The simulated pit runoff water quality is questionable due to the reliance on: 1) a non-conservative assumption of 40% of precipitation on the pit walls reporting to the sumps, and 2) simulated solid phase precipitation of copper oxides and iron-bearing phases with slow growth kinetics at surface temperatures. The runoff water quality has extremely low iron concentrations that are inconsistent with leachate from existing waste rock piles. The runoff is pumped from the pits, and this questionable water quality is assumed to report to the PTS.

The water quality modeling of seepage through the Tigranes-Artavasdes and Arshak pits suffers from similar procedural problems as the pit runoff modeling. The leachate bears little similarity to Site 27 waste rock leachate, which has a similar pH to the simulated leachate. Simulated iron and copper concentrations are extremely low.

The geochemical modeling of the water quality of post-closure seepage from the partially-backfilled Erato pit appears to be the most defensible of the geochemical models with respect to current, accepted methods, but there are some important concerns. Unclear is how a water balance model based on a seasonal pit lake (with water surface evaporation) with no backfill was adapted for use with backfill. Uncertainty of results was evaluated with a range of inputs. The simulated iron concentrations are low compared to Site 27 waste rock leachate, which has a similar pH. Otherwise, the simulated concentration ranges of other solutes encompass the concentrations in the Sites 13 and 27 waste rock leachates and mine portal drainage.

The post-closure solute transport simulations underestimate potential impacts to groundwater and surface water. The solute transport scenario and the local impacts scenario based on mixing are not conservative, with source concentrations determined by geochemical modeling that are too low. Loading rates to groundwater are also underestimated due to seepage rates from the pits that are too low, and the predicted concentrations do not include potential effects of the BRSF and HLF. The screening level spreadsheet (analytical) model approach used for solute transport is inappropriate for a project of this scope, extent, and complexity in such an environmentally-sensitive area. Predictions of impacts require an integrated approach that includes loading of constituents to groundwater and surface waters from all potential sources. The existing regional groundwater flow model should be revised and extended for transport simulations.

The Project water balance modeling results for the 95% probability of exceedance (covering wide uncertainty) suggest sufficient capacities are calculated for pit pumping and pond sizing. Uncertainty could be reduced with improved inputs for some questionable parameter values.

The baseline studies and the evaluations for the ESIA are poorly planned and poorly integrated, rushed, and incomplete. For example, impacts assessment modeling was performed before studies were complete or other modeling was performed on which inputs for a model are dependent (*e.g.*, unsaturated flow modeling of infiltration through the post-closure cover was not complete at the time of the HLF assessment). The mine closure plan was not complete at the time of the HLF assessment. Studies and planning were still being performed at the writing of the current version of the ESIA. Although the SWWB was updated, the models for fate and transport simulations and impacts assessments were not revised or updated.

Surface water and groundwater monitoring data provided by the MNP (SNCO, 2019) indicate the presence of a localized, transient spike in nitrate concentrations in water samples from Spring 529, located near Spandaryan reservoir. Given the absence of a corresponding trend in other constituents and in water quality in the Arpa River, the transient and localized nitrate trend cannot be attributed with a reasonable degree of scientific certainty to the initial Mine construction activities. Accordingly, no discernable impacts onto surface water or groundwater due to initial mine construction activities could be inferred.

3.4 Water and Geology - Mitigation Measures

The main sources of potential environmental impacts to surface water and groundwater are the BRSF, the HLF, the Mine pits, and all associated infrastructure for collecting, channeling, impounding, and treating contact water.

Generally, the design concepts used in the Amulsar ESIA/EIA for development of mitigation measures are reasonable and appropriate (e.g., low permeability liners, encapsulation, capping, drainage, and leachate treatment). However, a number of the measures and plans, are partial, not-sufficiently protective, and/or unreliable with a high degree of uncertainty, particularly due to deficient and questionable data, models, model simulations, design bases, and/or assessment.

3.4.1 Mine Pits

While the mine is operating, some of the runoff water will be collected and diverted to the HLF. Some of the runoff water accumulating in the pits and potentially generating ARD will infiltrate to groundwater through rock fractures. Post-closure mitigation measures are partial backfilling the Tigranes-Artavasdes and Erato pits and emplacement of an ET soil cover on backfill. Backfilling mitigates the negative effects of pit seepage to groundwater. The ET soil cover on the Tigranes-Artavasdes backfill will mitigate generation of ARD from backfill and seepage of ARD-impacted water to groundwater (by limiting water infiltration and air ingress). The PAG waste rock will have voids among rock particles/fragments that will permit infiltration. Some ARD may still occur. Runoff will also collect in the pits. The Arshak pit will not be backfilled and will seasonally accumulate runoff in the base of the pit.

There is a clear potential for contamination of groundwater by ARD-impacted pit seepage water. This contamination would particularly affect nearby springs, which are important for local livestock and wildlife. The Amulsar rocks have essentially no pH buffering capacity. With distance from the mine pits, some natural attenuation of chemical concentrations via dilution will occur before the contaminated groundwater reaches other environmental receptors (streams and rivers).

There are no contingency plans to address or mitigate groundwater contamination originating from the pits during the operation or closure phases beyond monitoring, for which no details are provided.

3.4.2 BRSF

While the mine is operating, the PAG waste rock (LV) will be placed on a non-PAG (VC) rock drainage layer, which will be underlain by compacted native clayey soil or a constructed clay liner. The design concept of using non-PAG drainage layer at the base of the waste rock pile and an underlying low permeability liner to mitigate infiltration to groundwater is adequate. However, the liner design criteria (*i.e.,* relatively small thickness, relatively high hydraulic conductivity, limited hydraulic conductivity testing, and compaction using vehicle traffic) are questionable and raise concerns about the long term performance, integrity, and protectiveness of the liner.

Other mitigation measures include sub-grade drains in perennial stream channels beneath the BRSF, a toe pond to collect contact water, and runoff diversion channels. Additional closure mitigation measures include capping the PAG waste rock with non-PAG VC waste rock, an ET soil cover, and directing contact water to the PTS.

The ET soil cover will mitigate generation of ARD from PAG waste rock and seepage of ARD-impacted water to groundwater (by limiting water infiltration and air ingress). The PAG waste rock will have voids among rock particles/fragments that will permit infiltration. Some ARD may occur.

3.4.3 HLF

The mitigation measures included in the design of the HLF are generally appropriate. The design includes a composite geomembrane-soil liner system and a drainage collection system above the liner that directs the PLS to the process pond. Diversion embankments and channels will be constructed upslope of the HLF to divert runoff away from the pad and collection ponds. Underdrains will be constructed in existing drainages and seeps within the leach pad and collection pond footprints. The leach pad will have a toe berm and perimeter berms to prevent overflow. The solution and storm flows will be routed to the process pond.

The process pond will have a composite double geomembrane-soil liner system and a leak collection and recovery system. The storm water ponds will have a composite geomembrane-soil liner. Closure measures for the HLF include an ET soil cover.

3.4.4 Contact Water Treatment Systems

The ESIA focuses on and proposes PTS for Mine contact water. Two PTS are proposed - one for the heap pile leachate after mine closure and the second for the BRSF leachate both during and after closure of mine operation. The heap pile leachate treatment system is addressed in a separate section, while the discussion below focuses on the PTS for the BRSF.

The ESIA and previous ARD Management Plan (Geoteam, 2016c) state that if treatment trials indicate that PTS will not meet the discharge criteria (MAC II standards) then a conventional packaged active water treatment system will be used. There are no descriptions of the decision-making process or details about the active treatment processes or requirements. The commitment to use active treatment in case of PTS inability to meet MAC II Standards, has been omitted in the updated ARD Management Plan (GRE, 2017). Therefore, this option cannot be assessed.

3.4.4.1 ARD - BRSF

The design of the PTS for the BRSF has significant shortcomings:

- The system design using a PTS has been selected much too early in the process and does not allow for the flexibility needed to deal with such a complex and uncertain water mixture. The design is based on modelled water quality that is questionable. If the modelled water quality is not valid, then the system, if not revised to meet the actual influent quality, will likely fail and result in the release of contaminated water at concentrations above permissible criteria into the receiving surface water.

The GARD Guide (INAP, 2009) indicates active water treatment is most appropriate during mine operations. A passive system is more appropriate for treatment of water with low chemical concentrations after the mine has been closed. Since water will need to be treated during the last several (five) years of mine operation, an active system may be more appropriate and may need to be considered as an interim or supplemental measure.

- The water quality modeling has significant discrepancies and uncertainties that raise concerns about the reliability of water quality projections and about the feasibility and effectiveness of the proposed PTS, especially during Mine operation.
    - The modelled iron concentrations for influent water are much too low for natural waters, especially waters impacted by ARD.
    - The charge balance for cations and anions in the incoming water for the PTS has a large error that significantly exceeds the acceptance criterion.
    - The aluminum concentrations are too low and inconsistent in different descriptions of the incoming water for the PTS.
    - Recent updates to the site-wide water balance (SWWB) will likely impact the projected PTS influent water quality and quantity.
    - During the years of mine operation, the water coming into the PTS will contain both water from the BRSF and excess water from the pits that is not used in the heap leach operation. The influence of the pits water on the overall water quality should have been included in the geochemical model, especially with the updated SWWB.
- Ammonia in the influent will most likely be present at concentrations significantly higher than the discharge criterion/standard, but the treatment process for ammonia is not addressed except for brief, extraneous comments. Although discussed, Nitrate treatment requires further and more robust evaluation. Nitrate and ammonia are likely to be the major contaminants that require treatment while the mine is operating to ensure the effluent meets the discharge criteria and prevent contamination of the receiving surface water.

3.4.4.2 HLF

The discussion of the HLS management and treatment has two major discrepancies:

- The projected HLS quality at the end of operation, both before and after cyanide treatment is unrealistic. The water quality used for geochemical modeling comes from tests that were not designed for assessment of environmental impacts, treatment, and compliance of the influent. The water quality results have internal inconsistencies indicating that some of the results are incorrect. Further, at the end of the mine operations, the HL water will have been in circulation for ten years and will likely have elevated concentrations of soluble constituents (sodium, nitrate, chloride) added to the water from operations and elevated concentrations of trace constituents leached from the ore (sulfate, trace metals) that will require treatment prior to discharge. There is no good modeling of these concentrations to know what to treat and how to treat them.

- There is no indication of how the barren solution after the pass-through the ADR will be managed and treated (only the treatment of the rinse water is conceptually discussed). This water may be on the order of 1 million m^3 and may contain high concentrations of ions that can be difficult to treat (sodium, chloride, nitrate, etc.), and thus may impact the quality of the receiving surface water if not treated prior to discharge.

  The water coming from the HL ore pile following closure will be treated in a PTS to be designed in the future after obtaining actual water quality data. Although PTS is potentially applicable for the post-closure HLF solution and leachate, there are no plans for laboratory treatability or pilot testing to assess the feasibility and effectiveness of PTS. Also, there are no discussions of contingent or supplemental measures in case of PTS failure.

3.4.5 Natural Disasters

River flood risk is extremely low. The current design of the contact water ponds includes free-board for the 100-year, 24-hour storm. Considering effects of climate change and the high degree of uncertainty in the Project data, designing the contact water ponds and diversion systems against the 500-year, 24-hour storm event (as recommended by the Nevada Division of Environmental Protection regulations and guidance for mine closures) may be warranted.

The seismic hazard risk is high for the Project Area. In the event of an earthquake, covers on the BRSF and pit backfill could be restored. Breached liners beneath the BRSF and the HLF would require temporary or permanent relocation of the rock and spent ore. The repair of conveyance piping for contact water ponds will require partial or complete drainage of the ponds. Contingency measures to handle and treat the stored contact water will be required. The revised construction standard should be reviewed for compliance of all mining infrastructure, including the potential need for reinforcement or double containment of piping. Historic landslides surrounding the Amulsar Mine should be documented in the ESIA.

The Mine pits and BRSF are within the Lake Sevan Immediate Impact Zone. Catastrophic earthquakes can cause a release of mine contact water and adversely impact groundwater and surface water within the Lake Sevan Immediate Impact Zone, particularly during the operation phase when large quantities of contact water are stored in ponds. Such releases will contaminate nearby springs and the Arpa River. The significance of the impacts on the Kechut and Vorotan Reservoirs and Darb River (and Sevan Lake) is uncertain because the models in the ESIA did not evaluate or quantify these impacts. Under certain circumstances, however, especially if releases occur post closure, such impacts can be limited due to the relatively smaller volume of contact water that will be released from the Mine compared to the significantly larger water volume in the watershed, including the Kechut and Spandaryan Reservoirs and Sevan Lake.

Due to the hydraulic and physical setting, the Mine water will not impact Jermuk springs.

3.5 Post Closure Cost

The Amulsar Mine closure cost bases and estimates are provided in Appendix 8.18 of the ESIA. The cost was reviewed for general consistency with standard practice. The cost estimates cover major rehabilitation and closure scope items. However, a number of cost items are questionable and the overall cost appears to be underestimated. Below are key concerns:

- The post closure OM&M period is limited to only five years. In the US, regulatory requirements and guides for closure indicate post closure costs, when contamination sources remain, should be estimated for a revolving 30-year period (minimum). Post closure costs should include routine OM&M and periodic replacement, maintenance and repair that will occur after 5 years, which can be significant. The reduced post closure monitoring period and the omission of the periodic replacement/maintenance costs will result in significantly underestimating the post closure costs.

  Increasing the post closure monitoring period from 5 years noted in the ESIA to the conventional 30 years, the total Mine rehabilitation and closure cost will increase from approximately \$34M to approximately \$70M (without other adjustments) .

- Contingency is too low at 6% and underestimates the actual Mine rehabilitation and closure cost. Cost estimation guides indicate that at this level of project development (pre-feasibility) and the high degree of uncertainty (*e.g.*, unreliable data and PTS and need for additional studies, *etc.*) the contingency can exceed 20%.

  Using a more realistic contingency of 20% instead of the ESIA 6%, the total indirect cost percent would increase from 21.3% to 35.3%. Accordingly, the total Mine rehabilitation and closure cost will increase from approximately \$34M (for the ESIA 6% contingency and 5-year post closure monitoring period) to approximately \$78M (for 20% contingency and a 30-year post closure monitoring period) without other adjustments.

- Treatment requirements are unrealistic (actual costs will be higher) due to incorrectly assumed low leachate concentrations and mass loading and missing processes.

- Professional/technical costs (design/engineering, project management, and construction management) at approximately 3% of total construction/capital cost (on the order of \$1M) are underestimated. Cost estimation guides indicate these services can exceed 15% of total construction costs for similar projects. Using 15% for these services would result in an additional increase to the Mine closure cost on the order of \$4M to \$5M.

- Many cost items are presented as lump sum without bases and cannot be assessed.

3.6 Environmental Monitoring Program

The Project needs to develop a comprehensive and defensible plan for future monitoring (operations, closure, and post-closure).

The number of surface water quality monitoring locations in the quarterly monitoring reports is insufficient. No locations on the Darb River or north of the Kechut Reservoir (including Jermuk) were sampled. Most locations north of the BRSF, including the stream in the vicinity of the Madikenc springs, the Spandaryan Reservoir, two locations around Gorayk, and all locations east and west of Amulsar Mountain were omitted.

The number of springs and groundwater quality monitoring locations is extremely inadequate. The sampling program is also unacceptable with respect the deficiency in baseline data.

The monitoring reports do not include potentiometric surface contour maps or contour maps of key constituents in groundwater. There are no time-concentration graphs and there is no assessment of results with respect to previous results and no discussion of analytical methods.

3.7 Water and Geology - Data Gaps

- Pumping tests to evaluate bulk hydraulic properties anisotropy, and the extent and influence of fractures and boundaries (faults and streams) with the objective to update the groundwater flow and transport models.
- Tracer tests to evaluate fracture characteristics and extent and key transport parameters and to improve the groundwater flow and solute transport models.
- Laboratory testing of surrogate rock pile materials (from existing waste rock piles) with the expected particle size distribution of pit backfill and BRSF waste rock and topsoil for saturated hydraulic conductivity, soil-drainage and relative permeability curves, and thermal properties to update the infiltration models.
- Grass leaf area index and root depth data for soil cover models.
- Better records of springs, seeps, and river flows (continuous records).
- Considerably more water quality data for statistical analyses.
- Monitoring stations at more perennial springs around Amulsar Mountain and the BRSF.
- Better recharge constraints, including continuous flow measurements on the major rivers and watershed modeling.
- Better water balance constraints in the BRSF, pit backfill, and HLF models.
- Realistic data and geochemical modeling of the range of influent concentrations coming from ARD or the blasting activities (acidity, iron, aluminum, sulfate, nitrate, and ammonia) in the water sources contributing to the influent for the BRSF PTS for the PTS design and how these concentrations will change during and after mining operations.
- Data from laboratory bench scale and field pilot testing of proposed treatment processes to demonstrate effective treatment of the range of concentrations of parameters in leachate from ARD and the blasting activities to the PTS for both the BRSF/pits and HLF.
- Chemical analysis of a bench scale pregnant leach solution that represents the effects of all processes and loading from all sources during numerous cycles of leaching.
- Isotopic data for unaltered LV and basalt across the GSA.
- Geologic data for the broader GSA.
- Surface fault and fracture mapping.
- Elevations and construction details of the Spandaryan-Kechut tunnel.
- Wells near the Spandaryan-Kechut tunnel to determine groundwater levels with respect to the tunnel and the water quality that may be entering the tunnel, now and in the future, to improve understanding of groundwater flow and the site model.

- Flow data for upper reaches of the Darb River above Ughezdor and the Porsughlu River flowing into Spandaryan Reservoir.
- A surface water quality monitoring location on the main tributary of the Darb River downstream of station AW006, just before the confluence with the Darb River or just downstream of the tributary on the Darb River, to ensure all impacts from the mine pits are detectable.
- Additional deep monitoring wells north-northwest of the BRSF, southwest of the Arshak pit, and east of the Tigranes-Artavasdes pit, screened sufficiently deep to have saturated rock adjacent the well screens the entire year.
- Flow measurements at the Pluskandyal springs and the other community springs southeast of Ughezdor.
- Flow measurements for the two springs on the south side of the Porsughlu River that supply water to Gorayk.
- Flow measurements at the springs around Benik Pond
- Multiple samples and tests of well-defined geochemical test units based on mineralogy; also a range of spent ore types/textures.
- Better analyses of full sets of anions and cations in solutions used in geochemical modeling to ensure charge balance.
- Field assessments of various potential fault alignments of the ATB and their potential impacts on water resources.

3.8 Biodiversity

This ESIA provides an opportunity for the Republic of Armenia to assess biodiversity and its status in the Amulsar region. This is especially the case for the Brown bear (*Ursus arctos)* and *Potentilla porphyrantha*, as it triggered international and national focus on key species of concern generating extensive field derived data.

ESIA/EIA Sections on Biodiversity were evaluated in view of best practice recommended in terms of ESIA development and in particular the importance of functional ecology approach in this type of evaluation.

No breach to any national or international regulations or recommendations are to be noted.

Observations highlighted throughout the assessment and in this conclusion are mainly intended for use in the event of an update or improvement of the ESIA especially that, given the amount of efforts invested to develop this ESIA, the methodology could have been improved to cover ecological functionalities and a more exhaustive assessment.

No violation is to be reported. The report had focused and provided quality and exhaustive information on two flag species which are the *Ursus artos* and *Potentially porphyrantha* while addressing other species in a less exhaustive and sometime insufficient manner.

Main concerns are:

- Some data gaps or over simplification of data in the Baseline that have led to an underestimation of the impacts on key receptors which in turn lead to inappropriate mitigation measures and therefore a suggestion of offset program that does not enable to reach the No Net Loss neither the net gain claimed in the ESIA and required by IFC PS6 and EBRD PR6.

In particular:

1. Quantified evaluation of impacts (and ideally geolocation) deserves more clarification to understand how the magnitude of impacts has been estimated and reported
2. Some key species are not properly addressed in the impact evaluation and properly considered in the mitigation measures section. This is the case for:
    a. Ursini viper group
    b. Eastern rock nuthatch
    c. "Other birds" group are considered as a group in the SAP while every species has specific ecological features and consequently specific needs.
3. Off set program reports NNL and Net gain while
    a. Measures of Potentilla are still experimental, results need to be monitored and offset program design is recommended.

It was suggested to initiate a conservation program on other populations of *P. porphyrantha* in Armenia and response was that other population reported in the literature were not found as a result of a field investigation. Should this statement be confirmed, the Population of *P. prophyrantha* located in the Amulsar mountain becomes the ONLY viable population in RA which increases the need to properly mitigate the impacts.

b. Eastern rock nuthatch and Lesser Krestrel are not considered in the offset

c. Ursini vipers group is not considered

d. Brown bear set aside and wild life crosses being experimental measures, those should be monitored and a more in depth offset program proposed

The following comments are mainly intended to provide guidance on possible improvement on eventual future versions (if applicable):

- Provide consistent figures and non-redundant information throughout the various chapters - an effort towards harmonization of the format and the content of the various chapters.
- Present a clear methodology regarding the quantified evaluation of impacts.
- Include geolocalized maps presenting the assessment, the impacts and the importance of the direct and indirect impacts on habitats and species.
- Include a summary in the text of the various key elements when presented in appendices to improve lisibility.
- Develop clear synthesis and summary tables enabling transversal evaluation in view of ecological stakes and expected impacts to better present the information available.
- Review the methodology to cover all project area, key seasons and functional approach in addition to proper field investigation pressure in view of the large extent of the area.
- Clearly distinguish between mitigation and experimental measures and in case of non-confirmed zero residual impact, account for an appropriate offset measure.
- Avoid oversimplified conclusions especially when it comes to the NNL or Net gain claimed in the offset program.

3.9 Biodiversity – Data Gaps

The major weakness of the biodiversity assessment lies in the absence of geolocated information and the absence of synthesis enabling the assessor to understand and assess the effective extent of project's components and their impacts on various ecological receptors.

The essential gaps needed to be fulfilled are described below.

1- Baseline data

a. Project's components vis-à-vis the ASCI, IPA, IBA, KBA,, Priority areas for Conservation, and existing and planned protected areas network

b. Complete field work with adequate field intensity and methodology with sampling plan taking into account all footprint of the project for insects and reptiles

c. Habitat detailed description (ex : Potentilla), ecological functionalities of each habitat (ex : Lesser kestrel), geolocalisation of habitats (ex : specific habitat for Vipera eriwanensis, or mapping of host plant for Apollo butterfly), based on reliable methodology and field observation intensity

2- Calculations with clear reporting tables

a. Definition and geolocalisation of the project's footprint surfaces (direct impact, different levels of indirect impacts) and clear overlaps with each species habitat

b. assessment of the impacts (before mitigation and after mitigation, with synthesis tables) on the various receptors (surfaces, number of individuals when known, ecological functionalities impacted…)

3- Information

a. list of endemic plants species that occur vis-à-vis or might occur in the site (22 mentioned but not listed)

b. list of latin names of species with ethnobotanical value (provided in local names)

4- Methodology

a. Clear methodology for the evaluation of significance of impacts

b. Mitigation measures for all priority receptors

c. Monitoring program for avoided impacts

d. Anticipation of offsetting programs for priority receptors not taken into account in the current offset program (bird species such as Lesser kestrel, nuthatch, vipers...) with adequate developed monitoring programs and geo localised management measures

3.10 Air Quality

Summary and main conclusions of the assessment of air quality sections of the EIA/ESIA are:

- The regulations adopted for the assessment of impacts on air quality do not fully comply with the IFC requirements (which mandate the consideration of national standards as a priority and in their absence to adopt IFC standards) in the ESIA since Hg, HCN, and HCl are not considered in the assessment while there are national standards for these parameters that need to be complied with; furthermore these parameters were not considered in the baseline assessment.
- For the NO_2, SO_2, PM_{10}, and $PM_{2.5}$, baseline values are acceptable.
- Emissions of fugitive dust from the mining activities, namely TSP and PM_{10}, were generally calculated correctly and their impact is negligible on the settlements (from around 1 km and beyond) in line with the ESIA and EIA conclusions.
- $PM_{2.5}$ emissions were not estimated and their impact on the settlements was not assessed properly; proper modeling shall be conducted with an adequate model that takes into account the complex wind field in the area. The impact is expected to be low but needs to be assessed.
- Road transport exhaust emissions have negligible impact due to their distances from the receptors in line with what the ESIA and EIA suggest.
- Boilers emissions were assessed properly in the EIA but are not mentioned in the ESIA. These run on natural gas which emits low levels of pollutants. However, their impact was assessed in the EIA through the Raduga model which is considered not appropriate for this analysis. The impact of the boilers is not expected to be significant but a proper modeling shall demonstrate it.
- The ADR plant emissions were not estimated correctly since Hg was not considered and a solid estimation of the emissions for HCN and HCl was not made. These emissions shall be determined by the process and plant manufacturer. Afterwards, a proper modeling shall be conducted taking into account the baseline for these pollutants at the receptors' locations in order to set the emission limit values since these do not exist on the national level.
- The types of mitigation measures presented in the EIA and ESIA are generally acceptable but few were suggested to be added to decrease further the emissions from the stationary and fugitive sources. Additional assessment is needed to conclude if the performance of these mitigation measures are sufficient (i.e. air dispersion modeling, determination of the emission limit value, etc.).
- The environmental monitoring program presented in the EIA and ESIA is acceptable but is proposed to be augmented to better control and monitor the sources of pollution and their impact.

In general, no major issues were identified in a way that cannot be mitigated. Taking into account the additional mitigation measures and monitoring actions, the impact of the project related to air quality is likely to be manageable.

4.0 Responses to Specific TOR Questions

4.1 Water and Geology

This section presents responses (**bold**) to specific questions (*italic*) included in the TOR.

i. TOR Question: Are the assessments presented by Lydian in the ESIA and EIA Reports and in the appendices attached to them sufficient, qualified, scientifically justified and comprehensive, or not; did the conclusions, derive from the reliable and actual data and was the methodology developed for these conclusions comprehensive and reliable?

Response: Most tools used in the assessment are suitable and are consistent with acceptable and standard practices. However, key elements of the assessments are inadequate, deficient, and inaccurate. Baseline data deficiencies abound for geology, ARD characterization, hydrogeology, surface water and springs flow, and surface water and groundwater quality. Deficiencies led to questionable simplifications and interpretations. Models for assisting with the assessments are oversimplified, incorrectly parameterized, procedurally incorrect, poorly calibrated, and not conservative. Key data, conceptualizations, and modeling approaches are unreliable, and impacts assessments are incomplete, leading to conclusions that are unreliable with a high degree of uncertainty. Good isotopic data were acquired, from which reliable conclusions can be reached.

ii. TOR Question: Are the methods of control of production of wastewater, mine waters, presented in ESIA and EIA reports, scientifically justified and effective, or not; do they stem from the regulatory requirements and international standards?

Response: The methods of control of wastewater production and mine waters are conceptually adequate, some have been effective in previous applications, and some are partly scientifically justified (See Section 2.1.5). The methods are based on local regulatory requirements and partly conform to international standards. However, the passive treatment system chosen for the PD-8 and BRSF water is designed for water with low incoming iron and aluminum concentrations and low dissolved oxygen. The water quality modeling is insufficient to justify such a system, because higher iron or aluminum concentrations, detected during testing, could cause the system to fail. In addition, the water quality coming into the treatment system will vary at different stages in the mine life – during operation the water will have higher concentrations of nitrate and ammonia, while after the mine closes these concentrations will decrease and the focus of the treatment will be on ARD products. A single passive system is not suited for treating such changing conditions. The GARD Guide recommends that an active system be used during mining operations, while a passive system may be more suited for post-mining conditions. Finally, there is no discussion of how ammonia will be treated. The treatment system will likely need to be redesigned to fully treat the varying constituents and concentrations in the wastewater. Also, the PTS for the BRSF/Mine Pits leachate treatment may need to be implemented earlier than estimated due to questionable water balances from the BRSF and Mine pits.

Some of the mitigation measures for ARD at the pits and BRSF (see Sections 2.1.5.1 and 2.1.5.2) are partially effective.

The ARD mitigation plans do not include contingency measures for groundwater contamination originating from the pits.

iii. TOR Question: Does the monitoring program, presented in Lydian's ESIA and EIA, include all necessary components (land, air, water, flora, fauna, etc.) of the environment and are the arrangements, foreseen by the program, sufficient in terms of the set standards, or not?

Response: **The available monitoring programs are for the pre-construction (baseline) and construction phases. The surface water and groundwater monitoring programs have all the necessary components. Augmentation of the programs with more monitoring stations is necessary, especially for springs monitoring. The number of surface water and groundwater quality samples is deficient at many existing stations. Meaningful statistics cannot be developed for reliable comparison of future water quality due to the limited number of samples. In addition, a few more monitoring wells are necessary north-northwest of the BRSF, southwest of the Arshak pit, and east of the Tigranes-Artavasdes pit to better assess the potential impacts to groundwater.**

The available monitoring plans do not cover the operation and post closure phases.

iv. TOR Question: Which risks, in particular, were not taken into account in terms of environmental security in the ESIA and EIA Reports? What dangers to the environment and to the health of the population may occur as a result of their omission? Are these possible negative consequences recoverable, or not, and if they are, what time frame and what type of financial resources would be necessary?

Response: **Known faults within the Project study area were not considered in the seismic hazards analysis. Movement on the seismically-active PSSF fault system could cause fault slip in the study area, potentially compromising the liner beneath the BRSF and the cover and destabilize the waste rock pile (Zirak Fault beneath BRSF). This fault could conduct ARD-impacted seepage water from the BRSF toward the Kechut Reservoir and/or to the Vorotan River. Fault slip on the Agarakadzor Fault passing through the vicinity of the pits and BRSF could also impact the stability and integrity of the BRSF and pit backfill and cover systems. Ground motion could also impact the stability of the HLF, liner, and cover and inflict damage on the contact water channels, ponds, and PTS, potentially resulting in releases of impacted water to surface water and groundwater.**

The potential significance of fault and fracture flow in the groundwater study area was not considered in the analyses of potential impacts to the environment. Solute transport is many orders-of-magnitude faster in fractures than rock and sediment matrices, with much less attenuation. ARD-impacted groundwater could be rapidly transported to springs, streams, and rivers, potentially impacting community water supplies and livestock grazing activities.

Covers on the BRSF and pit backfill can be restored, if impaired by earthquakes. Breached liners beneath the BRSF and the HLF would be a challenging problem to address, requiring temporary or permanent relocation of the rock and spent ore. A destabilized BRSF and/or pit backfill could result in permanent loss of the non-acid generating VC layer of rock between the cover and the PAG rock. Any exposed PAG rock on pit walls or in the BRSF, HLF, or pit backfill due to earthquakes could impact the environment for hundreds, or possibly on the scale of a thousand or more years.

The concentrations of key constituents in contact water (e.g., iron, aluminum, nitrate, ammonia, and sulfate) are underestimated, which may cause the PTS to fail (unless redesigned or augmented). Such failure may result in the release of contaminants to the environment (surface water and groundwater) at concentrations exceeding RA discharge criteria/MAC standards.

Mitigation measures for the Mine pits are limited to periodic pumping during operation and backfilling and the placement of an ET soil cover post closure. Contingent and supplemental measures are necessary to mitigate ARD impacts on the groundwater quality.

v. *TOR Question: Is there any interaction between Amulsar water basin, the adjacent underground and the surface water, rivers, water reservoirs, Spandaryan-Kechut water reservoir hydro-technical structure and Jermuk mineral water reservoir, or not?*

Response: Groundwater flow and contaminant transport pathways between the Project Area and the Jermuk thermal springs do not exist.

Rivers and tributaries surrounding and within the Project Area are connected to groundwater. Groundwater discharges from the Project Area to springs and rivers. Releases of untreated Mine contact water can contaminate groundwater and can reach and impact surface waters. Groundwater from the Project Area also discharges to the Spandaryan-Kechut tunnel through sections of the tunnel where the walls/joints are leaky (i.e., areas of direct hydraulic connection between the groundwater and the tunnel). Isotopic data suggest most of the discharge of groundwater to the Spandaryan-Kechut tunnel occurs north of the Mine in the Cenozoic basalt, where groundwater is shallowest in the vicinity of the Arpa River and the Kechut Reservoir.

Surface water in reservoirs generally seeps to groundwater. The dam on the Arpa River causes head buildup in the Kechut reservoir and corresponding groundwater mounding, which induces downward and outward hydraulic gradients and flow. Therefore, direct discharge of groundwater to the reservoir does not occur. However, groundwater that discharges to springs, streams, and the Spandaryan-Kechut tunnel will flow into the reservoir.

If a deep aquifer underlies the volcanic rocks in the area, interaction between groundwater in the volcanic rocks of the Project Area and the deep aquifer is unlikely. Groundwater originating in the Project Area by local infiltration of

precipitation discharges to springs and the Arpa, Darb, and Vorotan Rivers and their tributaries.

vi. *TOR Question: Is the data on sulfide compounds in the rock, presented in the ESIA and EIA, calculated correctly, or not, are the control methods of the acid drainage scientifically justified, or not, can they effectively prevent acid drainage water into the environment?*

Response: The acid-generating potential of the rock was calculated incorrectly. The Modified Sobek method was used for acid-base accounting, which determines maximum potential acidity based only on sulfide sulfur. This approach is incorrect because nearly all samples from both pit areas have acidic paste pH values indicative of acidic sulfate salts (e.g., alunite and jarosite), identified in both VC and LV. The analyzed percentage of sulfate should have been included in the AP calculation. The ARD Management Plan ignores the importance of oxidation of ferrous iron (from pyrite oxidation) in generating ARD.

The methods to limit acid mine drainage are scientifically justified, but they cannot completely prevent ARD. Backfilling the mine pits above the level of a pit lake effectively prevents evapoconcentration and most acid generation in the saturated backfill. Water acts as an oxygen ingress barrier because the rate of oxygen diffusion in water is extremely low. Sulfide oxidation potential is eliminated or negligible. Evapotranspiration soil covers should limit infiltration of precipitation and ingress of oxygen to the waste rock in the BRSF and pit backfill. However, infiltration of precipitation during prolonged wet conditions and snowmelt will occur, carrying oxygenated water into the PAG rock. The layer of non-acid generating VC on the BRSF will not deflect infiltration in the PAG rock. The LV PAG rock is not an impermeable pile of fat clay. The LV waste rock will consist of blocks, chunks, and pieces of rock with a range of grain sizes. Pore space between these various rock particles will permit infiltration. Consequently, some ARD may occur. Furthermore, the mine pit walls and bottom will be exposed and will permit seepage of accumulated water into the groundwater.

The design criteria of the clay liner under the BRSF are questionable and raise concerns about the integrity and protectiveness of the liner.

vii. *TOR Question: Depending on the chemical content of the ore, the size and location of the heap leaching facilities, and the plans of the open pit exploitation and subsequent closure of the mine, which areas of the mining site are most likely going to generate acid drainage, in what volumes, and as a result of what type of geochemical processes and changes?*

Response: The largest volume of acid rock drainage will be generated in the Mine pits after closure. Exposed pit walls will remain in all three pits. The volume of ARD will be a function of precipitation and snowmelt running down the walls and through the oxidation rind. Oxidation of pyrite under moist, unsaturated conditions and secondary minerals with stored acidity will release acid and solutes to runoff. Soil covers and sloped surfaces will enhance runoff of unimpacted water from the BRSF, the HLF, and backfill. Net infiltration through these piles will also be limited by evapotranspiration from the soil cover, which

will also limit oxygen ingress. Unlike the BRSF and the HLF, which will have liners beneath the piles to prevent seepage of ARD to groundwater, the ARD from pit runoff will seep to and impact groundwater.

viii. *TOR Question: Can the waters flowing from acid drainage come into contact with surface and ground water systems? If so, how, in what period of time and with what consequences can this potential leakage contaminate surface and underground water systems, including those of Jermuk, Vorotan and Arpa rivers, adjacent tributaries and streams, Spandaryan and Kechut water reservoir hydro-technical structure, Lake Sevan, as well as change the chemical content of water and what consequences will occur as a result of this impact?*

Response: The answer to the previous question addresses impacts to groundwater by ARD. ARD-impacted groundwater becomes surface water at springs, streams, and rivers. Disturbed areas around the mine pits could generate ARD that runs off directly to surface waters. Ephemeral springs in the vicinity of the mine pits are the expression of short groundwater pathways. Seepage of ARD-impacted runoff from the pit walls can discharge within a timeframe of days to months, depending on the connectivity of fractures to the ground surface. Discharge from ephemeral springs during the spring snowmelt is evidence of the rapidity of flow through fractures on the mountain ridge. The time for ARD-impacted seepage to reach perennial springs and streams lower on the mountain sides is conceptually longer, but good connectivity for groundwater flow through faults and fractures could shorten the time commensurate with ephemeral springs at some discharge locations.

Ephemeral and perennial spring waters and groundwater emerging in streams high on the mountain sides can reach the major rivers in a few hours. For example, the Vorotan River is within 3 km of the mountain ridge. Assuming a moderate flow velocity of 0.3 m/sec, the transit time would be 2.8 hours.

The time for ARD-impacted groundwater to discharge at the major rivers is speculative and dependent on fracture connectivity. Data from pumping tests and tracer tests would be needed to estimate the time. Assuming the liner beneath the BRSF and the Toe Pond are effective in containing ARD seepage, impacted groundwater from the Project may not discharge to the Spandaryan-Kechut tunnel. Isotopic data do not support discharge of Amulsar Mountain ridge groundwater to the tunnel. Under the same assumption, the Kechut Reservoir and Lake Sevan would not be impacted.

Under conditions resulting from earthquake impairment of the BRSF, ARD-impacted groundwater could discharge at the northern end of the Spandaryan-Kechut tunnel, resulting in impacts to Kechut Reservoir and potentially Lake Sevan through the Kechut-Sevan tunnel. Likewise, impacted groundwater could discharge to springs and streams at the northern end of the Project area, in turn discharging to Kechut Reservoir. The transit time of this groundwater cannot be estimated with available data. Direct discharge of groundwater to the Kechut reservoir will not occur due to downward vertical hydraulic gradients beneath the reservoir. ARD-impacted groundwater will not reach Jermuk.

Earthquake damage to HLF, process ponds, BRSF liner, and contact water channels could release impacted water to groundwater and potentially directly to the stream in the vicinity of the HLF. A release to the stream would impact the Arpa River within a few hours.

The consequence of ARD releases to surface water and groundwater is loading of the rivers, reservoirs, and lakes with metals and other constituents that may result in exceedance of MAC standards. The extent of loading and change in concentrations is dependent on dilution and potential attenuation during transport. For example, precipitation of ferrihydrite and aluminum hydroxide could attenuate metals through sorption to these phases, as well as iron and aluminum. Statements about the potential extent of impacts to surface water bodies are conjectural without good transport and dilution analyses that are deficient in the ESIA. However, potential mixing of impacted waters, first with the Kechut Reservoir water and then Kechut Reservoir water with Lake Sevan water, would probably not generate significant or even measurable changes in concentrations of Lake Sevan water due to the sequential dilutions in both reservoirs and the size of Lake Sevan. This condition assumes whole lake mixing in Lake Sevan, not local concentrations at the discharge location of the Kechut-Sevan tunnel.

ix. *TOR Question: Has the extent of potential environmental damage, resulting from the exploitation of the mine, as well as the timeframe and cost of the mine's reclamation been properly calculated and subsequently justified in the EIA and the ESIA reports?*

Response: See the response to question xiii regarding environmental damage.

The total cost for Mine rehabilitation and closure and the duration of the post closure monitoring are underestimated as noted below:

- The post closure operation, maintenance & monitoring (OM&M) period is limited to only five years. In the US, Federal and State regulatory requirements and guides for closure (e.g., RCRA 40 CFR Part 264.117; Nevada NAC 445A.446; USEPA, 2000) indicate post closure costs, especially when contamination sources remain, should be calculated for a revolving 30-year period (minimum). Post closure costs should include routine OM&M activities as well as periodic replacement, maintenance and repair actions that will be required after 5 years, which can be significant. The reduced post closure monitoring period and the omission of periodic replacement/repair costs will results in significantly underestimating the post closure costs.

  Increasing the post closure monitoring period from 5 years in the ESIA to the conventional 30-year period, the total Mine rehabilitation and closure cost will increase from approximately \$34M to approximately \$70M (without adjustment for periodic replacement costs or realistic contingency) .

- Contingency (scope and bid) is too low at 6% and underestimates the actual Mine rehabilitation and closure cost. The USEPA (2000) and AACE (2008a; 2008b; 2009) cost estimation guides indicate that at this level of project development (pre-feasibility) and the high degree of uncertainty (*e.g.*, unreliable data and PTS and need for additional studies, *etc.*) the contingency will likely exceed 20%. The Amulsar feasibility study (SGS, 2014 Table 21.5) used 16% for the initial capital phase.

Using a realistic contingency of 20% instead of the ESIA 6%, the total indirect cost percent would increase from 21.3% to 35.3%. Accordingly, the total Mine rehabilitation and closure cost will increase from approximately $34M (for the ESIA 6% contingency and 5-year post closure monitoring period) to approximately $78M (for 20% contingency and 30-year post closure monitoring period) without other adjustments.

- Treatment requirements are likely unrealistic (actual costs are likely higher) due to incorrectly assumed low leachate concentrations and mass loading.
- Technical/professional costs (design/engineering, project management/ administration, and construction management) are underestimated at about 3% of total construction cost. USEPA (2000) indicates these costs are commonly greater than 15% for similar projects. The Amulsar feasibility study (SGS, 2014 Table 21.5) used 10% for the initial capital phase. Using 15% for these services would increase the total rehabilitation and closure cost by an additional amount on the order of $4M to $5M.

x. *TOR Question: Taking into account the location of Amulsar mine, its geographical position, adjacent residential and health resort areas, can the exploitation of the mine with all of its processes of open pit mining, heap leaching and barren rock storage facility, be conclusively considered safe, and if not, what type of environmental damage can this result in?*

Response: The ESIA/EIA assessments are deficient and corresponding conclusions are unreliable. Accordingly, the question of whether exploitation of the ore deposit can conclusively be considered safe cannot be answered. The question about environmental damage is answered in responses to previous questions.

xi. *TOR Question: Do the processes of storing, transportation, use of toxic and dangerous materials, applied in production process, mentioned in ESIA and EIA reports, abide by regulatory requirements and international standards? Is there a proposed plan of action for prevention of leakage and emissions in case of natural disasters, and if so, is this plan scientifically justified and sufficient, or not?*

Response: *Processes of storing, transportation, use of toxic and dangerous materials, applied in production process, mentioned in ESIA and EIA reports, generally abide by regulatory requirements and international standards.*

The Emergency Preparedness and Spill Response Plan (Appendix 8.9 of the ESIA) includes preparing for and responding to overtopping/leak/failure of the solution and water treatment ponds, releases/spills of hazardous materials, and natural disasters such as earthquakes, flooding, and landslides. The document contains practical procedural information, not scientifically justified plans and actions.

River flood risk is extremely low. The contact water ponds have free-board to absorb increased runoff. The ponds were designed based on an updated SWWB that used stochastic analysis to account for a range of precipitation events, and the ponds were designed for a 100-year, 24-hour storm. According to the Nevada Division of Environmental Protection, ponds and diversion systems should be designed to have capacity for the 500-year, 24-hour storm event.

The mining infrastructure sites (buildings/foundations) that were designed based on a seismic hazards analysis are the HLF, BRSF, open pits, crushing plant, and overland conveyor system. See Section 2.1.1.3.2 for further details.

Noteworthy are the following statements in the Emergency Preparedness and Spill Response Plan with respect to each type of event:

- Earthquake, Landslide, Subsidence, Erosion, or Other Geophysical Event:

The Site has been designed to withstand any expected seismic events, and geotechnical testing conducted thoroughly. These measures should reduce the risks due to seismic events or landslip. No additional precautions are expected to be necessary as a result.

- Overtopping of solution/storm event ponds:

There is a low likelihood of such an event except in the most severe / unprecedented storm conditions. Given the volumes involved, it would be considered to be a Level III event.

- Catastrophic Failure of HLF solution ponds:

There is a low likelihood of such an event due to the design measures taken. In the event of such an occurrence, this would be treated as a Level III event

- Cyanide Spill:

All scenarios and potential incidents are to be treated as potential Level III and require specific response procedures as per the Cyanide Management Plan CMP) Ref GEOTEAM-ENV-PLN0221).

Level III is defined as follows:

A major incident beyond the resources of the Project, where there are subsidiary problems to complicate the situation such as fire, explosion, toxic compounds, and threat to life, property and the environment spillages. Assistance may be required from local, regional, and/or national organizations. The media will often be present and politicians at all levels will be requesting action.

xii. *TOR Question: Are the landslides in the surroundings of the Amulsar mining complex included in the ESIA and EIA reports and appendices? Do these reports include scientifically justified calculations and consequences of possible activation of landslides as a result of explosions? If not, what would be the potential and scientifically calculated chances and consequences of landslide activation as a result of explosions, and what* *type of geological damage and hydrological contamination, particularly to Jermuk mineral water basin, might occur?*

Response: Among the ESIA/EIA documents provided for review, there is no documentation of historic landslides surrounding the Amulsar Mine. Potential landslides are addressed in Section 2.4.4 of the EIA in the context of slope stability in the mine pits based on geotechnical data acquired through the exploration drilling program. The assessment is based on rock strength, RQD data, and orientation of discontinuities determined from rock core and includes the likelihood of earthquake-induced rock avalanches, slides, and slumps. The assessment does not pertain to the potential activation and consequences of landslides induced by blasting that would affect the environment and/or communities surrounding the Project. Landslides are mentioned in very few places in the ESIA and EIA. Section 6.8.2 of the ESIA addresses the unlikely risk of landslides contributing additional sediment load to surface waters in the context of soil destabilization due to removal of surface cover and high rainfall or snow melt. The Golder (2013) earthquake hazard assessment includes a Table 3.2 that describes landslide potential in terms of earthquake seismicity, but the report does not address the potential for landslides resulting from blasting. An assessment of potential landslide activation and the consequences is not possible with the available information.

xiii. TOR Question: Do the EIA and ESIA reports and appendices include a comprehensive assessment of the economic and financial damage caused to the human habitat, the air, land and water resources, as a result of the exploitation of the mine? Are these calculations scientifically justified and correct, if not, what is the financial and economic extent of this potential damage?

Response: Section 6 of the EIA addresses the environmental damage assessment. In this assessment, economic loss is calculated according to RA Government Decree 764-N dated May 27, 2015. Potential economic damage is calculated as a function of damage to soil resources, water resources, and the atmosphere. The scope of this 3rd Party Assessment does not include the assessment of natural resources or economic damages; noteworthy is that the assessment excludes a value for damage to water resources based on the assumption that no contamination will occur. On this basis, the assessment of potential damages is unrealistic.

4.2 Biodiversity

i. *TOR Question: Are the assessments presented by Lydian in the ESIA and EIA Reports and in the appendices attached to them sufficient, qualified, scientifically justified and comprehensive, or not; did the conclusions, derive from the reliable and actual data and was the methodology developed for these conclusions comprehensive and reliable?*

Response: The assessments presented in the report were performed by highly qualified scientists; they are generally to be considered suitable and therefore acceptable despite some data deficiencies and over simplification of the conclusions and interpretation of impacts.

Details on data deficiencies

1- The insect baseline assessment is mainly located outside project boundaries and therefore is necessarily lacking proper geographical coverage. In addition, functional ecological approach is missing.

2- The assessment for reptiles is under sized 7 days for 1800 ha and the habitat mapping for keys species is missing.

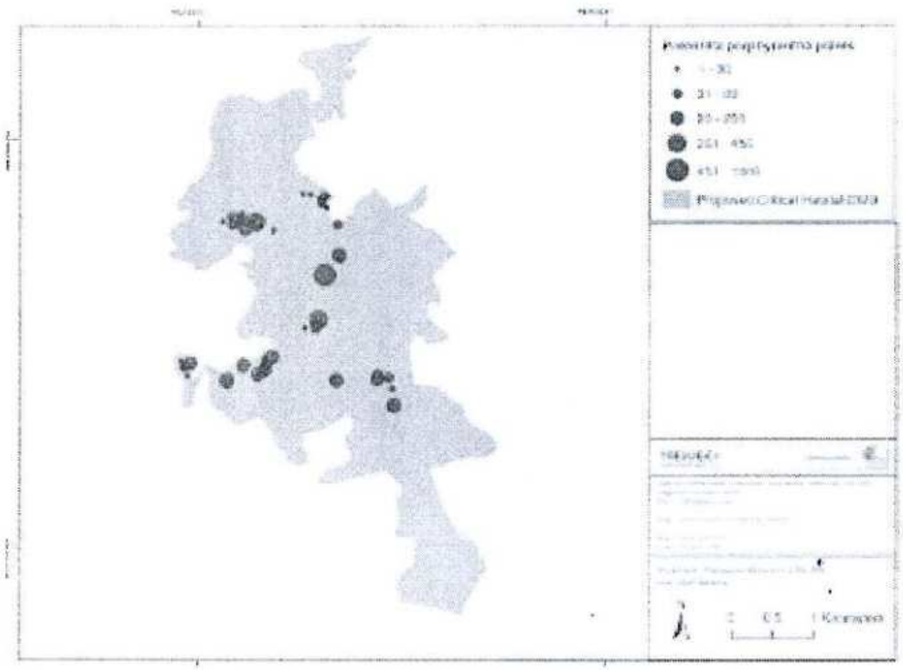
3- Bird assessment is missing the night surveys for *Bubo bubo* and no functional habitat description for priority species.

4- Summer surveys for bats are missing to enable proper evaluation of bat activity and no functional map (hunting areas, transit areas and shelter areas) is included.

5- A clear overestimation and mis-illustration of habitat of *Potentilla porphyrantha* leading to an underestimation of the impact of the project.

The distribution map of *Potentilla porphyrantha* (sampled points) is provided without description or mapping of the critical habitats for this species identified as "subalpine meadow with alpine elements" (in green in the below map) in which the species occurs on suitable rock substrate (see photo).

Figure 4.10.6: Small boulder with 50 plants of *P.porphyrantha*

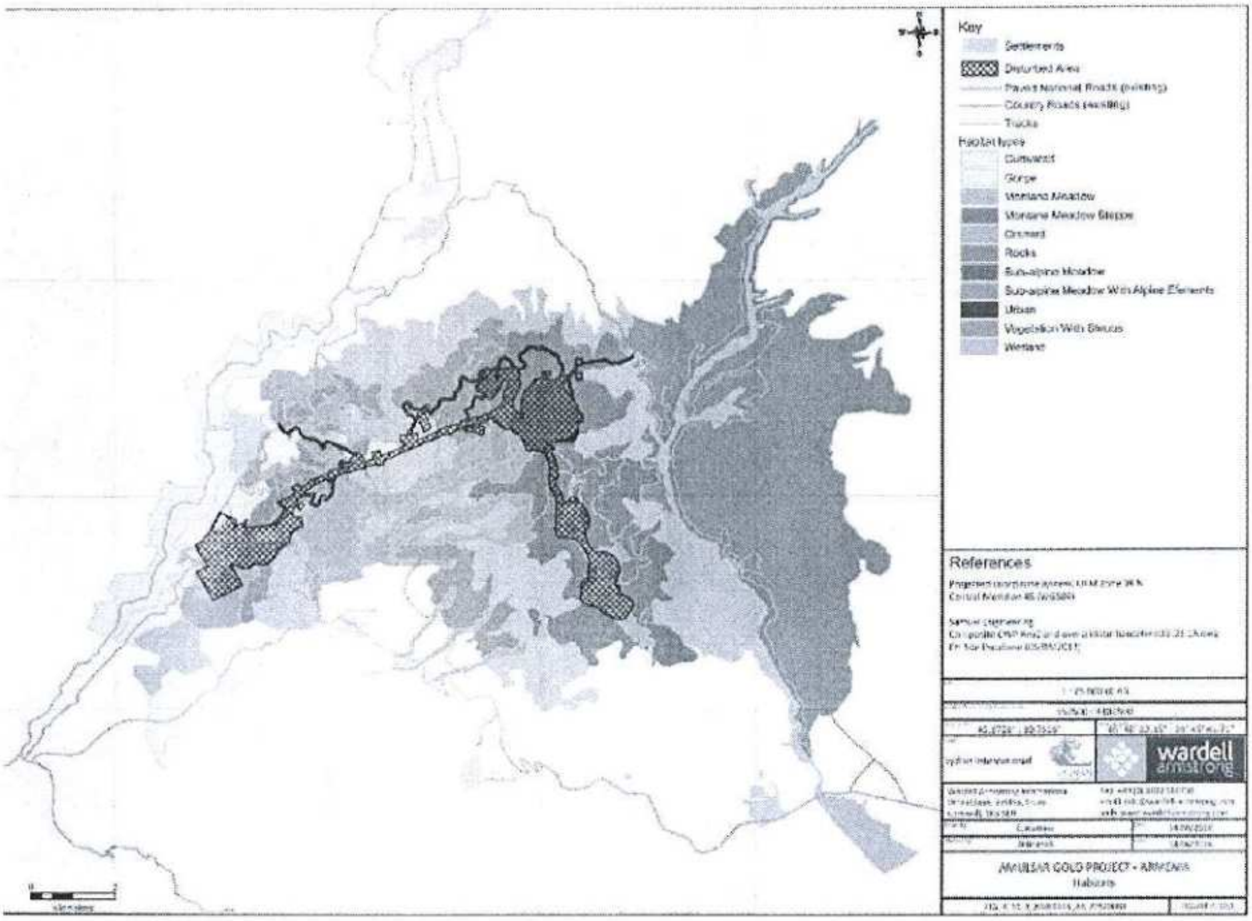


As per the map, the habitat will be heavily impacted by the project. The report states

"The physical footprint of the project on this species is estimated to be on 150.5 hectares (12.5% of the total area of critical habitat)".

This assumes that the species occupies the entire area of critical habitat (1200 hectares) when it occurs only on a subset of the area where suitable habitat occurs. Therefore, 12.5% is an underestimate of the area occupied by this species.

Effort to count of all individuals; a precise map of species habitat would have significantly improved the estimate of project physical footprint and potential mitigation.



ii. TOR Question: Does the monitoring program presented in Lydian's ESIA and EIA, include all necessary components (habitats, flora, fauna) of the environment?

Response: The document presents a clear monitoring program for habitats and key species of high ecological concern for flora and fauna.

The mitigation measures suggested for *Potentilla porphyrantha* are still experimental and should therefore be considered as ongoing accompanying measures instead of mitigation measures. In this configuration, an offset program on *P. porphyrantha* is recommended especially in view of the time laps needed to reach conclusive results in the experiments.

Extracts from the report

« Confirmation of the need for an offset is contingent on a) monitoring results showing more extensive impacts than predicted, with decline in the condition and/or survival of plants in the residual population on Amulsar Mountain; b) research through the BAP failing to improve understanding of the species' ecology and requirements; c) failure to propagate or grow the species successfully ex-situ from seed; d) lack of confidence that suitable conditions can be created post-mining; or e) results of genetic studies suggesting the Amulsar population is genetically distinct or unique".

To our evaluation the need for an offset is required whenever no conclusive demonstration on the absence of residual impact is reached.

iii. TOR Question: Are the arrangements, foreseen by the program sufficient in terms of the set standards, or not?

Response: The report has abided by the Republic of Armenia's legal framework as well as lenders' standards and International Conventions.

However, as presented, the mitigation and offset measures do not enable to convincingly reach the No Net Loss and Net Gain on biodiversity as claimed, and some major impacts have been underestimated to lead to proper mitigation measures and subsequent estimation of residual impacts.

Extracts from the report:

« Although the process of identifying specific offset interventions is not fully complete, the majority of these species is expected to benefit from the Project's natural habitat offset, through "additional conservation actions". These would form part of the Project's adaptive management approach, with further specific offset interventions being identified and implemented for these species and for migratory raptor species of conservation importance, if monitoring showed decline in breeding or feeding activity due to unforeseen Project impacts"

To our understanding, the offset program cannot be in development phase when the ESIA has been finalized. It should not include such broad statements as "majority of the species" and "additional conservation actions".

iv. *Taking into account the location of Amulsar mine, its geographical position, were the impact of activities on biodiversity (ecosystems, habitats and wild species) properly assessed and considered?*

   Response Major ecological stakes and major receptors were adequately identified in the report.

   Improving baseline assessment by adopting functional ecological approach could improve the conclusions.

v. *TOR Question: Do the EIA and ESIA reports and appendices, as well as the plan for mine closure include comprehensive and scientifically justified measures for the preservation or restoration of the fertile topsoil?*

   Response: The measures reported are mainly experimental trials for the preservation and future restoration of the top soil. No conclusive results on suggested future restoration measures are presented, enabling a clear answer to this question.

vi. *Is the conservation status of patrimonial species (endemic, vulnerable, rare) including Potentilla porphyrantha and Acantholimon caryophllaceum and Parnassius appolo among others properly assessed?*

   Response: The conservation status of *Potentilla porphyrantha*, *Acantholimon caryophllaceum* and *Ursus arctos* were properly assessed.

   Other species of importance are lightly addressed throughout the various sections of the report.

   Details

   Some key species (receptors) are missing appropriate mitigation measures and therefore offset program, especially the lesser Kerstrel, the Eastern rock nuthatch and the ursini viper group.

   No exhaustive baseline for insects is provided.

vii. Is the Biodiversity offset program proposed, effective and applicable?

As presented, the BOP can only be partially implemented since suggested actions are not geolocated, nor are they presented in a detailed operational method. The major contribution of the BOP is to finance the Jermuk National Park over 5 years;

4.3 Air Quality

i. Are the assessments presented by Lydian in the ESIA and EIA Reports and in the appendices attached to them sufficient, qualified, scientifically justified and comprehensive, or not; did the conclusions, derive from the reliable and actual data and was the methodology developed for this conclusion comprehensive and reliable?

Response: Most tools used in the assessment are suitable and are consistent with acceptable and standard practices. However, some of the key elements were not assessed in the baseline and their impact was not assessed with a sound methodology. The Raduga model used for the assessment of the boilers and the ADR plant is not appropriate taking into account the site of the project. However, emissions of TSP and PM_{10} from fugitive emissions along with their impact assessment were reliable. Further limitations identified are presented in the response to Question ii.

ii. Were the resultant emissions from the controlled immovable sources calculated correctly, or not; are these scientifically justified and correspond to the regulatory requirements, or not? If they are not, the assessment is to provide what would be the resultant emissions from the controlled immovable sources and what would be the extent of harmful impact on the air, water, biodiversity, land and health of the population?

Response: The immovable sources consist of boilers and the Gold ore processing plant. Boilers emissions were assessed properly. However, their impact was assessed using the Raduga model which is considered not appropriate for this exercise. The impact of the boilers is not expected to be significant but a proper modeling shall demonstrate it. As for the ADR plant, emissions were not estimated correctly: the assessment did not consider Hg and did not present a solid estimation of the emissions for HCN and HCl. These emissions shall be determined by the process and plant manufacturer since these are much dependent on many variables in the process configuration. Afterwards, a proper modeling shall be conducted as for the boilers taking into account the baseline for these pollutants at the receptors' locations in order to set the emission limit values since these do not exist on the national level. Electrical generators are mentioned in the SOP for Air Quality Management and monitoring for the construction phase but these sources are not mentioned in any assessment and it is not clear whether they will be used in the operation phase or not. Abatement techniques for HCN and HCl are well-known and controlled with the alkaline solutions. Emissions following effective control equipment are not expected to be high. Settlements are located relatively far from the plant and emissions are not expected to breach the ambient air quality standards. Mercury emissions are not expected to be high since the content of the soil as indicated in the ESIA is already at most of 0.05 g/t and with the different emissions abatement, air quality

standards are not expected to be breached. The most toxic of these compounds is mercury. WHO states that exposure to mercury – even small amounts – may cause serious health problems, and is a threat to the development of the child in utero and early in life. It may have toxic effects on the nervous, digestive and immune systems, and on lungs, kidneys, skin and eyes. WHO considers Hg as one of the top ten chemicals or groups of chemicals of major public health concern.

iii. *Does the monitoring program, presented in Lydian's ESIA and EIA, include all necessary components (land, air, water, flora, fauna, etc.) of the environment and are the arrangements, foreseen by the program, sufficient in terms of the set standards, or not?*

Response: The environmental monitoring program related to air quality is acceptable but is suggested to be augmented to better monitor and control the sources of pollution and their impacts. These additions mainly relate to the monitoring of stationary sources.

iv. *Are the calculations of the range of dust expansion, as the result of exploitation of the mine complex, as well as the proposed measures for lessening and preventing their harmful impact as suggested in the EIA and ESIA reports scientifically justified?*

Response: Emissions of fugitive dust from the mining activities, namely TSP and PM_{10}, were generally calculated correctly and their impact is negligible on the settlements (from around 1 km and beyond) in line with available international guidance. $PM_{2.5}$ emissions were not estimated and their impact on the settlements was not assessed properly, proper modeling shall be conducted with a proper model that takes into account the complex wind field in the area. The impact is expected to be low on the receptors but needs to be assessed. The mitigation measures are suitable for the project and acceptable. Additional measures were suggested to lower further the impact of dust expansion.

5.0 References

Adamia, S., G. Zakariadze, T. Chkhotua, N. Sadradze, N. Tsereteli, A. Chabukiani, and A. Gventsadze. 2011. Geology of the Caucasus: A Review. Turkish J. Earth Sci., Vol. 20, 2011, pp. 489-544.

Anthony P Clevenger. Treweek Environmental Consultants. Impacts of Amulsar Mine on Armenian Brown Bears and Recommended Mitigation. Treweek Environmental Consultants. September 2016.

Armenian Red Book, 2011.

Association for Advancement of Cost Estimation (AACE). 2008a. AACE International Recommended Practice No. 40R-08. Contingency Estimating: General Principles. June 25, 2008.

Association for Advancement of Cost Estimation (AACE). 2008b. AACE International Recommended Practice No. 41R-08. Risk Analysis and Contingency Determination Using Range Estimating. October 27, 2008.

Association for Advancement of Cost Estimation (AACE). 2009. AACE International Recommended Practice No. 42R-08. Risk Analysis and Contingency Determination Using Parametric Estimating. January 26, 2009.

ASTM D5611-94(2016), Standard Guide for Conducting a Sensitivity Analysis for a Groundwater Flow Model Application, ASTM International, West Conshohocken, PA, 2016, www.astm.org.

ASTM Standard D5744, 2007e1 *(editorial comments made in April 2010)*, Standard Test Method for Laboratory Weathering of Solid Materials Using a Humidity Cell, ASTM International, West Conshohocken, PA, 2007, www.astm.org.

Australian NPI (2006). National Pollutant Inventory, Emission estimation technique manual for Gold ore processing Version 2.0

Australian NPI (2012). National Pollutant Inventory, Emission estimation technique manual for mining version 3.1

Balkani Wildlife Society, Bulgaria. Report on New Circumstances Related to the Environmental and Social Impact Assessment (ESIA) of the Amulsar Gold Project in Armenia: November 2018.

Barr Engineering Co., 2014. NorthMet Project Rock and Overburden Management Plan, Version 6, December 15, 2014. Prepared for Polymet Mining Inc.

Blue Minerals Consultancy, Buka Environmental and Clear coast Consulting. 2018. Amulsar Gold Project: Overview of Concerns with the Amulsar Gold Project, Potential Consequences and Recommendations. January 2018.

Blue Minerals Consultancy. 2017. Evaluation of Lydian Amulsar Gold Mining Project: Assessment of ARD Potential and Effects on Surface Water and Groundwater. June 17, 2017.

Buka Environmental. 2017a. Evaluation of Hydrogeologic Issues Related to Development of the Amulsar Gold Project: Key Assumptions and Facts. Report to H. Bronozian. 19 June 2017.

Buka Environmental. 2017b. Evaluation of Geochemical Characterization Results and Proposed Additional Studies for the Amulsar Project. Memorandum to H. Bronozian. 31 October 2017.

Burton, AC, et al (2018), Density and distribution of a brown bear (Ursus arctos) population within the Caucasus biodiversity hotspot. Journal of Mammalogy 99; Pages: 1249-1260.

Canadian Pits and Quarries Report guide. https://www.canada.ca/en/environment-climate-change/services/national-pollutant-release-inventory/report/pits-quarries-guide.html. Accessed June 2015 and May 2019.

Clear Coast Consulting, Inc. 2017. Review of water treatment at the proposed Amulsar Gold project. Memorandum to H. Bronozian. June 13 2017.

Doherty. 2010. PEST, Model-Independent Parameter Estimation User Manual 5th edition. Watermark Numerical Computing.

EMEP/EEA (2016). EMEP/EEA Air Pollutant Emission Inventory Guidebook. European Environment Agency.

Faure, G. 1986. Principles of Isotope Geology. New York: John Wiley & Sons, 589 p.

Gelden, A.L. 2004. Hydraulic Tests of Miocene Volcanic Rocks at Yucca Mountain and Pahute Mesa and Implications for Groundwater Flow in the Southwest Nevada Volcanic Field, Nevada and California. Geological Society of America Special Paper 381.

Geoteam, 2016b. Amulsar Gold Project, Environmental Monitoring Plan (ESIA Appendix 8.12), V. 6, June 2016.

Geoteam, 2018. Amulsar Gold Project, Environmental Monitoring Plan, V. 9, March 2018.

Geoteam. 2014. Working Design. Amulsar gold-bearing quartzite deposit, RA Vayots Dzor region.

Geoteam. 2015. Amulsar Gold Project – Site 27 Barren Rock Storage Facility Design Report. October 2015.

Geoteam. 2016a. Amulsar Gold Project. Cyanide Management Plan (ESIA Appendix 8.11). V. 5. June 2016.

Geoteam. 2016c. Amulsar Gold Project. Acid Rock Drainage Management Plan Report. Version 3. (ESIA Appendix 8-19). June 2016.

Ghosh, S.K. 2014. Significant changes from ASCE 7-05 to ASCE 7-10, part 1: Seismic design provisions. PCI Journal, Winter 2014.

Golder Associates. 2016b. Preliminary Mine Reclamation, Closure, and Rehabilitation Plan (ESIA Appendix 8-18). June 2016.

Golder Associates. 2013. Earthquake Hazard Assessment and Seismic Parameters, Report No. 1138159713 038 R Rev1.

Golder Associates. 2014a. Amulsar Groundwater Model Report. August 2014, Report No. 14514150095.506/B.2.

Golder Associates. 2014b. Hydrogeological Risk Assessment - Proposed Heap Leach Facility, Report No. 14514150095.509/B.1.

Golder Associates. 2014c. Amulsar Gold Project: Erato Post-Closure Pit Water Balance. July 17, 2014, Report No. 14514150095.503/B.1

Golder Associates. 2014d. Assessment of Groundwater Quality Impacts arising from Pit Development. August 2014, Report No. 14514150095.512/B.O.

Golder Associates. 2014e. Evaluation of Water Quality in the Post-Closure Erato Pit. August 2014, Report No. 1138159714.

Golder Associates. 2014f. Amulsar Gold Project. Estimate of Nitrate and Ammonia Concentrations in Mine water as a Product of Blasting. Technical memorandum, 17 July 2014.

Golder Associates. 2016a. Site-Wide Water Balance, Amulsar Gold Project, April 27, 2016. Report No. 1138159716 001 R01 Rev2.

Golder Associates. 2016c. Technical Memorandum: Climate Data Analysis. August 19, 2016, Document No.: 1138159717 001 TM01 Rev1, 1660086.501.B0.

Golder Associates. 2017. Amulsar Barren Rock Storage Facility Stability Analysis. June 9, 2017. Document No.: 0-00-RPT-CIV-17059.

Golder Associates. 2018. Amulsar Gold Project, Site-Wide Water Balance –Revision 1, August 30, 2018, Report No. 0-00-DTD-CIV-17197 (1660086.546/A.1).

Golder Associates. 2019. Memorandum: Major Ion and Isotope Analysis – 2018/2019. January 29, 2019, Proj. No. 1660086.585_A.2.

GRE. 2014a. Memorandum: Amulsar Pit Backfill Seepage Model. July 7, 2014, Proj. No. 13-1064.

GRE. 2014b. Memorandum: Amulsar BRSF Seepage Model. July 14, 2014, Proj. No. 13-1064.

GRE. 2014c. Amulsar BRSF Runoff Memo. July 10, 2014, Proj. No. 13-1064.

GRE. 2014d. Amulsar Project Geochemical Characterization and Prediction Report – Update. August 31, 2014.

GRE. 2014e. Amulsar Pits Surface Water Quality. July 14, 2014, Proj. No. 13-1064.

GRE. 2014f. Technical Memorandum: Tigranes-Artavasdes Backfill and Arshak Pit Seepage Source Terms. August 7, 2014, Proj. No. 13-1064.

GRE. 2014g. Technical Memorandum: BRSF Seepage Source Term for the Regional GW Model. August 5, 2014, Proj. No. 13-1064. (Appendix C in Golder Associates Response to ESC Audit Comments, 1 September 2017).

GRE. 2017. Amulsar Gold Project. Environmental and Social Management Plan (ESMP), Acid Rock Drainage (ARD) Management Plan. Version 4. October 2017.

GRE. 2018a. Memorandum: Amulsar Kinetic Cells Results Update, Project No. 17-1157.

GRE. 2018b. Technical Memorandum: ARD Block Model. August 31, 2018. Project No. 17-1157.

Grosjean, M., R. Moritz, S. Hovakimyan, R. Melkonyan, A. Ulyanov, and H. Rezeau. 2018. Link between Cenozoic magmatism and porphyry-epithermal systems in the Lesser Caucasus, Armenia: new temporal and geochemical constraints. 21st Congress of the Carpathian Balkan Geological Association, Salzburg, Austria (September 10- 13, 2018).

GRZ. 2011. Findings of geologic exploration at Amulsar Gold Project, RA Vayots Dzor Province in 2007-2010, as of 01.01.2011, with reserve estimation (8 Volumes). Volume 1.

Gusek, J.J., G. Fatore, L.P. Jesselyn, A. Aghajanyan. 2018. Bench-scale nitrate and sulphate biochemical reactor case study: Amulsar Mine, Armenia. Presented at Tailings and Mine Conference '18. Keystone Colorado.

Helsel, D.R. 2005. Nondetects and Data Analysis, Statistics for Censored Environmental Data. Hoboken, NJ: John Wiley & Sons, Inc., 250 p.

Holcombe, R. 2013. Amulsar 3D Geological Model Revision: Summary and Resource Implications. November 2013.

Holcombe, R., T. Coughlin, N. Oliver, M. Demi, H. Aloyan, F. Baker, and A. Turner. 2013. Amulsar, Armenia: An IOCG chameleon? Presentation summary in September 2013.

IAQM (2016). IAQM Guidance on the assessment of dust from demolition and construction v1.1, Institute of Air Quality Management, London. www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf.

International Finance Corporation (2007). Environmental, Health, and Safety Guidelines. Air emissions and Ambient Air Quality.

International Network for Acid Prevention (INAP). 2009. . The Global Acid Rock Drainage (GARD) Guide; www.gardguide.com. Accessed March-May 2019.

Interstate Technology & Regulatory Council (ITRC). 2013. Biochemical Reactors for Mining-Influenced Water. November 2013.

Kappes-Cassidy & Assoc. 2012. Amulsar Project. Metallurgical Test Work Report. March 2012.

Karlsson, T., and P. Kauppila. 2016. Waste Rock Characterization versus the Actual Seepage Water Quality. Proceedings IMWA 2016, Freiberg/Germany | Drebenstedt, Carsten, Paul, Michael (eds.) | Mining Meets Water – Conflicts and Solutions.

Knorr, K.H., C. Blodau. 2007. Controls on schwertmannite transformation rates and products. *Applied Geochem.* 22. 2006-2015.Lydian Armenia. 2018. Amulsar Gold Project. Environmental and Social Management Plan (ESMP): Quarterly Environmental Report – Q1 2018. April 2018.

Lydian Armenia. 2018. Amulsar Gold Project. Environmental and Social Management Plan (ESMP) – Quarterly Environmental Monitoring Report: Q 1- 2018. April 2018.

Lydian Armenia. 22 April 2019. Environmental Impact Assessment – Biodiversity Baseline Chapter 2.8.

Madden, M.E., A.S. Madden, J.D. Rimstidt, S. Zahrai, M.R. Kendall, and M. Miller. 2012. Jarosite dissolution rates and nanoscale mineralogy. *Geochimica Cosmochimica Acta. 91* 306-321.

Maest, A.S., J.R. Kuipers, C.L. Travers, and D.A. Atkins. 2005. Predicting Water Quality at Hardrock Mines: Methods and Models, Uncertainties, and State-of-the-Art.

Melkonyan and Gevorgyan, 2017. Assessment of Change Trends of Key Climate Parameters and Forecast Scenarios. Developed by: Advisers to the Director of Hydrometeorological Service, RA Ministry of Emergency Situations, Yerevan 2017.

Miller. 1998. Predicting Acid Drainage. Groundwork v. 2, p. 8-9.

Mojave Desert (2013). Mojave Desert Air Quality Management District, Antelope Valley Air Pollution Control District, Emissions Inventory Guidance, Mineral Handling and Processing Industries.

Myer, T. 2016. Acid Mine Drainage Risks – A Modeling Approach to Siting Mine Facilities in Northern Minnesota USA. Journal of Hydrology, v. 533, p. 277-290.

National Assembly of the Armenian Republic. The Law of the Republic of Armenia on Environmental Impact Assessment. 20 November 1995.

National Assembly of the Armenian Republic. The Law of the Republic of Armenia on supervision over nature protection. 11 April 2005.

National Assembly of the Armenian Republic. The Law of the Republic of Armenia on Fauna. 03 April 2000.

National Assembly of the Armenian Republic. The Law of the Republic of Armenia on Flora. 23 November 1999.

National Assembly of the Armenian Republic. The Law on Environmental Impact Assessment and Expert Examination. 21 June 2014.

Nevada Division of Environmental Protection: Mining Closure Guidance, Policies, and Applications (https://ndep.nv.gov/land/mining/closure/guidance-policies-and-applications).

Oliver, N.H.S. 2013. "Amulsar, Armenia: Hydrothermal System Appraisal."

Ontario (2009). Air dispersion modeling guidelines for Ontario.

Reuss, J.O. and D.W. Johnson. 1986. *Acid Deposition and the Acidification of Soils and Waters*, Springer-Verlag, New York.

SGS E&S Engineering Solutions Inc. (SGS). 2014. Amulsar Feasibility Study (NI 43-101). Project No. 439-07. Document No. Q439-07-028-01. October 22, 2014.

SNCO (Environmental Monitoring & Information Center) – RA Ministry of Nature Protection. 2019. Monitoring data for 3 surface water monitoring stations (Arpa River, Vorotan River, and Kechut reservoir) and four springs (Spring 529, Spring 650, Spring 2048, and Spring 2060). April 2019.

Snoeyink, V. and D. Jenkins. 1980. *Water Chemistry*, J. Wiley and Sons,

Sovereign Consulting. 2015. Amulsar Passive Treatment System (PTS) - Design Basis. Technical Memorandum. December 9, 2015.

Stahl, R.G., D.S. Fanning, and B.R. James. 1993. Goethite and jarosite precipitation from ferrous sulfate solutions, *Soil Sci. Amer. J. 57*. 280-282.

Standard Methods. 1999. Standard Methods for Examination of Water & Wastewater. American Public Health Association, American Water Works Association, Water Environment Federation.

Stewart, W.A., S.D. Miller, and R. Smart. 2006. Advances in Acid Rock Drainage (ARD) Characterization of Mines Wastes. Paper presented at the 7th International Conference on Acid Rock Drainage (ICARD), March 26-30, 2006, St. Louis, MO. Lexington, KY: American Society of Mining and Reclamation (ASMR), ed. R.I. Barnhisel.

Stumm, W. and J.J. Morgan. 1981. *Aquatic Chemistry, 2nd ed.*, J. Wiley and Sons, New York.

Treeweek Environmental Consultants. Annual Report of Lydian International's Research Project on Potentilla porphyrantha. 08 December 2017.

Treeweek Environmental Consultants. Biodiversity Action Plan for Amulsar, Armenia. 01 March 2017.

Treeweek Environmental Consultants. Half Year Report of Lydian International's Research Potentilla porphyrantha Project. 01 August 2018.

Treeweek Environmental Consultants. Survey of Brown Bear Ursos arctos at Amulsar (Armenia) Interim Report. August 2018.

UK Environment Agency (2011). Technical guidance note M8, Monitoring Ambient Air. Version 2.

United Nations. Convention on biological diversity. 29 December 1993.

United Nations. Convention on the conservation of European wildlife and natural habitats. Chart of signatures and ratifications of Treaty 104. 01 August 2008.

United Nations. Convention on the Conservation of Migratory Species of Wild Animals. 01 March 2011.

US Environmental Protection Agency (EPA). 2016. Aquatic Life Ambient Water Quality Criterion for Selenium - Freshwater (2016). EPA 822-R-16-006. June 2016.

US Environmental Protection Agency (EPA). 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002. July 2000.

US Environmental Protection Agency (EPA). 2002. *Nitrification*. Distribution System Issue Paper, Office of Ground and Surface Water. August 15, 2002. Accessed on-line, May 19, 2019.

US Environmental Protection Agency (EPA). 2014. Reference Guide to Treatment Technologies for Mining-Influenced Water. EPA 542-R-14-001. March 2014.

Vallack, H.M., Shillito, D.E. (1998). Suggested Guidelines for Deposited Ambient Dust; - Atmospheric Environment, vol. 32, (16), 2737 – 2744).

Vithana, C.L., L.A. Sullivan, E.D. Burton, R.T. Bush. 2015. Stability of schwertmannite and jarosite in an acidic landscape. *Geoderma. 239-240.* 47-57.

Wardell Armstrong LLP. 2016. Amulsar Gold Mine Project. Environmental and Social Impact Assessment (ESIA). June 2016.

Wardell Armstrong LLP. 2017. Amulsar Gold Mine. Response to Reports Prepared for Mr. H. Bronozian. August 18, 2017.Welch, S.A., D. Kirste, A.G. Christy, F.R. Beavis and S.G. Beavis. 2008. Jarosite dissolution II – Reaction kinetics, stoichiometry, and acid flux. *Chemical Geology. 254.* 73-86.

Williamson, M.A., C.S Kirby, and J.D. Rimstidt. 2006. Iron dynamics in acid mine drainage. Paper presented at the 7th International Conference on Acid Rock Drainage, March, 2006. Published by the American Society of Mining and Reclamation, pp 2411-2423.

World Health Organization (2000). Air Quality Guidelines for Europe. Second edition.

World Health Organization (2006). Air Quality Guidelines. Global Update 2005.

World Wide Fund for a living planet, Armenia. Feedback on the biodiversity and biodiversity offsets presented in the EIA of the Armenian Amulsar gold mine project and its annexes. 31 January 2018.

Yu, J.Y., B. Huo, J.K. Chou, J.P. Chu, H.W. Chang. 1999. Apparent solubilities of schwertmannite and ferrihydrite in natural stream waters polluted by mine drainage. *Geochimica Cosmochimica Acta. 63.* 3407-3416.

Zhu, C., and G. Anderson. 2002. Environmental Applications of Geochemical Modeling. Cambridge, UK: Cambridge University Press, 284 p.

Appendix A: Amulsar Block Physiographic Map and Geologic Map of Vayots and Faults Alignments