

SECTION B: BASELINE ASSESSMENT

CHAPTER B4: NOISE AND VIBRATION

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4. NOISE AND VIBRATION

4.1 INTRODUCTION

This Chapter of the ESIA describes baseline noise and vibration conditions in the vicinity of Oyu Tolgoi construction and operations activities. These include:

- The Temporary and Permanent Airports;
- The Gunii Hooloi water supply borefield and the water pipeline to the Oyu Tolgoi site; and
- Along the infrastructure corridor to the Gashuun Sukhait border crossing on the Mongolia/Chinese border.

4.2 SOURCES OF DATA

The previous DEIAs prepared for the Oyu Tolgoi Project present limited information regarding baseline noise conditions. The DEIA for mining and processing facilities¹ contained an assessment of noise for activities within the Mine Licence Area, and information related to noise was included in the DEIA for the Permanent Airport², but very limited baseline data on noise was collected for other Project features – particularly the Gunii Hooloi water supply borefield and pipeline and along the Oyu Tolgoi to Gashuun Sukhait road.

Consequently, additional baseline monitoring has been undertaken to fill identified gaps in the existing baseline. This comprises the following additional studies:

- Sustainability East Asia LLC (2010). Sustainability Noise Survey: Noise measurements made in the vicinity of the area surrounding the mine and the airport, Sustainability East Asia LLC, June 2010;
- Sustainability East Asia LLC (2010). Sustainability Noise Survey: Noise measurements made in the vicinity of the area surrounding the mine and the airport, Sustainability East Asia LLC, August 2010;
- Mongolian Academy of Sciences (2010). Ground Vibration Noise Assessment Report. Vibration, Mongolian Academy of Sciences, November 2010; and
- Oyu Tolgoi LLC (2011). Oyu Tolgoi Supplemental Noise Survey – noise measurements made along the water supply pipeline and Oyu Tolgoi to Gashuun Sukhait Road, Oyu Tolgoi Environmental Department, March 2011.

4.3 NOISE & VIBRATION STANDARDS & GUIDELINES

International good practice dictates that a project should adopt the more stringent of local regulatory requirements and international standards and guidelines³. Mongolian noise limits are typically more stringent than international standards and guidelines, as a result, while both Mongolian and international standards are cited in this baseline assessment, the Project has been developed to meet Mongolian standards.

4.3.1 Mongolian Noise and Vibration Standards

Mongolian Noise Standards

Mongolian standards establish a maximum environmental noise exposure for the public as 60 decibels (dB) (measured on the A scale; dB(A)) during daytime and 45 dB(A) during the night. These are set out in Mongolian national standard *MNS 4585:2007 Air Quality. Technical general requirements*.

¹ Eco-Trade (2006), Oyu Tolgoi Project Environmental Impact Assessment, Volume 3 Mining and Processing, Eco-Trade LLC 2006

² Eco-Trade (2011), Oyu Tolgoi Project Environmental Impact Assessment Report for the Permanent Airport, Eco-Trade LLC 2011

³ For example, see IFC Performance Standard 3, para. 8.

Mongolian Vibration Standards

There are no existing Mongolian environmental quality standards for ground-borne vibration or blasting overpressure.

4.3.2 International Good Practice Noise and Vibration Guidelines

IFC

The IFC provides noise guideline levels for both day and night-time periods according to the nature of the receptor⁴. Under IFC guidelines, noise abatement measures should achieve either the levels given below or generate a maximum increase in background levels of no more than 3 dB(A). No specific thresholds are provided by IFC with regard to vibration.

EBRD

The EBRD's Performance Requirement PR3 requires that projects be designed to comply with applicable EU environmental requirements. The EU Noise Directive (2000/14/EC) establishes a common EU framework for the assessment and management of exposure to environmental noise but does not establish specific environmental noise limits – leaving these to be determined by Member States.

Convention on International Civil Aviation

Annex 16 to the 1944 Convention on International Civil Aviation (CICA) deals with the protection of the environment from the effects of aircraft noise. Annex 16 was adopted in 1971 and addresses aircraft noise; human tolerance to aircraft noise; aircraft noise certification; criteria for establishment of aircraft noise abatement procedures; land use control; and ground run-up noise abatement procedures. Noise standards developed in accordance with the principles of Annex 16 have continued to evolve as aircraft technology has advanced. All aircraft used at Oyu Tolgoi airports will be certified by the Mongolian authorities. Mongolia is a contracting state to International Civil Aviation Organisation (ICAO). Noise impacts from Oyu Tolgoi-operated aircraft will therefore be limited through compliance with the provisions as set out within the CICA Annex.

4.3.3 Project Standards

Noise

Table 4.1 below provides a summary of Mongolian and international good practice guidelines for ambient noise.

Table 4.1: Mongolian and International Standards for Permissible Ambient Noise Levels

Standard	Maximum allowable noise limit (hourly measurement), 1hr LA _{eq} in dB(A)	
	Day (07:00-22:00)	Night (22:00-07:00)
IFC Guideline: Industrial/ Commercial	70	70
IFC Guideline: Residential/ Institutional/ Educational	55	45
MNS 4585:2007	60	45

From Table 4.1 it can be seen that the IFC daytime limit for non-industrial receptors is marginally more stringent than the Mongolian limit. Typically, the Project has been designed to meet Mongolian noise standards, but the more stringent IFC limits will be used for the purpose of this ESIA. IFC industrial/commercial guidelines will be used within the boundary of the Mine Licence Area, while outside the Mine Licence Area the more stringent IFC guidelines related to residential, institutional and educational areas will be used.

Ground-borne Vibration and Blasting Overpressure

The Project has adopted Australian and New Zealand Environmental Council (ANZEC) guidelines which are often used as a guide for international good practice in mining projects worldwide due to the extensive

⁴ International Finance Corporation (2007). Environmental Health & Safety General Guidelines, 30 April 2007.

experience of Australia in the mining sector. The specific guidelines adopted are: *Australian and New Zealand Environmental Council (ANZEC), Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration, 1990*. Under these guidelines:

- The recommended maximum for air-blast overpressure is 115 dB (Lin peak) which can be exceeded on up to 5% of the blasts over a period of 12 months. However the level should not exceed 123 dB (Lin Peak) at any time; and
- The recommended maximum for ground vibration is 5 mm/sec (peak particle velocity, PPV). This value can be exceeded on up to 5% of the blasts in a 12 month period, although a maximum of 10 mm/sec should not be exceeded at any time.

4.4 BASELINE NOISE CONDITIONS

Baseline noise conditions as set out in this ESIA have been monitored during a period of initial project construction. As such, the assessment cannot give a fully representative assessment of pre-Project baseline noise conditions but will still provide a reasonable assessment of the impact of increased Project-related noise on identified receptors.

4.4.1 Identification of Noise Sources

The Oyu Tolgoi Project is located in a remote area of southern Mongolia with no existing heavy industrial facilities in the vicinity of the Mine Licence Area. The nearest comparable operations and industrial activities are at Tsogttsetsii and Dalanzadgad respectively – both over 100 km from the Oyu Tolgoi Project. The coal transportation route from coal mines in the vicinity of Tsogttsetsii does pass within 20 km of the Oyu Tolgoi Mine Licence Area. Noise measurements along the road were taken during the March 2011 Oyu Tolgoi Noise Baseline Survey.

Principal noise sources associated with the Project include:

- Activities within the Mine Licence Area, including construction and operation of open pit and underground mines, a processing plant, and supporting infrastructure;
- The construction and operation of the Gunii Hooloi water abstraction borefield and pipeline;
- The construction and operation of the Oyu Tolgoi to Gashuun Sukhait road and the electrical transmission line from the Chinese border to Oyu Tolgoi; and
- The construction and operation of the temporary and permanent airports some 5-7 km to the north of the Mine Licence Area.

4.4.2 Identification of Receptors

For the purposes of noise monitoring, an “environmental receptor” has been defined as a “*group, area or component of the environment that could be negatively impacted by increases in ambient noise levels above the accepted day and night-time levels [the Project Standards]*”⁵.

In accordance with this definition, potential types of environmental receptors identified as part of the baseline noise monitoring survey undertaken by Sustainability East Asia LLC⁶ in the vicinity of the Mine Licence Area include:

- Fresh water springs used by wildlife; and
- Permanent winter herder camps.

Based on an identification of noise receptors, a baseline noise monitoring programme was established to include both identified receptors and representative locations of both summer and winter camps.

⁵ Sustainability East Asia LLC (2010). Oyu Tolgoi Baseline Noise Monitoring Programme for Copper-Gold Mine Project. Sustainability, June 2010

⁶ Sustainability (2010), Oyu Tolgoi, Baseline Noise Monitoring Report, June 2010, IMM030

Freshwater Springs

Three freshwater springs were identified within the vicinity of the Mine Licence Area (see *Figure 4.1*). From north to south, these are Boor Ovoo, Khukh Khad and Bural. The two most southerly of the water springs were selected for noise measurement locations as the Boor Ovoo spring is within the Mine Licence Area and will be removed⁷ as part of the construction of the waste rock dump.

Permanent Winter Herder Camps

No permanent winter herder camps exist within 10 km of the Oyu Tolgoi mine. The nearest town of Khanbogd, with a population of just over 3,000, is located 35 km to the east.

Due to ongoing environmental studies and community consultation in early 2003, it was recognised that there would be a need for a residential exclusion zone around the Mine Licence Area. Hydro-geological reports advised that shallow water resources at Oyu Tolgoi could be affected near the Mine Licence Area from the draining of the open pits during the life of the mine. Predictions of dust emissions from the tailings storage facility showed potential wind-blown dust extending beyond the Mine Licence Area boundary.

Based on these predictions the proposed 10 km exclusion zone around the Oyu Tolgoi camp was confirmed. Ten km was taken as a reasonable estimate of the radius from which to seek to exclude herder winter camps (but not temporary summer camps) to protect herders from adverse environmental and/or health and safety impacts from the Project. To reflect the fact that temporary summer herder camps may be established anywhere outside the Mine Licence Area but within the exclusion zone, monitoring points have been established 1.5 km from the boundary of the Mine Licence Area (see *Figure 4.3*). Noise measurements were taken at the 10 km boundary from the Mine Licence Area to represent permanent winter camps where herders reside during winter periods, as well as at the 1.5 km perimeter from the license boundary to represent those potential nomadic herders that may pass within the 10 km boundary area.

All new winter herder camps are now established outside the 10 km exclusion zone (see *Figure 4.2*). Over a 10 km distance, noise levels will reduce by a minimum of 80 dB (based on inverse square law propagation calculations from a point source) such that noise levels will typical fall to background levels.

With regard to ground-borne vibration, the reduction in vibration levels over a 10 km distance is difficult to predict and is highly dependent on the nature and properties of the underlying geology.

A summary of the nearest permanent residential areas is provided in *Table 4.2*. These areas are considered too far from mining activities to be impacted by mining noise and vibration and subsequently measurements have not been recorded at these specific locations.

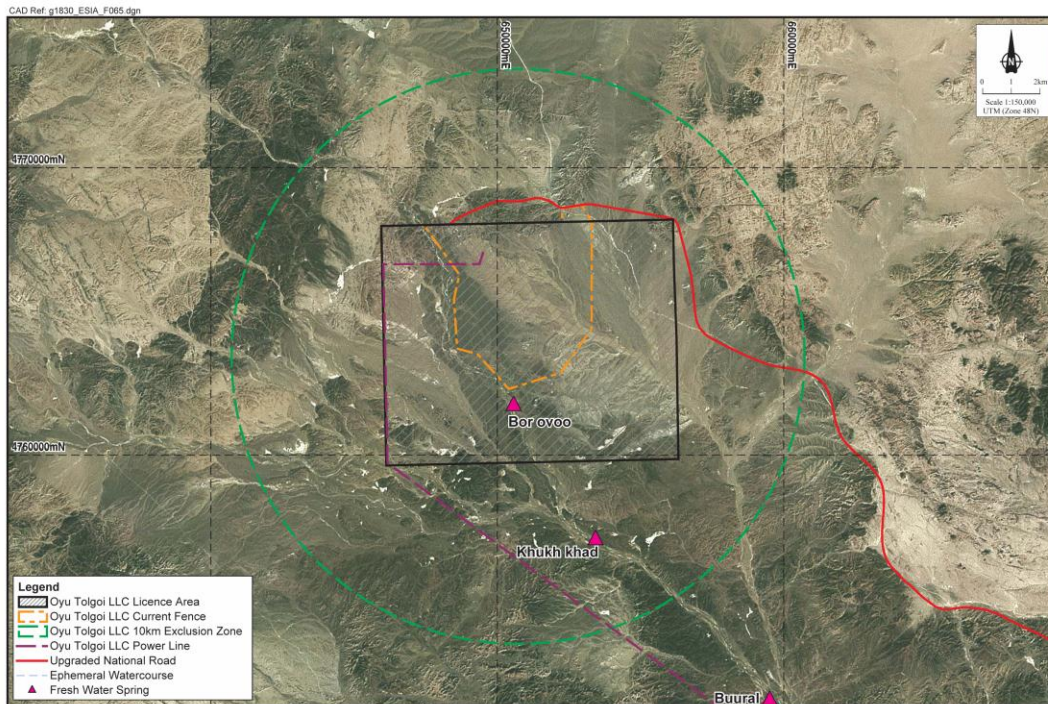
Table 4.2: Nearest Residential Areas to the Oyu Tolgoi Mine Licence Area

Community	Distance from Site*	Description
Gashuun Sukhait	80	Border Crossing
Dalanzadgad	220	<i>Aimag</i> capital
Khanbogd	35	<i>Soum</i> centre
Bayan Ovoo	60	<i>Soum</i> centre
Manlai	110	<i>Soum</i> centre
Ulaanbaatar (for comparison)	550	National capital

Source: *Sustainability (2010), Oyu Tolgoi, Baseline Noise Monitoring Report, June 2010, IMM030*

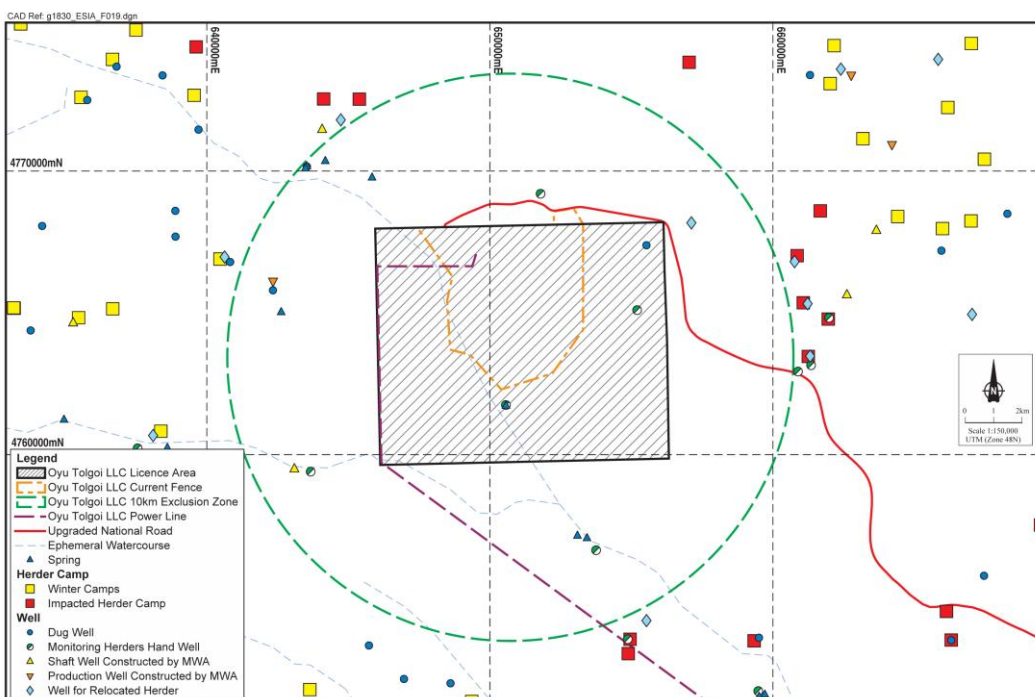
⁷ The Bor Ovoo Spring will be replaced at an alternative location situated outside the Mine Licence Area

Figure 4.1: Location of Fresh Water Springs



Source: Sustainability (2010), Oyu Tolgoi, Baseline Noise Monitoring Report, June 2010, IMM030

Figure 4.2: Location of Winter Herder Camps



4.4.3 Noise Baseline Assessment Methodology

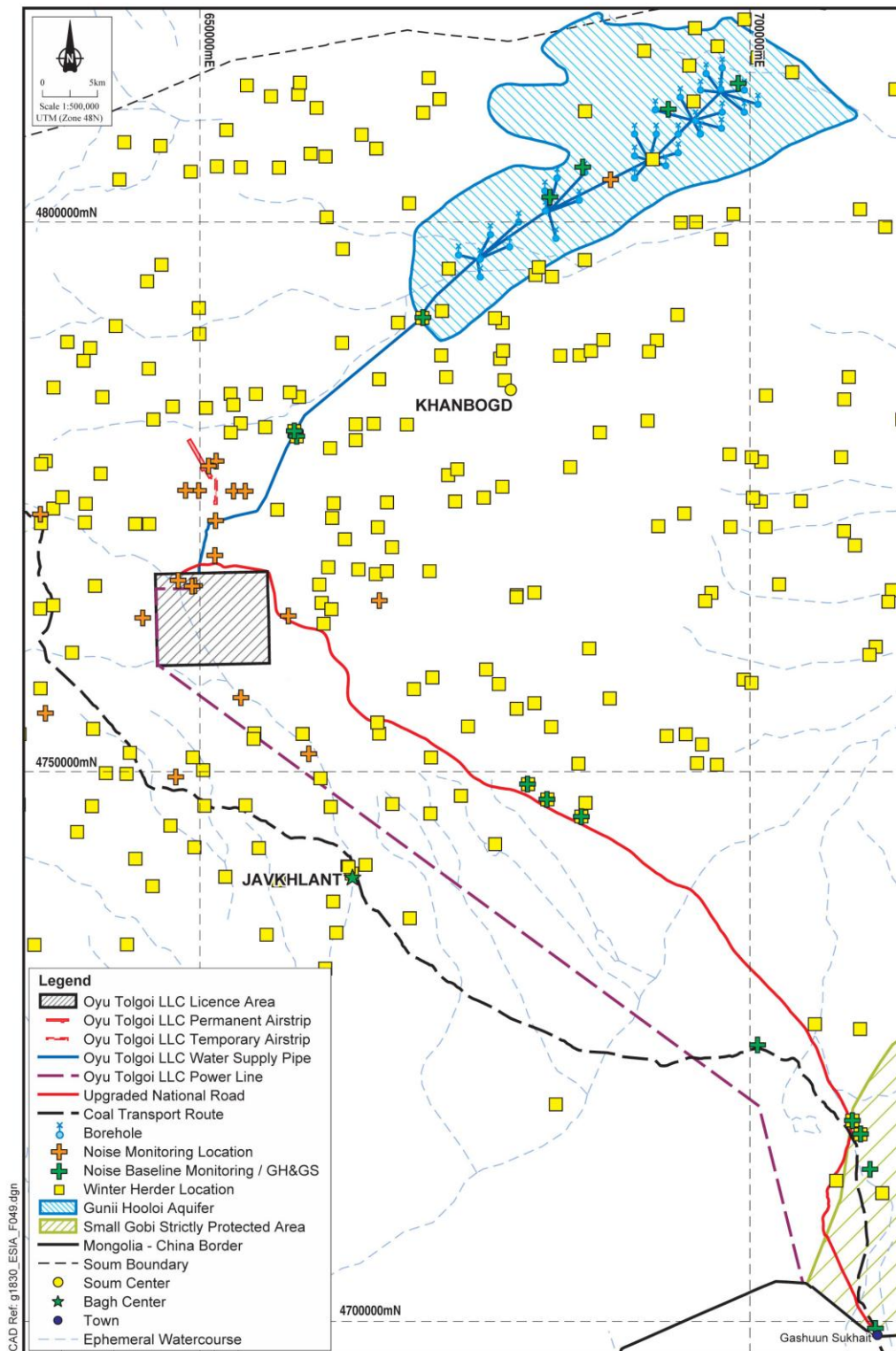
All Project noise monitoring has been undertaken in accordance with the *Baseline Noise Monitoring Program for Copper-Gold Mine Project* (Sustainability, 2010), which forms the basis for all baseline and on-going noise monitoring in order that a consistent approach and methodology was followed. The program makes reference to noise monitoring protocol guidance notes including:

- Western Australia's Environmental Protection Authority "Guidance for the Assessment of Environmental Factors – Environmental Noise";
- Australian Standard 1055:1 "Acoustics – Description and Measurement of Environmental Noise Part 1: General Procedures"; and
- Australian Standard 1055:2 "Acoustics – Description and Measurement of Environmental Noise Part 2: Application to Specific Situations".

Measurement Locations

An overall plan showing the location of all of the monitoring sites at the mine and surrounding areas is presented in *Figure 4.3*. Each area is then broken down into specific areas on the following pages for clarity.

Figure 4.3: Noise Monitoring Locations



During the June and August 2010 surveys, noise monitoring was undertaken at a number of locations:

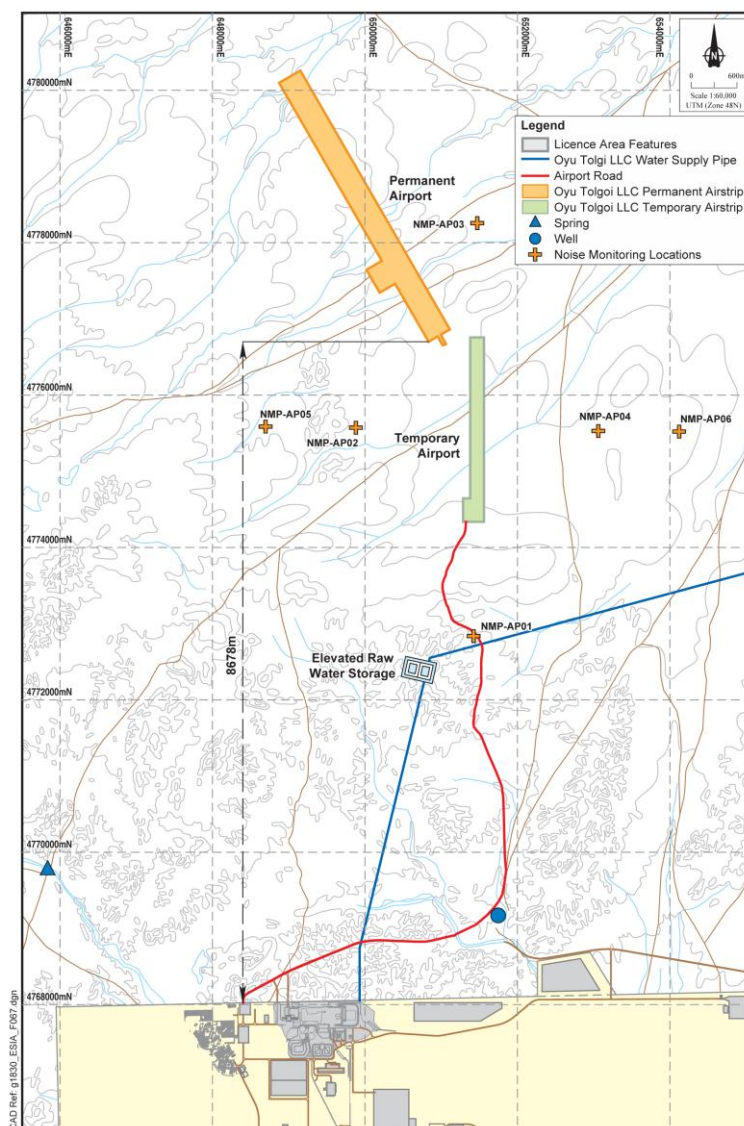
- 1.5 km from the boundary of the Mine Licence Area (representing the closest distance to the fence line at which a herder is likely to establish a temporary summer camp);
- 10 km from the boundary of the Mine Licence Area (representing the closest distance to the fence line at which a herder is likely to establish a permanent winter camp);

- At the location of the temporary and permanent airport (the two sites adjoin one another);
- Boor Ovoo and Khukh Khad springs along the Undai within 10 km of the boundary of the Mine Licence Area; and
- The Gunii Hooloi borefield.

The noise monitoring locations No. 1, 2, 3 and 4 are referred to as the 'Inner Monitoring Sites'. The remaining sites, 5 to 11, are referred to as the 'Outer Monitoring Sites'.

Daytime noise monitoring was also undertaken around the temporary domestic airport in August 2010⁸ and these locations are shown on *Figure 4.4*.

Figure 4.4: Noise Monitoring Locations around the Temporary Domestic Airport



In a separate monitoring programme during March 2011, day and night-time noise measurements were recorded along the Oyu Tolgoi to Gashuun Sukhait road and along the Gunii Hooloi water supply pipeline route. While not representing specific potential receptors, measurements have been made at various locations in order to provide a benchmark against which to compare future measurements. The noise

⁸ Reflecting the fact that the airport will only operate during daylight hours.

measurement locations during the March 2011 noise monitoring programme are presented in *Figure 4.5* and *Figure 4.6*.

Figure 4.5: Noise Monitoring Locations Along the Oyu Tolgoi to Gashuun Sukhait Road

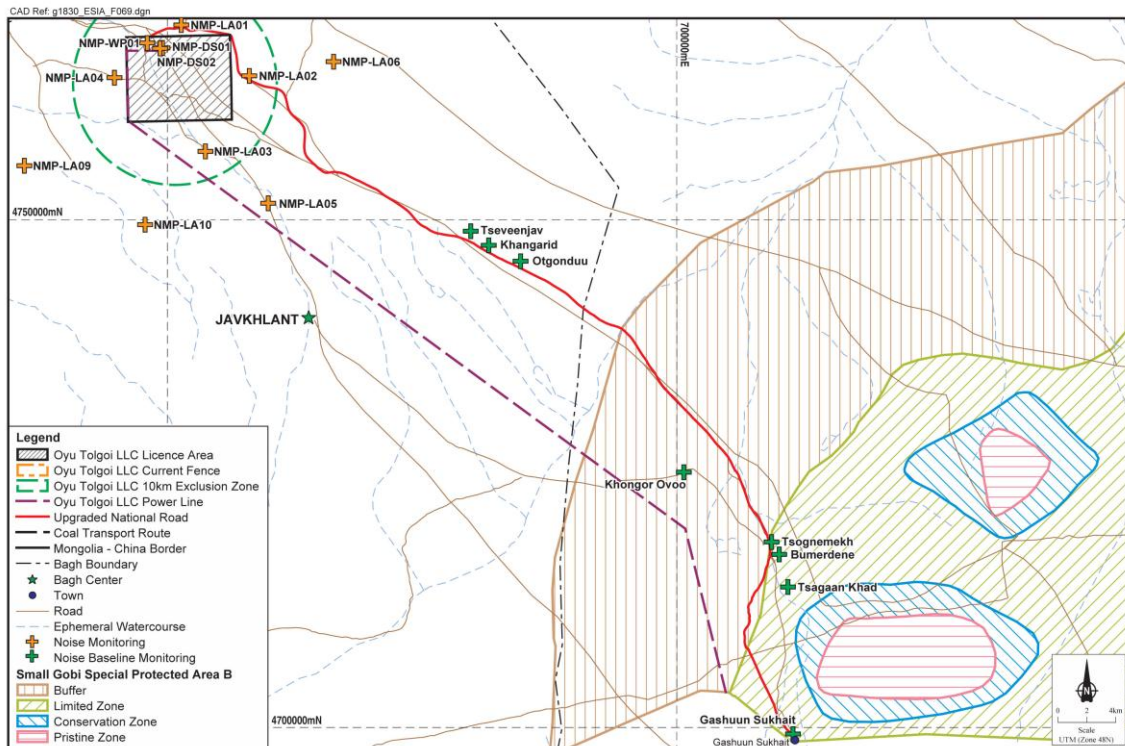
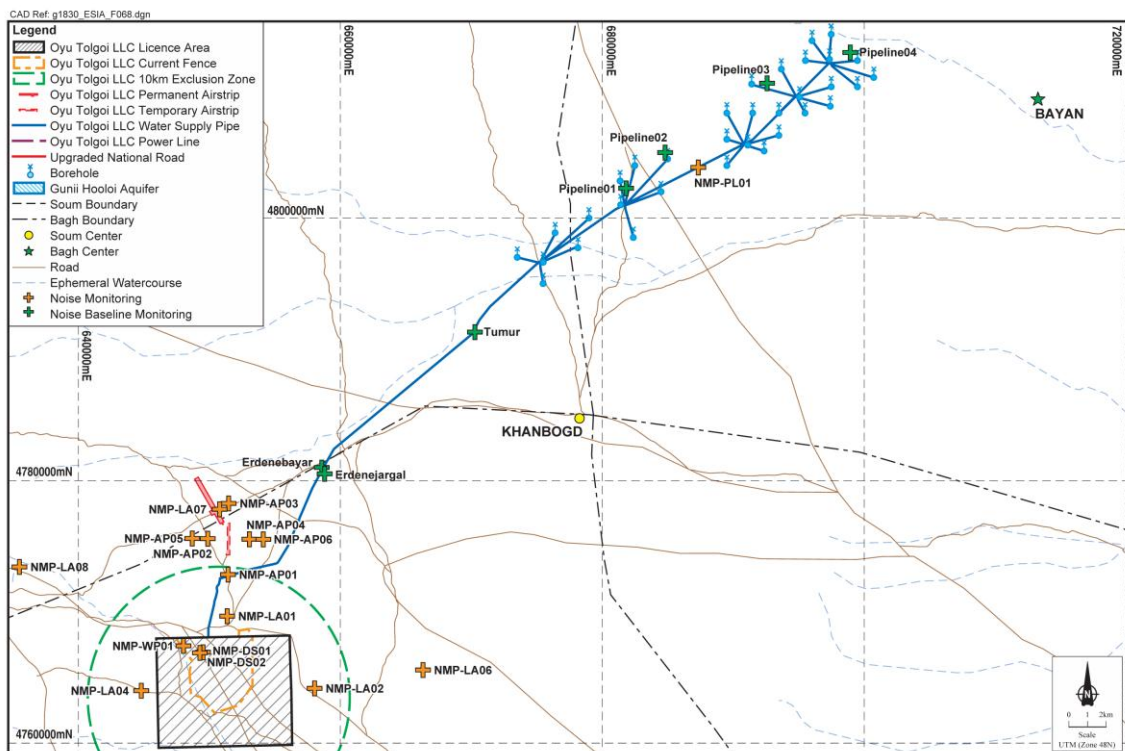


Figure 4.6: Noise Monitoring Locations Along the Pipeline



Noise Measurement Equipment and Methodology

Measurements were taken with one of either two monitors, namely:

- CEM DT-8820; or
- B&K Mediator 2238.

Both these monitors meet the requirements of *Clause 5: Instrumentation of the Australian Standard 1055.1-1997: Acoustics – Description and Measurement of Environmental Noise* (as required for the Baseline Noise Monitoring Program (Sustainability, 2010)). Despite the noise monitors meeting international instrumentation requirements, a number of issues were encountered during periods of high winds as outlined later in this section. Nonetheless, the results generated are considered to be representative of noise levels at the monitoring points due to undertaking two rounds of monitoring in June and August 2010.

All measurements were 20 minutes in duration which was considered sufficient to capture representative noise baseline conditions. The following parameters have been recorded; LA_{eq} , LA_{min} and LA_{max} . The LA_{eq} has been recorded as the ‘average’ noise level over the measurement period, the LA_{min} as the minimum noise level over the measurement period and the LA_{max} as the maximum noise level over the measurement period.

4.4.4 Monitoring Results

June 2010 Noise Survey

The results of the noise monitoring assessments undertaken in June and August 2010, presented as the daytime and night-time levels at the Inner and Outer monitoring sites, are provided in the following figures. It should be noted that the Mongolian standard and the Project Standard have been overlain onto the figures for illustrative purposes only.

Figure 4.7: June 2010 Day Time Noise Levels – Inner Monitoring Sites

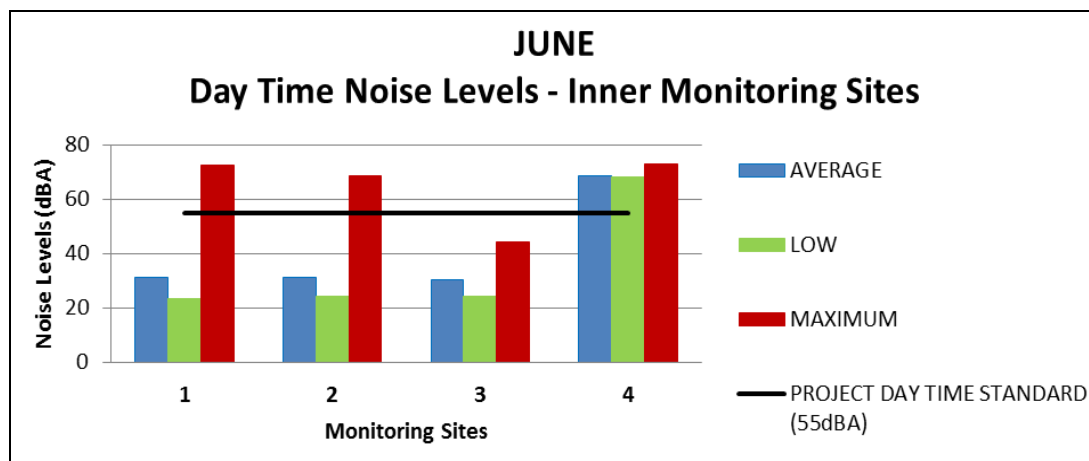


Figure 4.8: June 2010 Day Time Noise Levels – Outer Monitoring Sites

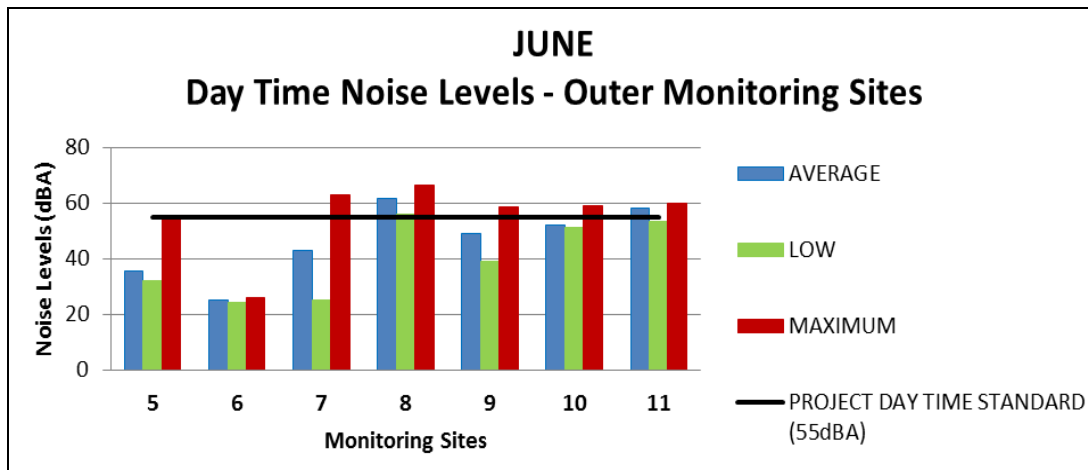


Figure 4.9: June 2010 Night Time Noise Levels – Inner Monitoring Sites

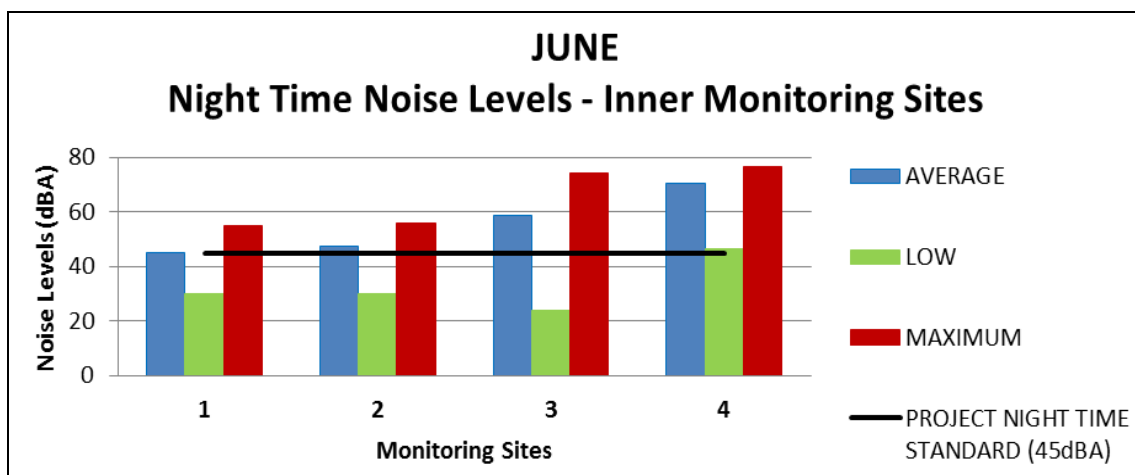


Figure 4.10: June 2010 Night Time Noise Levels – Outer Monitoring Sites

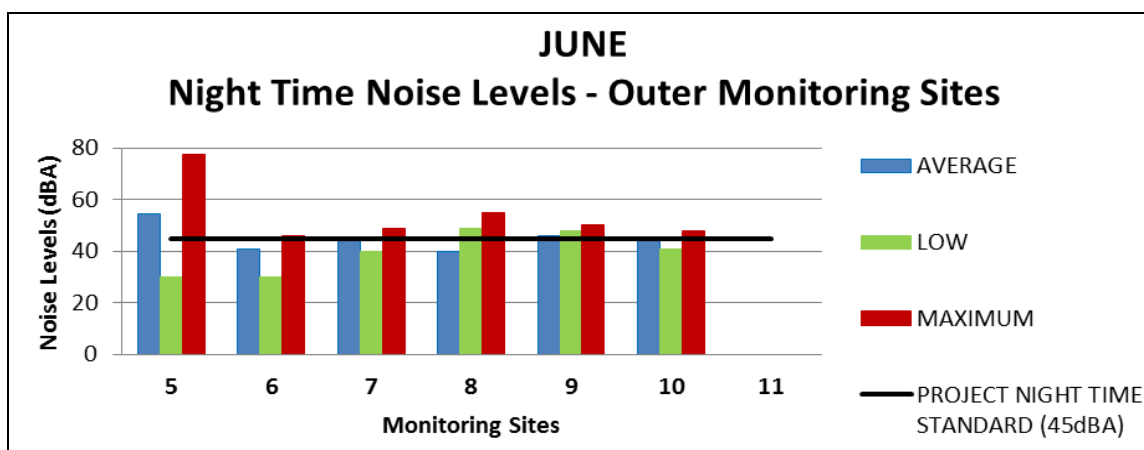


Figure 4.11: August 2010 Day Time Noise Levels – Inner and Outer Monitoring Sites

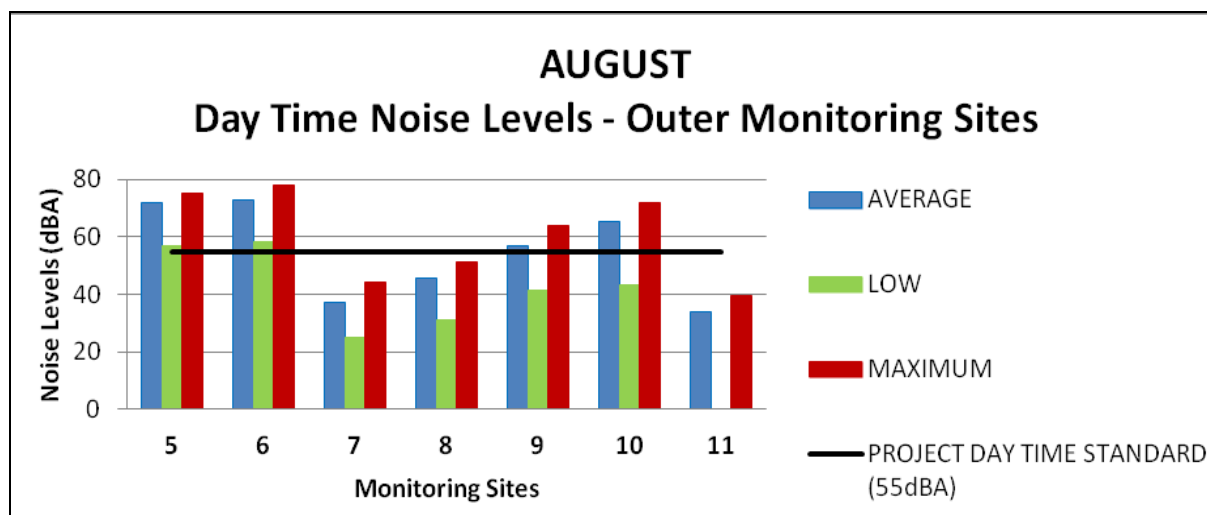
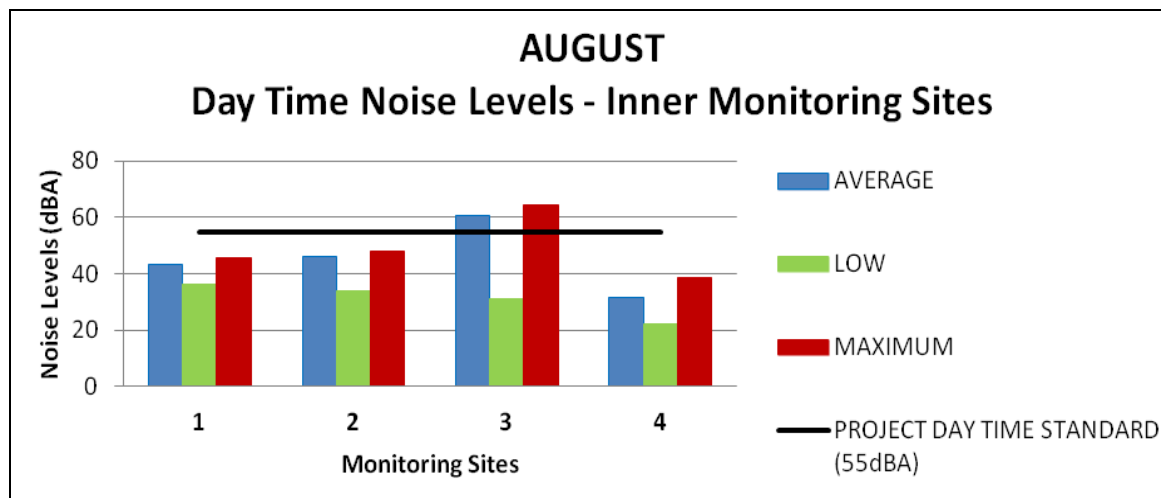
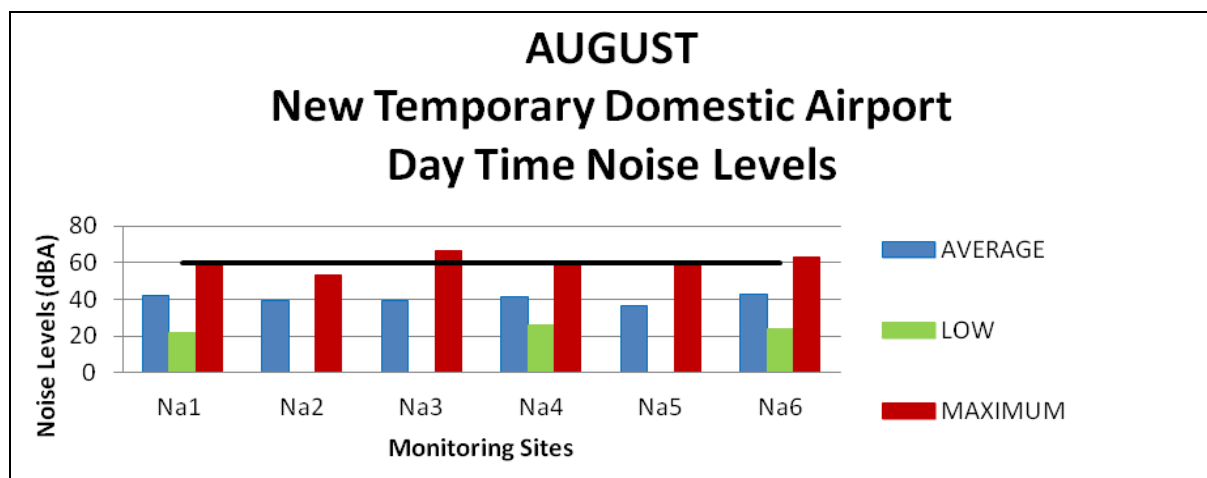


Figure 4.12: August 2010 Day Time Noise Levels – Temporary Domestic Airport



The above graphs are average presentations of the data from the supplementary noise survey of June 2010⁹ and August 2010¹⁰ which provide the full details of the monitoring results.

March 2011 Noise Survey – Water Pipeline

A summary of the results from the March 2011 noise survey along the water supply pipeline are presented below for both day-time and night-time baseline noise. The location of the monitoring points is set out in *Figure 4.6*.

Figure 4.13: Day Time Noise Monitoring along Water Pipeline (dB(A))

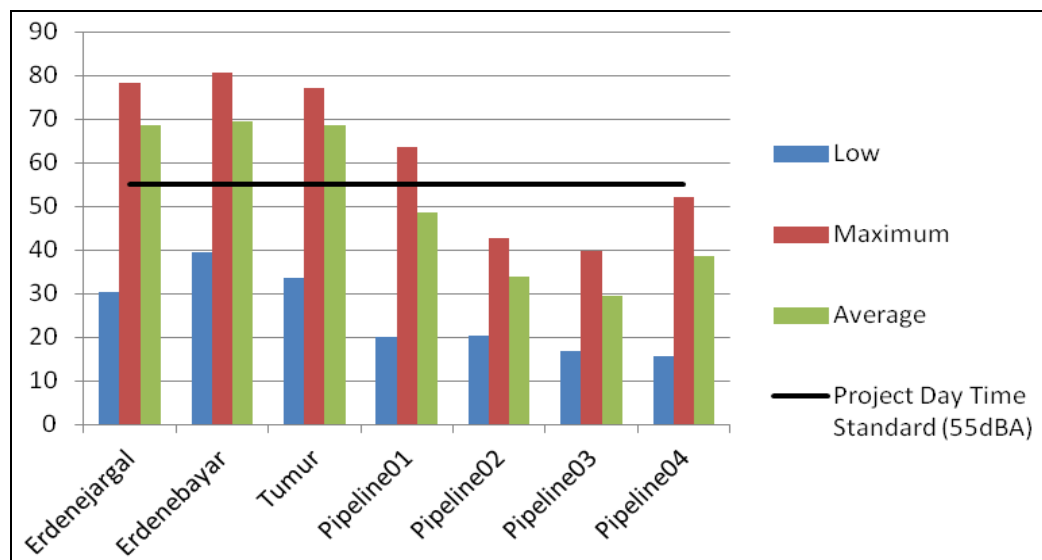
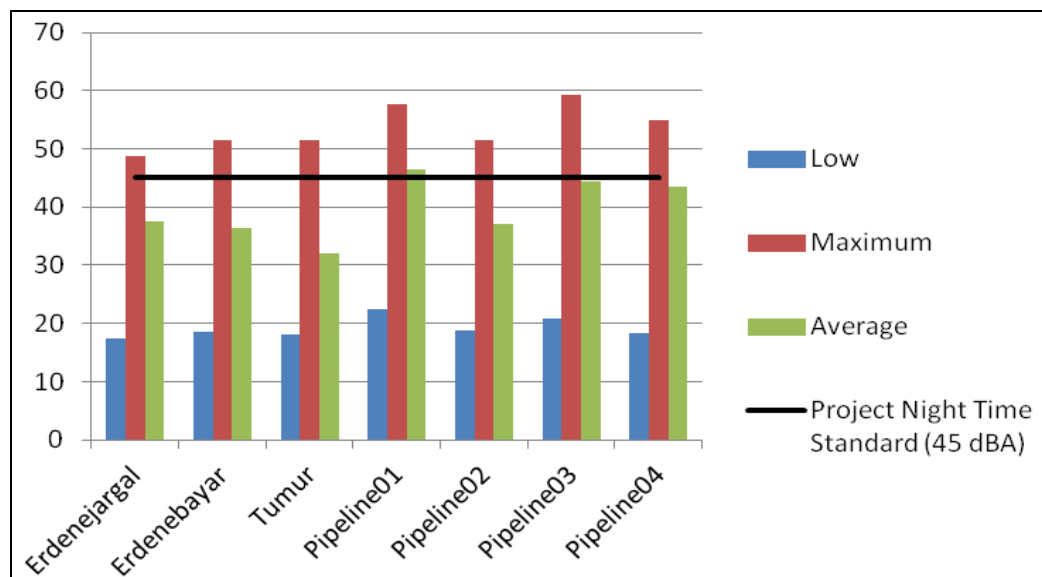


Figure 4.14: Night Time Noise Monitoring along Water Pipeline (dB(A))



⁹ Sustainability (2010), Oyu Tolgoi Baseline Noise Monitoring Report, June 2010, IMM03 pp 9-11

¹⁰ Sustainability (2010). Sustainability Noise Survey: Noise measurements made in the vicinity of the area surrounding the mine and the airport, August 2010

March 2011 Noise Survey – Oyu Tolgoi to Gashuun Sukhait Road

A summary of the results from the March 2011 noise survey along the Oyu Tolgoi to Gashuun Sukhait road are presented below for both day-time and night-time baseline noise. The location of the monitoring points is set out in Figure 4.5.

Figure 4.15: Day Time Noise Monitoring along Oyu Tolgoi to Gashuun Sukhait Road (dB(A))

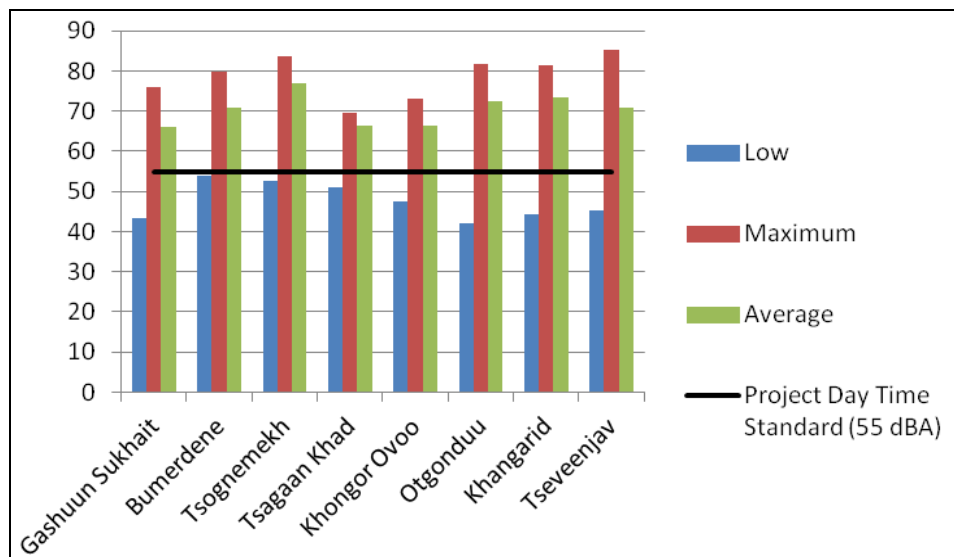
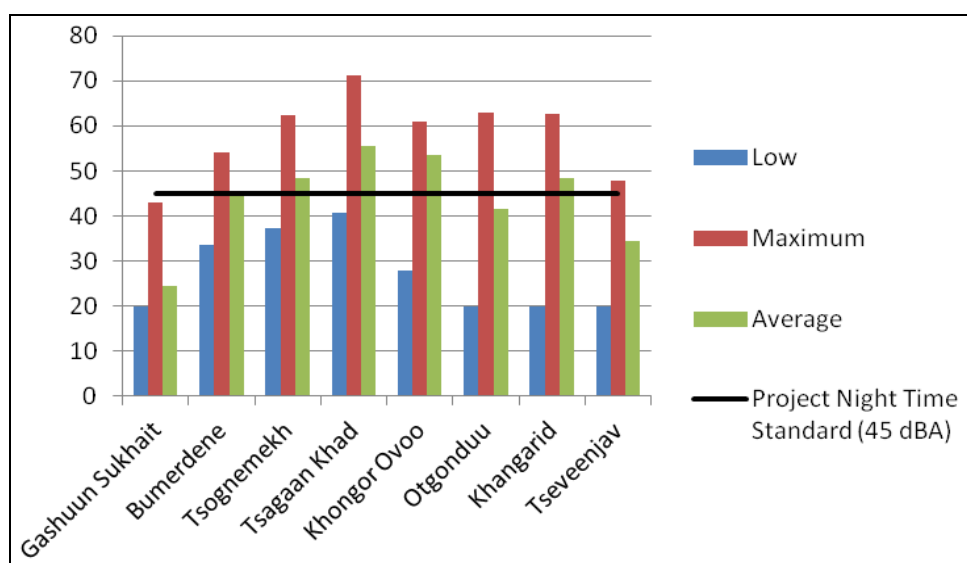


Figure 4.16: Night Time Noise Monitoring along Oyu Tolgoi to Gashuun Sukhait Road (dB(A))



4.4.5 Discussion of the 2010 Noise Monitoring Surveys

June and August 2010 Survey

Figure 4.7 shows monitored noise levels during the daytime at the Inner Monitoring Sites in June 2010. During this period, initial site preparation activities were being undertaken. While the maximum noise level recorded at Sites 1 and 2 exceed the Project daytime Standard (of 55 dB(A)), the average monitored noise level is below the value is below the Project Standard. At Site 3, all monitored noise levels were below the Project Standard. During the August 2010 monitoring survey, noise levels at sites 1, 2 and 3 were below the Project Standard.

The noise level at Site 4 was monitored in June 2010 during a period of high winds (10.5 m/s), and this is reflected in the consistently high noise levels recorded. In the August 2010 survey, the noise levels recorded at Site 4 were lower, consistent with the monitoring undertaken at other sites.

Figure 4.8 presents the noise levels recorded during the day at the Outer Monitoring Sites. Although a number of the maximum noise levels recorded exceed the Project Standards, the majority of the average noise levels were below this level. Measurements at Sites 8 and 11 are above the day-time Project Standard:

- Site 8 is located on the coal transportation route and the consistently high readings are likely to be influenced by road traffic; and
- Monitoring at Site 11 was conducted during a period of high winds (10.5 m/s) which is likely to have affected the reading. The August monitoring results indicate that the average and maximum noise levels at Sites 5, 6 and 10 were above the Standards. At Site 11, the August monitoring round recorded significantly lower noise levels, consistent with the lower wind speed during the monitoring period.

The night-time noise levels at the Inner Monitoring Sites are presented in *Figure 4.9*. The results indicate that on all occasions the average night time noise levels at the monitoring sites exceed the Project Standard of 45 dB(A). A review of the wind speed data collected during the noise monitoring indicates that all night-time monitoring at all the Inner Monitoring Sites was conducted during periods of high winds which influenced the noise monitoring results. The exception to this is Site 2 where the wind speed was approximately 2 m/s, however, a number of construction-related trucks were recorded in the vicinity during monitoring.

Figure 4.10 presents the recorded night-time noise levels at the Outer Monitoring Sites. The measurement made at Site 5 was done so during a period of high winds (11 m/s) which may have affected the recorded noise level. At sites 7, 9 and 10, the average value is at or in excess of the night-time Project Standard of 45 dB(A).

New Temporary Domestic Airport

Daytime monitoring results for the airport (*Figure 4.12*, for August only) indicate that average noise levels at all of the monitoring locations were below the Project Standard, while the maximum noise levels at site 1, 3, 4, 5 and 6 were at or just above the Project Standard.

4.4.6 Discussion of the March 2011 Noise Monitoring Survey

The March 2010 noise monitoring survey was designed to provide baseline noise data away from the Mine Licence Area, along the Oyu Tolgoi to Gashuun Sukhait road and along the route of the Gunii Hooloi water supply pipeline.

Noise Levels Along the Oyu Tolgoi to Gashuun Sukhait Road

The average noise levels recorded during the day range from 66 dB(A) to 77 dB(A) along the Oyu Tolgoi to Gashuun Sukhait Road. These measurements are in excess of the Project Standard. During the night-time, noise measurements range from 25 to 56 dB(A). Measurements recorded at the Tsevenjav, Otgonduu and Gashuun Sukhait sites are below the Project Standard. The baseline noise levels along the Oyu Tolgoi to Gashuun Sukhait Road are influenced significantly by the existing traffic using this road. While the majority of heavy vehicle movements along the road are related to Oyu Tolgoi Project construction, almost half of the total vehicle movements are by non-Oyu Tolgoi related vehicles (see *Chapter B11: Transport and Infrastructure*).

Noise Levels Along the Gunii Hooloi Water Supply Pipeline Route

Noise measurements made at the Erdenejargal, Erdenebayar and Tumor monitoring locations along the pipeline route were above the daytime Project Standard. Measurements at the Erdenejargal and Erdenebayar locations were influenced by traffic noise from the coal transportation route and has led to higher average values being recorded. At all three of these monitoring locations (Erdenejargal, Erdenebayar and Tumor) recorded wind speeds were relatively high (above 5 m/s) and may have also contributed to relatively elevated noise readings. Average recorded noise levels recorded at locations Pipeline 01, 02, 03 and 04 sites were below the Project Standards.

With regard to night-time noise measurements, results from all monitoring sites were below the Project Standards with the exception of sites Pipeline 01 (which was marginally above the Project Standard) and Pipeline 03 (which was at the Project Standard).

4.5 GROUND-BORNE VIBRATION

The Research Centre of Astronomy and Geophysics (RCAG) was commissioned by Oyu Tolgoi to conduct a seismic noise survey in the vicinity of the Oyu Tolgoi mine¹¹. Mobile seismic monitoring stations were temporarily deployed and acquire and quantify existing baseline ground-borne vibration levels. The area surveyed includes the Oyu Tolgoi Mine Licence Area and its vicinity within an approximate 20 km radius, to encompass those areas that may be influenced by mining-related activities such as blasting with explosives.

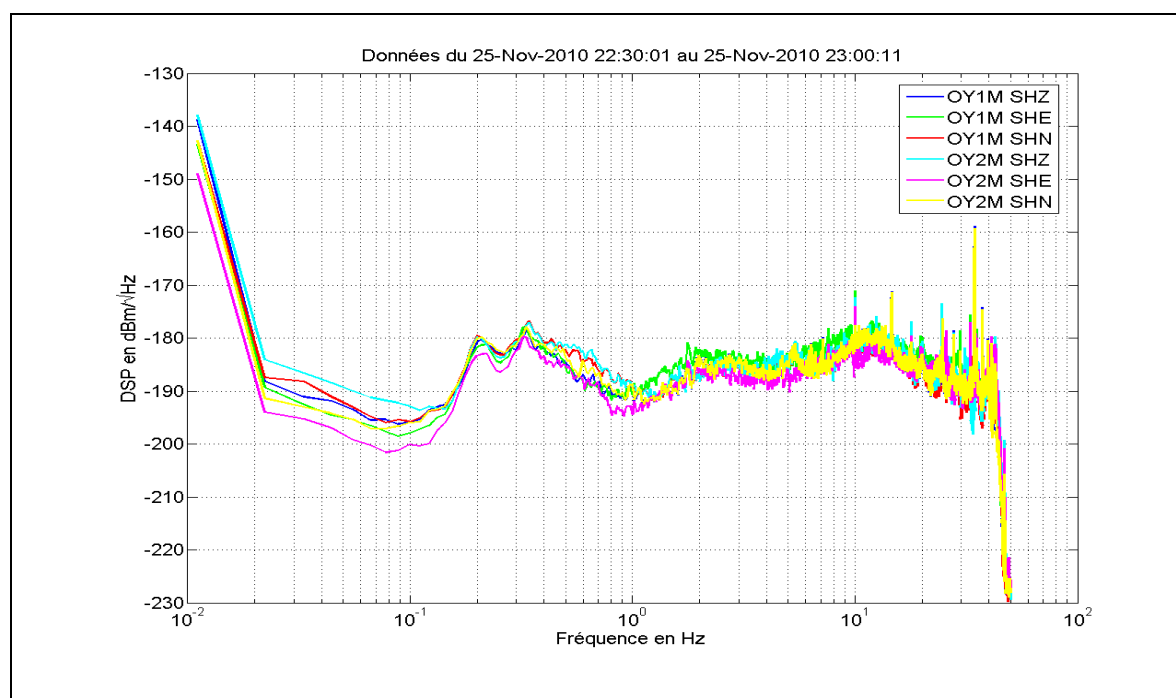
4.5.1 Methodology

The survey was undertaken in November 2010. Short period seismometers (L-4D-3C, 1Hz natural frequency, Mark Products) and Digitisers (Aorai, 24 bits, DASE) were utilised and calibrated prior to the field survey.

Based on the Project Area having potentially high levels of activity during existing mining operations, a sampling frequency of 100 Hz (100 samples per second) was selected on both systems, enabling noise to be characterised in the frequency range 0 to 50 Hz.

A 'huddle test' was also performed to ensure that all instruments were recording the same values. The results of the test showed a strong correlation between sensor readings as presented within *Figure 4.17*.

Figure 4.17: Seismic Sensor Huddle Test Results



The measurements were carried out in accordance with RCAG's seismic station installation guidance to provide a consistent methodology throughout the survey. Each station was buried to remove any wind noise influence as illustrated in *Figure 4.19*.

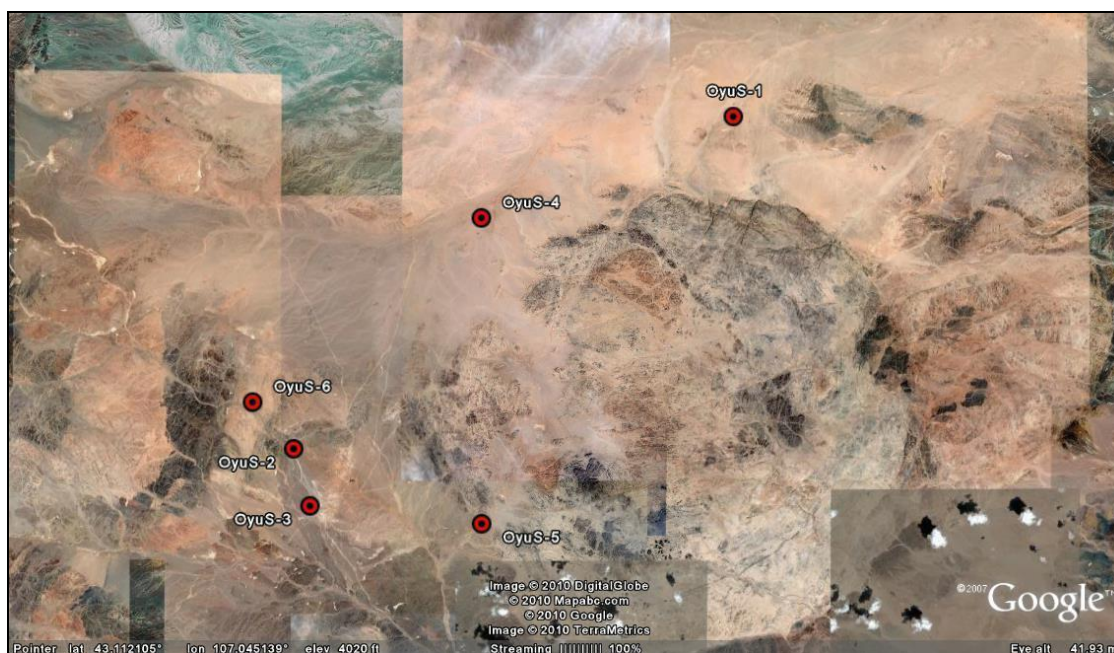
¹¹ Research Centre of Astronomy and Geophysics (2010). Oyu Tolgoi Mine Site Ground Vibration Noise Assessment. November 2010. Mongolian Academy of Sciences.

Figure 4.18: Sample Field Installation



A total of 6 points were chosen to assess background seismic noise levels. Most of the sites were measured for at least 12 hours, and the monitoring ‘stations’ were moved point to point between locations¹². *Figure 4.19* presents the locations of the monitoring stations.

Figure 4.19: Seismic Noise Measurement Locations



During the survey three mining blasts were also recorded; the first at OyuS-2, the second at OyuS-4 and the third at OyuS-5 and OyuS-6 (simultaneously).

4.5.2 Results

The results obtained from the seismic noise survey are summarised in *Table 4.3*. In general, as would be expected, noise levels decreased with distance from the Oyu Tolgoi site. Sites measured in the Mine Licence Area were consistently observed at -150 dB with a 25 Hz peak.

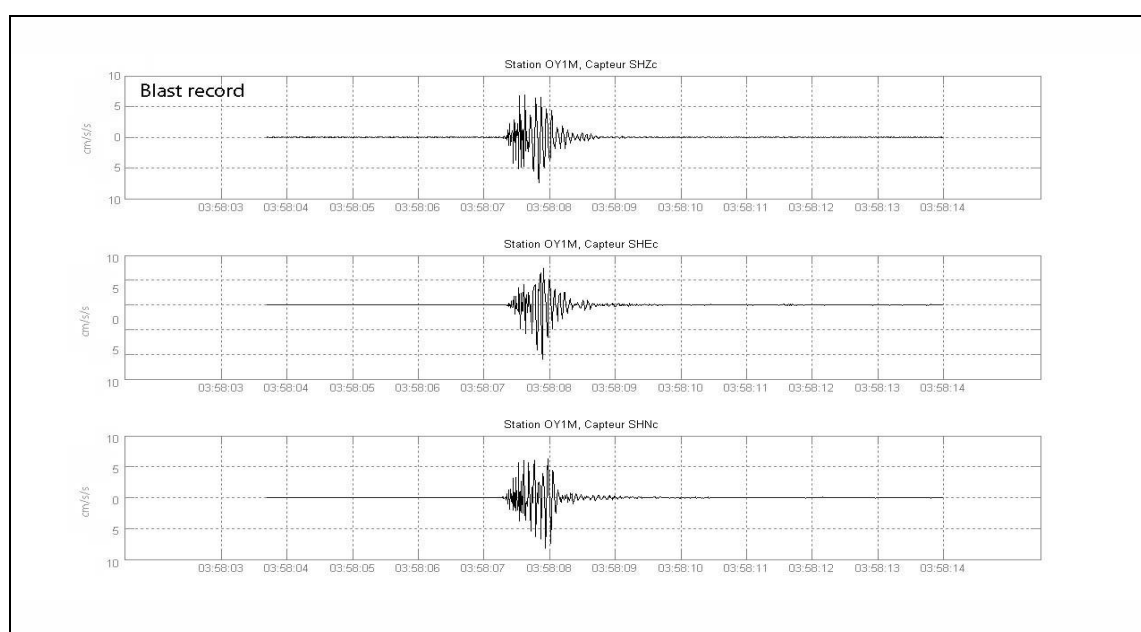
¹² One site was monitored for less than 12 hours due to potential interference from scheduled air travel.

Table 4.3: Seismic Survey Results

Site Name	Daytime (dB)	Night-time (dB)	Peaks (Hz)
OyuS-1	-173	-180	None
OyuS-2	-150	-170	25 (night)
OyuS-3	-150	-170	25
OyuS-4	-170	-190	None
OyuS-5	-180	-170	12.5
OyuS-6	-180	-	25

During blasting, measurements showed the biggest amplitude was recorded at OyuS-2 with an amplitude of 1.5×10^5 nm. The ground motion acceleration time history is presented in *Figure 4.20*.

Figure 4.20: Acceleration Record of Blast Recorded at OyuS-2



4.5.3 Discussion

The Oyu-2 and OyuS-3 Sites were located inside of the Mine Licence Area and had a daytime average noise level of 20-30 dB above the other sites. This noise level is likely to relate to underground mine development activity, surface construction activity and nearby vehicular movement.

The maximum acceleration recorded related to blasting was 8cm/s/s which corresponds to a Modified Mercalli Intensity (MMI) level II to III (broadly speaking, under this system, level II indicates that some people inside might notice vibration, and level III indicates that most people inside would notice vibration and some people outside might notice vibration). According to the blast information held by Oyu Tolgoi, this corresponded to a blast using 400-800 kg of explosives.

4.6 CONCLUSIONS

The Oyu Tolgoi Project is located in the South Gobi region of Mongolia. This is a remote area of southern Mongolia with no additional existing industrial facility noise sources located within the region or within Khanbogd *soum*. The coal transport route to the south and west of the Mine Licence Area is an existing source of noise. No permanent settlements exist within a 10 km radius of the Oyu Tolgoi mine site. The nearest town of Khanbogd, with a population of just over 3,000, is located 35 km (direct line distance) to the east. Hence there are no sensitive noise receptors identified close to mining and construction operations. However, wildlife and herders are potential receptors of noise associated with operation of the Oyu Tolgoi to Gashuun Sukhait Road and the construction of the Gunii Hooloi water supply pipeline.

This section has presented a summary of noise baseline conditions recorded during three surveys conducted during 2010 and 2011. Measurements have been made at locations considered to be representative of potential sensitive receptors to noise (permanent winter settlement camps and natural springs), or in areas that could in the future represent a noise-sensitive receptor (nomadic herders that could come within the 10 km exclusion zone during spring and summer migratory movements). Measurements have been made during day and night periods and the results compared against the Project environmental noise standards. The measurements have been undertaken in accordance with a monitoring program which will allow a consistent methodology for performing noise surveys throughout the operating life of the Project. The monitoring program has in turn referenced Australian guidance for noise measurement protocols to provide guidance on international good practice. Measurements were also collected near to the Temporary Airport. Average levels measured are less than the applicable Project Standards. Impacts related to the Permanent Airport are discussed in *Chapter C3: Noise and Vibration Impact Assessment*.

The results obtained over the monitoring survey periods were varied and clearly dependent on localised noise sources such as heavy goods vehicles. On some occasions readings were affected to some extent by local meteorological conditions, although this has been recorded and noted whenever this was the case.

The results obtained to date have provided Oyu Tolgoi with an initial baseline noise characterisation from around the Mine Licence Area which will be used to establish long-term trends going forwards, as well as provide input into the Noise impact assessment within this ESIA.