaf | SL02 | 35 | 35 | 35 | 45 |
| Spring Farm | SF20 | 43 | 41 | 36 | - |
| Menangle Park | MP03 / MP11 / MP22 / MP12 / MP23 | 49 | 45 | 40 | - |

WELL SITES DESCRIPTION & LOCATION

Monitoring was conducted at a selection of well sites. Table 2 provides a description of the well sites and operations during the measurements. Figures 1 to 4 show the locations of the various sites assessed.

Table 2 Description of Well Sites Assessed

| Site Name | Well | Comments |
|-------------|----------------------------------|---|
| RB07 | RB07 | This well is pump-operated during the day and free-flowing during the evening and night time. |
| RB10 | RB10 | This well is pump-operated. |
| EM20 / EM38 | EM20 / EM38 | During the measurements, both wells were producing. Neither well is pump-operated. |
| SL02 | SL02 | This well is free-flowing and has an enclosure. |
| SF20 | SF05 / SF07 / SF08 / SF09 | During the measurements, wells SF05, SF07, SF08 and SF09 were producing. None of them are pump-operated. |
| MP11 / MP22 | MP11 / MP22 | During the measurements, both wells were producing. MP22 is the only pump-operated well. |
| MP12 / MP23 | MP12 / MP23 | During the measurement, both wells were operating. Both wells are free-flowing. |
| MP03 | MP01 / MP02 / MP03 / MP09 / MP10 | During the measurements, wells MP02, MP03, MP09 and MP10 were producing. Except for MP02 which is pump-operated, all producing wells are free-flowing. |

Figure 1 EM20 / EM38, RB07 & RB10



Figure 2 MP11 / MP22, MP12 / MP23 & SL02

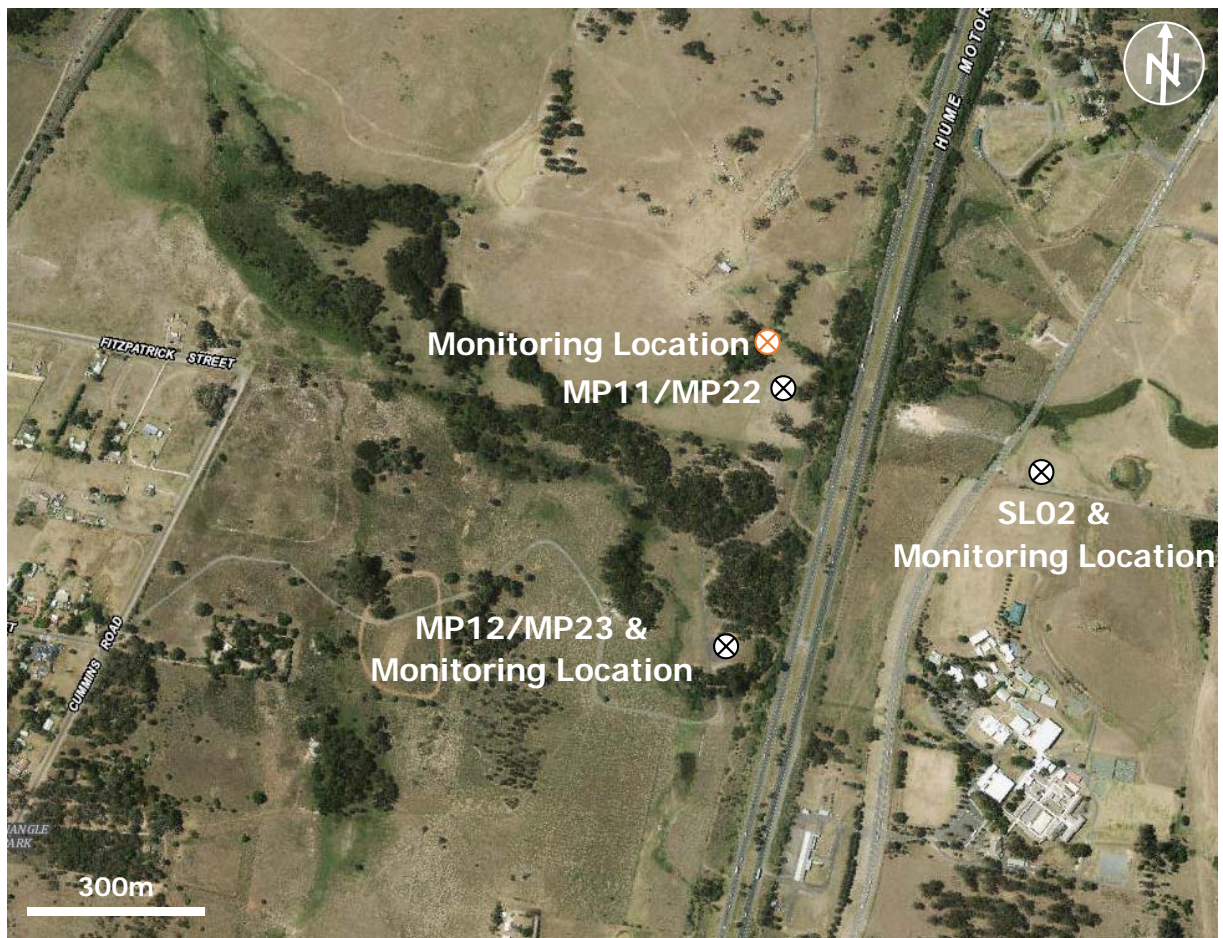


Figure 3 SF20



Figure 4 **MP03**

NOISE MEASUREMENT PROCEDURE

All measurements were conducted using a Bruel and Kjaer Type 2236 Sound Level Meter. This sound level meter conforms to Australian Standard 1259 *Acoustics – Sound Level Meters* as a Type 1 Precision Sound Level Meter which has an accuracy suitable for field and laboratory use. The A-Weighting filter of the meter was selected and the time weighting was set to “Fast”. The calibration of the meter was checked before and after the measurements with a Bruel and Kjaer Type 4230 sound level calibrator and no significant drift was noted.

The Bruel and Kjaer Type 2236 and Type 4230 have been laboratory calibrated within the previous two years in accordance with our in-house Quality Assurance Procedures.

The sound level meter used holds a current NATA Calibration Certificate (Calibration Certificate valid for 2 years is attached to this letter).

All measurements were conducted on Thursday, 20 November 2014. Weather conditions were generally considered suitable for measurements in accordance with the NSW *Industrial Noise Policy (INP)* (ie. wind speeds of less than 5m/s and no rain). Measurements were paused during brief periods of wind exceeding 5m/s (this was determined using a hand-held digital anemometer AR816).

Cloud cover was observed to range 30-60% during the measurements.

Well sites with pump-operated wells were louder than free-flowing well sites. For pump-operated wells, the pump represented the dominant noise source.

Noise generated by the free-flowing and pump-operated wells were relatively constant in nature. Most of the measurements had to be conducted relatively close to the well site in order to accurately measure noise generated by the site. For those sites, 5 minute measurements were sufficient to establish accurate $L_{Aeq,15min}$ noise levels.

ASSESSMENT OF MEASURED LEVELS

Table 3 shows the measured L_{Aeq} levels and assesses the estimated $L_{Aeq,15min}$ noise levels at the closest receivers which is compared against the relevant noise criteria. The calculated sound power level (SWL) for each well site is also provided.

Table 3 Measurement Results

| Well Site | Pump-operated? (Yes/No) | Measurement Time | Measured LAeq Level from Well Site (dBA) | Measured LA1,1min Level from Well Site (dBA) | Distance/Direction of Monitoring Location relative to Well Site | Comments | Calculated LAeq SWL of Well Site (dBA) | Distance/Direction of Closest Receiver relative to Well Site | Estimated LAeq,15min Level from Well Site at Closest Receiver (dBA) | LAeq,15min Noise Criteria (dBA) | LA1,1min Noise Criteria (dBA) | Complies? (Yes/No) |
|-------------|----------------------------|------------------|--|--|---|---|--|--|---|---------------------------------|-------------------------------|--------------------|
| MP12 / MP23 | No | 2.40pm-2.45pm | 50 | n/a | 3m (n/a) | Measurement dominated by Hume Highway traffic noise | 68 | 325m (E) | <30 | 49 | n/a | Yes |
| MP11 / MP22 | Yes | 2.50pm-3.05pm | 48 | n/a | 63m (NNW) | Measurement dominated by Hume Highway traffic noise | 92 | 200m (NNW) | 36 | 49 | n/a | Yes |
| SL02 | No | 3.15pm-3.20pm | 47 | n/a | 1m (n/a) | Measurement dominated by Hume Highway traffic noise | 55 | 210m (N) | <30 | 35 | n/a | Yes |
| RB10 | Yes | 3.48pm-4.03pm | 42 | n/a | 107m (N) | Measurement dominated by insect noise | 91 | 210m (NW) | 34 | 39 | n/a | Yes |
| RB07 | Yes | 4.10pm-4.15pm | 53 | n/a | 24m (S) | Measurement dominated by insect noise | 89 | 145m (S) | 36 | 39 | n/a | Yes |

| Well Site | Pump-operated? (Yes/No) | Measurement Time | Measured LAeq Level from Well Site (dBA) | Measured LA1,1min Level from Well Site (dBA) | Distance/Direction of Monitoring Location relative to Well Site | Comments | Calculated LAeq SWL of Well Site (dBA) | Distance/Direction of Closest Receiver relative to Well Site | Estimated Level | | Complies? (Yes/No) | |
|-----------------------|----------------------------|------------------|--|--|---|---|--|--|---|-------------------------------|--------------------|-----|
| | | | | | | | | | LAeq,15min from Well Site at Closest Receiver (dBA) | LA1,1min Noise Criteria (dBA) | | |
| EM20 / EM38 | No | 4.30pm-4.45pm | IA ¹ | n/a | 300m (NW) | Measurement dominated by insect noise | - | 335m (NW) | <30 | - | n/a | Yes |
| SF20 SW ² | No | 5.00pm-5.15pm | 42 | n/a | 75m (SW) | Measurement dominated by distant traffic noise | 88 | 135m (SW) | 36 | 43 | n/a | Yes |
| SF20 NNE ² | No | 5.25pm-5.40pm | IA ¹ | n/a | 435m (NNE) | Measurement dominated by distant traffic noise | - | 445m (NNE) | <30 | 43 | n/a | Yes |
| MP03 | Yes | 6.10pm-6.15pm | 56 | n/a | 20m (SSE) | Measurement dominated by Hume Highway traffic noise | 90 | 200m (SSE) | 35 | 45 | n/a | Yes |
| SL02 | No | 6.45pm-6.50pm | 47 | n/a | 1m (n/a) | Measurement dominated by Hume Highway traffic noise | 55 | 210m (N) | <30 | 35 | n/a | Yes |

| Well Site | Pump-operated? (Yes/No) | Measurement Time | Measured L _{Aeq} Level from Well Site (dBA) | Measured L _{A1,1min} Level from Well Site (dBA) | Distance/Direction of Monitoring Location relative to Well Site | Comments | Calculated L _{Aeq} SWL of Well Site (dBA) | Distance/Direction of Closest Receiver relative to Well Site | Estimated | L _{Aeq,15min} Noise Criteria (dBA) | L _{A1,1min} Noise Criteria (dBA) | Complies? (Yes/No) |
|----------------------|----------------------------|------------------|--|---|--|---|---|---|--|--|--|-----------------------|
| | | | | | | | | | L _{Aeq,15min} Level from Well Site at Closest Receiver (dBA) | | | |
| MP11 / MP22 | Yes | 7.02pm-7.17pm | 48 | n/a | 63m (NNW) | Measurement dominated by Hume Highway traffic noise | 92 | 200m (NNW) | 36 | 45 | n/a | Yes |
| MP12/MP23 | No | 7.25pm-7.40pm | 50 | n/a | 3m (n/a) | Measurement dominated by Hume Highway traffic noise | 68 | 325m (E) | <30 | 45 | n/a | Yes |
| RB10 | Yes | 8.03pm-8.18pm | 42 | n/a | 107m (N) | Measurement dominated by insect noise | 91 | 210m (NW) | 34 | 39 | n/a | Yes |
| RB07 | No | 8.25pm-8.40pm | 33 | n/a | 4m (S) | Measurement dominated by insect noise | 53 | 145m (S) | <30 | 39 | n/a | Yes |
| SF20 SW ² | No | 9.01pm-9.16pm | 34 | n/a | 135m (SW) | Measurement dominated by distant traffic noise | 85 | 135m (SW) | 34 | 41 | n/a | Yes |

| Well Site | Pump-operated? (Yes/No) | Measurement Time | Measured L _{Aeq} Level from Well Site (dBA) | Measured L _{A1,1min} Level from Well Site (dBA) | Distance/Direction of Monitoring Location relative to Well Site | Comments | Calculated L _{Aeq} SWL of Well Site (dBA) | Distance/Direction of Closest Receiver relative to Well Site | Estimated | L _{Aeq,15min} Noise Criteria (dBA) | L _{A1,1min} Noise Criteria (dBA) | Complies? (Yes/No) |
|-----------------------|----------------------------|------------------|--|--|---|---|--|--|---|---|---|--------------------|
| | | | | | | | | | L _{Aeq,15min} Level from Well Site at Closest Receiver (dBA) | | | |
| SF20 NNE ² | No | 9.27pm-9.42pm | IA ¹ | n/a | 435m (NNE) | Measurement dominated by distant traffic noise | - | 445m (NNE) | <30 | 41 | n/a | Yes |
| MP03 | Yes | 10.00pm-10.15pm | 56 | 58 | 20m (SSE) | Measurement dominated by Hume Highway traffic noise | 90 | 200m (SSE) | 35 | 40 | - | Yes |
| MP03 | Yes | 10.19pm-10.34pm | 56 | 58 | 20m (SSE) | Measurement dominated by Hume Highway traffic noise | 90 | 200m (SSE) | 35 | 40 | - | Yes |
| SF20 SW ² | No | 11.56pm-0.11am | 37 | 39 | 135m (SW) | Measurement dominated by distant traffic noise | 87-88 | 135m (SW) | 36-37 ³ | 36 | - | Undetermined |

Notes: 1. IA = Inaudible

2. Measurements were conducted for the residential receivers to the SW (Holland Drive) and to the NNE (Jane Court) of the well site.

3. Noise levels generated by well site could not be accurately established due to interfering traffic noise.

Wells with pumps were measured with a SWL ranging between 89-92dBA. Free-flowing wells generally had SWLs below 69dBA except for SF20 which was measured with a SWL of 85-88dBA.

All identified well sites were found to comply with the relevant criteria except for SF20 which may have generated a negligible 1dB exceedance at the Holland Drive residence during the night time measurement although this could not be accurately established due to interfering traffic noise. It should be noted that a 1dB fluctuation in noise levels is not detectable to the human ear.

$L_{A1,1min}$ noise levels were also observed during the measurements and were found to comply with the relevant night time $L_{A1,1min}$ noise criteria.

POST-MITIGATION MEASUREMENTS AT SF20

Due to the undetermined compliance of night time noise levels generated by the SF20 well site, it was decided to conduct an additional 15-minute night time measurement to ensure compliance is achieved.

Noise walls were erected at the SF20 well site on Wednesday, 26 November 2014 in order to reduce noise impacts at the residential receivers to the southwest of the site. The walls are approximately 3m in height and run along the southern and western sides of the well site. Figure 5 shows the noise walls currently in place at the SF20 well site.

Figure 5 Noise Walls at SF20



The measurement was conducted using the same sound level meter as the other measurements.

Monitoring was carried out early in the morning of Thursday, 15 January 2015 between 12.10am and 12.25am.

Weather conditions were considered suitable for measurements in accordance with the NSW *INP* (ie. wind speeds of less than 5m/s and no rain). Wind speed was determined using a hand-held digital anemometer AR816. Cloud cover was observed to be 0% during the measurement.

Monitoring was conducted 40m away from the well site in the direction of the closest residential receiver (SW). The well site was measured with an $L_{Aeq,15min}$ of 43dBA. Based on this measurement result, noise generated by SF20 is expected to be less than 25dBA at the closest residence on Holland Drive, therefore complying with the night time $L_{Aeq,15min}$ noise criterion of 36dBA. This is consistent with the result of a spot measurement conducted at the house on the same night where the well site was found to be inaudible.

I trust this information is sufficient. Please contact us if you have any further queries.

Yours faithfully

WILKINSON MURRAY



Roman Haverkamp

Senior Engineer

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AAAC

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Calibration Certificate

Number : C13438

Client Details : Wilkinson Murray Pty Ltd

Level 4, 272 Pacific Highway
Crows Nest NSW 2065

Equipment Tested/ Model Number : B&K Type 2236

Instrument Serial Number : 2030550

Microphone Serial Number : 1903087

Preamplifier Serial Number : N/A

Ambient Temperature : 21°C

Relative Humidity : 34%


Barometric Pressure : 100.9 kPa

Calibration Technician : Adrian Walker

Calibration Date : 07-August-2013

Secondary Check by : Tim Williams

Report Issue Date : 08-August-2013

Approved Signatory : 

Tested To : AS1259.1:1990

AS1259.2:1990

Comments : All tests passed for type 1

| Clause and Characteristic Tested | Result | Clause and Characteristic Tested | Result |
|--|--------|--|--------|
| 10.2.2: Absolute sensitivity | Pass | 10.4.2: Time weighting characteristics F and S | Pass |
| 10.2.3: Frequency weighting | Pass | 10.4.3: Time weighting characteristic I | Pass |
| 10.3.2: Overload indications | Pass | 10.4.4: Time weighting characteristic P | Pass |
| 8.9: Detector-indicator linearity | Pass | 10.4.5: R.M.S performance | Pass |
| 8.10: Differential level linearity | Pass | 9.3.2: Time averaging | Pass |
| 10.3.3: Accuracy of level range control | Pass | 9.3.5: Overload indication | Pass |
| 10.3.4: Inherent weighted system noise level | Pass | | |



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