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6.4 Greenhouse Gas Emissions and Climate Change

6.4.1 Introduction

This chapter evaluates and assesses the greenhouse gas (GHG) emissions attributable to the construction, operation, and closure of the Amulsar Project, and the potential effects climate change could have on the Project (such as temperature and precipitation changes). This chapter has been structured as follows:

- Section 6.4.2 assesses the GHG emissions, including the potential impacts, proposed mitigation measures and residual impacts;
- Section 6.4.3 presents an overview of the carbon management plan for the project; and
- Section 6.4.4 assesses the climate change projections that may affect the Project, and how these may impact the Project.

The chapter has been prepared in accordance to the International Finance Corporation (IFC) 2012 Performance Standards[1] (PSs) and EBRD 2014 Performance Requirements[2] (PRs), as well other relevant best practices which are referenced at the appropriate parts of this chapter (see Table 6.4.1).

[1] International Finance Corporation (IFC). 2012. IFC Performance Standards on Environmental and Social Sustainability. January 2012.
[2] European Bank for Reconstruction and Development (EBRD). Environmental and Social Policy, 2014

Table 6.4.1: IFC Performance Standards and EBRD Performance Requirements Key Relevant Requirements	
Greenhouse Gases	**Climate Change**
PS1 and PR 1 require that the risks and impacts identification process evaluates emissions of GHG.	**PS 1 and PR 1** require that the risks and impacts identification process considers the relevant risks associated with a changing climate and the adaptation opportunities.
PS 3 and PR 3 require consideration of measures for improving efficiency in consumption of energy, water, as well as other resources and material inputs. Also, options should be considered to reduce project-related GHG emissions during the design and operation of the project. For projects producing >25,000 tonnes of carbon dioxide equivalent (tCO_2e) per year, the direct GHG emissions within the physical project boundary and indirect emissions associated with offsite production of energy (i.e. purchased electricity) should be quantified in accordance to internationally recognized methodologies (i.e. IPCC) and EBRD Methodology for Assessment of Greenhouse Gas Emissions.	**PS 4 and PR 1** require that projects should take into account the fact that communities that are already subjected to impacts from climate change may also experience an acceleration and/or intensification of impacts from project activities since climate change effects may exacerbate their vulnerability; and projects must identify and mitigate risks and potential impacts on priority ecosystem services that may be exacerbated by climate change.

6.4.2 Greenhouse Gas Emissions

Scope of Assessment

Greenhouse gas (GHG) emissions have been calculated for the project based on both an annual and cumulative basis. The calculations have assessed the net gain in GHG emissions attributable to the Amulsar Project, acknowledging that it is a greenfield Project and therefore the Project will generate new GHG emissions. The emissions have been calculated using standard methodologies as defined by the Greenhouse Gas Protocol[3].

The Greenhouse Gas Protocol divides emissions into three categories as follows and illustrated in Figure 6.4.1:

- Scope 1 – direct emissions: from sources owned or under the operational control of the company or project;
- Scope 2 – indirect emissions: from the consumption of purchased electricity from the grid; and
- Scope 3 – indirect emissions: an optional reporting category allowing for other indirect

[3] World Business Council for Sustainable Development (WBCSD), World Resource Institute (WRI). 2004. GHG Protocol: Corporate Accounting and Reporting Standard. 2004

emissions associated with but not controlled by the company to be included, such as contractor activities.

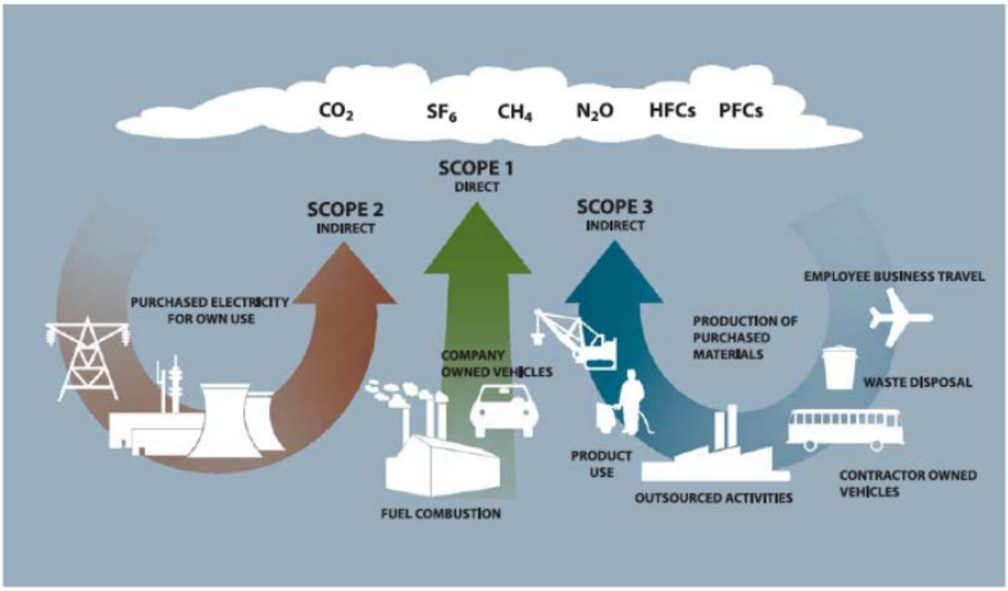

Figure 6.4.1: GHG Emissions Boundary (Source: Greenhouse Gas Protocol)

Consistent with the requirements of the IFC Performance Standards, the scope of emissions that have been assessed for the Amulsar Project are within scopes 1 and 2.

Project Activities Giving Rise to GHG Emissions

Potential GHG emissions arising from the Project will occur during exploration, construction, operations, and decommissioning phases of the project as follows:

- Exploration phase emissions are associated with project activities and air travel to date and will be reported in the Carbon and Energy Management Plan (see Table 6.4.7);
- During the construction phase of the project, Scope 1 emissions from GHGs will be emitted from the following activities:
  - Clearing of vegetation (land use change) for mine pits and construction of project facilities (land use change is applied to the life of the mine as the construction of new elements of the mine are undertaken through its operational life);
  - Construction vehicles and equipment for construction of mine facilities;
  - Fuel use from diesel generators for construction activities and a worker accommodation camp that would accommodate 500-920 employees;

  - Blasting as part of the construction works;
- During construction, Scope 2 indirect emissions will arise from electricity that is sourced from the Armenian grid for temporary housing in hotels in Jermuk. The accommodation requirements for workers during the construction period has been defined in Appendix 8.25 (Workers Accommodation Management Plan) and will result in Scope 1 (direct) and Scope 2 (indirect) emissions. Grid electricity will also be used for ancillary equipment and processing facilities starting in the seventh month of construction;
- During operations, GHG will arise from both Scope 1 (direct) and Scope 2 (indirect) sources including:
  - On-road vehicles for hauling of ore and barren material;
  - Non-road vehicles for mining of ore;
  - Explosives for blasting;
  - Scope 2 indirect emissions will come from the electricity that is sourced from the Armenian grid for equipment, ancillary facilities, and the hotel accommodation; it is expected that all other employees would be commuting from their homes to the Project site and these emissions have not been taken into account;
  - Activities from the closure of the mine will also contribute to GHG emissions. These activities include the use of on-road and non-road vehicles for the removal and dismantling of ancillary mine facilities, and reclamation of the open pits and waste facilities.

Construction GHG Emissions

GHG emissions will be emitted from clearing of land, and use of both on-road and non-road vehicles for the construction of mine facilities. The Project disturbed area covers approximately 930 hectares of land. The footprint of land disturbed was determined by conducting a vegetative analysis using GIS shape files of the project footprint, therefore the land use types would differ from the cadastre/GIS analysis. This land can be characterized by type as shown in Table 6.4.2.

Table 6.4.2: Summary of Land Use types	
Land Type	**Affected area**
	ha
Scrub	14
Agriculture	138
Pasture[i]	684
Bare Ground	94
Wetlands	0
Settlement	0
Total	**930**
Notes: i. Includes totals for shadow, cloud, and Ice/snow	

The mine facilities will be constructed over a two year period where on-road vehicles such as diesel powered trucks and non-road vehicles such as bulldozers, loading shovels and haul trucks will be used throughout the construction phase. It is estimated that the construction period will consume 14.7 million litres of diesel fuel including power generators and the transportation of employees from the temporary construction camp site and surrounding hotels to the mine.

Additionally, emissions from ammonium nitrate/fuel oil (ANFO) blasting agent will contribute to direct operating GHG emissions. The amount of ANFO used for construction is estimated to be approximately 1.4 million kg of blasting agent.

The use of electricity from the Armenian grid (mainly nuclear power and hydroelectric dams) for the lighting, heating, and operations of the temporary construction camp, offices for employees, and other construction activities will contribute to GHG emissions, however will be minimal. During construction, approximately 22,070MWh of electricity would be used. Diesel generators would be operational as the main power source for the first seven months, and as supplementary power to the Armenian electric grid for the rest of the construction. Additionally, there will be transportation for workers from their accommodation to the site.

The estimated GHG emissions for the entire duration of the construction phase amount to 63,412 metric tonnes of carbon dioxide equivalent (tCO_2e) which are summarized in Table 6.4.3 below. This equates to 31,706 tCO_2e on average for each year of the construction period.

Table 6.4.3: Summary of GHG emission from Construction Phase				
Source	**CO_2**	**CH_4**	**N_2O**	**CO_2e(iii)**
	tonnes	**tonnes**	**tonnes**	**tonnes**
Land Use(i)	14,238	-	-	14,238
Fuel Use (ii)	37992	2	2	38338
Electricity(iv)	10,438	0	0	10,439
Blasting	241	0	0	397
Total	**62909**	**3**	**1**	**63412**

Notes:
(i) Calculated based on IPCC National Inventory Methodology, Volume 4, Chapter 2
(ii) CO_2, CH_4, N_2O emissions were estimated based on The Climate Registry Reporting Protocol Table 12.5, 13.3, 13.6
(iii) CO_2e emissions were estimated based on a global warming potential of 1, 25, and 298 for CO_2, CH_4, and N_2O, respectively (40 CFR Part 98, Subpart C).
(iv) Calculated based on grid emission factor for the Electricity System of the Republic of Armenia for 2012 (UNDP-GEF, 2014)

Operational GHG Emissions

The calculated annual GHG emissions for the operation of the mine are presented in Table 6.4.3 and were based upon the following:

- Direct emissions from use of on-road and non-road vehicles, and explosives which will be emitted during the operational phase of the project. On-road vehicles such as haul trucks will be used to transport ore and barren material. Over the lifetime of the project, ore will be transported from Tigranes and Artavazdes deposits initially; closer to the completion of these two pits, mining will begin in Erato. Ore mined from the open pits will be transported to the two-stage processing facility plant by diesel haul trucks. Additionally, barren rock from the open pit will be hauled to the Barren Rock Storage Facility (BRSF), and trucks will also be operating at the Heap Leach Facility (HLF). GHG emissions from use of on-road and non-road vehicles will vary each year the mine is under operation based upon the final mining sequence. For the purposes of this chapter, given this potential variation, which will only be resolved once operations commence, a conservative approach has been adopted by using the estimated highest volume of fuel required.
- The use of diesel fuel to transport employees from hotel accommodations to the site. It was estimated that five buses and 30 passenger vehicles will be utilized for transportation each day. Transportation services would be available 365 days per year.
- Additionally, emissions from ANFO blasting agent and Emulsion explosives will contribute to direct operating GHG emissions. The amount of ANFO and emulsion

explosives used will vary each year the mine is under operation. For the purpose of this chapter, given this potential variation, a conservative approach has been adopted by using the highest amount of ANFO required. Approximately 8.2 million kg of ANFO and 975,000 kg of Emulsion explosives are estimated to be used per year.

- Indirect GHG emissions will arise from electricity generation needed to power equipment, ancillary facilities, processes, and the hotel accommodations for employees. Electricity will be sourced from the national Armenian grid. It is estimated that the project facilities will use 49,636 MWh of electricity per year from the Armenian grid. The grid emission factor used in this analysis is 0.473 tCO_2/MWh, which has been adjusted for operating margin[4] for 2013[5]. Since the conveyor will have an installed capacity of approximately 3MW, and would be generating electricity during operations due to its downhill run, electricity generated has been accounted for as regenerative energy. This has been accounted for in the total electricity consumption.

Table 6.4.4: Summary of Annual GHG Emissions from the Operational Phase

Source	CO_2	CH_4	N_2O	CO_2e
	Tonnes/year	Tonnes/year	Tonnes/year	Tonnes/year
Direct Emissions				
All vehicles and equipment – fuel use[(i)]	65,532	4	2	66,132
Blasting – use of explosives[(ii)]	1,565	3	3	2,576
Indirect Emissions				
Electricity[(iii)]	23,478	0	0	23,478
Total	**90,575**	**7**	**5**	**92,186**

Notes:
(i) See Table 1 and 2 in Appendix 6.4.1 for detailed table of GHG emissions due to fuel use
(ii) See Table 3 in Appendix 6.4.1 for detailed table of GHG emissions due to explosives
(iii) See Table 4 in Appendix 6.4.1 for detailed table of GHG emissions due to electricity

As shown in Table 6.4.4, fuel use in vehicles and equipment is the main source of operational GHG emissions, followed by electricity use. Figure 6.4.2 and Figure 6.4.3 show a further breakdown of GHG emissions by activity for fuel use and electricity respectively.

4 Operating margin is the concept where the effect of the project to the grid (e.g., drawing of electricity from the grid) is responded to by the operation of the grid.
5 United Nations Development Programme (UNDP). 2014. Calculation of Grid Emission Factor for the Electricity System of the Republic of Armenia for 2012. January 2014. Ministry of Nature Protection of the Republic of Armenia.

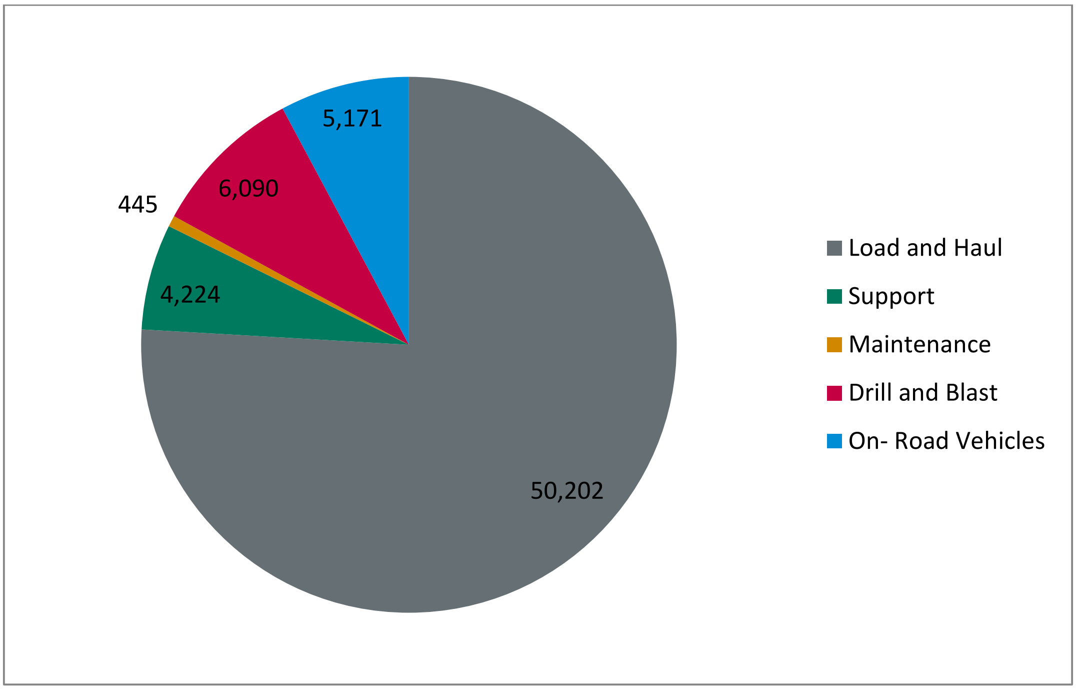

Figure 6.4.2: GHG Emissions from Fuel Use (in tCO_2e/year)

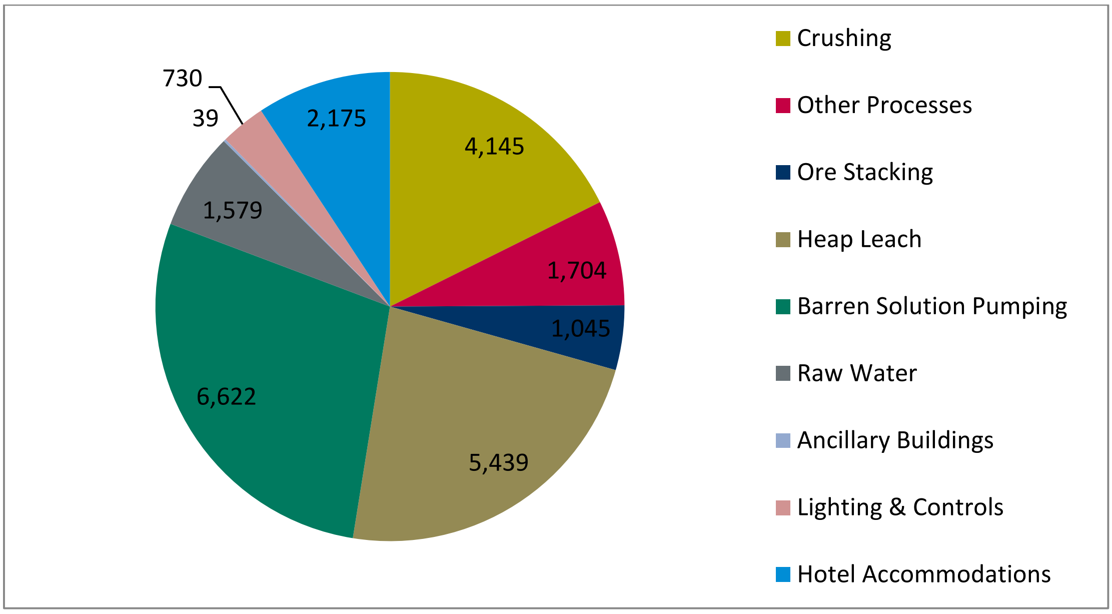

Figure 6.4.3: GHG Emissions from Electricity (in tCO_2e/year)

Mine Closure and Decommissioning

For the purposes of this assessment, it is assumed that the GHG emissions for decommissioning of the mine upon closure are the same as for construction in terms of fuel consumption. This equates to 3,025 tCO_2e on average for each year of the construction period. Land use change associated with re-vegetation as part of the mine rehabilitation plan, which would provide a carbon sink, has not been included in the calculations. Emissions associated with mine closure are estimated to be as summarized in Table 6.4.5.

Table 6.4.5: Summary of GHG emission from Closure and Decommissioning Phase				
Source	**CO_2**	**CH_4**	**N_2O**	**CO_2e[(ii)]**
	tonnes	**tonnes**	**tonnes**	**tonnes**
Fuel[(i)] Use	1,541	0.09	0.04	1,555
Electricity	4,495	-	-	4,495
Total	6,036	0.1	0	6,050

Notes:
(i) CO_2, CH_4, N_2O emissions were estimated based on The Climate Registry Reporting Protocol Table 12.5, 13.3, 13.6
(ii) CO2e emissions were estimated based on a global warming potential of 1, 25, and 298 for CO_2, CH_4, and N_2O, respectively (40 CFR Part 98, Subpart C).

Following rehabilitation, there will be the potential for carbon sequestration through plant growth and capture into soil biomass and organic matter. However, for the purpose of this assessment, in the early years post closure, it has been assumed that carbon sequestration will be minimal and not sufficient to calculate an offset of the carbon emissions associated with the heavy plant and equipment required for closure and rehabilitation (see Table 6.4.5).

Cumulative Emissions

The profile of emissions from the mine during its full life-cycle is presented in Figure 6.4.4. This shows the relative difference in annual emissions for the different project stages, and also the cumulative GHG emissions of 990,332metric tonnes of CO_2e for the life-time of the mine.

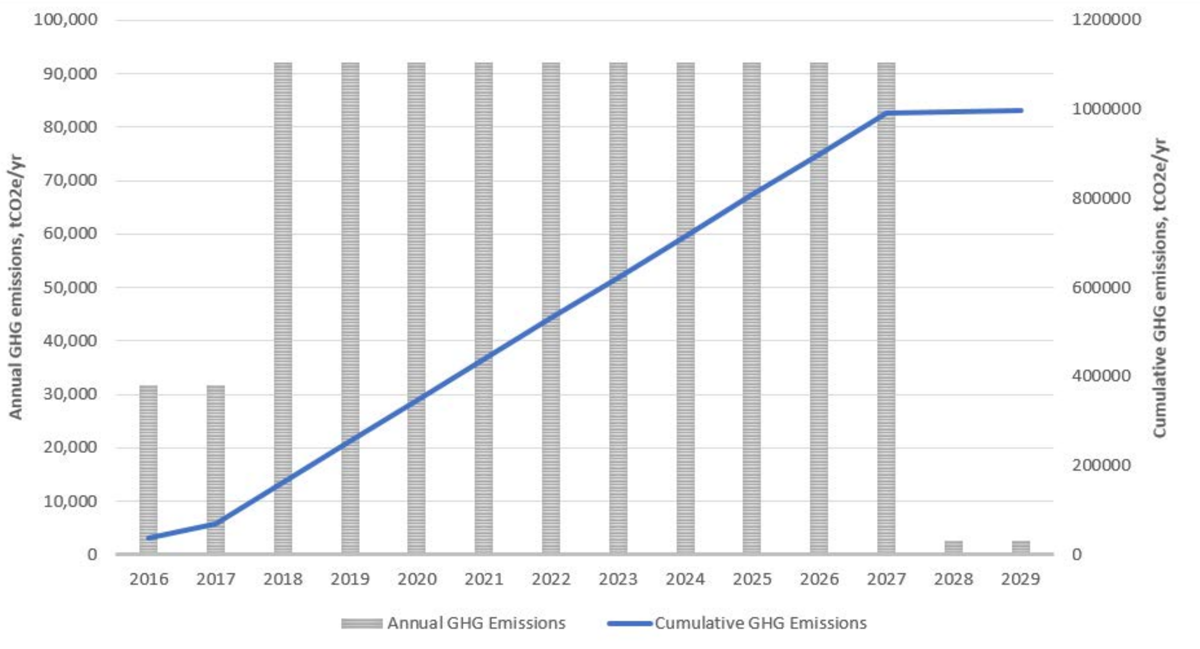

Figure 6.4.4: Cumulative GHG Emissions

GHG Mitigation Measures

Section 6.4.2 has identified the main sources of GHG emissions associated with the project, namely due to fuel combustion and electricity usage. GHG emissions have already been reduced through the design of the Project as follows:

- Minimizing the land clearance for project facilities;
- Selection of long overland conveyor transport over truck haulage of ore from the crusher to the heap leach facility (HLF);
- Regeneration capacity of electricity from the conveyer;
- Reduced the distance haul trucks travel to the BRSF by moving it closer to the open pits;
- Deployment of electric wheel motors for trucks which are more efficient while loaded and travelling downhill;
- Provide insulation for buildings to minimize heat losses;
- The use of modern, energy efficient electrical equipment and mobile plant with fuel-efficient engines;
- All new mobile plant to be fitted with remote sensed fleet management software to manage utilisation, condition, maintenance and efficiency of use within each area of mining activity;
- Process plant will be fitted with performance management software, providing continuous data on fuel consumption, efficiency of use and alert to maintenance and breakdown.
- Use of electricity for heating ancillary buildings and accommodation instead of natural gas as Armenia's electricity is primarily generated from gas fired nuclear power, hydroelectric generation and gas fired power generation.

GHG mitigation opportunities are also being explored further as the project design is advanced and operational activities are further developed. These include:

- Consideration of the use of biofuel (i.e. biodiesel) in non-road equipment. This approach requires further understanding of the opportunity to source a reliable and secure source of biodiesel, and will also require an assessment of the life-cycle emissions to ensure the source of the biodiesel is not compromising overall GHG emissions (this is particularly true when considering potential land use implication of biodiesel). At the time of writing, such sources of blended diesel fuels are not available in Armenia, however the Project will continue to monitor potential options;

- Consideration of energy efficient technology such as CFLs or LEDs for lighting if available in Armenia which are more energy efficient than incandescent light bulbs. Additionally, consideration for motion sensor lighting in ancillary building to further provide energy savings;
- Scheduling of excavation and haulage activities to optimize activities and avoid double handling, where this is operationally practical. As the mine logistics and scheduling are progressed, consideration will be given to optimizing vehicle and equipment movements so as to minimize operational distances and times. As shown in Figure 6.4.2, a particular focus on the excavation and haulage activities is merited due to their large GHG contribution;
- Consideration of alternative heat sources such as waste oil burners, ground and air source heat pumps for heating (and cooling) in buildings;
- The detailed design process will also ensure that other energy-intensive uses such as the crusher plant are analysed further for energy efficiency opportunities;
- Should incineration of non-hazardous and hazardous waste be developed for the Project, the potential for heat recovery to supplement space heating will be included in the design criteria; and
- As identified previously, the Armenian national power grid is supplied primarily by nuclear power plants and hydropower followed by gas fired thermal. The Project has investigated the potential to purchase "green" energy (specifically, hydropower from a nearby hydroelectric plant) to supply the Project. However, the plant supplies electricity to the grid and the Armenian grid cannot currently differentiate energy sources when purchasing electricity. Green energy contributions to the national grid are expected to increase in the near-term with the commissioning of the Iran-Armenia Wind Farm and the Jermaghbyur Geothermal Power Plant. This trend is expected to result in indirectly decreasing the Project's GHG emissions. Lydian will continue to monitor and support renewable energy sources in Armenia; any change to the potential for renewable energy supply would be reported in the annual report required by the Carbon and Energy Management Plan (see Table 6.4.7).

Residual Impacts due to GHG Emissions

The Project will continue to seek to reduce its GHG emissions throughout its lifecycle. Further guidance will be provided in the Carbon and Energy Management Plan, which will be prepared prior to commencement of construction activities, when the design has been finalized and reported annually for the duration of operations. The plan will also report the annual emissions, back-dated to the commencement of exploration at the Project. Table 6.4.6 presents a summary of the anticipated GHG impacts and planned mitigation measures. It is acknowledged that whilst the main impact associated with GHG emissions is their contribution to climate change, the Amulsar Project is one of a myriad of human sources impacting the emissions of GHGs and contributing to climate change, and projected changes in local, regional, and global climate cannot be attributed in isolation to the proposed Project.

Table 6.4.6: Impact Summary – GHG Emissions

Impact	Source	Primary Receptor (1)	Phase (2)		Significance (3)		Mitigation Measures	Management Plan (4)
			C	O	ST	LT		
Greenhouse Gas Emissions	Offsite power generation, onsite mobile plant and heating plant emissions	A	X	X	N	M -	• Energy efficiency measures incorporated into engineering design. • Require use of modern, energy-efficient mobile plant. • Fleet management software for continuous management of utilisation, efficiency, condition and maintenance requirements for mobile and static plant used in mining operations. • Implement logistics management of haulage and excavation activities to avoid idling and double-handling. • Perform regular maintenance on mobile plant. • Seek additional opportunities for GHG emissions reduction throughout Project lifecycle, including consideration of renewable energy opportunities, if it is supplied as a separate generation source through the Grid. • During detailed design, energy-intensive uses such as the crusher plant will be assessed for energy efficiency opportunities.	Carbon and Energy Management Plan (see Appendix 8.24)

Notes:
(1) Primary Receptors:
(2) Project Phase: C = Construction, O = Operations, E = employees
(3) Expected Significance Rankings: ST = short-term with mitigation, LT = long-term with mitigation, R = residents, Fl = flora, Fa = fauna, A = atmosphere, S + = significantly improved, S - = significantly adverse, M - = moderately adverse, N = neutral, M + = moderately improved
(4) The Carbon and Energy Management Plan will be prepared during 2015, with annual emissions back calculated to the start of explanation phase at the Project.

6.4.3 Carbon and Energy Management Plan

A summary of the Carbon and Energy Management Plan is presented in Table 6.4.7.

Table 6.4.7: Carbon and Energy Management Plan		
Carbon & Energy Management Plan		
Monitoring approach	Baseline	Develop a greenhouse gas emissions monitoring programme in order to establish baseline data from key sources and within key locations of the Project area. Establishing baseline data will assist in capturing any unnecessary and potentially detrimental releases as the project progresses over time. The baseline will be based on all emission from the onset of the exploration programme. The emissions inventory will be published annually, commencing prior to commencement of construction activities of the mine, when design has been finalized. This should include GHG emissions from commencement of exploration activities. The first annual monitoring report (April, 2016) has been reported in Appendix 8.24.
Level 3 SOPs	The level 3 plans will include the following: • Develop a GHG database – energy and emissions data will be collected upon commencement of work to determine baseline factors. As the Project progresses, emissions data will be collected at regular intervals to ensure environmental outputs are continuously monitored and mitigated when possible. • Fleet management - all vehicles are to be maintained as is recommended by the manufacturer in order to decrease emissions and maximize the efficiency and longevity of the equipment. • Fleet management software – all new vehicle and static plant to be fitted with remote data capture of fuel use, efficiency of operation, plant condition and requirements for maintenance. • Vehicle Usage - guidelines will be in place for the length of time vehicles may remain idle, particularly as temperatures increase. The use of energy efficient practices such as reducing idling of equipment and maintaining construction equipment and vehicles according with manufacturer's recommendations will be conducted. This will also be supported by logistics considerations to ensure no double-handling of ore, especially of more GHG-intensive activities such as excavation and haulage. • Electricity usage management - throughout the course of the Project electricity usage is to be tracked to manage the use of electricity utilized to power project equipment. Consider the use of renewable energies to power some or all Project facilities (such as small scale wind or solar for ancillary or office buildings and ground/air source heat pumps for heating/cooling in buildings) as well as recognizing the potential to purchase green electricity from the local grid. Monitor any impacts the Project may have on the electricity availability and usage of neighbouring communities and work sites. • Continual monitoring of mitigation opportunities - as the Project progresses, potential mitigation strategies will be continually monitored. New opportunities will be identified as a component of this Plan.	

6.4.4 Climate Change and Adaptation

This section considers the relevant risks associated with a changing climate and the adaptation opportunities associated with the Project.

Historical Climate Trends

Between 1895 and 2010, the annual average temperature has increased globally. Since 1935[6], the air temperature in Armenia has increased by 0.85°C, annual precipitation has decreased by 6%, and during the summer, the average air temperature has increased by 1°C while no increases were recorded in the winter. Frequent droughts have been observed in Armenia since 1990. According to the Second National Communication on Climate Change, droughts and increased aggravated southern winds have been observed in Syunik and Vayots Dzor, the two provinces in which the Project is located, in the last ten years.

Climate Change Projections

In order to assess climate change impacts on the Project, projections for how the climate may change in the vicinity of the Project need to be determined.

Global Level

The Intergovernmental Panel on Climate Change (IPCC) is an intergovernmental scientific body tasked with evaluating the science of climate change. The IPCC publishes reports relevant to the implementation of the UN Framework Convention on Climate Change (UNFCCC) to provide the international community with authoritative assessments on which to base response strategies. The latest of these is the 5th Assessment Report on Climate Change (AR5), published in 2014.

Future climate change projections are made through the construction and use of global climate models (GCMs), which distil key physical and dynamical processes of the climate systems into equations and algorithms. GCMs are getting more and more sophisticated over time and they are validated by testing their ability to recreate the observed climate record. GCMs typically have a large resolution in the range 100-300km, which restricts their use at more regional and local levels.

According to IPCC global climate models, the average annual temperature in the region of the

[6] Republic of Armenia, Ministry of Nature Protection. 2010. The Second National Communication on Climate Change. Yerevan. 2010

Project is predicted to increase by between 0 and 2.3°C above the baseline of 1960-1990 by 2030. As a result, seasonal changes would be observed such as earlier spring season and a longer and hotter summer.

Local Level

The projections simulated by global climate models are often simulated at space scales too coarse for direct use in impact studies at regional scale or smaller. Downscaled climate change projections have been prepared for Armenia, and these have been recognized by the national government though the Ministry of Nature Protection, as presented in the Second National Communication on Climate Change, dated February 2010.

Downscaled climate change projections for Armenia with a 25-km spatial resolution are available, corresponding to the SRESA2 (A2) and SRESB2 (B2) greenhouse gas (GHG) emissions scenarios[7] and for three time periods of 2011-2030, 2031-2070, and 2071-2100. Further discussion on long term climate trends in Armenia through 2070 is presented in Chapter 4.2.5. Taking the 2011-2030 projections, which best align with the Project timeframe, and using the more conservative A2 (high emissions) emission scenario results, the following projected changes have been used for this assessment:

- Annual temperature is expected to increase by 1°C by the year 2030;
- Summer months will experience higher temperature increases (up to 2°C) compared to winter;
- Annual precipitation is expected to decrease by 7%, although precipitation in the winter will be abundant; and
- These climate change forecasts will lead to decreased water flow by approximately 7%, reduced precipitation from snow (between 7-11%), and will accelerate the desertification process.

[7] To account for the fact that future climate change will be impacted by emissions of GHGs which we have yet to emit, the evolution of which is highly uncertain, the IPCC published a special report on emissions scenarios (SRES) which developed a set of emission scenarios for use in GCMs. SRES scenario A1 assumes rapid economic growth, low population growth and rapid introduction of new more efficient technologies. The A1 scenario has 3 alternative future energy use storylines: fossil fuel intensive A1FI, the non-fossil fuel (nuclear and renewable) A1T, and A1B which is a balance between the two. The SRES A2 scenario assumes a very heterogeneous world, fertility patterns across regions converge very slowly, which results in high population growth. Economic development is primarily regionally oriented and per capita economic growth and technological change is more fragmented and slower. The SRES B1 scenario assumes a convergent world with low population growth. Rapid changes toward a service / information economy. Reductions in material intensity, and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to sustainability. And the SRES B2 scenario has emphasis on local solutions to development and sustainability. Moderate population growth, intermediate economic development, and less rapid and more diverse technological change.

Impacts of Climate Change

The construction phase of the mine is planned to commence with early phase works in Q2 of 2016 and will continue for 2 years. Climate conditions during the 2 year construction period would not be expected to be different from current conditions even under the more conservative (A2) model scenario.

The mine is expected to be operational for 10 years after construction. During this period, the above projections show that annual temperature is expected to increase and precipitation will decrease. These projected changes are deemed to be within the proposed design and operational tolerances of the Project, and therefore no material impacts on the Project are predicted.

As the Project progresses into detailed design, these climate projections will be fully considered. In particular, issues such as the final water balance, the biodiversity (sensitivity of *Potentilla porphyrantha* and the Sub-alpine vegetation) and closure planning and restoration will be considered. Table 6.4.8 presents a summary of the anticipated climate change impacts and planned mitigation measures. This is further addressed in the cumulative impact assessment in Chapter 7.

Table 6.4.8: Impact Summary – Climate Change								
Impact	**Source**	**Primary Receptor (1)**	**Phase (2)**		**Significance (3)**		**Mitigation Measures**	**Management Plan**
			C	**O**	**ST**	**LT**		
Change in Climate	Based on projections from the Armenian Government	Project *(note this assessment is impacts to the Project from a changing climate)*	X	X	N	N	• Tolerance to changes already built into the design and operation proposals. • No specific mitigation measures required, however a review detailed design stage will include a thorough integration of the climate projections.	Annual reporting required by the Carbon and Energy Management Plan Appendix 8.24)

Notes:
(1) Primary Receptors:
(2) Project Phase: C = Construction, O = Operations, E = employees
(3) Expected Significance Rankings: ST = short-term with mitigation, LT = long-term with mitigation, VH = very high, MA = major, M - = moderate, Mi = minor, N = negligible