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AMULSAR ECOLOGY CHIROPTERA (BAT) SURVEY

Amulsar Gold Mine

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REPORT

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1.0 INTRODUCTION

Golder Associates (UK) Ltd (Golder) was commissioned by Lydian International Ltd (Lydian) to undertake bat habitat assessment and bat activity surveys that will form part of the baseline of the Environmental and Social Impact Assessment (ESIA) for the Amulsar Project near the town of Jermuk in southeastern Armenia (Figure 1). The Project is a proposed open pit gold mine development, with a gold heap leach facility (HLF) and processing plant. Amulsar is a high-sulphidation type epithermal gold project.

Baseline ecological data will be used as a benchmark against which to assess potential impacts on bats and bat habitat associated with the mine development.

Figure 1: Site Location Map

2.0 APPROACH AND METHODOLOGY

2.1 Delineation of Study Area

The area of study covered by this report relates to the environs of the Amulsar Project and is bounded broadly by the valley of the Vorotan River to the east, the Arpa River to the west and the Spandaryan reservoir to the south. The Amulsar Mine development will include an open pit, crushing plant, heap leach facility, barren rock storage facility, mine camp and access roads.

The study area is considered at two scales as follows:

- 'Local Study Area' (LSA) comprises the footprint of the development and associated infrastructure which may directly impact local area habitats and associated species; and

- 'Regional Study Area' (RSA) comprises broader areas potentially indirectly affected by the proposed development and includes unaffected reference sites.

2.2 Bats in the RSA (Ecology and Threats)

According to Yavruyan, *et al* (2008) the RSA provides a rich mosaic of habitats suitable for a number of bat species. The abundance of standing water provided by reservoirs and running water offered by the Vorotan, Arpa and Darb systems and the extent of gorge and basalt batholith habitat provides abundant foraging and roosting habitat for a number of bat species.

2.2.1 Bats and Altitude

Bat distribution in relation to altitude is dependent on air temperature and the concentrations of flying insects, Yavruyan, *et al* (2008). Generally, most bats in the Caucasus do not live higher than 1,500 m above sea level (asl) (Yavruyan, *et al*, 2008). However, some species such as *Rhinolophus hipposideros, Myotis brandtii, Myotis. daubentonii, M. emarginatus, M. nattereri, Nyctalus noctula, E. serotinus, Plecotus auritus, Pipistrellus nathusii, Hypsugo savii,* and occasionally *also Barbastella barbastellus* can be found as high as 1,800m asl.

A further suite of species *Myotis blythii*, *M. mystacinus*, *Nyctalus lasiopterus*, *Pipistrellus pipistrellus*, *Vespertilio murinus*, *Plecotus auritus*, *Myotis brandtii*, *Eptesicus serotinus* and *Tadarida teniotis* have been noticed at over 2,000m asl (Yavruyan, *et al*, 2008).

2.2.2 Bat Roost Sites

According to Yavruyan, *et al* (2008) bat roosts within the Caucasus can be defined by the following criteria:

- Nursery roosts, where female bats give birth to and nurture their offspring;
- Wintering roosts, where bats hibernate in winter;
- Summer roosts, used by males and those females that do not participate in reproduction and usually live separately from nursing females and form summer colonies;
- Transitory roosts used for a limited time or during migration; and
- Mating roosts used by male bats for attracting females and coupling, where temporary mating colonies are established.

2.2.3 Threats

Threats to bat species within the Caucasus including the RSA, within the Caucasus, include the following factors defined by Yavruyan, *et al* (2008).

- General population decline;
- Increased human Impact (habitat destruction);
- Roost site disturbance (cave tourism); and
- Direct persecution.

3.0 METHODS

3.1 Literature Review and Previous Studies

Since 2008, Lydian and/or Geoteam (wholly owned by Lydian) have undertaken or commissioned a range of ecological surveys in the RSA, with the main focus on terrestrial flora and fauna. The environmental studies and reports provided by Lydian included the following:

- Lydian International - Geoteam CJSC, 2008. *Project Amulsar Report. Environmental Studies, 2008;*
- Geoteam CJSC, 2009. *Design of the Amulsar Open Mine of Gold-bearing Quartzites. Environmental Aspects*;
- Lydian International - Geoteam CJSC, 2009 *Report on Environmental Studies and Activities Performed in 2009 in the Area of Saravan Licence N42, Armenia;*
- Lydian International - Geoteam CJSC, 2010. *Studies of Amulsar Biodiversity*; and
- American University of Armenia, 2011. *Interim Technical Report on the Project: Development of Recommendations for Minimisation of Environmental Risks of the Gorhayk Mining area.* Unpublished report to Geoteam Ltd.

A review of available literature and records of bat fauna in the RSA, Armenia and relevant neighbouring areas was conducted. The data derived was collated to provide an indicative species list of bats that are likely to be present within the study area, and the field survey program tailored accordingly.

A number of reports and literature outputs were identified during the Desk Study which indirectly and directly address the nature conservation interest of the RSA in the context of bat ecology. The reports and literature included:

- The Armenian Red Data book, 2010;
- Chemonics International Inc, 2000. *Biodiversity Strategy and Action Plan for Armenia;*
- Ministry of Nature Protection, 1999a. *Biodiversity Strategy and Action Plan for the Republic of Armenia.* Jerevan, 1999;
- Ministry of Nature Protection, 1999b. *First National Report to the Convention on Biological Diversity incorporating A Country Study on the Biodiversity of Armenia.* Yerevan, 1999; and
- Khanjyan N., 2004. *Specially Protected Nature Areas of Armenia.* Ministry of Nature Protection. Jerevan, 2004.

Online resources consulted included:

- *Millennium Ecosystem Assessment*: http://www.maweb.org/en/index.aspx (accessed on 01 April 2014);
- *Biodiversity of Armenia:* http://enrin.grida.no/biodiv/biodiv/national/armenia/index.htm (accessed on 25 May 2014);
- *The IUCN Red List of Threatened Species*: http://www.iucnredlist.org/ (accessed on 25 May 2014);
- Bats – Conservation Action Plan for the Caucasus: http://www.cepf.net/Documents/bat_cons_action_plan.pdf (accessed on 25 May 2014); and
- Update to the National Report on the implementation of the EUROBATS Agreement in the Republic of Armenia http://www.eurobats.org/sites/default/files/documents/pdf/National_Reports/nat_rep_Arm_2008.pdf (accessed on 10 June 2014).

3.2 Field Study

The bat surveys were commensurate with good practice, following the guidance set out in *The Bat Worker's Manual* (Mitchell-Jones and McLeish, 2004), *Bat Surveys: Good Practice Guidelines* (Hundt, 2012) and the Guidelines for Surveillance and Monitoring of European Bats (EUROBATS, 2010).

3.2.1 Survey Timing and Personnel

Golder[1] conducted an initial field visit between 7 April 2013 and 18 April 2013, and a bat activity survey, static monitoring and walked transect survey from 12 May 2013 to 15 June 2013. The Institute of Zoology (IoZ) undertook a bat trapping survey in June 2013. The work was assisted by Geoteam staff. Habitat assessment, static monitoring and walked transects were undertaken by Geoteam during April, May and June 2014.

3.2.2 Roost Potential Assessment

An initial roost potential scoping assessment was undertaken by Golder in the RSA and LSA on 6-18 April 2013 and by Geoteam during May 2014. The tabulated results for this survey and supporting figures are provided in Appendix A.

Features assessed within the RSA and LSA providing bat roost potential include the following:

- Caves and mine adits;
- Cracks and fissures within bedrock features; and
- Buildings (within the RSA) with:
  - Missing roof or ridge tiles;
  - Holes in the roof or gable end; and
  - Gaps under the eaves.

Features were assigned bat roosting potential (BRP) grades (Table 1, Appendix A).

Table 1: Criteria for Bat Roost Potential Assessment

Category	Bat Roost Potential	Description
1	**Negligible**	Generally used where a structure initially looks like it has significant bat roost potential, but on closer examination, the structure has no importance for roosting bats. In this survey, it has been used where a structure has been inspected and found not to contain any of the features of use to bats.
2	**Low**	Superficially the structure may have some interest to roosting bats, but it is considered sub-optimal to the extent that the surveyor would not anticipate bats to favour it.
3	**Moderate**	A structure that has some potential for roosting bats, but is less than ideal in some way. The surveyor would neither expect, nor be surprised to find a bat in a structure categorised as having moderate bat potential.
4	**High**	A structure with 'ideal' features which, in the experience of the surveyor, is wholly appropriate for use by roosting bats. For example, it has no obstructions below cavity entrances, the cavity is upward leading, the tree/structure has a high degree of connectivity with likely navigation routes, and surrounding habitat offers good foraging potential. The structure might be particularly prominent and likely to be noticed by navigating bats.
5	**Confirmed**	Positive signs of bats are found, i.e. individual bats, bat droppings or existing records of a bat roost are directly associated with this structure.

[1] Freddy Brookes MSC MCIEEM

3.2.3 Activity Surveys

Five transects were walked to determine how bats were using the RSA and LSA (refer to Drawing 1 for details of transect routes). Activity Surveys were undertaken between 12 May and 15 June 2013 and during May 2014.

Transect 'A' (LSA) was approximately 2.5 km in length. Transect 'B' (LSA) was approximately 2 km in length and the Arpa gorge Transect 'C' (RSA) was approximately 2 km in length. Transects A1 and B1 were walked by Geoteam during May 2014, both these routes were approximately 2km in length.

The transect routes were designed to provide indications as to bat activity in areas that may be subject to the project influence. In addition, the Arpa gorge transects during 2013 and 2014 (within the RSA) were designed to provide a reference data set in habitat that was considered to provide optimal roosting and foraging opportunities for bat species.

The transect routes were slowly walked and a four minute stop was undertaken at ten 'listening stations' for transects A, A1, B, B1 and C. The activity transect surveys began at sunset and lasted approximately two hours.

The transects were carried out utilising an *Anabat* SD1 to record numbers and species of bats within the RSA and LSA. Any bat calls which were unidentifiable during the survey were later analysed using the '*Analook*' software program.

In addition to the walked transects undertaken within sites 27 and 28 (proposed mine infrastructure) during 2014, Geoteam undertook a survey within the Arpa gorge in order to provide a 'control' result for quality assurance purposes. The purpose of this survey was to to generate bat sonograms using *Anabat* software in habitat that was considered to be optimal, outside of the area likely to be affected by the project.

3.2.4 Ground Level Static Monitoring

The methodology for static monitoring was adapted from *Good Practice Guidelines, Surveying for Onshore Wind Farms* (BCT 2011) and involved surveying proposed mine infrastructure features such as the BRSF, HLF and Mine Camp during May and June 2013 and 2014. This guidance document provides best practice methodologies that are not specific to windfarms and have crossover value to mining projects. Drawing 1 provides all of the *Anabat* static detection survey points.

Anabats were positioned at the proposed infrastructure locations within the LSA (refer Drawing 1), and adjacent to features likely to be used by bats e.g. stream, gorge, built structure etc. within the RSA (Drawing 1). Table 2 provides a summary of the features assessed and when these features were monitored.

Table 2: Static Monitoring Locations and Timing

Reference (Drawing 1)	Monitored During	Number of Nights Surveyed	Altitude (M)
1	12,13,14,15 and 16 May (2013)	5	2,439
2	12,13,14,15 and 16 May (2013)	5	2,606
3	20,21,22,23 and 24 May (2013)	5	2,012
4	20,21,22,23 and 24 May (2013)	5	2,152
5	27,28,29,30 and 31 May (2013)	5	2,034
6	10,11 and 12 June (2013)	3	1,425
7	13,14 and 15 June (2013)	3	1,425
1a	23,24 and 25 June 2014	3	2,550
2a	4,5,8, and 9 June 2014	4	1,650
3a	11,12,13,14 and 15 June 2014	5	1,800
4a	18,19, 20, 21 and 22 June 2014	5	2,570

3.2.5 Trapping Survey

Surveys undertaken by the Armenian IoZ were led by Dr. Eduard Yavruran, Professor of Yerevan State University and Russian-Armenian (Slavonic). Dr Yavruran co-authored *Bats, Conservation Action Plan for the Caucasus* (Yaruran *et al*. 2008). Surveys were undertaken during June 2013 and the survey suite concentrated on what was considered to be optimal bat roosting and foraging habitat within the RSA. During the surveys, mist nets were deployed. Captured bats were DNA sampled via wing tissue samples. In addition, bat droppings were gathered at roost sites in order to determine the extent and seasonality of roost usage. Bat detectors (Peterson D 230 and Peterson D 240 X) were also utilised during dusk surveys to determine presence and distinguish species within the RSA.

3.3 Study Limitations

- It is noted that a lack of records for a species does not mean that said species is absent from the area. Species may be under-recorded in any area due to lack of survey effort, because certain species are elusive and occur in low numbers or because they are difficult to identify.
- The lack of ecological designation for a geographic area does not necessarily imply that said area is of low conservation value, as ecologically important sites (particularly those of local to regional value) may not be subject to designation.
- Overnight temperatures during the field survey undertaken by Golder in May were unseasonably cold. Temperatures within the LSA regularly dropped to <5 degrees Celsius. These temperatures are low enough to compromise bat activity; therefore bat activity in the LSA is likely to be under-recorded during the May surveys;
- Overnight temperatures within the Arpa gorge, part of the RSA, were suitable for bat activity surveys as temperatures were >8 degrees Celsius during all survey events. In order to overcome issues associated with depressed overnight temperatures, the activity surveys were extended into June 2013; and
- Surveys undertaken within the RSA during June were adversely affected by a software issue and loss is integrity on a memory card. This is likely to have resulted in fewer bat sonograms being recorded during this element of the study.

4.0 RESULTS

4.1 Literature Review and Previous Studies

Desk Study results that are pertinent to Chiroptera within the LSA and RSA include the following two documents:

- Yavruyan, *et al* (2008) Bats – Conservation Action Plan for the Caucasus: http://www.cepf.net/Documents/bat_cons_action_plan.pdf (accessed on 25 May 2013); and
- Update to the National Report on the implementation of the EUROBATS Agreement in the Republic of Armenia http://www.eurobats.org/sites/default/files/documents/pdf/National_Reports/nat_rep_Arm_2008.pdf (accessed on 10 June 2013).

Twenty-six bat species are thought to be potentially present within the RSA (derived from Yavruyan, *et al*, 2008). These are summarised in Table 3. They are considered to be potentially present within the RSA based on the habitat affinity of each species in the context of the abundant mountain steppe habitat within the RSA.

Table 3: Bats Potentially Present within the RSA (Yavruyan *et al,* 2008)

Species	Status in Armenia	National Population Trends	Habitats	Average Number in Colonies
Rhinolophus euryale	RBA, rare	Stable	S,MS,MF	15 - 350
Rhinolophus mehelyi	RBA, rare	Decline	MS,MF,S	5 - 30
Rhinolophus hipposideros	Rare	Decline	MS	1 - 175
Rhinolophus ferrumequinum	Common	Stable	V	10 - 7000
Rhinolophus blasii	Recently described/rare	Decline	MS,S	5 - 55
Myotis blythii	Common	Stable	V	1 - 10000
Myotis bechsteinii	New, numerous	Decline (?)	V	1 - 7
Myotis nattereri	RBA, rare	Decline	MS, MF	5 - 12
Myotis schaubii	New, numerous	Decline (?)	MS, MF	1 - 3
Myotis emarginatus	Rare	Decline	V	1 - 5
Myotis mystacinus	Rare	Decline	V	1 - 12
Myotis daubentonii	New, numerous	(?)	V ?	1 - 3
Plecotus auritus	Common	Decline (?)	V	1 - 142
Plecotus austriacus	Rare	Decline	MS	1 - 7
Plecotus macrobullaris	Rare	Decline (?)	V	1 - 5
Barbastella barbastella	Rare	Decline	MS	1 - 7
Barbastella leucomelas	RBA, rare	?	MS, MF	1 - 5
Nyctalus noctula	Rare	?	LF, MS, MF	2 - 12
Pipistrellus kuhlii	Common	Stable	V	10 - 8000
Pipistrellus pipistrellus	Common	Stable	V	35 - 28000
Pipistrellus pygmaeus	New record, numerous	Stable	V	3 - 45
Hypsugo savii	Rare	?	V	1 - 2
Vespertilio murinus	Rare	?	MS	2 - 5
Eptesicus serotinus	Rare	?	V	1 - 3
Eptesicus bottae	Numerous	?	MS, S	1 - 2
Miniopterus schreibersii	RBA, rare	Decline	MS, MF	2 - 220

Status: RBA – Red Book of Armenia
Habitats: MS – Mountain Steppe; MF – Mountain Forest; V – Various.
? – indicates uncertainty/data deficiency

4.2 Field Study

4.2.1 Roost Potential Assessment

The results of the bat habitat scoping and roost potential assessment are fully represented within Appendix A and summarised as follows. The majority of the LSA is dominated by mountain steppe habitat (Figure 2) indicative of grazed swards that have developed at a height >2,000m above sea level (asl). Furthermore, opportunities for bats are limited by a lack of roosting locations such as caves and adits, and also a general lack of suitable prey (winged insects), most likely due to sub-optimal weather conditions at this elevation.

Figure 2: Impoverished ground flora with obvious signs of recent agricultural cultivation. No bat roosting potential (BRP) and sub-optimal foraging potential

A single rock feature suitable for roosting bats was identified within the former proposed HLF site (*Anabat* Static Detection Point 4, Drawing 1 and Appendix A). This feature contained cracks and crevices that may be utilised by roosting bats and was assigned 'moderate' bat roosting potential in accordance with Hundt (2012). In addition, dilapidated buildings were recorded within sites 27 and 28 though these were tin roofed structures that would be afforded significant diurnal temperature fluctuations. This lack of thermal stability dictates that roosting conditions would be sub-optimal for bats.

Habitat within the Erato and Tigranes/Artavazdes Pits was considered to have negligible potential for roosting bats. The high altitude (>2,750m asl) combined with an absence of features suitable for roosting bats represents unsuitable habitat.

Habitat within Site 13 at an altitude of approximately 2, 400 m asl may provide foraging opportunities for bat species (refer Figure 3). This location is relatively close (<1.5 km) to the Vorotan river. Wetland terrestrial habitat occurs in this location, which may support flying insects for bat foraging. Standing water features within the LSA include the reservoir west of Site 6 (Figure 4) which may offer foraging potential to bats in the form of emergent winged insects.

Figure 3: Former proposed Waste Dump looking southerly, no bat roosting potential

Figure 4: Reservoir and stream west of mountain offering foraging and commuting potential to species such as Daubenton's bat Myotis daubentonii

Habitat within the broader RSA, especially within the Arpa gorge (Figure 7), provided niche conditions for a diverse assemblage of bat species. In addition, churches, schools, houses and even livestock pens (chicken sheds) provided 'High' and 'Confirmed' bat roosting potential locations in accordance with Hundt (2012). The Gndevank Monastery (Figure 5), Arpa gorge near Gndevaz was surveyed in May 2013 and a single European barbastelle *Barbastella barbastellus* (Figure 6) was observed roosting within one of the Monastery chambers (*Anabat* static detection point 7, Drawing 1). The Monastery is situated approximately 3 km form the proposed HLF and approximately 8 km from the BRSF.

Figure 5: Gndevank Monastery, Arpa Gorge

Figure 6: Roosting European barbastelle Barbastella barbastellus

Figure 7: Optimal bat roosting habitat within the RSA (Arpa Gorge) for crevice-dwelling bat species, and 'free-hanging' families such as the Rhinolophidae (Horseshoe bats)

4.2.2 Activity Surveys

Transects A, B and C were each walked once during May 2013. Transects A1 and B1 were walked once during May 2014. Bat activity was not recorded on Transects A, A1, B and B1 (LSA). Overnight temperatures when undertaking all Transect surveys were > 7 degrees Celsius.

Bat activity was recorded on Transect C (RSA, Arpa Gorge); common pipistrelle *Pipistrellus pipistrellus* (Figure 8) and an unidentifiable *Myotis* species (Figure 9) made regular passes throughout the length of Transect. Temperatures within the Gorge (Transect C) were suitable for undertaking this type of assessment as they were >8 degrees Celsius.

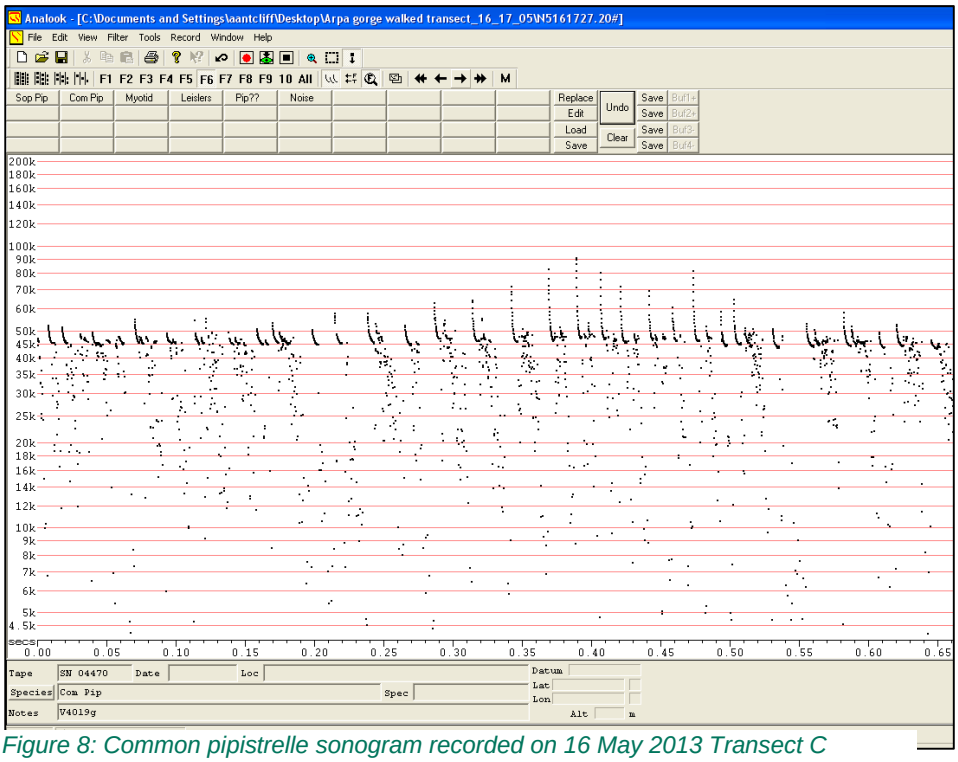

Figure 8: Common pipistrelle sonogram recorded on 16 May 2013 Transect C

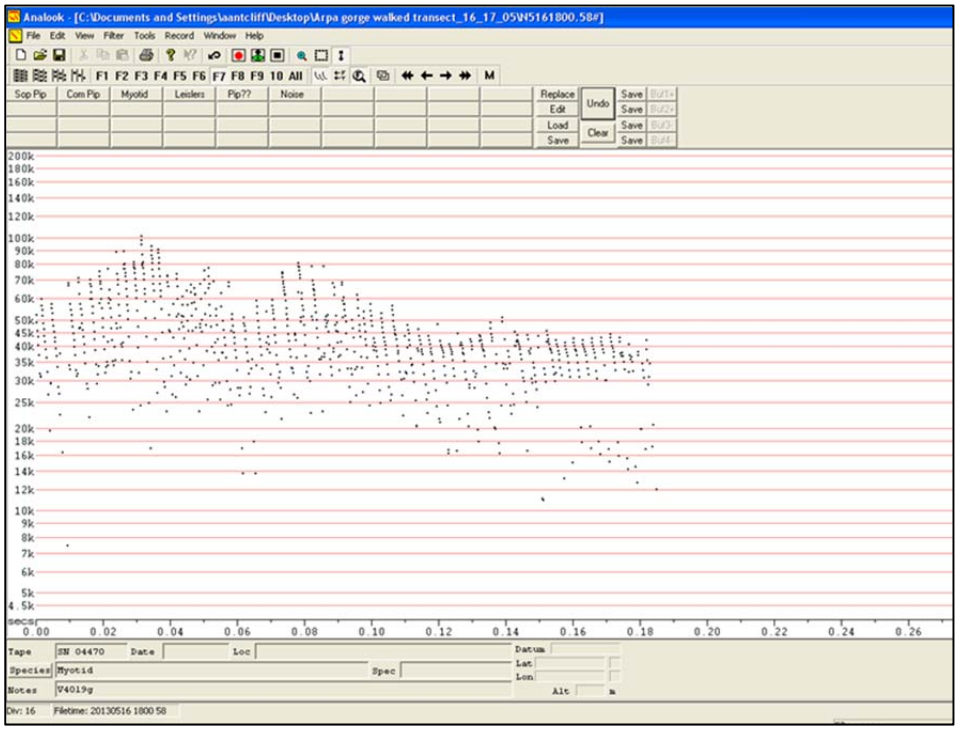

Figure 9: Myotis sp. sonogram recorded on 16 May 2013 Transect C

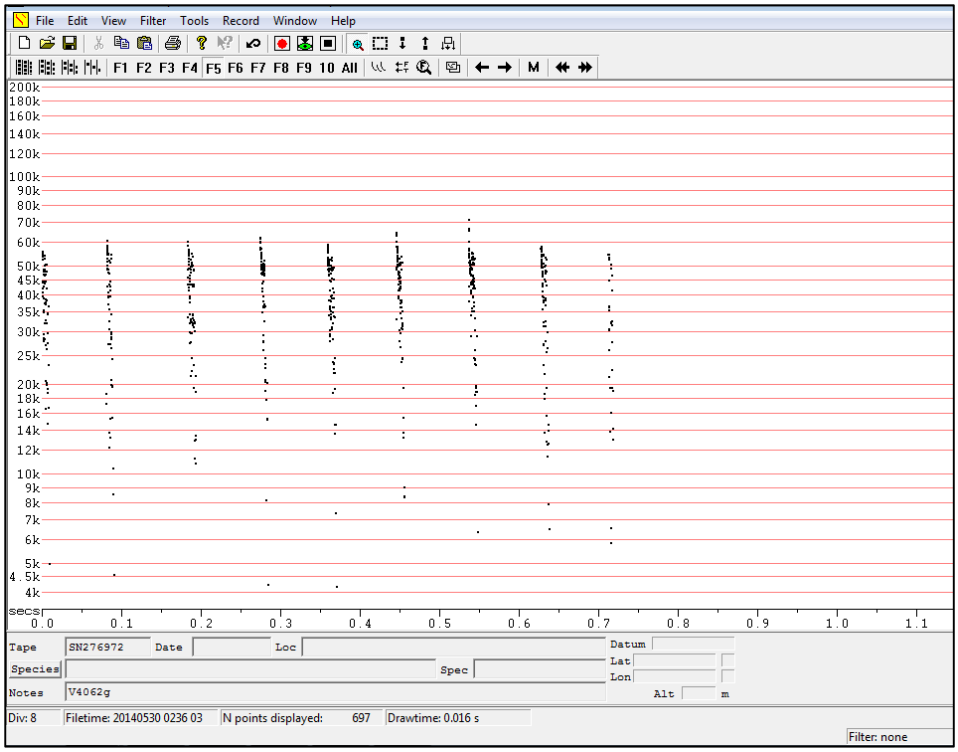

Figure 10: Anabat Sonogram recorded within the Arpa gorge by Geoteam during the 2014 baseline surveys.

The control results undertaken by Geoteam within the Arpa gorge during 2014 revealed the presence of a *Pipistrelle* species. This result and sonogram (Figure 10) gives confidence that the negative results obtained within the project affected area are due to the absence of bats.

4.2.3 Ground Level Static Monitoring

The results of the ground level static monitoring surveys conducted at Locations 1-7 are shown in Table 4. Drawing 1 shows the locations of the static detection points. No bat activity was recorded at locations 1, 1a 2, 2a, 3, 3a, 4, 4a and 5. Activity at static detection points 6 and 7 is generally low though this may attributed to the software constraints identified previously within Section 4.2.

It should be noted that the number of bat passes cannot be used to determine the number of actual bats in an area. For example, a single bat may forage in the vicinity of the passive monitoring station for an hour and generate over 100 calls. To overcome this limitation, activity transects were used in combination with passive monitoring. The passes that were recorded at Locations 6 and 7 were common pipistrelle (*P. pipistrellus*) and an unidentified myotid bat (*Myotis* sp.).

Table 4: Static Monitoring Survey Results

Reference (Drawing 1)	Total Bat Passes	Average Bat Passes per Night
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	9	3
7	11	3.6

4.2.4 Bat Trapping Survey

Habitat within the LSA was considered to be of 'poor' quality for roosting and foraging bats. However, the IoZ targeted their efforts on the RSA and specifically the Arpa Gorge due to the abundance of roosting and foraging habitat. Four bat species from two Families were captured at a single location on the Arpa River, on 5 June 2013. The results are summarised in Table 5; full details are provided in Appendix A.

Table 5: IoZ Results June 2013

Common Name	*Species*	Number Caught
Lesser mouse-eared bat	*Myotis blythii*	1
Geoffroy's bat	*Myotis emerginatus*	3
Whiskered bat	*Myotis mystacinus*	3
Serotine	*Eptesicus serotinus*	1

Bat species recorded on detectors during mist netting at Arpa Gorge included:

- Common pipistrelle;
- Leisler's bat (*Nyctalus leisleri*)*;* and
- European free-tailed bat (*Tadarida teniotis).*

5.0 DISCUSSION

5.1 Species Richness

In total, eight species of bat were either trapped or recorded within the RSA during surveys in 2013 and 2014. This number represents ca. 30% of the bats considered 'likely' to be present in the RSA in accordance with Yavruyan *et al,* 2008. The European barbastelle, a species classified as being 'Near Threatened' by the IUCN was recorded within the RSA (Arpa Gorge) though according to Mitchell-Jones *et al.* 1999 this species is generally restricted to altitudes of <1,900 m in the Caucasus and as such is likely to be absent from the LSA.

5.2 Bat Activity

Low levels of bat activity were generally recorded within the RSA. No bats were recorded within the LSA. This may be attributed to the low temperatures experienced during the May suite of surveys during 2013. However, surveys undertaken in June during warmer conditions did not produce records of bats within the LSA. This provides strong indications that the general sub-optimal habitat and lack of affinity between bats and mountain altitudes of >2000 m asl are combining to lower the likelihood of bats utilising the LSA.

5.3 Species of Concern

The concept of species of concern (SoC) has been used to help focus baseline surveys towards taxa with high vulnerability. SoC listings also link directly with the definition of critical habitat as defined by IFC (Performance Standard 6 2012). The definition of SoC applied is: presumed endemics and species that likely meet the criteria for Endangered or Critically Endangered status according to the IUCN Red List guidelines (regardless of whether they are currently on the list), or for which the Project could result in a change in population values that would push a vulnerable species over a threshold causing it to qualify for Endangered or Critically Endangered status. Specifically SoC were defined using the following criteria:

- International Union for Conservation of Nature (IUCN) listing (Critically Endangered and Endangered);
- National listing ('Fully Protected' and 'Partially Protected);
- Restricted distribution range;
- Species new to science; and
- Species not evaluated by IUCN but that would likely meet the criteria for Endangered or Critically Endangered status.

The key results of the Chiroptera surveys have been evaluated against statutory conservation criteria provided within Appendix B. Indications as to conservation significance are provided in accordance with the International Union for Conservation of Nature and Natural Resources (IUCN) 2012 criteria.

Table 6: Conservation Status of Species Likely to Inhabit the RSA in Accordance With Yavruyan *et al* (2008)

Common Name	Latin Name	Recorded in the LSA	Recorded in the RSA	Armenian Red Book Species	IUCN Status
Mediterranean Horseshoe Bat	*Rhinolophus euryale*	-	-	✓	NT
Mehely's Horseshoe Bat	*Rhinolophus mehelyi*	-	-	✓	VU
Lesser horseshoe bat	*Rhinolophus hipposideros*	-	-	-	LC
Greater Horseshoe bat	*Rhinolophus ferrumequinum*	-	-	-	LC

Common Name	Latin Name	Recorded in the LSA	Recorded in the RSA	Armenian Red Book Species	IUCN Status
Blasius's horseshoe bat	*Rhinolophus blasii*	-	-	-	LC
Lesser Mouse-eared Bat	*Myotis blythii*	-	✓	-	LC
Bechstein's bat	*Myotis bechsteinii*	-	-		NT
Natterer's bat	*Myotis nattereri*	-	-	✓	LC
Schaub's myotis	*Myotis schaubii*	-	-	-	DD
Geoffroy's bat	*Myotis emarginatus*	-	✓	-	LC
Whiskered bat	*Myotis mystacinus*	-	✓	-	LC
Daubenton's bat	*Myotis daubentonii*	-	-	-	LC
Brown long-eared	*Plecotus auritus*	-	-	-	LC
Grey long-eared bat	*Plecotus austriacus*	-	-	-	LC
Mountain long-eared bat	*Plecotus macrobullaris*	-	-	-	LC
European barbastelle	*Barbastella barbastella*	-	✓	-	NT
Asian barbastelle	*Barbastella leucomelas*	-	-	✓	LC
Noctule	*Nyctalus noctula*	-	-	-	LC
Kuhl's Pipistrelle	*Pipistrellus kuhlii*	-	-	-	LC
Common pipistrelle	*Pipistrellus pipistrellus*	-	✓	-	LC
Soprano pipistrelle	*Pipistrellus pygmaeus*	-	-	-	LC
Savi's Pipistrelle	*Hypsugo savii*	-	-	-	LC
Particoloured bat	*Vespertilio murinus*	-	-	-	LC
European free-tailed bat	*Tadarida teniotis*	-	✓	-	LC
Leisler's	*Nyctalus leisleri*	-	✓	-	LC
Serotine	*Eptesicus serotinus*	-	✓	-	LC
Botta's Serotine	*Eptesicus bottae*	-	-	-	LC
Common Bentwing Bat	*Miniopterus schreibersii*	-	-	✓	NT

5.4 IFC PS6 and Critical Habitat

The concept of 'Critical habitat' is defined within the International Finance Corporation (IFC) Performance Standard (PS) 6 and the European Bank for Reconstruction and Development (EBRD) Performance Requirement 6 to facilitate the identification of areas of high biodiversity value.

The intention of classifying areas as Critical Habitat is to identify the key biodiversity resources of a location. If projects are likelty to affect critical habitat, it is necessary to implement stringent mitigation programmes which result in a net gain in biodiversity.

The five criteria for defining Critical Habitat specified in paragraph 16 of PS 6 (2012) are as follows:

1) Critically endangered and endangered species;

2) Endemic and restricted-range species;

3) Migratory and congregatory species;

4) Unique assemblages of species; and

5) Key evolutionary processes.

Table 7 below presents the key baseline results pertaining to bat species in relation to the critical habitat criteria. Specifically, the Table assess the likelihood of species of conservation concern being present within the RSA and LSA and whether a designation of Critical Habitat may be triggered on the basis of bat presence or use of any given location.

Table 7: Baseline Ecology Summary Table

Key Results	Critical Habitat[2] Criteria met
Eight species of bat were recorded utilising the RSA during surveys undertaken in May and June 2013/14. No bat species were recorded utilising the LSA.	No
Of the eight species of bat recorded using the RSA all are classified as being of LC (Least Concern) (IUCN) with the exception of the European barbastelle which is classified as NT (Near Threatened).	No
No species of bat listed within the Armenian Red book were recorded during the surveys of 2013. Though, Yavruyan, *et al* (2008) indicate that up to 28 species of bat may utilise the RSA throughout the year in a residency or transitory context. Of these, five species are listed within the Armenian Red book. In addition, one species is classified as being VU (Vulnerable), four are NT (Near threatened) and one is DD (Data deficient) in accordance with the IUCN Red List.	No

The habitats within the proposed mining and infrastructure footprint within the LSA and the habitats within the RSA including the Arpa Gorge are inherently different. The RSA contains a mosaic of habitats that are likely to support up to 28 species of bat and some of these species are listed as being of conservation concern at the National and International scale.

Habitat within the LSA is generally sub-optimal for bat species, being of relatively high altitude, lacking structural diversity, linear commuting features and roosting habitat. However, discrete areas within the LSA may offer some value to foraging bats. Standing water bodies such as the reservoir situated west of the former proposed HLF (Static Detection Point 5, Drawing 1) and wetlands associated with the former proposed Waste Dump within Transect route A are likely to fulfil a foraging, socialising and commuting role for bat species.

Field surveys undertaken by the IoZ in June 2013, together with evidence documented by Yavruyan, *et al* (2008) indicates that the Arpa Gorge (RSA) may be an important migratory feature for a number of bat species. The Arpa Gorge provides optimal foraging, roosting and commuting habitat; and the plethora of permanent and transient roosts provide refugia for bat species during migratory passage.

[2] Critical Habitat (CH) as defined by IFC (Performance Standard 6, 2012).

6.0 CONCLUSIONS

The LSA is considered to have low potential to support bats owing to the general lack of suitable roosting habitat. Discrete areas of the LSA, for example site 13 and the Reservoir West of site 14, may provide some foraging opportunities for bat species. The species that may utilise the LSA are considered likely to be 'widespread and abundant' and are not considered to be of conservation concern.

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Report Signature Page

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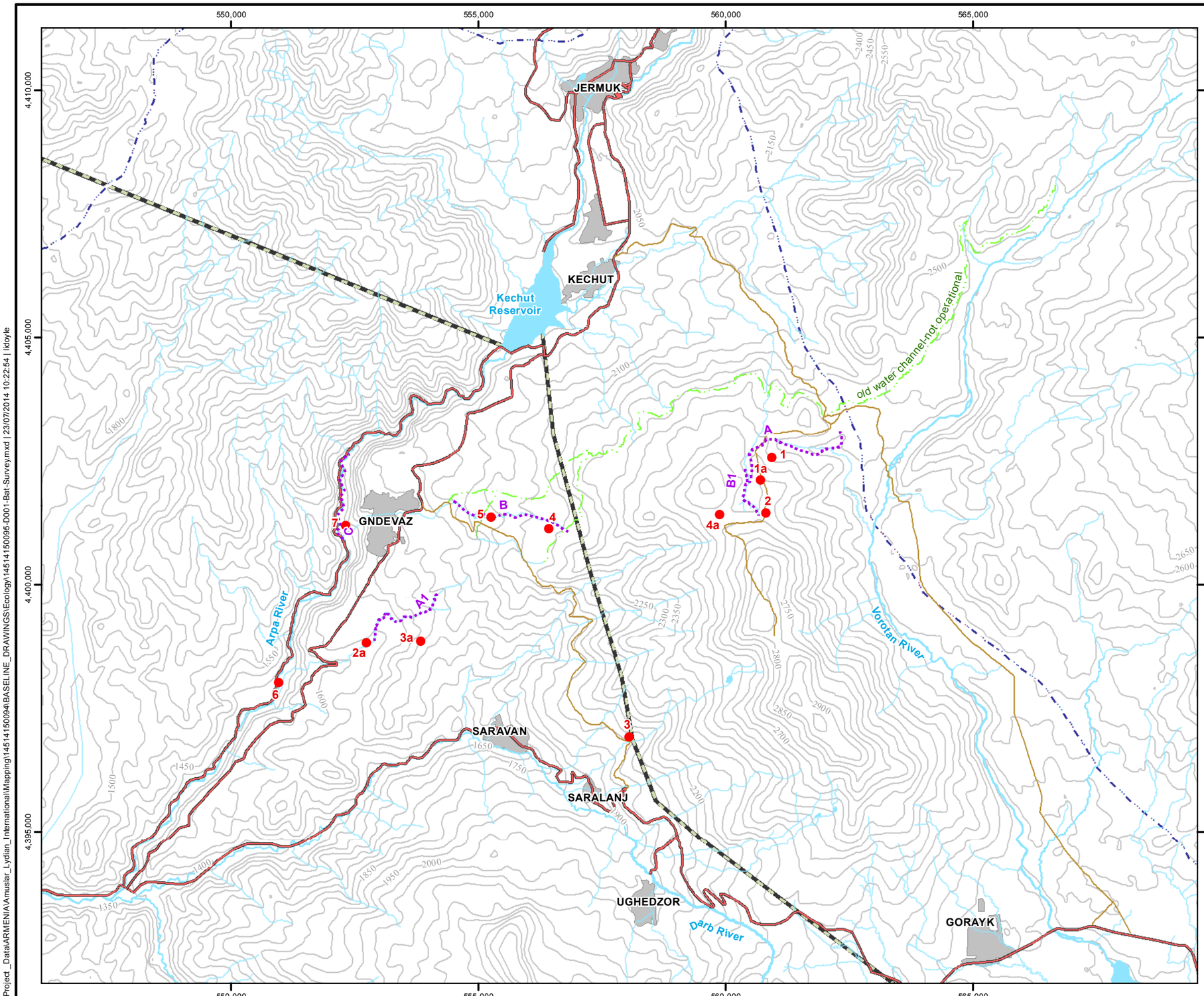
DRAWING

Drawing 1 – Bat Survey

August 2014
Report No. 14514150094.503/B.0



Legend

- Anabat Static Detection Survey Point
- Anabat walked transect route
- Gas Pipeline
- Indicative Spandaryan-Kechut and Kechut-Sevan Tunnel Alignments
- Contour (10 metre)
- Gravel Road
- Paved Road
- Town
- Watercourse

REFERENCES

Coordinate System: WGS 1984 UTM, Zone 38 North, Meter.
Data provided by client

N

1,500 750 0 1,500 METRES

SCALE 1:80,000 1 CENTIMETRE = 0.8 KILOMETRES
WHEN PRODUCED AT SIZE A3

PROJECT

LYDIAN INTERNATIONAL LTD.
AMULSAR GOLD PROJECT

TITLE

Bat Survey Anabat Static detection Units and Anabat Walked Transect Routes

Golder Associates
Bourne End, UK

PROJECT No.	14514150094		FILE No.	
DESIGN	FB	10/07/2014	SCALE AS ABOVE	REV 0
GIS	LD	23/07/2014		
CHECK	FB	23/07/2014		
REVIEW	CN	23/07/2014		

DRAWING 1

E:\Project_Data\ARMENIA\Amuslar_Lydian_International\Mapping\14514150094\BASELINE_DRAWINGS\Ecology\14514150095-D001-Bat-Survey.mxd | 23/07/2014 10:22:54 | lidoyle

APPENDIX A

Bat Habitat Scoping Assessment

LOCAL STUDY AREA

Bat Scoping Location 1:

Site Description	Survey Type	GPS Location (UTM) and Altitude (m)	Date Scoped
Site 14	Initial Habitat Assessment	0556428 4401134 (2152 m)	11/04/2013

Looking westerly within the site 14. Impoverished ground flora in congrunece with obvious signs or recent agricultural cultivation. Negligible bat roosting potential (BRP) and sub-optimal foraging potential.

Bat Scoping Location 2:

Site Description	Survey Type	GPS Location (UTM) and Altitude (m)	Date Scoped
Site 14	Initial Habitat Assessment	2103m	11/04/2013

Looking southerly within site 14. Some ground flora establishment indicitive of a lack of recent cultivation. Negligible bat roosting potential (BRP) and sub-optimal foraging potential.

Bat Scoping Location 3:

Site Description	Survey Type	GPS Location (UTM) and Altitude (m)	Date Scoped
Site 14	Initial Habitat Assessment	2165m	11/04/2013

Looking easterly within site 14. Some ground flora establishment indicitive of a lack of recent cultivation. Note: Stone piles created by local farmers to facilitate ploughing and associated cultivation. Neligible bat roosting potential (BRP) and sub-optimal foraging potential.

Bat Scoping Location 4:

Site Description	Survey Type	GPS Location (UTM) and Altitude (m)	Date Scoped
Site 14	Initial Habitat Assessment	0556231 4401297 (2103m)	11/04/2013

Exposed rock strata within site 14. Abundant fissures and crevices that were physically surveyed utilising an endoscope and high powered 'Clu-Lite'. No evidence of roosting bats though an exhaustive physical survey was not possible. Site to be surveyed utilising static Anabat and also traditional emergence survey, moderate bat roosting potential.

Bat Scoping Location 5:

Site Description	Survey Type	GPS Location (UTM) and Altitude (m)	Date Scoped
Site 14	Initial Habitat Assessment	-	11/04/2013

Site 14. Some ground flora establishment and some sub-optimal linear vegitative establishment. Negligible bat roosting potential (BRP) and sub-optimal foraging potential.

Bat Scoping Location 6:

Site Description	Survey Type	GPS Location (UTM) and Altitude (m)	Date Scoped
Site 14	Initial Habitat Assessment	-	11/04/2013

Ploughed terrace looking east. Negligible bat roosting potential (BRP) and sub-optimal foraging potential.

Bat Scoping Location 7:

Site Description	Survey Type	GPS Location (UTM) and Altitude (m)	Date Scoped
Site 13	Initial Habitat Assessment	-	11/04/2013

Site 13 looking southerly. Negligible bat roosting potential (BRP) some sub-optimal foraging potential.

Bat Scoping Location 8:

Site Description	Survey Type	GPS Location (UTM) and Altitude (m).	Date Scoped
Site 13	Initial Habitat Assessment		11/04/2013

Site 13 looking westerly. Negligible bat roosting potential (BRP) some sub-optimal foraging potential.

REGIONAL STUDY AREA

Bat Scoping Location 9:

Site Description	Survey Type	GPS Location (UTM) and Altitude (m)	Date Scoped
Arpa Gorge, Jermuk	Initial Habitat Assessment	-	12/04/2013

Arpa Gorge in the periphery of Jermuk ca. 6 km from site 14. A plethora of high potential bat roosting habitat was noted throughout the Arpa Gorge. The value of the roosting habitat is further underlined when considering the close proximity of optimal foraging and commuting riparian habitat provided by the Arpa river. *Note: This habitat forms part of the Regional study area and will not be directly impacted upon by the proposed development of the mine.*

Bat Scoping Location 10:

Site Description	Survey Type	GPS Location (UTM) and Altitude (m)	Date Scoped
Gndevank Monastery, Arpa Gorge near Gndevaz	Initial Habitat Assessment	-	12/04/2013

Gndevank Monastery situated within the Arpa Gorge exhibited a number of tunnels and structures that offered significant roosting potential for a number of bat species. The Monastery is situated ca. 3 km from site 14. During the initial habitat scoping a European barbastelle *Barbastella barbastellus* was observed roosting within one of the Monastery chambers (confirmed roost). *Note: This habitat forms part of the regional study area and will not be directly impacted upon by the proposed development of the mine.*

IOZ TABULATED RESULTS

IoZ Results June 2013

Common Name	*Species*	Date	Location	GPS	Sex	Age	Location of Capture
Lesser mouse-eared bat	*Myotis blythii*	5/6/2013	Gndevaz village	N 39.73829 E 45.59731	Male	Adult	Net over Arpa river
Geoffroy's bat	*Myotis emerginatus*	5/6/2013	Gndevaz village	N 39.73829 E 45.59731	Male	Adult	Net over Arpa river
Geoffroy's bat	*Myotis emerginatus*	5/6/2013	Gndevaz village	N 39.73829 E 45.59731	Male	Adult	Net over Arpa river
Geoffroy's bat	*Myotis emerginatus*	5/6/2013	Gndevaz village	N 39.73829 E 45.59731	Male	Adult	Net over Arpa river
Whiskered bat	*Myotis mystacinus*	5/6/2013	Gndevaz village	N 39.73829 E 45.59731	Male	Adult	Net over Arpa river
Whiskered bat	*Myotis mystacinus*	5/6/2013	Gndevaz village	N 39.73829 E 45.59731	Female	Adult, Gravid	Net over Arpa river
Whiskered bat	*Myotis mystacinus*	5/6/2013	Gndevaz village	N 39.73829 E 45.59731	Female	Adult	Net over Arpa river
Serotine	*Eptesicus serotinus*	5/6/2013	Gndevaz	N 39.73829 E 45.59731	Male	Adult	Net over Arpa river

APPENDIX B

Legislation and Policy

1.0 LEGISLATIVE CONTEXT

1.1 Armenian Legislation

Armenia is an emerging democracy, and is currently in a negotiation process with the European Union, of which it may become an Associate Member. Therefore, laws applicable to EU are referred to where relevant. The regulation of the environment in Armenia is covered by the various Civil, Administrative and Criminal Codes of Armenia. The implementation of the '*Principles of the Legislation on Nature Protection'* in 1991 provided an over-arching environmental policy and more than 500 subordinate legislative acts which have been adopted to implement environmental laws.

Specific laws have been adopted pertaining to ecology and biodiversity including:

- Law on Specially Protected Areas 1991;
- Water Code (a prior code was adopted in 1992) 2002;
- Law on Environmental Impact Assessment 1995;
- Law on Environmental and Nature Use Charges 1998;
- Law on Flora 1999;
- Law on Fauna 2000;
- Law on Hydro-meteorological Activity 2001; and
- Water Legislation adopted by the National Assembly 2002.

The Ministry of Nature Protection (MNP) manages the environmental administration of Armenia through various agencies.

1.2 Armenian Wildlife Law and Legislation

As previously described, owing to the fact that Armenia is currently in a negotiation process with the European Union (EU) laws applicable to EU are included in this section.

1.2.1 Second National Environmental Action Plan

Armenia's Second National Environmental Action Plan (NEAP) was approved in 2008 and provides a strategic framework for policy and investment. Six broad objectives were prioritised in the action programme developed by the Biodiversity Working Group of the NEAP.

1.2.2 Biodiversity Strategy and Action Plan

The Biodiversity Strategy and Action Plan were prepared in 1999. They spell out the measures for the implementation of the Convention on Biodiversity. Special attention is given to the sustainable use of natural resources, institutional strengthening for biodiversity management and the protection and evaluation of the impact on natural resources.

1.2.3 Key Laws and Regulations

This section outlines key laws and regulations relating to biodiversity in Armenia.

1.2.3.1 Law on Principles of Environmental Protection (1991)

The law on Principles of Environmental Protection specifies principles of environmental policy of the State and establishes legal basis for development of environmental legislation.

1.2.3.2 Especially Protected Areas (1991)

The law on Especially Protected Areas defines categories of protected areas and regulates the following:

- Conservation of reference sites and ecosystems;
- Protection of natural monuments;
- Scientific research of nature; and
- Monitoring of the environment.

1.2.3.3 Water Code (2002 (1992))

The Code makes provision for the use and protection of water resources including the following:

- To establish the mechanisms of water resource management;
- Protect and conserve water resource;
- Provide a water resource inventory;
- Provide a sustainable water supply;
- Water supply and removal system security;
- Hydropower plant use regulation; and
- Water ecosystem management.

1.2.3.4 The Forest Code (1994)

The Forest Code provided legislative framework with regard to conservation, and sustainable use of water, soil and other values of forests including forested wetlands, and wetlands in the forest zone.

1.2.3.5 Payments for Nature Protection and Use of Natural Resources (1998)

The law on Payments for Nature Protection and Use of Natural Resources (1998) regulates the following:

- Payments for nature protection;
- Payments for use of natural resources, including biological resources;
- Forms of payments; and
- Amenability against violations.

1.2.3.6 Flora (1999)

The law on flora (1999) regulates rights and responsibilities of plant resource users and secures including:

- Conservation of qualitative and quantitative values of flora, plant habitats and genetic diversity;
- Sustainable use of plant resources; and
- Regulation of plant resource use.

1.2.3.7 Fauna (2002)

The law on Fauna (2002) regulates:

- Sustainable use of resources of wild animals; and
- Rights and responsibilities of plant resource users.

Secures:

- Conservation, protection, natural reproduction of animal genus and species diversity;
- Integrity of natural habitats;
- Survival of animal species and populations; and
- Integrity of migration ways.

1.3 European Directives

1.3.1 EC Habitats Directive

In 1992, the European Community adopted Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (European Community (EC) Habitats Directive). This is the means by which the European Community meets its obligations as a signatory of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention). The provisions of the Directive require Member States to introduce a range of measures including the protection of species listed in the Annexes I, II, IV and V; to undertake surveillance of habitats and species and produce a report every six years on the implementation of the Directive.

1.4 International Conventions

1.4.1 Ramsar Convention

Armenia ratified the Ramsar Convention in 1993; but despite the international importance of Lake Sevan and Lake Arpa, little has been done to implement this convention.

1.4.2 Convention on Biological Diversity

The Convention on Biological Diversity was ratified by Armenia in 1993, and the first stage of implementation is currently being undertaken, including the production of the first National Report earlier in 1999, along with the development of the National Biodiversity Strategy and Action Plan to meet reporting requirements for the convention.

1.4.3 Species of Concern

The concept of species of concern (SoC) has been used to help focus baseline surveys on taxa with high vulnerability and biodiversity value. SoC listings also link directly with the definition of critical habitat (CH) as defined by IFC [Performance Standard (PS) 6 2012]. The definition of SoC applied is considered to be Armenian Red book species, endemic species and species that are likely to meet the criteria for Endangered (EN) or Critically Endangered (CR) status according to the International Union for Conservation of Nature (IUCN) Red List guidelines (regardless of whether they are currently on the list), or for which the Project could result in a change in population values that would push a vulnerable species over a threshold causing it to qualify for Endangered or Critically Endangered status. Specifically SoC were defined using the following criteria:

- International Union for Conservation of Nature (IUCN) listing critically endangered [CR] and Endangered [EN]);
- Armenian Red book listed;
- Restricted distribution range (endemism);
- Species new to science; and
- Species not evaluated by IUCN but that would likely meet the criteria for Endangered or Critically Endangered status.

1.4.4 IUCN Listing

Species on the IUCN Red List of Threatened Species are categorised according to the following criteria (IUCN 2012):

- **Extinct (EX)** – when there is no reasonable doubt that the last individual has died; exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form;
- **Extinct in the Wild (EW)** – when a species it is known only to survive in cultivation, in captivity or as a naturalised population (or populations) well outside the past range;
- **Critically Endangered (CR)** – species that are considered to face an extremely high risk of extinction in the wild;
- **Endangered (EN)** – species that are considered to face a very high risk of extinction in the wild;
- **Vulnerable (VU)** – species that are considered to face a high risk of extinction in the wild;
- **Near Threatened (NT)** – species that do not currently qualify for 'critically endangered', 'endangered' or 'vulnerable' status, but are close to qualifying for or are likely to qualify for a threatened category in the near future;
- **Least Concern (LC)** – widespread and abundant species that have been evaluated and do not qualify for any of the above categories; and
- **Data Deficient (DD)** – taxa are suspected to belong to some of the previously mentioned categories, but there is insufficient information available to confirm an assessment.

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