

## APPENDIX 6.20.1 ECOSYSTEM SERVICES

<b>Appendix 6.20.1: Table 1 Ecosystem Services Provided by the Project Affected Area</b>	
<b>Ecosystem services</b>	<b>Within Project Footprint</b>
<b><i>Provisioning</i></b>	
Food from: <ul style="list-style-type: none"> <li>• livestock,</li> <li>• capture fisheries,</li> <li>• wild foods</li> <li>• crops,</li> <li>• aquaculture</li> <li>• wild animals</li> </ul>	<ul style="list-style-type: none"> <li>• Animals are raised for meat and milk.</li> <li>• Some wild fish are captured and there is some aquaculture at the confluence of the Vorotan and Spandaryan Reservoir and on the Arpa River.</li> <li>• Edible plant species gathered in the wild: fruit and nuts, mushrooms, berries and fresh herbs. Residents of both Gorayk and Kechut report bartering herbs and mushrooms collected from open fields for agricultural products unavailable in their own areas (e.g, nuts).</li> <li>• Local communities grow crops, vegetables and fruit. Apricots are particularly important as a source of income.</li> <li>• Honey is an important local product.</li> <li>• Hunting is popular and species such as Bezoar goat, wolf and bear are shot, as well as rabbits and wild pigs.</li> </ul>
Biomass fuel	Dung from livestock is dried and used as fuel, particularly by seasonal herders but also by surrounding communities, notably in Gorayk. Some seasonal herders have grazing leases within the project footprint and some Gorayk pastureland is affected. Some wood is also collected for fuel.
Hay	Local farmers and herders grow hay on Sub-alpine and Montane Meadows within the Project Affected Area. Hay is made for own use and for sale. The area is considered relatively productive and to produce high quality hay.
Freshwater	Inland bodies of water (groundwater and surface water) are used to supply freshwater for drinking by people and livestock. Snow-melt is harvested using ancient channels and used to irrigate village crop-lands. Water from natural springs in Jermuk is bottled and used for medicinal purposes locally as well as being sold commercially as bottled water. Spandaryan Reservoir is supplied by the Vorotan River. It is used for drinking water supply and for generation of hydropower. Villages obtain their water supply from the Vorotan River or associated springs, or from the Arpa Rive/ Ketchut Reservoir.
Biochemicals, natural medicines, and pharmaceuticals	Herbs are harvested locally for cooking and for traditional medicinal use. This region is well known for its herbs, also considered to be healthy for livestock. Many people have limited income and purchasing power, so dependence on natural remedies is relatively high.
Other animal products <ul style="list-style-type: none"> <li>• Wool</li> <li>• Livestock for breeding</li> </ul>	Wool is collected and is sold or used. Some herders with horses sell foals from breeding mares.
<b><i>Regulating</i></b>	
Regulating climate	Mountains may affect local rainfall patterns, but the area affected is relatively small compared with the extent of the entire mountain chain.

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<b>Ecosystem services</b>	<b>Within Project Footprint</b>
Regulating water flows and timing	The Project Affected Area is at the confluence of three river catchments and has a high density of streams. It plays a part in regulating water runoff, groundwater recharge and maintaining the water storage potential of the landscape. River floodplain and wetlands retain water and probably regulate flooding during runoff peaks, e.g. during snow-melt.
Controlling erosion	Current vegetative cover plays an important part in soil retention on steep slopes. Removal of vegetative cover could result in increased scour and soil erosion particularly during snow-melt. Localised landslides could become more likely as well as sedimentation of surface water bodies and water-courses.
Purifying water and treating waste	The Vorotan catchment and its associated wetlands currently provide a clean water supply to Spandaryan Lake and to local communities including Gorayk. Water quality is good in some respects due to limited levels of development/ landscape modification, but levels of coliforms measured in Gorayk's water supply are high. Wetlands along the Vorotan River probably play some part in purifying water in areas grazed by livestock.
The role of ecosystems in pollination	There are abundant wildflowers growing in the Project footprint which are used by local bee colonies and which are likely to support crop pollination, for example for apricot orchards.
<b>Cultural</b>	
Recreation and ecotourism: pleasure people derive from natural or cultivated ecosystems.	Limited ecotourism occurs in the area. There is a small amount that is concentrated on Gorayk and Jermuk IBAs. There is also some nature-based tourism associated with Jermuk. This includes organized tours to therapeutic hot springs and tourist features that include stuffed bears and live birds of prey. Jermuk residents were observed walking and socializing in the area of the proposed botanical gardens. Some international visitors come to observe the lesser kestrel colony at close quarters. The proposed new National Park at Jermuk could increase the importance of the area for ecotourism in the future.
Ethical and spiritual values including belief that all species are worth protecting regardless of their utility to people– "biodiversity for biodiversity's sake"	Local communities and people have strong traditional ties with the land. They have stated in interviews and in focus groups carried out for the Social Impact Assessment that they gain a degree of spiritual fulfillment from these links and attach quite strong existence values to their local biodiversity. The focus groups found that place identity, place attachment and sense of belonging were linked to an awareness and appreciation of complex ecosystems in the local area. There is strong reverence for sites associated with 'ancestors' and a strong sense of guardianship of nature for future generations.
Educational and inspirational	The Armenian Society for Protection of Birds has established links with local schools to improve levels of education and understanding about birds in the region. Local school children constructed artificial nest boxes for the lesser kestrel colony at Gorayk IBA. Universities and other academic institutions have carried out research studies on the biodiversity of the area and specifically within the Project Affected Area due to the presence of Armenian Red Book species. Fine artists in Jermuk depict local mountains and flora in their paintings. Women in a focus group in Gndevaz reported making jewelry from locally sourced stone.

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Ecosystem services	Within Project Footprint
Cultural and social identity	Individuals, groups and in some cases, whole villages are defined by the way they make a living from the land. These include daily and seasonal herders on Amulsar mountain, herbalists in Jermuk and later harvest apricot growers in Gndevaz. Growers in Gndevaz take their produce to be shown at food festivals in nearby villages.
Reference landscape	From Amulsar Mountain
<b>Supporting</b>	
Supplying habitat	The Project Affected Area plays an important part in providing habitat for a large number of species, some of which are nationally and globally threatened and are included in the Armenian or IUCN Red Books respectively. It provides important breeding habitat and also feeding habitat for migratory birds, particularly raptors.
Nutrient cycling	The Project Affected Area is highly productive where there are deeper chernozems, which lock nutrients effectively.
Primary production	The area is important for pasture because of its high productivity (supported by good soil and abundant water) and the variety of plants it produces, making it nutritionally valuable.
Pest control	Carnivorous animals such as foxes, wolves and bears as well as snakes and lizards eat rodents.
Sanitation	Wolves 'sanitise' the area by eating weak or sick animals. Similarly this function is fulfilled by ants.
Personal hygiene	In the focus group herders reported using springs for bathing.
Animal husbandry	Managed grazing across the Project Affected area supports animal breeding.
Water cycling	The Project area plays a part in water cycling.



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Ecosystem services and ecosystems supplying the service	Ecosystem service beneficiaries	Will the Project affect benefits from affected ecosystem services?	What is the level of dependence of the beneficiaries?	Do the beneficiaries have alternatives?	Priority ecosystem service?
<b>Provisioning</b>					
<p><b>1. Milk, milk-products, and meat from livestock</b></p> <p><i>Produced from Sub-Alpine Meadows, Montane Meadows and Montane Steppe Meadows on Amulsar</i></p>	<p>1a) Seasonal herders and their families</p>	<p><b>Yes</b></p> <p>Some herders use pasture or have grazing licenses in or partially overlapping with the Project Affected Area. Supply of grazing will decline due to the Project Footprint. Quality of some remaining pasture will decline due to Project impacts (dust deposition for example).</p>	<p><b>High</b></p> <p>All seasonal herders are highly dependent on income from either herding or from milk production or sale of other dairy products or meat. Seasonal herders also consume their own meat, milk and dairy products for food (protein) and this forms a significant component of their diet.</p>	<p><b>Uncertain, potentially limited</b></p> <p>A minority of seasonal herders have used the same land for years and would prefer to continue (see results of Herder Census). Others would prefer to use land closer to their home but have customary rights to access the land near Amulsar as the land used to belong to their village (there had been changes to community land ownership over the past 5 years). Not all herders are totally opposed to moving, but willingness to move is based on the assumption that suitable alternative land can be found with similar water and road access and a daily milk collection. This has not yet been confirmed. Note that a transition from seasonal to daily herding (if replacement land were to be found nearer to the home village) could have implications for social cohesion and “way of life”.</p>	<p><b>YES</b></p>

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	1b) Local herders with grazing land and hay meadows within the Project Affected Area, notably from Gndevaz Village.	<b>Yes</b> Village livestock are taken each day from the village onto village land to graze. Some of this land is within the HLF footprint and infrastructure (including the mine access road and conveyor) could also create barrier effects, affecting access to grazing.	<b>Moderate</b> Local herders have multiple sources of income and food but also rely on multiple activities to make ends meet and indicated in Focus Groups that they rely on multiple sources of income and food for their livelihood and wellbeing.	<b>Uncertain</b> The majority of local herders have been using the same land (ancestral land) for many years. Availability of alternative land not too far away from the village, with water and suitable access by road is not yet confirmed.	<b>YES</b>
	1c) Local herders from Gorayk, Saravan and Saralanj	<b>No</b> Local herders from these villages will not lose significant areas of grazing land.			<b>NO</b>
	1d) Herders in areas proposed for accommodation of displaced herders.	<b>Yes</b> Displaced herders livestock could increase stocking densities in replacement areas. This may be exacerbated by increased demand for livestock products. Production and income for existing herders could decline.	<b>Uncertain</b> Areas not identified yet.	<b>Uncertain</b> Location of alternative land with suitable access to water and road is not yet confirmed, nor is current use of this land. Affected herders can't be identified yet.	<b>YES/ UNCERTAIN</b>

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<p><b>2. Hay</b></p> <p><i>From Sub-Alpine Meadows, Montane Meadows and Montane Meadow Steppes</i></p>	<p>Farmers selling hay</p>	<p><b>Yes</b></p> <p>Those affected are largely resident in Gndevaz, with lesser potential effects on residents of other villages neighbouring the Amulsar massif.</p>	<p><b>Unknown</b></p> <p>Income from hay is one of relatively few sources of income for some farmers.</p>	<p><b>YES</b></p> <p>Since hay production is not restricted by access to water and road, there may be areas available for hay production outside of the area affected by the project with similar quality and productivity, but this is not clear for Gndevaz. The quality of the hayfields lost is not known, and it is not clear if some particular producers are going to lose a high proportion of their land.</p>	<p><b>Yes/Unclear:</b></p> <p><i>Specific risks to this group mean further information is needed to ensure any livelihood impacts can be mitigated through livelihood restoration measures.</i></p>
<p><b>3. Apricot production</b></p> <p><i>From Agricultural Land (orchards)</i></p>	<p>Gndevaz and Saravan apricot producers and their families: this area is famous for high quality apricots.</p>	<p><b>Yes</b></p> <p>There is considerable footprint on apricot orchards in Gndevaz (20% will be affected by land acquisition for Project). The Project is not expected to alter crop pollination.</p>	<p><b>High</b></p>	<p><b>Limited/ Uncertain</b></p> <p>Scope to improve the productivity of land around Gndevaz Village for apricots, for example through irrigation, is being explored. However it takes at least 10 years for trees to come into production. The potential new land is at lower elevation and apricots may not command the premium that apricots from the orchards at the HLF location do.</p>	<p><b>YES</b></p>

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<b>4. Mushrooms and herbs for tisanes, cooking and seasoning</b>  <i>From Sub-Alpine Meadows, Montane Meadows and Montane Meadow Steppes</i>	4a) Villagers who consume and barter mushrooms and herbs.	<b>Yes</b> Mushrooms and herbs are harvested from land within the Project Footprint or potentially isolated by barrier effects.	<b>High</b> 48 – 61% of rural people in this area say they have insufficient income to purchase food and barter wild food for items they cannot grow or obtain locally.	<b>Yes</b> 1. Plentiful alternative sources of land are available for foraging	<b>NO</b>
	4b) A minority of local herb and mushroom collectors who sell mushrooms and herbs for supplementary income.	<b>Yes</b> Mushrooms and herbs are harvested from land within the Project Footprint or potentially isolated by barrier effects. Quality of herbs and mushrooms may decline because of pollution or dust, or may be perceived to decline.	<b>Unknown/ Moderate</b> It is unusual for more than 30% of income to come from collecting. Although considered a supplementary source of income, losing it could be significant given the local tendency to pursue multiple livelihood activities to make ends meet. In Focus Groups during July 2014 in Gndevaz, villagers expressed concern about the quality of mushrooms and herbs harvested below the mine.	<b>Yes</b> 2. Plentiful alternative sources of land are available in the vicinity for foraging. Some harvesters could have to travel further or spend longer finding particular herbs and sourcing them from areas without impacts from the mine on quality.	<b>No.</b>
	4c) Small minority of herb and mushroom collectors who sell mushrooms and herbs as their sole source of income.	<b>Yes</b> Mushrooms and herbs are harvested from land within the Project Footprint or potentially isolated by barrier effects. People selling herbs in Jermuk indicated that they no longer harvest from areas within 1km of the mine due to concerns about potential health risks.	<b>High</b> In social surveys some “Foragers claimed that selling plants and medicines was their sole source of income” (Appendix 4.17.1). Some of the people selling herbs in Jermuk claimed that this was the case for them.	<b>Yes</b> Plentiful alternative sources of land available in the vicinity of the land for foraging. People selling herbs in Jermuk indicated that they still had access to plentiful alternative supply, despite their avoidance of Amulsar.	<b>NO.</b>



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<p><b>5. Dung for fuel</b></p>	<p>Dung is dried in local villages eg Gorayk for fuel and by herders</p>	<p><b>No</b> While some herders might lose access to land and therefore potentially have fewer animals, they don't use all the dung produced by their animals. A change in number of animals shouldn't prevent them from accessing dung to burn as fuel if needed.</p>			<p><b>NO</b></p>
<p><b>6. Vegetable gardens</b> <i>Small-scale agriculture</i></p>	<p>Local communities located along roads used by trucks transporting components and materials to the Project.</p>	<p><b>Yes</b> Deposit of exhaust gas and particulates from increased traffic onto gardens. This could reduce productivity, reduce palatability and possibly contaminate crops with toxic substances such as heavy metals.</p>	<p><b>Low / Uncertain</b> Few householders grow all their produce adjacent to the road.</p>	<p><b>Yes</b> Most householders can use alternative areas to grow produce.</p>	<p><b>NO</b></p>
<p><b>7. Honey production</b> <i>Small-scale agriculture</i></p>	<p>Honey producers and their families in Gndevaz with beehives in close proximity to the project activities.</p>	<p><b>Unknown</b> Honey production could theoretically be affected as a result of reduced production because of toxic effects, eg exposure to heavy metals in fugitive dust particularly along roads used to import components and materials. Change in vegetation is not expected to affect pollination by bees as they go very closely to their beehives.</p>	<p><b>Moderate/ High</b> For producers and their families, income from honey is a significant part of total income.</p>	<p><b>Yes</b> Hives can be located where they will not be exposed to risk.</p>	<p><b>NO</b></p>

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<b>8. Wild fish from the Vorotan River</b>	Unclear but informal fishing is quite intensive	<b>Yes/ unclear</b> The Project may contribute to cumulative impacts on fish in the Vorotan due to general degradation and overfishing associated with induced vehicle access, sediment run-off from roads, fugitive dust etc. Recent small-scale hydro-power developments will exacerbate barrier effects. Project may abstract water from Vorotan as mitigation to improve land around Gndevaz for apricot production and the implications of this for flows should be checked.	<b>No</b> No instances of fishing for subsistence purposes have been identified)		<b>No</b>
<b>Freshwater</b> <i>From Groundwater</i>	Jermuk Group	<b>No</b> The Project will not have any impact on the aquifer supplying Jermuk's bottled water (See Appendix 4.8.2 on groundwater monitoring and Appendix 6.9.1 for groundwater modeling.			<b>NO</b>
	Jermuk spring-related hospitality professionals	<b>No</b> The Project will not have any impact on the aquifer supplying Jermuk's springs. This does not mean there will not be any perceived impacts.			<b>NO</b>

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	Potable drinking supply for villages in the Project Affected Area	<b>No</b>			<b>NO</b>
<b>9. Freshwater</b>  <i>From Surface Water</i>	People who use surface water from the Vorotan (this is piped for domestic use) and from the Arpa. Water flow and quality in the Arpa is an intermediate service to commercial fish production based on the Arpa.	<p><b>No if controls are effective. Precautionary Approach needed due to importance of 9. service.</b></p> <ul style="list-style-type: none"> <li>- Abstraction of water from the Arpa may affect flow in the River and therefore commercial fish production.</li> <li>- Pollution of the Arpa River and tributary streams is possible by acid rock drainage and/ or heavy metal from the open pit, ROM stockpile and BRSF, transportation of materials along tracks, and any accidents and spills. Zero discharge to surface water (see Appendix 6.10.1).</li> <li>- Appendix 6.10.1 contains the details of the Site Wide Water Balance and demonstrates a zero discharge from the Project.</li> </ul>	<p><b>High</b> Water required for life.</p>	<p><b>No</b> Getting other sources of water would entail costs and alternative sources not currently known.</p>	<p><b>YES</b> <i>Precautionary Approach Needed. If all controls are effective impacts will be negligible but there could be perceived risks that should be managed through robust and participative monitoring programs.</i></p>

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<p><b>10. Electricity generation (planned and on-going)</b></p> <p><i>From Vorotan River and Spandaryan Reservoir or from Ketchut</i></p>	<p>State power company</p>	<p><b>No</b></p> <p>Some abstraction will take place from the Vorotan during the construction phase and also potentially as part of a mitigation strategy to provide alternative land for apricot growing in Gndevaz..</p>			<p><b>NO/ UNCLEAR</b></p>
<p><b>11. Medicinal plants</b></p> <p><i>From Sub-Alpine Meadows, Montane Meadows and Montane Steppe Meadows</i></p>	<p>Villagers who use herbs for medicinal purposes</p>	<p><b>Yes</b></p> <p><b><i>Loss in quantity or quality of medicinal plants available</i></b> due to:</p> <p>1) loss of access to traditional harvesting areas; or</p> <p>2) perceived impacts on health of plants harvested within the footprint of the operational mine.</p>	<p><b>Unknown</b></p> <p>Traditional medicine has a cultural basis but is also influenced by the limited accessibility and affordability of the local health services. This reduces effective health seeking behavior.</p> <p>In the Focus Group Discussions (see Appendix 6.20.2), the use of Traditional Medicine did not appear to be important. However, the FGDs were very brief and there was not an opportunity to discuss these practices in detail. In addition, they are not likely to create any potential health impacts of concern so were not an area of focus. If required these practices would need to be investigated in more detail.</p>	<p><b>Yes</b></p> <p>Plentiful alternative sources of land are available for foraging that will not be perceived as affected though villagers from Gndevaz may have to travel further.</p>	<p><b>NO</b></p>

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<b>Regulating services</b>					
<b>12. Regulating climate</b>  <i>From Alpine Zone and Sub-Alpine Zone</i>	People spending time in the area including local residents, tourists to Jermuk	<b>No</b> Mountains may affect local rainfall patterns. However the area affected is relatively small compared with the extent of the entire mountain chain.			<b>NO</b>
<b>13. Regulating water flows and timing</b>  <i>From Alpine Zone, Sub-Alpine Zone and Mountain Steppes</i>	Beneficiaries from groundwater and surface water including farmers using snow melt for irrigation	<b>Unknown</b> Changing landform might affect water runoff, groundwater recharge and water storage potential of the landscape, indirectly affecting water quantity.	<b>Not applicable</b> Intermediate service to freshwater from groundwater and surface water – see their prioritization		<b>NO</b>
<b>14. Erosion control</b>  <i>From Alpine Zone, Sub-Alpine Zone and Mountain Steppes</i>	People who live and use the area at risk of land slips.	<b>Yes</b> The mine will entail substantial vegetation clearing and earthworks. Risks are largely to land used for farming (grazing and hay production) which could suffer reduced productivity and access and to surface water bodies on the Mountain, which may be used for livestock to drink or for fishing.	<b>High</b> Without vegetative cover there is a high risk of erosion and land-slips in an area with steep slopes.	<b>No</b> There is no existing infrastructure that can provide the same level of protection, particularly to higher elevation hay meadows and pastures.	<b>YES</b>

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<p><b>15. Pollination</b></p> <p><i>From Montane Steppes and Montane Meadow Steppes</i></p>	Beneficiaries of apricot and honey production	<p><b>No</b></p> <p>Change in vegetation is not expected to affect pollination by bees as they forage relatively close to their beehives and these are largely located within the villages.</p>			<b>NO</b>
<b>Cultural services</b>					
<p><b>16. Eco Tourism</b> (e.g associated with Jermuk)</p>	Eco-tourists (including future generations who would benefit from proposed new National Park at Jermuk)	<p><b>Yes</b></p> <p>There will be visual impacts as well as perceive impacts on ecological health.</p>	<p>Moderate</p> <p>Current levels of dependence are not high but there are plans/potential to develop the sector. Limited ecotourism occurs in the area, concentrated on Gorayk IBA that is visited by some international visitors who come to observe the lesser kestrel colony at close quarters. Ecotourism is advertised in the Province.</p>	<p><b>Yes</b></p> <p>Tourist numbers are still pretty low but there are aspirations to develop tourism further in future and a new Park would improve opportunities.</p>	<b>NO</b>
	Skiing	<p><b>No</b></p> <p>Mountains may affect local snowfall patterns. However the area affected is relatively small compared with the extent of the entire mountain chain. There will be some visual impacts experienced from the ski mountain Jermuk caused by the Project (see Section 6.5)</p>			<b>NO</b>

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<p><b>17. Ethical: endangered species</b></p> <p><i>From small Alpine area on the mountain, Sub-Alpine Meadows, Montane Meadows and Montane Steppe Meadows</i></p>	<p>Armenian people in general</p>	<p><b>Yes</b></p> <p>The mine will cause substantial habitat change as well as noise and visual disturbance.</p>	<p><b>Uncertain</b></p> <p>Armenians attach quite strong existence values to their biodiversity and there are strong active local NGOs lobbying for conservation of biodiversity. Implications of decline in populations may not have a significant impact on livelihood. In Focus Groups, the majority were reluctant even to lose species such as wolf, but some were indifferent.</p>	<p><b>Uncertain for some species</b></p> <p>The area provides habitat for a large number of species, including some that are nationally and globally threatened and are included in the Armenian or IUCN Red Books respectively which, by definition, are declining in numbers.</p>	<p><b>NO</b></p>
<p><b>18. Cultural identity from herding way of life</b></p> <p><i>From Sub-Alpine Meadows, Montane Meadows and Montane Steppe Meadows</i></p>	<p>18a) a number of seasonal herder families use pasture or have grazing licenses which may partially overlap with the Project Footprint</p>	<p><b>Yes</b></p> <p>Change in pasture accessibility and restriction on use may occur because:</p> <ol style="list-style-type: none"> <li>1) they lose (access to) their usual pasture;</li> <li>2) there is a higher number of livestock on a smaller area as a result of land take by the Project. This needs to be monitored.</li> </ol>	<p><b>High</b></p> <p>Herding is the main way of life available to seasonal herders.</p>	<p><b>No</b></p> <p>Seasonal herders cannot maintain their herding activity without access to land but it may be possible to identify alternative locations, which are acceptable to the beneficiaries.</p>	<p><b>YES</b></p>

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	18b) Local herders from Gndevaz who are organized to graze their livestock together, either paying a herder or taking turns to supervise the livestock.	<p><b>Yes</b> Change in pasture accessibility and restriction on use because 1) they lose (access to) their usual pasture; 2) there is a higher number of livestock on a smaller area as a result of land take by the Project</p>	<p><b>High</b> Local herders participating in co-herding have strong social ties that they emphasized in Focus Group Discussions (see Appendix 6.20.2). This is particularly true of the older generation.</p>	<p><b>No</b> Local herders cannot maintain co-herding activity without access to particular areas of land and the ability to maintain their traditional seasonal patterns of use of the landscape.</p>	<p><b>YES</b></p>
<p><b>19. Reference landscape and Sense of Place</b>  <i>Amulsar Mountain and foothills above Gndevaz Village</i></p>	Residents of local villages who will experience a change in the landscape (visual and in terms of their use and appreciation of it). Key locations are Saralanj, Ughedzor, Gndevaz from which the open pit, crushing plant and some of the access road will be visible and Gndevaz which will experience significant change in its traditional use of the landscape.	<p><b>Yes</b> Dramatic change in landform for some receptors (see Landscape and Visual Assessment) and in cultural identify and sense of place for others, particularly in Gndevaz, where residents feel their village will become transformed into a “mining town”.</p>	<p><b>Yes</b> Local communities and people have strong ties with the land. They have stated in interviews carried out for the Social Impact Assessment that they gain a degree of spiritual fulfillment from these links.</p>	<p><b>No</b> Unique landscape and associated sense of place, also tied with traditional uses.</p>	<p><b>YES</b></p>



Appendix 6.20.1: Table 2 Summary of prioritisation process

Ecosystem services and ecosystems supplying the service	Ecosystem service beneficiaries	Will the Project affect benefits from affected ecosystem services?	What is the level of dependence of the beneficiaries?	Do the beneficiaries have alternatives?	Priority ecosystem service?
	Herders who graze around the site and will observe change	<b>Yes</b> Dramatic change in landform and land use.	<b>Yes</b> Herders have been grazing in the same environment for many years.	<b>No/ Uncertain</b> Herders have been grazing in the same environment for many years, though some would be prepared to relocated nearer to their home villages if suitable land could be found	<b>YES</b>
<b>20. Educational: study of rare plants</b>  <i>From Amulsar Mountain and Gorayk IBA</i>	Educational establishments (e.g., Armenian universities and institutes, conservation NGOs)	<b>Yes</b> The mine will entail substantial habitat change and noise and visual disturbance. It will also provide opportunities for research	<b>High</b> Armenian research institutes are involved in studying <i>Potentilla porphyrantha</i> and other RA Red Book plants in the Project Affected Area. Local schools come regularly to the lesser kestrel colony at Gorayk for visits and the colony is also studied by people studying for PhDs through ASPB/Birdlife International.	<b>Yes</b> The area provides habitat for a large number of species, some of which are nationally and globally threatened and are included in the Armenian or IUCN Red Books respectively. These species are declining in numbers by definition. However the proposed Project Strategy will deliver NNL/ a Net Gain if implemented as planned. However, beneficiaries have alternatives to maintain their livelihood and wellbeing.	<b>NO</b>
<b>Supporting services</b>					
<b>21. Supplying habitat</b>	Beneficiaries from touristic, ethical and educational value	<b>Yes</b> The mine will entail substantial habitat change and an increase visual disturbance. Impacts from noise, vibration and emissions to air are not significant.	<b>Not applicable</b> Intermediate service to touristic, ethical and educational value – see their prioritization		<b>NO</b>

Appendix 6.20.1: Table 2 Summary of prioritisation process					
Ecosystem services and ecosystems supplying the service	Ecosystem service beneficiaries	Will the Project affect benefits from affected ecosystem services?	What is the level of dependence of the beneficiaries?	Do the beneficiaries have alternatives?	Priority ecosystem service?
<b>22. Nutrient cycling</b>	Beneficiaries from all other services	<b>No</b> The affected area is not critical to levels of nutrient cycling in the region.			<b>NO</b>
<b>23. Primary production</b>	Beneficiaries of milk, milk product and meat from livestock	<b>No</b> The primary production affected by the project is not critical to the overall primary production in the region. It is a relatively small area			<b>NO</b>
<b>24. Water cycling</b>	Beneficiaries of water-related services	<b>Unknown</b> Changing landform might affect water runoff, groundwater recharge and water storage potential of the landscape, indirectly affecting water quantity.	<b>Not applicable</b> Intermediate service to all other water-related services – see their prioritization		<b>NO</b>
<b>25. Pest control by wild predators such as foxes and wolves</b>	Farmers in local villages who are beneficiaries of other production services	<b>Yes</b> Significant changes in landscape and land use could reduce numbers of predators, which are currently considered to play an important role in regulating pests such as voles (which eat crops and pasture) and other rodents.	<b>Uncertain</b>	<b>Yes/ uncertain</b> Beneficiaries have alternatives but they are not free.	<b>NO</b>

**Appendix 6.20.1: Table 3 Proposed Indicators as a Basis for Monitoring**

Priority ecosystem services	Current benefits derived from the environment	Potential indicators for monitoring	Current level of use / baseline
<b>Milk, milk products, meat from livestock</b>	Income from selling milk and milk products and meat  Number of goods exchanged against milk/ milk products/ meat  <i>(OR Average income/ year from selling milk and/ or milk products and/ or meat by any herder in the area)</i>	Current number of liters of milk/ kilos of milk products sold/ exchanged by each affected herder  Current number kilos of meat sold/ exchanged by each affected herder  <i>(OR Average current number of liters of milk/ kilos of milk products/ kilos of meat and sold/ exchanged by any herder in the area)</i>	<ul style="list-style-type: none"> <li>• Milk: 65 litres per day sold for 150AMD per litre (if collected) and 200AMD (sold at gate).</li> <li>• Each cow produces 13-1500 litres per annum</li> <li>• ‘Milk cream’ and cheese sell for 1500AMD/ litre.</li> <li>• Each household consumes 7 or 8 sheep per annum.</li> <li>• Each household consumes equivalent of 1 cow per annum.</li> <li>• Meat sells for 1700AMD/kg and costs 2500-3000AMD/kg to buy.</li> </ul>
	Current malnutrition or protein deficiency in each of the affected herder family	Current number of liters of milk/ kilos of meat and milk products consumed by each affected herder family	5 litres of milk consumed per household per day. Each household consumes approximately 750kg of beef per annum or 595kg of sheep per annum.
	Current employment income earned by each affected employed herder (total or by head of livestock)	Current number of head of livestock taken care of by each affected employed herder	Typically 3 cows per household and each cow costs US\$600 (200-250000AMD). Herders have at least one horse each that costs US\$800. Seasonal herders have approx. 40 cows each.
<b>Cultural identity from herding way of life</b>	Satisfaction with herding opportunity by each affected herder  <i>(OR Average satisfaction with herding opportunity in the area)</i>	Area used for herding and hayfield (acres) by each affected herder  <i>(OR Average area used for herding and hayfield in the area by any herder)</i>	Individual herder (interviewed) had 600 sheep, 1 mare. Seasonal herders require 1-1.5ha per cow.
	Average satisfaction with the state of the land by surveyed local villagers and land users.	Average perception regarding the integrity of the land by surveyed local villagers and land users	<ul style="list-style-type: none"> <li>• Physical features demarcate administrative and use boundaries.</li> <li>• Concern about ‘pollution’ includes belief that uranium is present in the Project Affected Area.</li> <li>• Difficult for users to anticipate future impact of mine.</li> </ul>

**Appendix 6.20.1: Table 3 Proposed Indicators as a Basis for Monitoring**

<b>Priority ecosystem services</b>	<b>Current benefits derived from the environment</b>	<b>Potential indicators for monitoring</b>	<b>Current level of use / baseline</b>
<b>Hay</b>	<p>Current income/ year from selling hay by each affected hay producer</p> <p>(OR Average income earned from selling hay by any hay producer in the area)</p>	<p>Current number of kilos of hay sold by each affected hay producer</p> <p>(OR Average number of kilos of hay sold by any hay producer in the area)</p>	<ul style="list-style-type: none"> <li>• Approximately 2000 bales produced per family at 100 bales/ha or 2 tonnes/ha.</li> <li>• 30% of people don't produce enough to sell.</li> <li>• Hay is sold for average 600 AMD per bale.</li> </ul>
<b>Reference landscape</b>	<p>Satisfaction with the place where they live by surveyed local villagers.</p> <p>(OR Levels of place attachment, sense of belonging and place identity)</p>	<p>Average perception regarding the integrity of the landscape</p> <p>(OR Levels of disruption to place attachment, sense of belonging and place identity)</p>	<ul style="list-style-type: none"> <li>• Strong level of place attachment and sense of belonging</li> <li>• Strong sense of interconnectedness and interdependence of ecological services</li> </ul>
<b>Apricots</b>	<p>Sense of pride in local produce</p>	<p>Level of viability for premium apricot production</p>	<p>Apricot production varies per tree from 50-300kg. Late apricots sell for 100AMD/kg. Strong sense of pride in production of 'premium' apricots</p>
<b>Regulation of land slips</b>	<ul style="list-style-type: none"> <li>• Number of hayfields damaged by land slips or affected by soil erosion over the last 5 years</li> <li>• Number of pasture areas that were damaged by land slips or erosion over the last 5 years</li> </ul>	<p>Vegetation cover in the Alpine Zone, Sub-Alpine Zone, Mountain Steppe considered to provide protection from soil erosion</p>	

**Appendix 6.20.1: Table 4 ESIA Focus Group Protocol and Schedule of Questions/Activities**

**ESIA Focus Group Protocol\_July14**

Date of interview: .....July 14      Name of facilitator(s): .....  
 Location: .....      Village: .....  
 No. of women: .....      No. of men: .....

**Introduction**

Welcome and thank you for participating in this discussion group. We would like to know about what activities you undertake in this area and how they might be affected by the proposed construction and operation of the Amulsar gold mine.

In order to make this work there are a few guidelines:

- It is voluntary for you to participate in this study.
- We would like your permission to record the discussion.
- Please give your opinion and allow other people to give their opinions too.
- All your responses will be anonymised and treated as confidential.

Do you have any questions?

*[With permission TURN ON RECORDER]*

So we can help link your thoughts and views together, it would help us if you would introduce yourselves, just letting us know your name and anything else that you'd like us to know about you.

*[Facilitator to start e.g. My name is...I work for.. as .. and I keep...]*

Name	Gender	Approx. age	Occupation	Other (e.g. livestock)

We are interested in finding out about ecosystem services. Ecosystem services describe the resources and processes that are supported by the local ecosystem. An ecosystem describes the relationship between living creatures (people, animals, birds, fish, plants, micro-organisms) and their habitat (water, air, soil).

In order to get the discussion started we are going to present you with a selection of cards that describe and/or depict ecosystem products and services that could be found in this area.

*[Place a set of laminated cards on the table]*

Each card has a picture on one side and a description on the other side (in Armenian/English). Please take a few minutes to look through the cards.

We are interested in which of these ecosystem products or services you consider **important for your livelihood or wellbeing**.

Appendix 6.20.1: Table 4 ESIA Focus Group Protocol and Schedule of Questions/Activities		
Concept	Questions/activity	Outcome
Importance	1. Please select the <b>products or services you obtain from this land</b> that you consider are <b>important for your livelihood</b> (source of income, exchange value, food) or <b>wellbeing</b> (physical, psychological, spiritual, cultural).	<i>Record important vs. not important</i>
	2. What other products or services do you obtain from this land that are important for your <b>livelihood</b> or <b>wellbeing</b> that are not shown on a card please let us know and we can create a new card.  <i>[Add name of product and/or services to blank cards]</i>	<i>Additional products or services</i>
Prioritisation	3. [Of those that are important], Which are the <b>most</b> important products or services for your <b>livelihood</b> or <b>wellbeing</b> ?  We would like you to create two piles of cards. One pile will have those that are 'most' important, another 'not' as important.  <i>[Record importance]</i>	<i>Most, least important</i>
	4. Why are these the <b>most important</b> for livelihood/wellbeing? <ul style="list-style-type: none"> <li>• Income</li> <li>• Traditional</li> <li>• Food &amp; diet</li> <li>• Health</li> <li>• Educational</li> <li>• Social</li> <li>• Religious/spiritual</li> <li>• Inspirational</li> <li>• Recreational</li> <li>• Tourism</li> <li>• Aesthetic</li> </ul> Please elaborate	<i>Most important only</i>
Quantity	5. <b>How many?</b> <ul style="list-style-type: none"> <li>• Animals and type</li> <li>• Trees</li> <li>• Hives</li> <li>• Kg of produce (e.g. hay, apricots, cheese)</li> <li>• Litres (e.g. milk)</li> </ul>	<i>Amount</i>
Use value	6. Are these products <b>for sale, exchange and/or own consumption?</b>	<i>Use</i>
	7. What is the <b>monetary and/or exchange value</b> of these products? AMD	<i>AMD</i>
Location	8. [Present map], Please indicate <b>where</b> these products and services come from?	<i>Annotate maps</i>
Access	9. <b>How and when</b> do you normally access the most important products and services? <ul style="list-style-type: none"> <li>• Season</li> <li>• Mode of transport (e.g. horse, on foot, car)</li> </ul>	<i>Month and type of transport</i>

Appendix 6.20.1: Table 4 ESIA Focus Group Protocol and Schedule of Questions/Activities		
Concept	Questions/activity	Outcome
Tenure	<p>10. Is the land where you access these products <b>privately owned, rented by you or is it communal land?</b></p> <ul style="list-style-type: none"> <li>• Community land</li> <li>• State land</li> <li>• Legal ownership land</li> <li>• Resident land</li> <li>• Don't know</li> </ul>	<i>Tenure type</i>
Dependence	<p>11. How <b>feasible/easy</b> is it for you to get <b>similar type, quantity, quality and benefit of these products and services in another way?</b></p> <ul style="list-style-type: none"> <li>• Buy</li> <li>• Exchange</li> <li>• Alternatives</li> </ul> <p>If feasible/easy, what, where and how? If not feasible/easy, why not?</p>	<i>Reasons</i>
Acceptability	<p>12. <b>How acceptable</b> would it be for you to access these products and services <b>in another way?</b></p> <ul style="list-style-type: none"> <li>• Not at all acceptable</li> <li>• Moderately acceptable</li> <li>• Very acceptable</li> </ul> <p>Why? Why not?</p>	<i>Degree of acceptability and reasons why</i>
Finish	<p>13. Is there <b>anything else</b> you would like to add?</p>	<i>Additional information</i>
	<p><b>Finish</b></p> <p>Thank you. We have reached the end of the discussion. We hope that it has been interesting for you. If you would like any more information please visit or contact the information centre.</p>	