



# REPORT

## HEAP LEACH FACILITY SITE ALTERNATIVES ANALYSIS

Amulsar Gold Project, Republic of Armenia

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## EXECUTIVE SUMMARY

This revised Site Alternatives Analysis report (SAA) summarizes the evaluation process conducted for the sites that were identified as potentially viable for development of a gold heap leach facility (HLF) for the Amulsar project in central Armenia. The SAA was a multi-disciplinary process led by Golder Associates Inc. (Golder). This final report has been completed by Golder for Lydian International Ltd. (Lydian). Technical specialists in the fields of geotechnical engineering (Golder), biodiversity (Trewick Environmental Consultants), cultural heritage (ERM), social (Lydian in-house), water resources (Golder), visual impacts (LUC) and experienced environmental and social development consultants (Gone Native and Shared Resources) were integrally involved in the creation and population of the decision matrices used in the SAA.

The SAA was conducted in order to ensure that the site selected for the HLF is the optimal site for a range of multidisciplinary considerations, consistent with the International Finance Corporation (IFC) requirements and in consideration of the views and specific regulatory requirements of the Government of Armenia. This revised HLF SAA report addresses the requirements of the IFC Performance Standards (PS), in particular PS1 on Assessment and Management of Environmental and Social Risks and Impacts and PS6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources.

In IFC PS 1, emphasis is focused on the assessment and management of environmental and social risks in particular with respect to greenfield development as discussed in Guidance Note (GN) 25:

- For greenfield developments, the ESIA includes an examination of technically and financially feasible alternatives to the source of such impacts, and documentation of the rationale for selecting the particular course of action proposed. The purpose of the alternatives analysis is to improve decisions on project design, construction, and operation based on feasible alternatives to the proposed project. This analysis may facilitate the consideration of environmental and social criteria at the early stages of development and decision-making based on the differences between real choices. The alternatives analysis should be conducted as early as possible in the process and examine feasible alternatives; alternative project locations, designs, or operational processes; or alternative ways of dealing with environmental and social impacts.
- IFC PS 6 emphasizes the need to avoid impacts on biodiversity and ecosystem services. No project activities should be carried out in critical habitat unless it can be demonstrated that there are no other viable alternatives within the region for development of the project on areas of habitat, which are not critical. Project activities within certain internationally recognized areas for biodiversity conservation should also be avoided with a similar requirement to demonstrate that there are no viable alternatives. This includes “key biodiversity areas” such as “Important Bird Areas (or IBAs).” Careful consideration of alternatives is important to demonstrate that appropriate efforts have been made to avoid impacts on natural and critical habitat and on key biodiversity areas.

The initial SAA report (dated February 2012) identified Site 6 as the preferred site for HLF development on technical grounds. The original Waste Dump Facility (WAI, 2012a) and HLF SAA (Golder, 2012a)



evaluations were completed prior to completion of the archaeology and biodiversity baseline studies. This site partially overlaps Gorayk Important Bird Area (IBA), a Key Biodiversity Area within which project activities should be avoided unless there are no viable alternatives. Subsequent to the conclusion of the February 2012 HLF SAA report, other viable alternatives became available for potential development as HLF sites.

In addition, subsequent to the completion of the original HLF SAA report, it has been determined that all the potentially viable WDF and HLF development sites within the Vorotan Valley are within the designated “non-immediate impact zone” of the Lake Sevan Catchment. Lake Sevan has an ecosystem of considerable importance to the Republic of Armenia and is legally protected. Therefore, Lydian has determined that potential ecosystem and biodiversity impacts to the Lake Sevan “non-immediate impact zone” from HLF and WDF development are to be considered in this revised SAA. As a result, both original HLF and WDF SAA evaluations have been revised to consider the additional baseline studies and potential impacts to the Lake Sevan non-immediate impact zone.

The revised HLF site selection process involved a four-step assessment:

1. The first step consisted of an initial high-level, desktop-based screening assessment to identify all potentially viable sites with apparently suitable topography for development of a HLF within 20-25km from the Amulsar deposit. This was followed by a site visit that selected 26 potential sites for further analysis based on a visual scoping assessment.
2. The Initial Screening Assessment to analyze the potentially viable sites for HLF development was a multidisciplinary process that drew on the expertise of a panel of subject-area experts based on five screening categories, namely (i) Biodiversity-Environmental; (ii) General Location; (iii) Infrastructure; (iv) Social/Cultural; and (v) Technical. A matrix based on 31 key criteria covering these categories was used to compare alternatives. Specialists identified potential “fatal flaws” for each category. Any alternative site that had a fatal flaw or for which development might result in significant adverse impacts across any of these 31 criteria was eliminated. Fourteen (14) of the identified sites were eliminated due to fatal flaws, with two sites eliminated due to significant adverse impacts. Ten sites were advanced to the next phase of assessment.
3. A Semi-quantitative Rating Assessment of these 10 sites was then completed. The ten sites were ranked for each indicator (across the five screening categories) and a weighting factor was applied for each site against this indicator. The team agreed to a list of 27 indicators capturing the main issues for the decision-making process to select a suitable site. The ranking system agreed upon included both a binary and specific ranking depending on the indicator as decided by the specialists. The binary ranking provided for a -3 rating for highly unfavorable conditions and a 0 rating for neutral conditions. The more specific ranking provided for a -3, -2, -1, and 0 rating based on specific criteria developed and agreed upon by the specialists. The unidirectional -3 to 0 scale captures the idea that potential impacts in all areas considered in the matrix are negative with regards to social and environmental receptors. Weighting factors were then developed on a 1 to 5 scale with a 5 carrying the most weight and 1 carrying the least. The selection of the weighting factor for each indicator was decided through a participative process involving all specialists that considered the relative significance of each primary indicator. Similarly, the rankings applied to each site for each indicator were identified firstly through specialist input, and then through participatory review with



- the group to reach consensus. The results were tabulated for these 10 sites and the scores assessed. Based on PS6 requirements, the three sites located in the IBA (Sites 5, 6 and 8) were removed from the assessment and reserved for consideration only if no other viable alternatives could be identified. The remaining seven sites, including a reduced Site 6 were then ranked in order of preference. A shortlist of four sites was then developed from the eight ranked sites.
4. The last step was the preparation of conceptual layouts for each shortlisted site as a basis for preliminary review by the specialists to agree on which sites would be viable from a technical and financial perspective.

The results of this revised HLF SAA completed for the Amulsar project resulted in the selection of four favorable HLF sites, with Site 14 identified as the preferred site for HLF development, followed by Site 11, Site 12 and lastly by Site 13. The most favorable HLF site, Site 14, is now undergoing further engineering evaluation using additional information from technical studies, field characterizations, and site-specific engineering evaluations. This information will be included in the revised Feasibility Study (FS) for the Amulsar project. The Site 14 HLF feasibility-level design will incorporate a number of features to mitigate for the potential adverse environmental, biodiversity, cultural heritage and social considerations that were identified during the SAA evaluations.

The SAA has objectively quantified and qualified the various options to arrive at the best option from technical, environmental, biodiversity, cultural heritage, and public safety and community/social points of view.





## Table of Contents

EXECUTIVE SUMMARY .....	ES-1
1.0 INTRODUCTION AND BACKGROUND .....	1
2.0 INTERNATIONAL FINANCE CORPORATION REQUIREMENTS .....	4
3.0 STAKEHOLDER ENGAGEMENT .....	7
4.0 INITIAL DESK STUDY AND SITE RECONNAISSANCE .....	8
5.0 SCREENING ASSESSMENT .....	9
5.1 Buffer Zones and Exclusion Areas .....	9
5.1.1 Buffer Zones .....	9
5.1.2 Exclusion Areas .....	10
5.2 Site Constraints .....	11
5.2.1 Suitable Topography .....	11
5.2.2 Geology and Hydrogeology .....	11
5.2.3 Capacity (Surface Area) .....	11
5.2.4 Environmental Factors .....	11
5.2.5 Social Factors .....	12
5.2.6 Infrastructure .....	12
5.2.7 Biological Diversity .....	12
5.2.8 Archeology .....	12
5.3 Ranking Criteria and Fatal Flaws .....	13
6.0 SEMI-QUANTITATIVE ASSESSMENT .....	20
7.0 CONCLUSIONS AND USE OF THIS REPORT .....	23
8.0 REFERENCES .....	24

## List of Tables

Table 1	HLF SAA General Process .....	3
Table 2a	Initial Screening Criteria – Biodiversity/Environmental .....	14
Table 2b	Initial Screening Criteria – General Location .....	15
Table 2c	Initial Screening Criteria – Infrastructure .....	16
Table 2d	Initial Screening Criteria – Social/Cultural .....	17
Table 2e	Initial Screening Criteria – Technical .....	19
Table 3	Screening Assessment – Sites Eliminated from Consideration .....	20
Table 4	Scoping Assessment and Selection for Semi-Quantitative Assessment .....	22



## List of Figures

Figure 1	Sites Considered for Screening Assessment
Figure 2	Potential HLF Sites and the Lake Sevan Non-Immediate Impact Zone
Figure 3	Sites Considered for Semi-Quantitative Assessment
Figure 4	Preferred HLF Sites

## List of Appendices

Appendix A	Field Reconnaissance Reports
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## 1.0 INTRODUCTION AND BACKGROUND

This revised Heap Leach Facility (HLF) Site Alternatives Analysis (SAA) has been prepared by Golder Associates Inc. (Golder) for Lydian International Ltd. (Lydian) to summarize the evaluation process conducted for the potentially viable sites for the location of a HLF for the Amulsar gold project in central Armenia. This revised HLF SAA was performed by Golder with collaboration from various discipline specialists from Golder (e.g., geotechnical, geology, environmental, water) and external experts for biodiversity (Jo Treweek, Treweek Environmental Consultants), cultural heritage (Emlen Myers, ERM), visual impacts (Sam Oxley, LUC), social and environmental consultants (Judy Kreps, Gone Native; and Liz Wall, Shared Resources), and Lydian in-house specialists and is intended to comply with international best practices with regard to assessment of alternative locations for major Project infrastructure components.

The initial HLF SAA report (Golder, 2012a) was prepared in late 2011 through early 2012 and evaluated 14 potential sites. These 14 sites are shown on Figure 1 in the earlier HLF SAA report (Golder 2012a) and are now included as Sites 1-14 as shown on Figure 1 in this revised HLF SAA. Of these 14 potential sites, Site 6 was selected for consideration and advancement by Lydian as part of the Feasibility Study for the Amulsar project. Site 6 is located along the east side of the Vorotan River within the Vorotan Valley and approximately 3 km northeast of the community of Gorayk and 4 km southeast of the planned open pits (see Figure 1). The Site 6 HLF location was then advanced to complete additional engineering evaluation and design as part of the Feasibility Study for the Amulsar project, as documented in the report prepared by KD Engineering with support from Golder and others (KD Engineering, 2012). The Feasibility Study identified proven and probable open pit mineral reserves of 2.26 million ounces gold and 9.63 million ounces silver. The Feasibility Study HLF was designed to accommodate up to 95 million tonnes (Mt) with potential for expansion for up to 120 Mt. Lydian has continued to advance the exploration and development of the Amulsar project with potential to increase the economic mineral resource.

Sites on the north and western sides of Amulsar Mountain in Vayots Dzor Marz (province) were excluded from the initial HLF SAA due to the perception of local concerns and objections to the development of a HLF with close or widespread visual impacts on key areas of the town of Jermuk. More recent baseline studies and regulatory consultations resulted in several findings that indicated the need for further consideration of alternatives.

Site 6 is partially located within the Gorayk International Bird Area (IBA), an internationally recognized “key biodiversity area.” As shown on Figure 1, the southern half of Site 6 is located within the Gorayk IBA, which was designated (amongst other features) because it supports two breeding pairs of Egyptian vulture (*Neophron percnopterus*), a species listed as Endangered by the International Union for Conservation of Nature (IUCN) and the national Red Book of Armenia. The International Finance



Corporation's (IFC) Performance Standard (PS) 6 (IFC, 2012a) permits development within certain internationally recognized areas only if there is no other technical and economically viable alternative in areas which are not "critical or natural" (paragraphs 13-19). This includes "key biodiversity areas" such as an IBA. In addition to Site 6, Sites 5 and 8 considered in the initial HLF SAA are also located within the Gorayk IBA.

The potential for a hydrological connection between Site 6 and Lake Sevan through the Spandaryan-Kechut (currently non-operational) and Kechut-Sevan tunnels was one concern due to the value placed on Lake Sevan within the country. Eleven of the fourteen HLF sites evaluated initially are located within the non-immediate impact zone of the Lake Sevan catchment, as illustrated on Figure 2. Under the Lake Sevan Law, Lake Sevan is categorized as an ecosystem of strategic importance and has a specific law that governs its protection. The catchment basin of Lake Sevan as defined by the Sevan Law, includes the Kechut and Spandaryan reservoirs, and the basins of the Vorotan River to Spandaryan reservoir and the Arpa River to Kechut reservoir. Article 10, Part 1 of the Law on Lake Sevan states that, "any type of activity detrimental to the Lake Sevan ecosystem is prohibited in the central, immediate impact, and non-immediate impact zones." Article 9.2 states that commercial activity in the non-immediate impact zone is to be carried out in accordance with the maximum permissible discharge standards (i.e. Maximum Allowable Concentrations or MACs) and the requirements set forth by the legislation of the Republic of Armenia. The law prohibits the allocation of mineral processing facilities in the area that qualifies as the immediate impact zone.

To ensure appropriate consideration of alternatives, Lydian initiated a review of the SAA process (in September 2012) and requested consideration of additional sites, including sites located on the western side of Amulsar Mountain in Vayots Dzor Marz and sites located outside of the boundaries of the Lake Sevan non-immediate impact zone and the Gorayk IBA. This revised HLF SAA, coordinated by Golder, was expanded to consider new technical options and to include potential sites beyond the 7 km radius limit that was considered initially. This revised HLF SAA report also includes consideration of the baseline assessments conducted for archaeology, biodiversity, and social aspects, as well as consideration of the full initial impact assessment presented in the ESIA draft report (WAI, September 2012).

Since involvement of stakeholders is essential to the success of the project, this revised report presents a discussion and overview of IFC requirements and an overview of Lydian's efforts regarding stakeholder engagement in Sections 2.0 and 3.0, respectively. The HLF site selection process was advanced by undertaking an initial high level, desktop-based screening assessment that included field reconnaissance and a fatal flaw analysis that identified 26 potentially viable sites. The desktop study is discussed in Section 4.0 and the screening assessment in Section 5.0. A fatal flaw analysis was established such that the following criteria resulted in a site being excluded from further consideration:



- The presence of unsuitable geotechnical conditions, (e.g., extensive ancestral landslides, poor foundations conditions due to weak clay strata and multiple springs, recent extensive lava flows, etc.)
- Significant visibility from Jermuk (due to its significance as a tourist destination)
- No suitable conveyor route and/or too far for economically viable truck haulage
- Insufficient capacity for HLF development considering a multiple-site scenario where a single site lacked capacity for a minimum of 60Mt

The screening phase was followed by a semi-quantitative site ranking evaluation of ten remaining sites, three of which were excluded from the final ranking due to their presence within the Gorayk IBA. A detailed discussion of the semi-quantitative process is presented in Section 5.0. This process included an evaluation and ranking using a numeric scoring system that included a weighting evaluation based on relative importance for a variety of sub-categories. Of the remaining seven sites, Sites 14, 11, 12, and 13 were identified in order of preference as the four sites for consideration by Lydian and the various specialists and experts involved in the final selection of the HLF for the Amulsar project. The SAA process is shown in general terms with respect to site assessment and selection in the Table 1.

**Table 1 HLF SAA General Process**

<b>Step 1 – Desktop Study and Site Reconnaissance</b>	<b>26 Sites Selected</b>
Step 2 – Initial Screening Review	Fatal Flaw Analysis and Review of Significant Adverse Conditions: 16 Sites Eliminated
Step 3 – Semi-Quantitative Ranking	Review of Remaining 10 Sites: 5, 6, 8, 9, 11, 12, 13, 14, 21, 24; Sites 5, 6, and 8 were not numerically ranked due to presence in Gorayk IBA. Site 6R added.
Step 4 – Site Selection	Sites 14, 11, 12, and 13 selected as the top 4 sites with Site 14 recommended for advancement



## 2.0 INTERNATIONAL FINANCE CORPORATION REQUIREMENTS

The SAA has been revised to include the requirements of IFC Performance Standards, in particular PS1 on Assessment and Management of Environmental and Social Risks and Impacts and PS6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources.

PS1 established the need to conduct an alternative assessment as part of the ESIA. In accordance with best practice, alternatives assessed typically cover siting of major infrastructure components. PS1 states in the footnote to paragraph 7 that “The client (i.e. Lydian) will conduct... an examination of alternatives”:

**“The client will establish and maintain a process for identifying the environmental and social risks and impacts of the project (see paragraph 18 for competency requirements). The type, scale, and location of the project guide the scope and level of effort devoted to the risks and impacts identification process. The scope of the risks and impacts identification process will be consistent with good international industry practice,<sup>10</sup> and will determine the appropriate and relevant methods and assessment tools. The process may comprise a full-scale environmental and social impact assessment, a limited or focused environmental and social assessment, or straightforward application of environmental siting, pollution standards, design criteria, or construction standards.<sup>11</sup> ... The risks and impacts identification process will be based on recent environmental and social baseline data at an appropriate level of detail. The process will consider all relevant environmental and social risks and impacts of the project, including the issues identified in Performance Standards 2 through 8, and those who are likely to be affected by such risks and impacts...**

*“11 For greenfield developments or large expansions with specifically identified physical elements, aspects, and facilities that are likely to generate potential significant environmental or social impacts, the client will conduct a comprehensive Environmental and Social Impact Assessment, including an examination of alternatives, where appropriate.”*

With respect to greenfield development, PS1 provides specific guidance within Guidance Note (GN) 25:

*GN25. “For greenfield developments, the ESIA includes an examination of technically and financially feasible alternatives to the source of such impacts, and documentation of the rationale for selecting the particular course of action proposed. The purpose of the alternatives analysis is to improve decisions on project design, construction, and operation based on feasible alternatives to the proposed project. This analysis may facilitate the consideration of environmental and social criteria at the early stages of development and decision-making based on the differences between real choices. The alternatives analysis should be conducted as early as possible in the process and examine feasible alternatives; alternative project locations, designs, or operational processes; or alternative ways of dealing with environmental and social impacts.”*

PS1 in paragraph 13 and 14 states that the client will establish management programs:

**“These programs, in sum, will describe mitigation and performance improvement measures and actions that address the identified environmental and social risks and impacts of the project... The programs may apply broadly across the client’s organization, including contractors and primary suppliers over which the organization has control or influence, or to specific sites, facilities, or activities. The mitigation hierarchy to address identified risks and impacts will favor the avoidance of impacts**



**over minimization, and, where residual impacts remain, compensation/offset, wherever technically<sup>20</sup> and financially feasible<sup>21</sup>.”**

Detailed definitions are provided in footnotes 20 and 21:

**“Technical feasibility is based on whether the proposed measures and actions can be implemented with commercially available skills, equipment, and materials, taking into consideration prevailing local factors such as climate, geography, demography, infrastructure, security, governance, capacity, and operational reliability.**

**“Financial feasibility is based on commercial considerations, including relative magnitude of the incremental cost of adopting such measures and actions compared to the project’s investment, operating, and maintenance costs, and on whether this incremental cost could make the project nonviable to the client.”**

PS6 specifically addresses the need to avoid impacts on biodiversity and ecosystem services when selecting locations to develop projects. Clients should not “significantly convert or degrade natural habitats” unless, *inter alia*, “no other viable alternatives within the region exist for development of the project on modified habitats. Furthermore, project activities must not be undertaken in critical habitat unless it can be shown that all the following conditions can be met (IFC PS6 paragraph 17):

- **“No other viable alternatives within the region exist for development of the project on modified or natural habitats that are not critical”**

PS6 Guidance Notes further emphasize the need to consider project development options, which would avoid impacts on natural or critical habitat. Compliance with the requirements of IFC PS6 in this regard was therefore a major driver behind review of viable alternatives.

In addition, PS6 Guidance Note states the following in paragraph 44 and 45 as noted below:

GN44. *“Significant conversion or degradation of natural habitat will not take place unless the client is able to demonstrate that all three requirements in paragraph 14 have been undertaken and the company has demonstrated that its proposed activities comply with land-use and licensing regulations. The first bullet point is that no viable alternatives exist for that project on modified habitat (within the region). This is especially relevant to agribusiness projects where it might be feasible in some cases to site the project on heavily modified and degraded lands rather than in areas that have recently been deforested or on other forms of natural habitat (e.g., tropical savanna). In these cases, a well-developed locations alternative analysis should be conducted to explore potential viable options for development on modified habitat. The term “viable” includes, but is not limited to, technically and financially feasible alternatives. This analysis will in most cases be in addition to the alternative analysis included as part of the risks and impacts identification process. It should be a considerably more in-depth analysis than what is typically included in an ESIA, and should provide specifics on alternatives in the landscape for developing the project as well as the breakdown of cost increases for developing modified versus natural habitat.”*



GN45. *“The second bullet point in paragraph 14 is with respect to stakeholder engagement and consultation. If a project has the potential to result in significant conversion or degradation of natural habitats, relevant stakeholder groups must be engaged as part of a rigorous, fair and balanced multi-stakeholder dialogue. Client requirements for stakeholder engagement are described in Performance Standard 1 and related guidance can be found in Guidance Note 1. Stakeholders should specifically be engaged with respect to (i) the extent of conversion and degradation; (ii) the alternatives analyses; (iii) biodiversity and ecosystem services values associated with the natural habitat; (iv) options for mitigation, including set-asides and biodiversity offsets; and (v) identification of additional opportunities for biodiversity conservation (see paragraph GN34). Clients must keep a record of such stakeholder engagement and consultation activities and demonstrate how viewpoints have been reviewed and integrated into the project design. Stakeholders should include a diverse set of opinions, including scientific and technical experts, relevant authorities/agencies responsible for biodiversity conservation or the regulation/management of ecosystem services, and members of the national and international conservation NGO community, in addition to Affected Communities.”*





### 3.0 STAKEHOLDER ENGAGEMENT

Lydian discovered the Amulsar deposit in 2006, with stakeholder engagement activities commencing as soon as geological investigations began on the mountain. The engagement process has become more formalized over the intervening years, with the creation of Community Liaison Committees (CLC) in the three initially affected villages (Saravan, Goryak, and Gndevéz) in 2010 and one more CLC created in 2011 for Jermuk. A Community Liaison Officer meets monthly with the CLCs in the four communities for updates & feedback. Lydian also consults with local communities through local program assistants.

Lydian has built a 5-year record of accomplishment of community engagement with local villagers (CLC, grievance boxes, monthly newsletters), fully compliant with International Best Practice regarding Stakeholder Engagement (World Bank Group, Equator Principles).

More than 50 public consultation, disclosure events & informal meetings have taken place since 2007 in the locally affected communities, and a formal Stakeholder Engagement Plan (SEP), prepared and implemented in line with IFC PS requirements, was adopted in early 2011, guiding how to consult, inform and work with local villagers. The SEP was updated in April 2013 to reflect the current project.

The results of this SAA will be shared with affected communities and Project stakeholders (including relevant regulatory authorities) via Lydian's existing stakeholder relations program.

Public meetings and consultations with stakeholders will take place in the coming months to present and discuss the outcomes of the HLF SAA.



#### 4.0 INITIAL DESK STUDY AND SITE RECONNAISSANCE

The revised SAA began with a desk study and evaluation conducted using available information to review potentially viable HLF sites in Vayots Dzor Marz and in an expanded area in Syunik Marz. This desk study resulted in the addition of nine sites (Sites 15-23) based on review of topographic maps and from input provided by the Lydian environmental and social management team (Armen Stepanyan and Didier Fohlen).

Senior Golder HLF technical specialists from Denver, Colorado (Brent Bronson and Rick Kiel) and Nottingham, England (Gareth Digges La Touche) conducted a detailed site reconnaissance of potentially viable HLF sites and surrounding vicinity areas with support from the mine Environmental Manager (Carl Nicholas) over a four-day period from 1 to 4 November 2012.

This phase of work comprised two distinct steps:

- The desk study comprising the identification of potential sites from satellite imagery combined with a digital elevation model of the area, available 1:100,000 topographic maps and existing knowledge of the area on the part of the Golder and Lydian teams.
- The field reconnaissance reviewed the site characteristics at each of the 23 sites identified on Figure 1. Notes were made of observations, regarding biodiversity, environmental conditions, infrastructure, and social, cultural, and technical issues, together with photographs at each site. These notes were compiled into a series of individual site reports during and immediately following the site reconnaissance.

During the field reconnaissance, 3 additional potential sites were added culminating in 26 total sites that were evaluated as part of the screening assessment discussed in the following section. The location of the sites considered during the screening assessment are shown on Figure 1 along with many of the key environmental, biodiversity, social, and infrastructure characteristics in the study area. Copies of the completed Field Reconnaissance Reports for each site are included in Appendix A.



## 5.0 SCREENING ASSESSMENT

The 26 sites identified on Figure 1 were initially evaluated as potentially viable locations for a HLF. The sites are situated within the Arpa, Darb, and Vorotan River catchment areas. As previously noted, eleven of the sites are located within the Lake Sevan non-immediate impact zone as depicted on Figure 2.

Based on the expert and specialist consultations and information gained from the field reconnaissance and input from the discipline specialists, the key project biodiversity, physical environmental, social, technical viability, and economic viability subcategory considerations were established and used to develop the screening criteria as shown on Tables 2a through 2e. The subcategory considerations are presented as headers in Tables 2a through 2e and are posed as questions such that a positive response means the constraint is favorable to the selection of the site. This was initially undertaken in a phased manner with discipline specialists populating the tables independently. The individual tables were then merged and the information provided was discussed during a round table meeting and conference call between Golder, Lydian, and the discipline specialists on 5 November 2012, after which a final version of the tables was prepared as agreed upon by all participants.

A discussion of the applicable buffer zones, exclusion areas, site constraints, ranking criteria and fatal flaw decision-analysis is provided in the following sections.

### 5.1 Buffer Zones and Exclusion Areas

Application of the *screening assessment* criteria shown on Tables 2a through 2e included definition and inclusion of buffer zones and exclusion areas around sensitive environmental features, communities, and service infrastructure. A buffer zone was generally considered a specifically delimited area within which HLF development was considered to be an adverse condition and was to be avoided in the planning stage. As such, the initial siting for the 26 sites avoided these areas. Exclusion areas were typically areas where HLF development would create an adverse condition to the environment or local community and was thus were avoided to the extent practical and given special consideration in the screening assessment and semi-quantitative ranking process.

#### 5.1.1 Buffer Zones

The buffer zones were defined in accordance with Armenian regulatory guidance, direction from Lydian for the gas pipeline and Vorotan to Arpa tunnel and on information provided by Geoteam CJSC and the draft ESIA prepared by WAI, and were identified as follows:

- Major Rivers (Vorotan, Arpa and Darb) and their significant, permanent tributaries – 200m from each bank, which exceeds the setback distance required by Armenian Decree N64 of 150 m.
- Iran-Armenia Gas pipeline – 200m buffer on either side based on information provided by the pipeline owner, ArmRus Gazprom.



- Spandaryan-Kechut Tunnel (currently not in operation) linking the Vorotan river to the Arpa river – 50m buffer on either side based on recent communications with Geoteam and similar regulatory requirements elsewhere in the European Union.

### 5.1.2 Exclusion Areas

Exclusion areas were identified to comply with Government of Armenia laws and international policies and standards. They were also identified to avoid impacts on key environmental and biodiversity receptors identified through baseline studies and impact assessments. The presence of a site within or near an exclusion area was considered as adverse within the initial screening assessment. Such sites were given more significance and generally ranked more negatively in the semi-quantitative ranking assessment. The following exclusion areas were identified:

- Settlements: 1km boundary around settlements to any periphery of the key mine infrastructure specific to gold metallurgical processing facilities based on the Armenian regulations for sanitation protective zones (SanPin 2.2.1/2.1.1.1200-03, 4.1.23). The presence of a sanitation protection zone was not considered to represent a fatal flow at the screening assessment stage as potential mitigation including physical relocation and economic compensation measures could be considered for some of the villages depending on site-specific conditions, social impacts, and after thorough local community input and involvement. Any site that advanced in the screening assessment that was located within an exclusion zone was heavily negatively weighted in the semi-quantitative ranking assessment. In addition, sites between 1 and 2 km around settlements were also considered as potentially adverse conditions.
- Gorayk and Jermuk Important Bird Areas (IBA).
- Biodiversity – potential critical habitat: Some parts of the search area may constitute critical habitat according to the definition in PS6, due (amongst other factors) to the presence of species that are listed as Endangered on the IUCN Red List and/or in the national Red Book. Egyptian vulture (Endangered) breeds in the area and populations pass through and feed during the spring and autumn migrations. There is also a population of an alpine plant, *Potentilla porphyrantha* (Critically Endangered in the Armenian Red Book) on Amulsar Mountain. Alternatives that would avoid impacts on potential critical habitat were sought.
- Archaeology: It was considered preferable to avoid known cultural heritage sites identified as having medium to high importance. Sites of unique importance for cultural heritage (i.e. no go zone) have been already identified and mapped by ERM.
- Lake Sevan Law: The catchment basin of Lake Sevan as defined by Sevan Law covers Kechut and Spandaryan reservoirs, which includes the basins of Arpa and Vorotan rivers up to Kechut reservoir. The Lake Sevan catchment basin is divided into three zones: the central zone, an immediate impact zone, and a non-immediate impact zone. The Potential HLF Site locations relative to the Lake Sevan Non-Immediate Impact Zone are illustrated on Figure 2. The purpose of identifying the non-immediate impact zone is to prevent the potential for negative impacts on Lake Sevan.



## 5.2 Site Constraints

The presence of villages and other limiting infrastructure, such as road crossings and existing government facilities that may create site constraints was identified and considered during the screening process.

The identification of potentially viable HLF sites at the initial *screening assessment* level was based on criteria shown on Tables 2a through 2e. The key initial screening criteria considered (in no particular order of significance) are discussed briefly in each of the following sub-sections.

### 5.2.1 Suitable Topography

The presence of steep slopes was considered generally as being unfavorable to the location of a conventional HLF and potentially unfavorable for a valley HLF unless the geometry permitted construction of a suitable toe buttress to provide adequate stability. Slopes in excess of 40% gradient were considered a technical fatal flaw, as that is the steepest slope gradient that a protective over liner (i.e. drain gravel) can be placed on a geomembrane liner. Steep slopes also were considered a constraint for access, construction, and HLF stability.

### 5.2.2 Geology and Hydrogeology

Each site was assessed based on the geologic and hydrogeologic conditions relative to the suitability of the site and foundation conditions for development of a HLF. Based on surveys undertaken by Lydian and observations during the site reconnaissance by Golder, each site was inspected for the presence of unfavorable geology (for example extensive recent surficial lava flows, hummocky topography indicative of unstable foundation conditions and landslides, numerous springs, snow avalanche chutes, etc.).

### 5.2.3 Capacity (Surface Area)

Each site was assessed based on surface area as to the likelihood of it having sufficient capacity to meet the project ore storage requirements (i.e., 95 Mt site with the capacity to be expanded to 120 Mt, for a single HLF scenario; or, alternatively, provide for a minimum of a 60 Mt HLF assuming a multiple HLF site development scenario).

### 5.2.4 Environmental Factors

The primary environmental constraints were those identified as requiring buffer zones or consideration of an exclusion area including the proximity to settlements, the IBAs, the Lake Sevan non-immediate impact zone, and other concerns related to general biodiversity of the sites. Other environmental factors considered were the presence of river crossings (with the aim to minimize crossings of major watercourses) and avoidance of impacts on perennial streams.



### **5.2.5 Social Factors**

Each site was evaluated with regard to its proximity to local communities and settlements, whether the construction of the HLF would require physical displacement of any inhabitants or would result in economic displacement. The specific type of economic displacement anticipated was noted and is predominantly associated with the loss of communal grazing lands by local and seasonal herders and relocation of community water supply infrastructure was considered. Also considered was the HLF visual impact potential from settlements and major highways. Impacts to community water supplies including both agricultural and potable water use were also addressed. Although fully considered in the SAA, economic displacement will be difficult to avoid due to the high levels of land-use by herders (both residential and seasonal) across the area; however, the degree of economic displacement does vary from one site to another.

### **5.2.6 Infrastructure**

The presence of any significant infrastructure was documented based on available mapping and site observations. Such infrastructure included roads, power transmission lines, a fiber optic line, irrigation and water supply channels, tunnels, a military observation station, a meteorological station, and a high-pressure trans-national gas pipe line. Such infrastructure is considered to pose constraints and/or mitigation requirements.

### **5.2.7 Biological Diversity**

Efforts were made to identify alternative locations for the HLF that would (a) avoid significant conversion or degradation of natural habitat and (b) avoid significant adverse impacts on critical habitat. Most of the study area is used to some extent for agriculture, including communal grazing, hay harvesting and in some cases cultivation for crops. Intensity of use varies and a large proportion of potential sites are considered “natural habitat” according to the definition in PS6 because they retain “viable assemblages of plant species of largely native origin.” Others are more intensively used and modified due to farming and include a higher proportion of artificially introduced species. Options outside the two IBAs in the area were identified. Based on the results of baseline ecological surveys and consultation with conservation organizations that are active in the area, alternatives that would avoid impacts on potential critical habitat were also sought. Further surveys of migratory and breeding raptors in spring 2013 and of populations of endangered plants will establish whether potential areas of critical habitat in the project area meet the thresholds included in PS6.

### **5.2.8 Archeology**

The archeological and cultural heritage potential of each site was assessed by ERM from the results of field inspections in 2011 and 2012 (total of 3), the results of field surveys commissioned by Geoteam with local archaeologists and the examination of satellite imagery. Sites were designated as either being of



*low potential* (for example no resources identified, but close to a site where resources have been identified), *high potential* (for example close to a site where resources have been identified and the site has not been surveyed to confirm absence), or *within* (for example where the site has confirmed archaeological resources within it. Some sites were not designated as there was insufficient data to undertake an assessment. These sites were not rated, as archaeological consultants had not been to them yet.

### 5.3 Ranking Criteria and Fatal Flaws

Following compilation of the screening criteria table the presence of adverse conditions, including fatal flaws, at each site was identified. Where adverse conditions were identified, they are highlighted on Tables 2a through 2e through shading. Adverse criteria are shaded orange, whereas conditions considered to represent fatal flaws are shaded red. The following criteria were established as indicative of a fatal flaw(s) that resulted in the site being excluded from further consideration:

- Significant visibility from Jermuk (due to its significance as a tourist designation)
- The presence of unsuitable geotechnical conditions, (e.g., extensive ancestral landslides, poor foundations conditions due to clay and multiple springs, recent extensive lava flows, etc.)
- No suitable conveyor route and/or too far for economically viable truck haulage
- Insufficient capacity for HLF development considering a multiple-site scenario where a single site lacked capacity for a minimum of 60Mt

If the site in question scored a fatal flaw (i.e. red) or had significant adverse conditions (i.e., orange) as determined and agreed to by the specialists team, then it was considered that the site did not warrant further assessment. Sites 1, 2, 3, 7, 10, 15, 16, 17, 18, 19, 20, 22, 23, and 25 were discounted from further assessment based on one or more fatal flaws. Site 4 was discounted based on a combination of significant adverse conditions including location within the Lake Sevan non-immediate impact zone and the Gorayk IBA, close proximity to Gorayk and other infrastructure, and the lack of available capacity for a HLF. Site 26 was also discounted based on a combination of significant adverse conditions including difficult construction conditions, access for heavy equipment, difficult closure conditions, and limited visibility (i.e., not widespread across the town or affecting key areas) at a distance of over 5km from Jermuk, The remaining sites that were advanced for additional evaluation in the *semi-quantitative* site ranking are shown on Figure 3.





Table 2a Initial Screening Criteria – Biodiversity/Environmental

Site	Outside Lake Sevan Non-Immediate Impact Zone?	Beyond 200 m of the Spandaryan Kechut Tunnel? [Note 5]	Beyond 1km sanitary protection zone for Communities?	Outside IBA Area boundary?	Outside area of supporting habitat for IBA? [Note 1]	Outside Natural Habitat? [Note 2]	Outside potential critical habitat? [Note 3]
1	YES	YES	NO (0.7km South of Saravan)	YES	YES	YES	YES
2	YES	YES	YES (1.1km E/NE of Ughedzor)	YES	YES	YES	YES
3	NO	YES	YES (Ughedzor – 2km E/NE)	Partially	NO	YES	YES
4	NO	YES	YES (2.3 km W/NW of Gorayk)	NO		YES	NO
5	NO	YES	YES (1.1km N of Gorayk)	NO		NO	NO
6	NO – Vorotan	YES	YES (2km N of Gorayk)	Partially	NO	NO	NO
7	NO – Vorotan	YES	YES (6km N/NE of Gorayk)	YES	NO?	NO	NO
8	NO – Vorotan	YES	YES (1.3km N/NE of Gorayk)	NO		NO	NO
9	NO – Vorotan	YES	YES (4km N/NE of Gorayk)	YES	NO?	NO	NO
10	NO – Vorotan	YES	YES (3km N/NE of Gorayk)	YES	NO?	NO	NO
11	NO – Vorotan	YES	YES (4km S/SE of Kechut)	YES	NO	NO	NO
12	NO – Vorotan	YES	YES (6km N of Gorayk)	YES	NO	NO	NO
13	NO – Vorotan	YES	YES (4km S/SE of Kechut)	YES	NO	NO	NO
14	YES	YES	YES (2km E of Gndevaz)	YES	YES?	NO	NO
15	YES	YES	YES (4km E of Gndevaz)	YES	YES	NO	NO
16	YES	YES	YES (3km NE of Saravan)	YES	YES	NO	NO
17	YES	YES	YES (1.8km NE of Saralanj)	YES	YES	NO	NO
18	YES	YES	YES (2km NE of Saralanj)	YES	YES	NO	NO
19	YES	YES	YES (1.6km E of Saralanj)	YES	YES	YES	YES?
20	YES	YES	NO (0.6km N of Saralanj)	YES	YES	YES	YES
21	NO – Vorotan	YES	YES (4km NE of Gorayk)	YES	NO?	NO?	NO
22	NO – Vorotan	YES	YES (1km N of Tsg huk)	YES	NO?	NO?	NO
23	YES	YES	NO (0.5km E of Sarnakunk)	YES	NO?	NO?	NO
24	YES	YES	NO (0.1 km W of Ughedzor)	YES	YES	YES	YES
25	YES	YES	YES (1.5km S/SE of Ughedzor)	YES	YES	YES	YES
26	NO – Kechut	YES	YES (1.5km SE of Kechut)	YES	YES	NO	NO

GENERAL NOTE to TABLES 2a - 2e: Red shading indicates a fatal flaw while orange shading indicates a potential significant adverse condition. Bold fonts indicate the site was selected for advancement to the semi-quantitative assessment phase.

Note 1: Supporting habitat for the IBA. Goryk IBA was designated based on certain criteria, notably Egyptian Vulture (EV) and lesser kestrel, but it was entirely designed as a buffer round the lesser kestrel breeding colony and doesn't reflect area important for EV and other species (see below). All species use Vorotan Valley but surveys not carried out for western side of the Concession Area. EV, Golden Eagle and Long-legged buzzard relatively adaptable in terms of feeding if area around nest site is not disturbed. Nest sites not confirmed.

Species	Season	Population Estimate	IBA Criteria	IUCN Status	Note
Lesser Kestrel <i>Falco naumanni</i>	breeding	10-20 breeding pairs	A1, B2	Least Concern	Hunts actively Site 6, entire hunting area not established
Egyptian Vulture <i>Neophron percnopterus</i>	breeding	1-2 breeding pairs	A1	Endangered	Breeding sites within or near IBA not known. Feeds widely but concentrations of feeding activity around sites 6 and 13
Long-legged Buzzard <i>Buteo rufinus</i>	breeding	5-6 breeding pairs	B2	Least Concern	Breeding sites previously on Amulsar. Relatively adaptable, feeds widely
Golden Eagle <i>Aquila chrysaetos</i>	breeding	2-3 breeding pairs	B2	Least Concern	Breeding sites not confirmed. Shortage of suitable sites likely; may be possible to create artificially.

Sites 4 and 5 inside IBA, but existing information suggests not used much by designated species; Site 6 and Site 13 have concentrations of feeding activity. Sites 7, 9, 10, and 21, 22, 23 may all be used by Gorayk EV, but use of these areas not known at present. EV likely to be able to adapt provided no major disturbance around nesting locations (Not known). Site 14: closer to Jermuk IBA. Little known about populations associated with Jermuk and their ranges.

Note 2: Need to show there were no alternatives on habitat that is not natural (this exercise) and achieve NNL of natural habitat if possible. Map needed of natural/modified habitat. Criteria for screening out "modified": cultivated land, intensively grazed areas (including round large herder camps) roads, tracks, paths, buildings. All other land likely to be "natural." Criteria for "natural": retaining high proportion of species that would be expected to occur in a relatively undisturbed or un-managed example of the vegetation type (e.g. steppe grassland).

Note 3: Critical Habitat – The entire area of search is within the migration corridor for raptors including Egyptian Vulture. It is not possible to confirm whether trigger densities of population for Critical Habitat will be met until proposed spring survey carried out. Until that point, the entire concession has to be considered potential CH for migratory raptors/EV at this stage. "NO" is indicated where existing information suggests suitability for feeding/settling likely to be lower due to land use, disturbance etc. (not definitive). NB critical habitat areas differ for different species. CH for Potentilla is not directly affected by any of the alternatives but NB location of conveyor from mine pit to 15, 16, 17, 18 could cross populations?

Note 4: Ecosystem Services – Vorotan Valley provides important services, as do rivers, grasslands, and forests around villages. Levels of dependence are not established. Input needed to determine whether there are any services that would be difficult to substitute for existing users who have limited alternatives and depend on these services a lot.

Note 5: Spandaryan – Kechut Tunnel - A 50 m buffer was maintained on either side of the tunnel alignment as a site selection criteria so all sites are at least 50 m from the mapped tunnel alignment.





**Table 2b Initial Screening Criteria – General Location**

<b>Site</b>	<b>4. Within rock allocation area (RAA)?</b>	<b>16. Within exploration license area?</b>
1	NO	YES
2	NO	YES
3	NO	YES
4	YES	YES
<b>5</b>	<b>YES</b>	<b>YES</b>
<b>6</b>	<b>YES</b>	<b>YES</b>
7	NO	YES
<b>8</b>	<b>YES</b>	<b>YES</b>
<b>9</b>	<b>NO</b>	<b>YES</b>
10	NO	YES
<b>11</b>	<b>Partially</b>	<b>YES</b>
<b>12</b>	<b>YES</b>	<b>YES</b>
<b>13</b>	<b>YES</b>	<b>YES</b>
<b>14</b>	<b>NO</b>	<b>NO</b>
15	NO	NO
16	NO	NO
17	Partially	Partially
18	Partially	Partially
19	YES	YES
20	NO	YES
<b>21</b>	<b>NO</b>	<b>NO</b>
22	NO	NO
23	NO	NO
<b>24</b>	<b>NO</b>	<b>Partially</b>
25	NO	YES
26	NO	Partially

**Note 1:** Bold fonts indicate the site was selected for advancement to the semi-quantitative assessment phase.



Table 2c Initial Screening Criteria – Infrastructure

Site	Radial distance from the Crusher	Avoids River crossing by conveyor?	Avoids Road crossing by conveyor?	Avoids gas pipeline crossing or impact?	Avoids Spandaryan-Kechut Tunnel crossing by conveyor?	Source of production and project water supply? [Note 1]	Heavy equipment access?
1	>5 km	NO	NO	YES	NO	Pipe from Vorotan or well field	MODERATE
2	>5 km	YES	YES	YES	NO	Pipe from Vorotan	FAVORABLE
3	>5 km	YES	NO	YES	NO	Pipe from Vorotan	FAVORABLE
4	<5 km	YES	YES	YES	YES	Pipe from Vorotan	FAVORABLE
5	<5 km	YES	YES	YES	YES	Pipe from Vorotan or well field	FAVORABLE
6	<5 km	NO	YES	YES	YES	Vorotan	FAVORABLE
7	>5 km	NO	NO	NO	YES	Ghoshabulagh or Vorotan pipe	MODERATE
8	>5 km	NO	NO	YES	YES	Ghoshabulagh	FAVORABLE
9	>5 km	NO	NO	NO	YES	Ghoshabulagh	FAVORABLE
10	>5 km	NO	NO	NO	YES	Ghoshabulagh	MODERATE
11	>5 km	YES	NO	NO	YES	Vorotan	FAVORABLE
12	<5 km	NO	NO	YES	YES	Vorotan	FAVORABLE
13	<5 km	YES	YES	YES	YES	Vorotan	MODERATE
14	<5 km	YES	YES	YES	NO	Gndevaz pipe or well field	FAVORABLE
15	<5 km	YES	YES	YES	YES	Pipeline	DIFFICULT
16	<5 km	YES	YES	YES	YES	Pipeline	DIFFICULT
17	<5 km	YES	YES	YES	YES	Pipeline	DIFFICULT
18	<1 km	YES	YES	YES	YES	Pipeline	DIFFICULT
19	<5 km	YES	YES	YES	YES	Pipeline	DIFFICULT
20	<5 km	YES	YES	YES	NO	Pipeline	DIFFICULT
21	<10 km	NO	NO	NO	YES	Pipeline	FAVORABLE
22	>10 km	NO	NO	NO	YES	Pipeline	FAVORABLE
23	>15 km	NO	NO	NO	YES	Pipeline	FAVORABLE
24	>5 km	NO	NO	YES	NO	Pipeline or well field	MODERATE
25	>5 km	NO	NO	YES	NO	Pipeline	FAVORABLE
26	<5 km	YES	YES	YES	YES	Pipeline	DIFFICULT

- Note 1:** Bold fonts indicate the site was selected for advancement to the semi-quantitative assessment phase.
- Note 2:** Demand is estimated as ~ 20 l/s
- Note 3:** Significant adverse conditions (orange shading) were considered where a river crossing was required by the conveyor and where the terrain would make access to heavy equipment very difficult.



Table 2d Initial Screening Criteria – Social/Cultural

Site	Site is not highly or widely visible from key areas of settlements (by day, and nighttime lighting)	Presence of community water supply point/source	Outside of area with known immovable cultural/archaeological sites (i.e. is the Site free of archaeological resources?)	Avoids Physical resettlement of local human inhabitants	Avoids economic displacement?
1	NO – Saravan and Saralanj	None identified	Not yet subject to archaeological survey or consideration, status unknown.	No	No – agricultural land
2	NO – Saralanj and Ughedzor	None identified	Not yet subject to archaeological survey or consideration, status unknown.	Yes	No – agricultural land and Ughedzor
3	NO – Saralanj and Ughedzor	None identified	Not yet subject to archaeological survey or consideration, status unknown.	Yes	No – agricultural land
4	NO – Saralanj and Ughedzor	None identified	Not yet subject to archaeological survey or consideration, status unknown.	Yes	No – agricultural land
5	NO – Gorayk	None identified	High Potential – Site 5 has neither been visited nor assessed via remote sensing, but it lies in close proximity to Site 6, which has a high number of known archaeological resources. It is believed that Site 5 has high potential to not be free of archaeological resources.	No	No
6	NO	Gorayk source adjacent	Within – Site 6 is known to contain archaeological sites. Site 6 is not free of archaeological resources.	Yes	No
7	NO	None identified	Not yet subject to archaeological survey or consideration, status unknown.	Yes	No
8	NO – Gorayk	None identified	High Potential – Site 8 has neither been visited nor assessed via remote sensing, but it lies in close proximity to Site 6, which has a high number of known archaeological resources. Further, there is one potential archaeological site that falls within Site 8, although this site has neither been visited nor confirmed. It is believed that Site 8 has high potential to not be free of archaeological resources.	Yes	No
9	NO	None identified	High Potential – Site 9 has neither been visited nor assessed via remote sensing, but it lies in close proximity to known archaeological resources. It is believed that Site 9 has high potential to not be free of archaeological resources.	Yes	No
10	NO – Gorayk	Community water pipe	High Potential – Site 10 has neither been visited nor assessed via remote sensing, but it lies in close proximity to known archaeological resources. It is believed that Site 10 has high potential to not be free of archaeological resources.	Yes	No
11	YES	Gndevaz canal and pipeline	Low Potential – Site 11 has been visited and no archaeological resources were encountered. However, Site 11 lies in close proximity to known archaeological resources. It is believed that Site 11 has low potential to not be free of archaeological resources.	Yes	No
12	YES	None identified	Within – Site 12 contains a number of confirmed archaeological sites. Site 12 is not free of archaeological resources.	Yes	No
13	YES	None identified	Low Potential – Site 13 has been visited. Potential archaeological features of negligible importance were visited and recorded. However, it is uncertain if those sites in Site 13 are actual archaeological features or not. Further, while the landscape is sub-optimal for ancient populations, it does lie within proximity of known archaeological resources. It is believed that Site 13 has low potential to not be free of archaeological resources.	Yes	No: herders
14	YES	Agricultural reservoir, Gndevaz canal and pipelines	Not yet subject to archaeological survey or consideration, status unknown.	Yes	No Gndevaz water supply; grazing and hay
15	NO – Gndevaz	Spring catch pit	Not yet subject to archaeological survey or consideration, status unknown.	Yes	No: herders
16	NO – Gndevaz	None identified	Not yet subject to archaeological survey or consideration, status unknown.	Yes	No: herders



Site	Site is not highly or widely visible from key areas of settlements (by day, and nighttime lighting)	Presence of community water supply point/source	Outside of area with known immovable cultural/ archaeological sites (i.e. is the Site free of archaeological resources?)	Avoids Physical resettlement of local human inhabitants	Avoids economic displacement?
17	NO – Saravan	None identified	<b>Low Potential</b> – Site 17 has been visited and no archaeological resources were encountered. However, the field walkover at Site 17 was quite expedient, and it is possible that potential resources were missed, even if Site 17’s location is sub-optimal for ancient populations. It is believed that Site 17 has low potential to not be free of archaeological resources.	Yes	No: herders
18	NO – Saravan	None identified	<b>Low Potential</b> – Site 18 has been visited and no archaeological resources were encountered. However, the field walkover at Site 18 was quite expedient, and it is possible that potential resources were missed, even if Site 17’s location is sub-optimal for ancient populations. It is believed that Site 18 has low potential to not be free of archaeological resources.	Yes	No
19	NO – Saravan and Saralanj	None identified	<b>Within</b> – Site 19 contains a number of confirmed archaeological sites. Site 19 is not free of archaeological resources.	No	No
20	NO – Saravan, Saralanj and Ughedzor	None identified	<b>Low Potential</b> – Site 20 has not been visited, but a remote sensing analysis was conducted. No potential archaeological features were identified from the satellite imagery. Site 20 is also heavily disturbed from agricultural activity. However, this Site cannot be considered free of archaeological resources until a field visit occurs that searches for archaeological resources commonly not found through remote sensing techniques. It is believed that Site 20 has low potential to not be free of archaeological resources.	No	No: herders
21	<b>NO – Gorayk and Tsghuk</b>	<b>None identified</b>	<b>Not yet subject to archaeological survey or consideration, status unknown.</b>	<b>Yes</b>	<b>No: herders</b>
22	NO – Tsghuk	HEP/Community pipelines	Not yet subject to archaeological survey or consideration, status unknown.	Maybe	No: herders
23	NO – Samakunk	HEP/Community pipelines	Not yet subject to archaeological survey or consideration, status unknown.	No	No
24	<b>NO – Ughedzor</b>	<b>Community supply pipeline and agricultural collection system</b>	<b>Not yet subject to archaeological survey or consideration, status unknown.</b>	<b>No</b>	<b>No</b>
25	NO – Ughedzor	None identified	Not yet subject to archaeological survey or consideration, status unknown.	No	No
26	NO - Visible at a distance (over 5km) from Jermuk, but this would not be widespread across the town or affect key areas.	Gndevaz canal and pipelines	Not yet subject to archaeological survey or consideration, status unknown.	Yes	N0

- Note 1:** Bold fonts indicate the site was selected for advancement to the semi-quantitative assessment phase.
- Note 2:** Significant adverse conditions (orange shading) for visual impacts of the social and cultural screening criteria were considered with respect to visibility from the local effected communities. A fatal flaw (red shading) was considered with respect to the potential for close (under 5km) or widespread visual impacts from key areas of the tourist town of Jermuk. The water fountains, waterfall and associated areas of the town center are considered to be the key tourist area, and from which visibility should be minimized.
- Note 3:** Significant adverse conditions (orange shading) for immovable cultural/archeological sites was considered where confirmed sites were known to occur on the site.
- Note 4:** Significant adverse conditions (orange shading) were considered where there was potential for the need to resettle local human inhabitants as a result of the planned HLF development.



Table 2e Initial Screening Criteria – Technical

Site	Does site include suitable space for ponds, ADR plant?	No apparent significant geotechnical flaws (e.g., foundation conditions, general site gradient and/or avalanche zones)	Constructability	Acceptable Conveyor Route Topography	Is Site Topography Suitable for Conventional HLF or Valley LF?	Does site have capacity for 95Mt with potential increase to 120 Mt?	Does site have capacity for 60Mt assuming a multiple HLF site development scenario	Avoids management of shallow groundwater or significant (perennial) seeps and springs?	Avoids potentially difficult closure constraints (i.e., upgradient surface-water conditions and long-term groundwater issues)?
1	MAYBE	NO – landslides indicative of weak foundation conditions	Difficult	NO	Conventional	YES	YES	NO	NO
2	YES	NO – landslides indicative of weak foundation conditions	Moderate	YES	Conventional	NO – would require multiple sites	NO	YES	NO
3	YES	YES	Good	YES	Conventional	NO – would require multiple sites	NO	NO	NO - road
4	YES	YES	Good	YES	Conventional	NO – would require multiple sites	YES	YES	NO - road
5	YES	NO – some landslides but moderate slopes, could buttress	Moderate	YES	Conventional	YES	YES	NO	NO
6	YES	YES	Good	YES	Conventional	YES	YES	YES	YES
7	YES	NO – cannot create suitable foundation due to presence of extensive lava flows	Difficult	NO	Valley	YES	YES	NO	NO
8	YES	YES	Good	NO	Conventional	YES	YES	YES	YES
9	YES	YES	Difficult	YES	Conventional	NO – would require multiple sites	YES	NO	NO
10	NO	YES	Moderate	NO	Conventional	NO – would require multiple sites	NO	NO	NO
11	YES	YES	Moderate	YES	Conventional	YES	YES	YES	YES
12	YES	YES	Good	YES	Conventional	NO – would require multiple sites	YES	YES	YES
13	YES	NO – foundation problematic but warrants further investigation	Moderate	YES	Valley	YES	YES	NO	NO
14	YES	YES	Good	YES	Conventional	YES	YES	YES	YES
15	NO	NO – landslides, no buttress	Difficult	NO	Valley	YES	YES	NO	NO
16	NO	NO – landslides, no buttress	Difficult	NO	Valley	NO – would require multiple sites	NO	NO	NO
17	NO	NO – landslides, no buttress	Difficult	NO	Valley	NO – would require multiple sites	NO	NO	NO
18	NO	NO – landslides, no buttress	Moderate	NO	Valley	NO – would require multiple sites	NO	NO	NO
19	NO	NO – landslides, no buttress	Difficult	NO	Valley	NO – would require multiple sites	NO	NO	NO
20	YES	NO – landslides, no buttress	Moderate	YES	Conventional	YES	YES	NO	NO
21	YES	YES	Good	NO	Conventional	YES	YES	NO	YES
22	YES	YES	Good	NO - too far for trucking	Conventional	YES	YES	NO	NO
23	YES	YES	Good	NO - too far for trucking	Conventional	YES	YES	NO	NO
24	YES	YES	Moderate	YES	Conventional	YES	YES	NO	NO
25	YES	NO – wet ground, no buttress. Darb headwaters	Difficult	YES	Conventional	NO – would require multiple sites	YES	NO	NO
26	YES	YES	Difficult	YES	Valley	YES	YES	NO	NO

**Note 1:** Bold fonts indicate the site was selected for advancement to the semi-quantitative assessment phase.

**Note 2:** Significant adverse conditions (orange shading) were considered if suitable space was not available for construction of the process ponds and ADR plant.

**Note 3:** Significant adverse conditions (orange shading) were considered for sites with a moderate amount of problematic foundation conditions, while a fatal flaw (red shading) was considered for sites where the presence of landslides or other conditions (e.g., lava flows) were observed to an extent that would be prohibitive to development of a HLF at this site.

**Note 4:** Significant adverse conditions (orange shading) were considered where the site conditions would result in difficult construction conditions typically defined as a site where extensive earthworks, steep slopes, or problematic foundation conditions were present (i.e., extensive landslides or lava flows to remediate).

**Note 5:** Significant adverse conditions (orange shading) were noted on conveyor routes where the presence of multiple river crossings, road crossings or a combination of steep terrain were present with a fatal flaw (red shading) considered when the combination of adverse conditions and a distance greater than 10km would be too far for trucking resulting in non-economically viable conditions.

**Note 6:** Significant adverse conditions (orange shading) were considered for smaller sites if the site could not provide capacity for at least 95Mt as a stand-alone site, while a fatal flaw (red shading) was considered if the site did not have capacity for at least 60Mt in a multiple-site scenario.

**Note 7:** Significant adverse conditions (orange shading) were considered for sites where shallow groundwater, significant seeps and springs, and difficult closure constraints were noted.



## 6.0 SEMI-QUANTITATIVE ASSESSMENT

The *screening assessment* resulted in 16 sites that were eliminated, with 14 sites eliminated based on fatal flaws and two sites eliminated based on multiple significant adverse impacts. Table 3 presents an overview of the sites excluded in the *screening assessment* and the basis for their exclusion.

**Table 3 Screening Assessment – Sites Eliminated from Consideration**

Site Number	Basis for Elimination During the Screening Assessment
1	1 fatal flaw: geotechnically unstable
2	2 fatal flaws: geotechnically unstable and insufficient capacity even considering a multiple HLF site development scenario
3	1 fatal flaw: insufficient capacity even considering a multiple HLF site development scenario
4	Multiple adverse conditions: within IBA, Lake Sevan non-immediate catchment, visible from multiple communities, would require a multiple HLF site scenario, close proximity to main road
7	1 fatal flaw: extensive recent lava flows and geotechnically unsuitable
10	1 fatal flaw: insufficient capacity even considering a multiple HLF site scenario
15	1 fatal flaw: geotechnically unstable
16	2 fatal flaws: geotechnically unstable and insufficient capacity even considering a multiple HLF site development scenario
17	2 fatal flaws: geotechnically unstable and insufficient capacity even considering a multiple HLF site development scenario
18	2 fatal flaws: geotechnically unstable and insufficient capacity even considering a multiple HLF site development scenario
19	2 fatal flaws: geotechnically unstable
20	1 fatal flaw: geotechnically unstable
22	1 fatal flaw: site is too far for economically feasible ore conveyance
23	1 fatal flaw: site is too far for economically feasible ore conveyance
25	1 fatal flaw: geotechnically unstable, Darb headwaters
26	Multiple adverse conditions: difficult constructability and access from heavy equipment, difficult closure conditions, and visible at a distance (over 5km) from Jermuk, but not widespread across the town or affecting key areas

The ten remaining potentially viable sites (5, 6, 8, 9, 11, 12, 13, 14, 21, and 24) were advanced to the *semi-quantitative* assessment phase with a site ranking evaluation undertaken. Sites 5, 6, and 8 were excluded from the final ranking, leaving seven sites, due to their presence within the IBA, once it became apparent that viable alternative sites are present, and per the guidance in IFC PS6. An eighth site consisting of a reduced Site 6 (Site 6R) was added to include only that portion of Site 6 located outside of the IBA.

The *semi-quantitative* assessment process then consisted of ranking each of the eight sites using a numeric scoring system that included a weighting evaluation based on relative importance for a variety of sub-categories. The result of the Semi-Quantitative Ranking Assessment is presented on Table 4. The basis for the scoring criteria used to rank each site indicator is provided in the Note column on Table 4.



The scoring system used was as follows:

- -3 where the criteria was considered to have a major adverse impact on site selection (e.g. inside the Lake Sevan Non Immediate Impact Zone)
- -2 where the criteria was considered to have a moderate adverse impact on site selection (e.g. two major river crossings)
- -1 where the criteria could be considered to have a slight adverse impact on site selection (e.g. shallow groundwater and minor springs)
- 0 where no negative criteria were identified

In some cases, the indicator ranking was considered as a binary criteria with only a -3 and 0 applied (i.e., the condition either did or did not exist), while in other cases the indicator ranking included the full range of scores from -3 to 0. A category-weighting factor was applied to allow consideration of the relative importance for each of the various indicator sub-categories to be considered in the overall ranking. The weighting factor was determined by the discipline specialists. For example, the location of a site within the Lake Sevan non-immediate impact zone was weighted higher (more important) than the presence of natural habitat. Similarly, the presence of adverse geotechnical conditions was weighted higher than the available site capacity. In addition, a reduced footprint for Site 6, designated as Site 6R as shown on Figures 1 through 3, was added which consists of that portion of Site 6 that is located outside of the Gorayk IBA resulting in a total of eight sites advanced for consideration in the *semi-quantitative* site ranking evaluation.

Of these remaining eight sites, Sites 14, 11, 12 and 13 emerged from the evaluation as the four most viable HLF sites for consideration by Lydian and the various stakeholders as the location for the Amulsar project HLF with Site 14 selected as the preferred site for HLF development (illustrated on Figure 4).

It is understood and noted that during the upcoming revision to the Feasibility Study and update to the ESIA that studies for identification and inclusion of potential mitigation, management, and on-going monitoring measures will be implemented to address potential adverse impacts as appropriate for the selected Site 14.





Table 4      Scoping Assessment and Selection for Semi-Quantitative Assessment

Factor	Indicator	Rating Scale	Weighting	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site 6	Notes
				5	6	8	9	11	12	13	14	21	24	Reduced	
Biodiversity Environmental	Outside of Lake Sevan Non-Immediate Impact Zone	-3 or 0	5	-3	-3	-3	-3	-3	-3	-3	0	-3	0	-3	Yes or No - binary
	Beyond 1km Sanitary Protection Zone for Communities	-3 or 0	3	0	0	0	0	0	0	0	0	0	-3	0	Yes or No - binary
	Outside Area of Supporting Habitat for IBA	-3, -2, -1 or 0	3	-3	-3	-3	0	-1	-2	-3	0	-3	0	-3	Specialist Assessment
	Outside Natural Habitat	-3, -2, -1 or 0	2	-3	-3	-3	-3	-1	-2	-3	0	-3	0	-3	Specialist Assessment
	Outside Potential Critical Habitat	-3, -2, -1 or 0	5	-3	-3	-3	-3	-2	-2	-3	-2	-3	-1	-3	Specialist Assessment
General Location	Within Rock Allocation Area	-3 or 0	1	-3	0	-3	-3	-3	0	0	-3	-3	-3	0	Yes or No - binary
	Within Exploration License Area	-3 or 0	2	0	0	0	0	-3	0	0	-3	-3	-3	0	Yes or No - binary
Infrastructure	Centralization, Efficiency & Safety for Processing	-3, -2, -1 or 0	2	-2	-3	-3	-3	-1	-2	0	-1	-3	-3	-3	-3=>10km, -2=5-10km, -1=2-5km, 0=< 2km
	Avoids River Crossing by Conveyor	-3, -2, -1 or 0	3	-1	-3	-2	-2	-1	-2	0	0	-3	-2	-2	-3=2 or More Rivers, -2= One River, -1=Stream, 0=No
	Avoids Road Crossing by Conveyor	-3, -2, -1 or 0	1	0	-1	0	-1	-2	-1	0	-1	-2	-3	0	-3=3 Roads, -2=2 Roads, -1=1 Road, 0=No
	Avoids Gas Pipeline Crossing	-3 or 0	1	0	0	0	-3	-3	-3	0	0	-3	0	0	Yes or No - binary
	Avoids Spandaryan-Kechut Tunnel Crossing by Conveyor	-3 or 0	1	0	0	0	0	0	0	0	-3	0	-3	0	Yes or No - binary
	Source of Production and Project Water Supply	-3, -2, -1 or 0	3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-2	-1	-3=Darb, -2=GW, -1=Vorotan, 0=Nearby
Social and Cultural	Proximity to Settlements	-3, -2, -1 or 0	4	-2	-2	-1	-1	0	0	0	-2	-1	-3	-1	-3=< 2km, -2=2-5km, -1=5-10km, 0=>10km
	Visibility to Settlements	-3, -2, -1 or 0	3	-3	-3	-2	0	0	0	0	0	-1	-3	-1	Yes or No - binary
	Presence of Community Water Supply Point/Source	-3 or 0	2	0	-3	-3	0	-3	0	0	-3	0	-3	0	Yes or No - binary
	Potential to affect Cultural Heritage/Archeological Sites	-3 or 0	3	-2	-3	-2	-1	0	-3	0	-1	-1	-1	-3	-3=Confirmed Arch Sites Present, -2=High Arch Potential, -1=Medium Arch Potential, 0=Low Arch Potential
	Avoids Physical Resettlement of Local Human Inhabitants	-3 or 0	5	-3	0	0	0	0	0	0	0	0	-3	0	Yes or No - binary
	Avoids Economic Displacement	-3, -2, -1 or 0	3	-2	-2	-2	-2	-2	-2	-3	-3	-2	-3	-2	-3=LACP/Herders, -2=Herders, -1=minor, 0=No
Technical	Suitable Space for Ponds and ADR Plant	-3, -2, -1 or 0	4	0	0	0	-3	-1	-2	0	0	0	0	0	-3=No Suitable Pond Location, -2=Multiple Pond Locations, -1=Poor Pond Location, 0=No
	No Apparent Geotechnical Flaw s	-3, -2, -1 or 0	5	-3	0	0	0	0	0	-3	0	0	-1	0	-3=Landslides, -2=Poor, -1=Localized Wet Conditions, 0=Favorable Conditions
	Constructability	-3, -2, -1 or 0	4	-2	0	-1	-2	-2	0	-2	-1	0	-1	-1	-3=Very Difficult, -2=Moderate, -1=Localized Challenges, 0=Good
	Acceptable Conveyor Route Topography	-3, -2, -1 or 0	4	-1	-2	-2	-2	0	-1	0	-1	-3	-3	-2	-3=Steep Topo, -2= Moderate Terrain, -1=Perennial Streams, 0=No
	Capacity for 95 Mt with Potential Increase to 120 Mt	-3 or 0	3	0	0	0	-3	0	-3	0	0	0	0	-3	Yes or No - binary
	Does Site have Capacity for 60 Mt Assuming Multi-site Scenario	-3 or 0	1	0	0	0	0	0	0	0	0	0	0	-3	Yes or No - binary
	Avoids Management of Shallow Groundw ater, Seeps, Springs	-3, -2, -1 or 0	4	-1	0	0	-2	0	0	-3	-1	-1	-1	0	-3=Extensive Seeps & Shallow GW, -2=Moderate, -1=Localized Springs & Seeps, 0=None
	Avoids Potentially Difficult Closure Constraints	-3, -2, -1 or 0	4	-1	-1	0	-3	0	0	-3	-1	-1	-1	0	-3=Extensive Underdrain System, -2=High Visibility/Moderate Seeps, -1=Localized Seeps, 0=No Constraints
GRAND TOTAL				-137	-114	-103	-128	-76	-88	-104	-70	-113	-130	-106	
SITE RANK				ONLY IF NO VIABLE ALTERNATIVE			7	2	3	4	1	6	8	5	

Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site 6
5	6	8	9	11	12	13	14	21	24	Reduced		





## 7.0 CONCLUSIONS AND USE OF THIS REPORT

This revised HLF SAA report constitutes an unbiased assessment of the viable alternatives based on the recent baseline data and impact assessment information. The revised SAA objectively quantifies and qualifies the various site alternatives and considerations to rank each of the potentially viable sites to select the sites with the most favorable technical, economic, environmental, and social attributes. In this regard, additional sites outside the Vorotan watershed were included to address PS1 and PS6 requirements of avoiding siting the HLF in critical habitat and to consider the impacts of the Lake Sevan Law.

The results of this revised HLF SAA for the Amulsar project indicate that **Site 14 is the preferred site for HLF development.**

Golder has prepared this report with input from others as noted in Section 1.0, exclusively for the use of Lydian for the specific application to siting of the HLF for the Amulsar project. The analyses reported herein were performed in accordance with accepted standard of care practices, based on the information available at the time the study was completed. No third-party entity shall be entitled to rely on any of the information, conclusions, or opinions contained in this report without the written approval of Lydian and Golder.

Golder appreciates the opportunity to support Lydian on this task. Please contact the undersigned with any questions or comments on the information contained in this report.

Sincerely,

**GOLDER ASSOCIATES INC.**

Rick Kiel, P.E.  
Senior Geological Engineer

Gareth Digges La Touche  
Senior Hydrogeologist

Brent Bronson, P.E.  
Principal Geotechnical Engineer

REK/GDLT/BRB/rjg

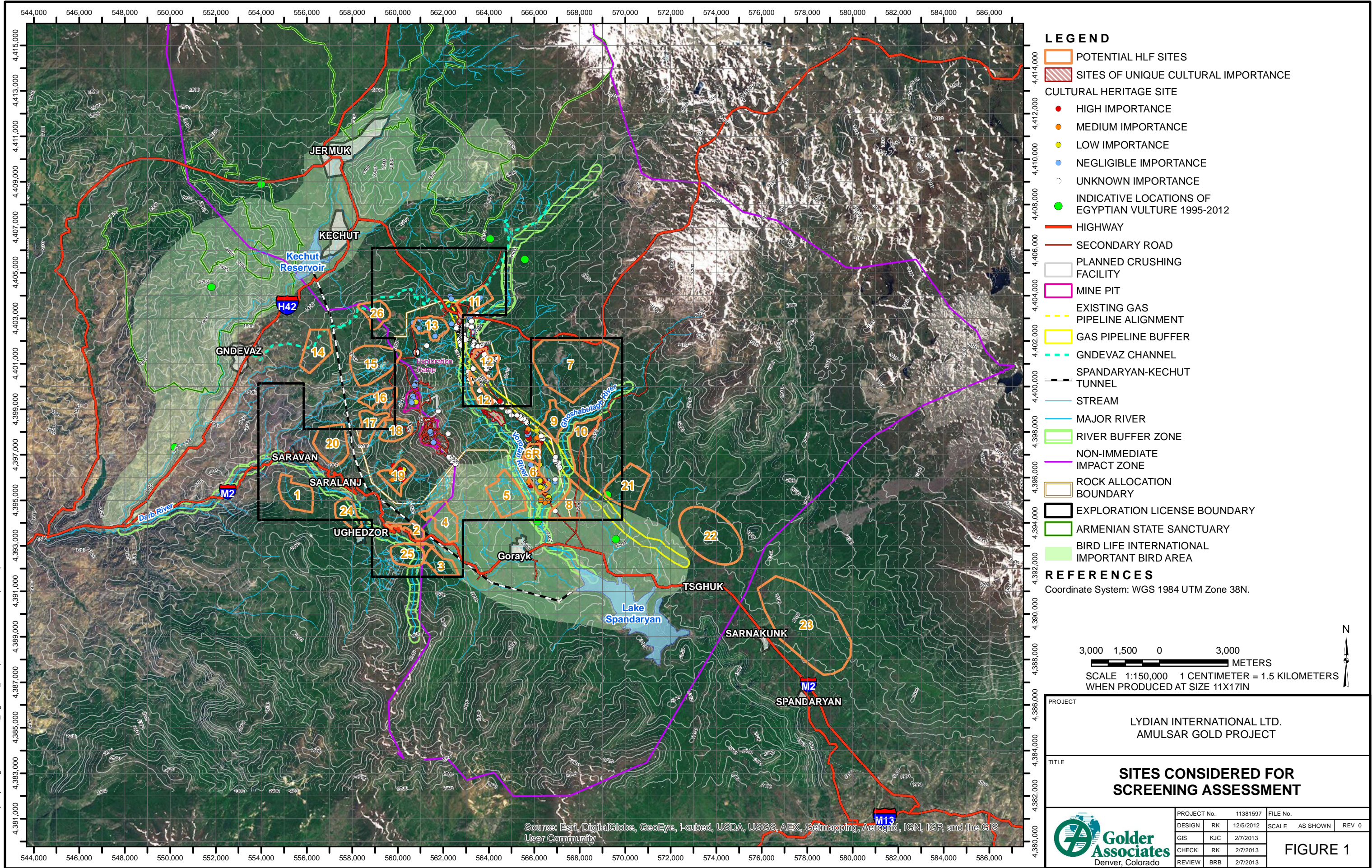


## 8.0 REFERENCES

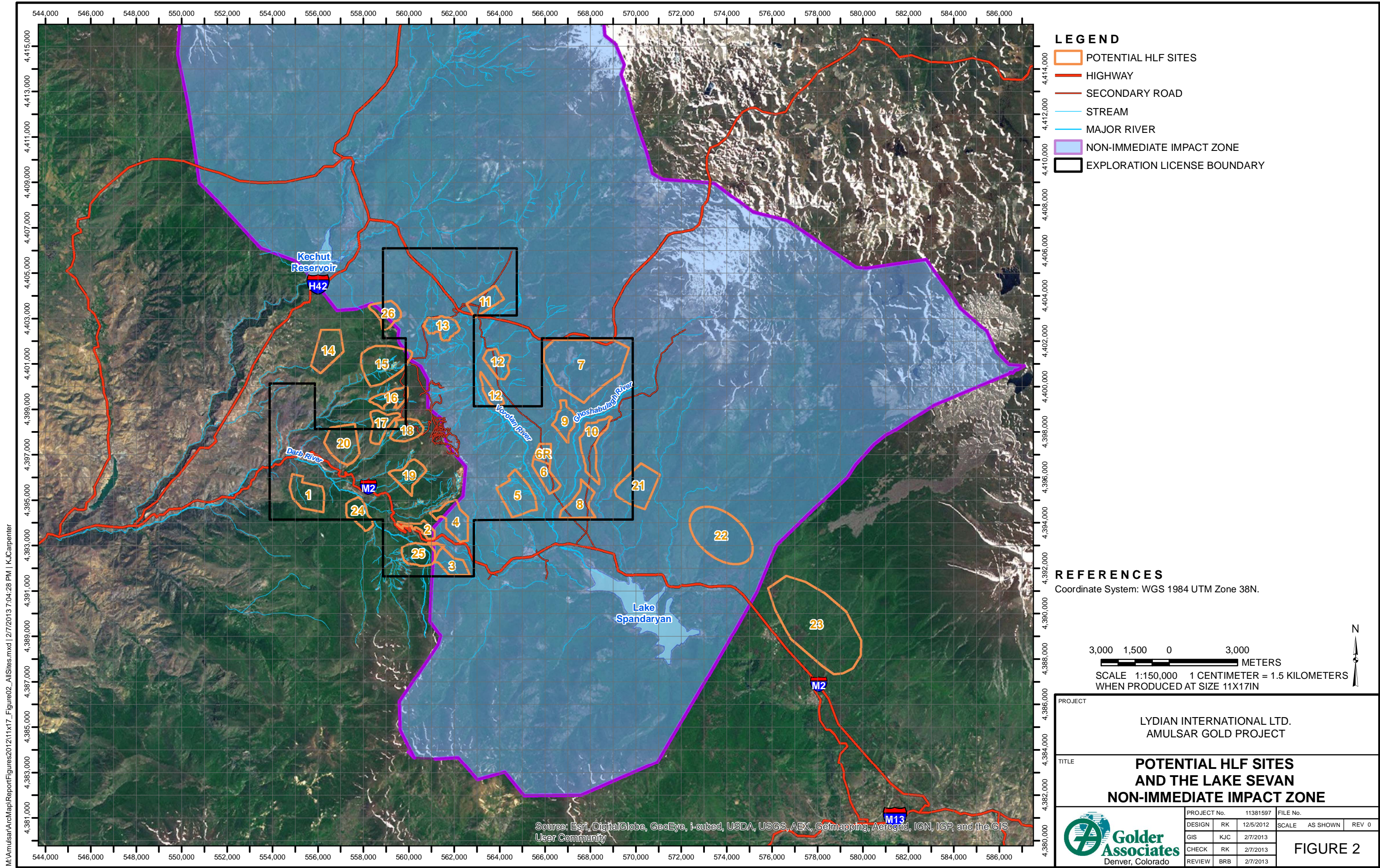
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## FIGURES

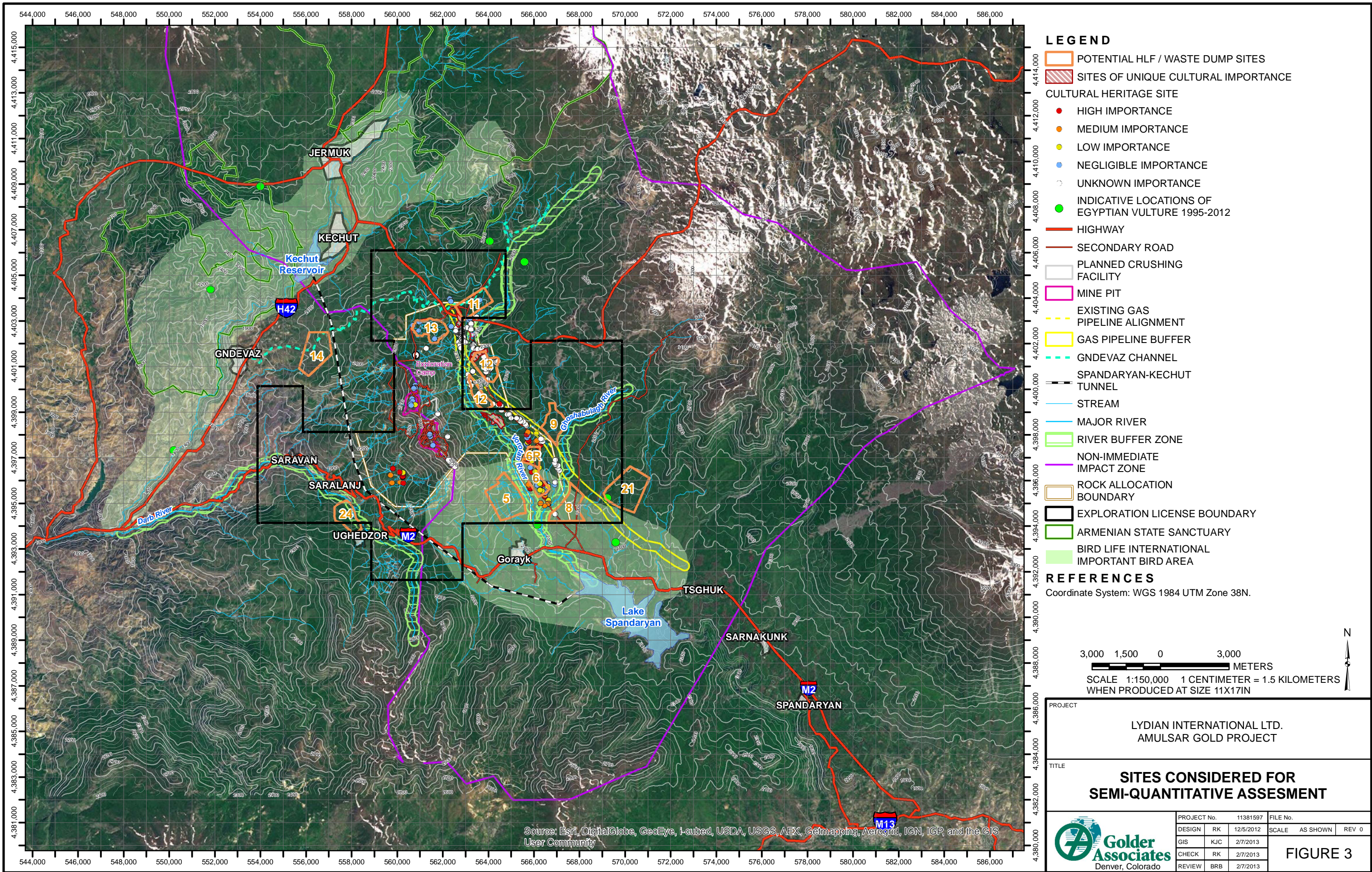






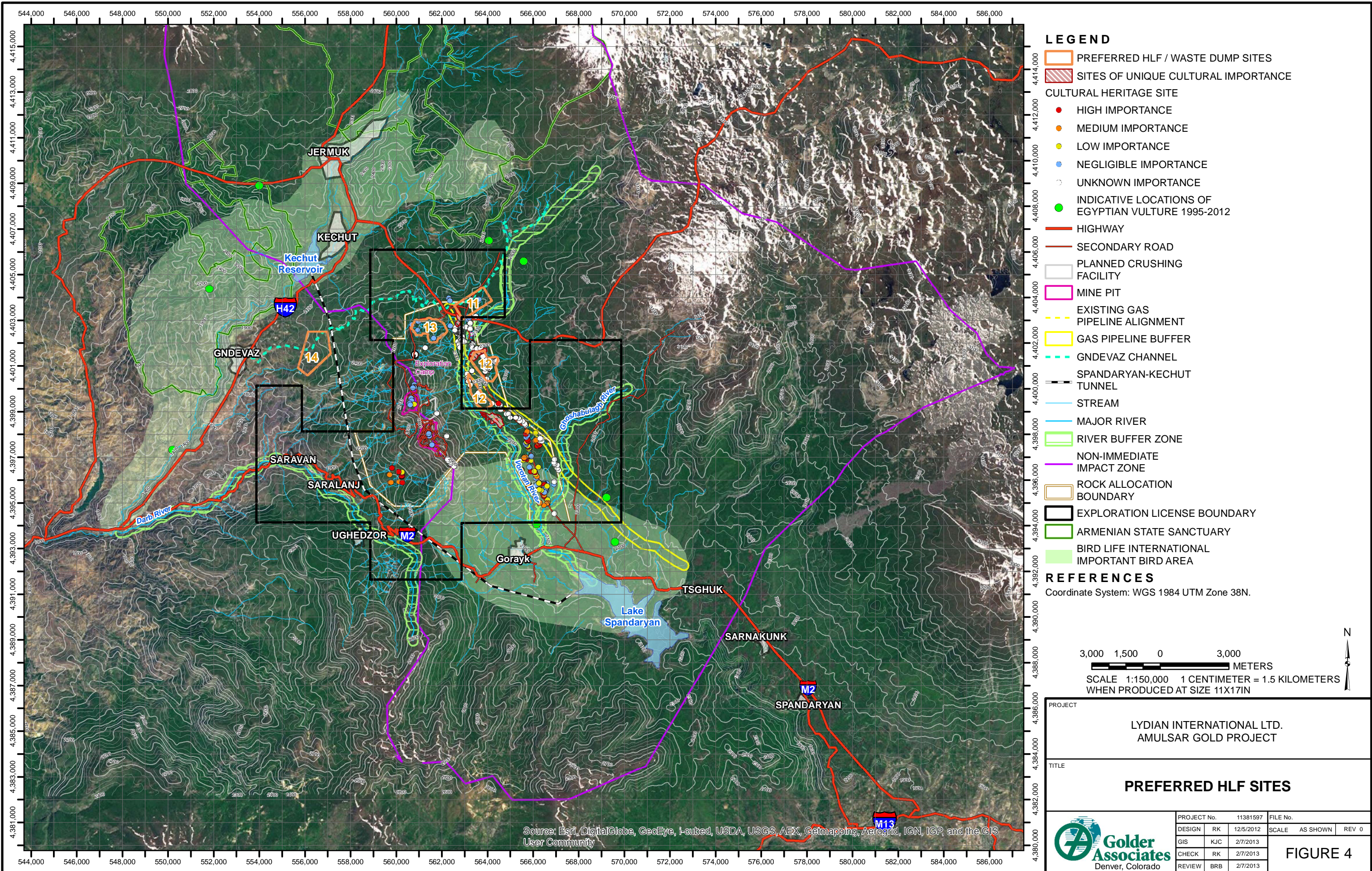








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**APPENDIX A**  
**FIELD RECONNAISSANCE REPORTS**



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 1, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #1	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~20 °C	<b>Wind:</b>	~0-5 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 1 is located approximately 1 km south of the villages of Saravan and Saralanj and 2 km west of Ughedzor on the south side of the Darb River in Vayots Dzor Marz and ~6 km from the open pits. The site is located on undulating terrain with an average gradient of approximately 15 percent with local areas at a maximum gradient of ~25 percent or approximately 4H:1V. There is an approximate 300 meter change in elevation across the site from the southwest to northeast. The site is located in the Darb River catchment and is 800 meters from the Darb River and crossed by an ephemeral stream. The terrain is slightly hummocky, indicative of the potential for clayey foundations and slope instability due to creep or shallow landslides.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Ore conveyor route would need to be transported over the A331 trunk road, the Darb River, and above Saralanj
- Would need to construct an access bridge across the A331 road. Road crossing will require culverts and large amount of fill.
- Conveyor route will need to be approximately 15m wide and likely need to be routed down the southeast side of Amulsar towards Site 24 then west towards Site 1.

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- Site will require large quantity of site grading and fill to provide stable foundation for heap leach pad due to moderate slopes.
- Hummocky topography – indicative of questionable geotechnical conditions
- Water supply will need to be located; shallow groundwater is unlikely to be present

### 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Outside of the Lake Sevan Non-Immediate Impact Zone
- Approximately 200 m from the Darb River

# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 1, 2012

- Saravan and Saralanj located in close proximity resulting in visual, noise, dust, possible risk to local water supply
- The site is highly visible from the main highway
- No significant cultural issues identified
- Communal grazing land with some locally established trees, but no evidence of orchards

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Looking SW towards Site 1 from A331 near Saralanj (WAI, 2011)



### PHOTO 2

Looking towards the Darb River at southern end of Site 1



<b>Date:</b>	November 1, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #2	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~20 °C	<b>Wind:</b>	0-5 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 2 is located on the west side of Vorotan Pass in Vayots Dzor Marz north of the A331 (M2) main road, immediately south of the Spandaryan-Kechut Tunnel buffer zone, and approximately 4 km south of the open pits. The site is located approximately 2 km east of Saralanj and 3 km west of Gorayk. The site is located on gently to moderately sloping land with an average gradient of ~6 degrees. Three electric power lines cross the site. It is located in the Darb watershed immediately adjacent to the Vorotan catchment and is bounded on three sides by watercourses. A local rest station for travelers on the main road is located immediately north of the site.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Conveyor would conceptually need to be routed down the south ridgeline to the site
- Road access for equipment is favorable

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- Very small site with insufficient low gradient area to provide critical stability for the toe of the heap leach facility (HLF).
- Site would only provide a small percent of the required HLF capacity
- No opportunity for expansion due to buffer zones and infrastructure.
- Only viable if the majority of HLF development and capacity is provided for at other sites occurs, and therefore would require separate process pond and carbon plant
- Logistically problematic due to the adjacent A331 highway
- Limited ability to site a HLF due to size and buffer constraints
- Water supply will need to be pumped or piped to the site
- In the Darb catchment outside of Lake Sevan non-immediate impact zone

# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 1, 2012

## 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Highly visible from the main highway
- Dust and noise would impact the tourist stop
- No significant cultural issues identified
- Communal grazing land with intensive grazing

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Looking north at Sites 2 from the A331 (M2) highway



### PHOTO 2

Looking NW at Site 2 from the A331 (M2) highway



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 1, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #3	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~20 °C	<b>Wind:</b>	0-5 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 3 is located east of Vorotan Pass and on the south side of the A331 (M2) main road in Syunik Marz and approximately 4.5 km south of the open pits. The site has slopes ranging from 5 to 15 degrees, is crossed by two ephemeral streams and is near the divide between the Vorotan and Darb River catchments, within the Vorotan catchment. Two high voltage electric power lines cross the site. The Spandaryan-Kechut Tunnel is located at the northeast edge of the site.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Ore would need to be transported via conveyor over the A331 trunk road
- Road access for equipment is favorable

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- Lacks sufficient heap leach facility (HLF) storage capacity within the portion of the site that is moderately sloping and suitable for HLF development, and would therefore require an additional HLF site to accommodate the ore requirements
- Limited opportunity for expansion due to steep gradient
- Two high voltage power lines cross the site

### 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Located within the Sevan Lake Non-Immediate Impact Zone
- Partially located within the Gorayk IBA
- Highly visible from the main highway
- Dust and noise would impact the tourist stop
- No significant cultural issues have been identified
- Communal grazing land, with signs of intensive grazing



# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 1, 2012

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Looking SSE into Site 3  
(WAI 2011)



### PHOTO 2

Looking SW into Site 3  
(WAI 2011)



### PHOTO 3

Looking ESE towards Lake  
Spandaryan



# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 1, 2012

## PHOTO 4

Looking SW into Site 3



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 1, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #4	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~20 °C	<b>Wind:</b>	0-5 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 4 is located northeast of Vorotan Pass and the A331 (M2) main road in the Syunik Marz province in the Vorotan catchment, approximately 3.5 km south of the open pits. The site is located approximately 2.5 km west of Gorayk. The site is located on moderate to steeply sloping ground ranging from 9 to 20 degrees. The site is crossed by two ephemeral streams. There is evidence of surface cracking indicating ground movement in the central portions of the site. There are multiple infrastructures located within the site limits including an active meteorological monitoring station, high voltage power lines, an abandoned structure that appears to be a former mining or quarry operation (with associated concrete foundations, existing buildings and spoils piles and infrastructure which includes ponds, dirt roads and temporary dwellings).

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Ore conveyor route would be conceptually be located along the southern end of Amulsar mountain to Site 4
- Road access for equipment is favorable

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- Lacks sufficient HLF storage capacity within the portion of the site that is moderately sloping and suitable for HLF development and would therefore would require a second HLF development site
- One high voltage electric power line crosses the site.
- A military observation/communication post and radar installation is located at the southern edge of the site (possible permitting constraint).

### 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Within the Gorayk IBA
- Within the Lake Sevan Non-Immediate Impact Zone



# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 1, 2012

- No significant cultural issues identified
- Communal grazing land
- Highly visible from the main highway
- Upgradient of Spandaryan-Kechut Tunnel

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Looking West – Northwest



### PHOTO 2

Looking West – Northwest from south of the main road



<b>Date:</b>	November 1, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #5	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~20 °C	<b>Wind:</b>	0-5 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards, Carl Nicholas	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 5 is located immediately north of Gorayk Village in the Syunik Marz province on steep to moderately sloping ground averaging ~11 degrees, with sections up to ~15 degrees on the northwest boundary. The site is located approximately 3.5 km from the open pits. It is located in the Vorotan catchment and within the Lake Sevan non-immediate impact zone with a large number of streams and watercourses crossing the site. The presence of slightly hummocky topography on portions of the site is indicative of the potential for slope instability due to creep or shallow landslides, an indicator of argillic altered clayey foundation conditions,. The eastern boundary of the site is formed by the buffer zone on the west bank of the River Vorotan. Other land uses include seasonal grazing.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Conveyor route would conceptually be located along the southern end of Amulsar mountain
- Favorable traffic and access roads, but Gorayk village potentially would need to be relocated to develop a HLF

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- Questionable foundation geotechnical conditions for a high stress lined HLF
- Relatively large site but limited potential for expansion
- Topography exhibits a cross slope with portions of the site sloping east towards the Vorotan River and portions sloping southward toward Gorayk Village making the design of solution collection systems challenging (e.g., may require the development of two sets of process ponds and carbon plant facilities)
- One electric power line crosses the site
- Power substation in close proximity to the site

# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 1, 2012

## 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Within the Gorayk IBA
- Within the Lake Sevan Non-Immediate Impact Zone
- Proximity of Gorayk would potentially require relocation of the village
- No significant cultural issues identified
- Communal grazing land

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Looking SW at Site 5 from the Gorayk Road. Gorayk is to the left in the photo



### PHOTO 2

Looking NW at Site 5 from the NW edge of Gorayk village football field



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 3, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #6	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	8 °C	<b>High Temp.:</b>	15 °C	<b>Wind:</b>	5-10 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Carl Nicholas	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 6 is located on the east side of Amulsar Mountain, ~250 m east of the Vorotan River in Syunik Marz and approximately 3.5 km east-southeast of the open pits. The site is situated approximately 60-70 m above the Vorotan River with the southern end of the leach pad located in close proximity to the downgradient Ghoshabulagh River. An ephemeral drainage runs roughly through the middle of the site from north to south. The site gradient is generally up to the northwest and north, and varies in elevation from approximately 2150 to 2300 m. The unpaved road from Gorayk and a fibre optic cable cross the site. Poles for the overhead power line from a planned hydroelectric plant and a buried electric power line also cross the site from south to north. Site 6 was included as the HLF Site in the September Feasibility Study. The land is used for communal grazing land.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Local access road and fiber optic cable will need to be relocated
- The conveyor route will require a Vorotan river crossing

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- The site has sufficient HLF capacity for 95-Mt with expansion capabilities for 120-Mt at one location
- One buried electric power line is indicated as crossing the site. A fiber-optic communication cable runs parallel to the power lines
- Favorable foundation conditions

### 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Within the Lake Sevan non-immediate impact zone
- The Southern half of the site is located in the Gorayk IBA
- The presence of archaeological features has been documented on site



# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 3, 2012

- The site is used for communal grazing and grass hay crop
- Close proximity upgradient to the Ghoshabalugh River, and upgradient of the Vorotan River

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Looking north into Site 6  
(WAI 2011)



### PHOTO 2

Looking SW into Site 6



### PHOTO 3

Ghoshabalugh River, located  
near the downgradient toe of  
Site 6



<b>Date:</b>	November 3, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #7	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~15 °C	<b>Wind:</b>	5-10 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Carl Nicholas	Lydian

## 1.0 BASIC DESCRIPTION OF THE SITE

Site 7 is located in a broad valley 7-8 kilometers from the open pits, east of the Vorotan Valley and west of the Ghoshabulagh River in the Syunik Marz province. The site is located on moderate to steeply sloping ground ranging from ~5 to 30 degrees with small shallow valleys in the upper sections of the tributary streams feeding the Vorotan in the east. The site is remote from permanent settlements but used for communal grazing and grass hay cutting. The site lies in the Vorotan water catchment approximately 4-5 km northeast of Gorayk.

## 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Conveyor access to the site would require a river crossing, high-pressure gas line crossing, and local road crossing.
- Access to the site involves crossing the route of the high-pressure (HP) gas pipeline.

## 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- If favorable, site would be developed as a valley fill HLF
- Presence of numerous large scale blocky basalt flows/scree deposits across this site represent a likely fatal flaw from a technical development and would be cost prohibitive to attempt to mitigate.
- Multiple internal drainage catchments would require separate process collection ponds

## 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Within the Lake Sevan Non-Immediate Impact Zone
- Several perennial streams located within the interior of the site, including the Ghoshabulagh River along the eastern perimeter
- Visible from Gorayk
- Possible cultural issues identified
- Communal grazing land

# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 3, 2012

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Looking towards Site 7 from south (WAI 2011)



### PHOTO 2

Looking into central portion of Site 7 at extensive recent late-stage volcanic basalt flows



### PHOTO 3

Looking towards the southeast of Site 7 towards at the Ghoshabulagh River



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 1, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #8	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	8 °C	<b>High Temp.:</b>	~20 °C	<b>Wind:</b>	0-5 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards, Carl Nicholas	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 8 is located 0.5 km north of the A331 (M2) main road, east of the Vorotan River and approximately 1-2 km east northeast of Gorayk in Syunik Marz. The site is located on gentle to moderately sloping ground averaging ~3 degrees and is situated between two tributary streams that drain to the Vorotan River to the west and directly to Lake Spandaryan to the south. The site lies in the Lake Spandaryan direct catchment. The southern limit of the site is ~1.5 kilometers from Lake Spandaryan. The northern boundary of the site is limited by the buffer zone of the HP gas pipeline.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Access to the site would require two river crossings by a conveyor, first over the Vorotan River then over the Ghoshabulagh River, a high pressure gas line crossing and over the local access road.
- Road access from the main road would be favorable

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- The site has significant HLF capacity with room for expansion (no design has been completed to define the available capacity)
- Foundation conditions appear to be suitable for HLF development

### 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Located within the Gorayk IBA
- Located within the Lake Sevan Non-Immediate Impact Zone
- Very close to Gorayk and Lake Spandaryan, with high visibility both from Gorayk and from the main highway
- No significant cultural issues identified
- Communal grazing and grass hay harvesting land



# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 1, 2012

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

On Site 8 looking southwest  
(WAI 2011)



### PHOTO 2

On Site 8 looking northeast



### PHOTO 3

On Site 8 looking south to Lake  
Spandaryan. Gorayk is to the  
southeast with grazing land in  
the foreground.



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 3, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #9	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~15 °C	<b>Wind:</b>	5-10 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Carl Nicholas	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 9 is located approximately ~3 km northeast of Gorayk in the Syunik Marz province approximately 4.5 km from the open pits. The site is located on gentle to moderately sloping ground averaging ~5 degrees and north of Site 6, from which it is separated by the high pressure gas pipeline. The site lies in the Vorotan water catchment and is located between the buffer zones of the Vorotan and the Ghoshabulah Rivers. Two ephemeral watercourses cross the site draining north-south.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- The ore conveyor would require one river crossing, local road and high pressure gas pipeline crossing
- Road access would be favorable

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- Potential valley fill site
- Foundation conditions are geotechnically favorable, comprised of a basalt foundation, except for areas with local small blocky lava flows
- The qualitative assessment is that the site lacks sufficient HLF storage capacity for the Amulsar ore requirements, therefore requiring an additional HLF development location
- Restricted opportunity for expansion due to buffer zones and infrastructure.
- Perennial stream flows through the site

### 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Within the Lake Sevan Non-Immediate Impact Zone
- No significant cultural issues identified
- Communal grazing and grass hay harvesting
- Visible from Gorayk and the main highway

# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 3, 2012

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Site 9 looking northeast  
(WAI 2011)



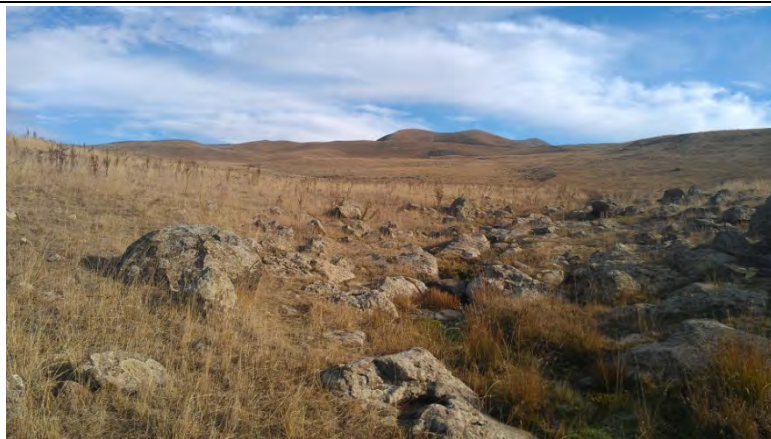
### PHOTO 2

Site 9 looking north



### PHOTO 3

Perennial stream within central  
portion of Site 9



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 3, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #10	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~15 °C	<b>Wind:</b>	5-10 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Carl Nicholas	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 10 is located approximately 3 km northeast of Gorayk in Syunik Marz approximately 5.5 km from the open pits. The site is located on a relatively narrow basalt ridge with gentle to moderately sloping ground in the lower reaches (~5 degrees). The site is separated from Site 8 by the HP gas pipeline which forms the southern boundary. The site is located in the Vorotan Water catchment and is located east of the Ghoshabulagh River.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Conveyor and road access to the site would require crossings for two rivers (Vorotan & Ghoshabulagh Rivers), a high pressure (HP) gas pipeline and local access road

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- Has significant technical challenges and limitations, due to the following considerations:
  - Site 10 is located along or adjacent to a basalt ridge, with drainage flowing 3 to 4 different directions, requiring multiple sets of process ponds and process facilities
  - The site lacks sufficient HLF storage capacity for the ore storage requirements, requiring at least one additional and significantly larger HLF site
- There is limited opportunity for expansion due to buffer zones and infrastructure.

### 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Within the Lake Sevan Non-Immediate Impact Zone
- No significant cultural issues identified
- Communal grazing and grass hay harvesting land
- Immediately adjacent to IBA
- Visible from Gorayk and the main highway



# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 3, 2012

- Bounded by the Ghoshabulagh River on the west and by an unnamed perennial stream on the east

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Looking west along central ridge in Site 10



### PHOTO 2

Perennial drainage within the interior of Site 10



### PHOTO 3

View south along the ridge line of Site 10



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 2, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #11	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~15 °C	<b>Wind:</b>	5-10 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards, Carl Nicholas	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 11 is located 10 km north of Gorayk on the north side of the Vorotan River and 5.5 km northeast of the open pits. The site has generally undulating ground averaging ~9 degrees, located immediately north of the Vorotan River and planned hydroelectric plant. The high pressure (HP) gas pipeline forms the western boundary of the site. The Gndevaz water/irrigation channel/pipeline crosses through the north central portion of the site. A marked change in gradient forms the northern boundary. Three ephemeral drainages cross the site draining north to south. An electric power line traverses the western section of the site. A fiber-optic communication cable traverses the center of the site. The presence of archaeological features was noted on and adjacent to the site.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Would require a truck or conveyor access route crossing over the HP gas pipeline

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- The site has sufficient capacity for 95 Mt plus capacity for increase to 120Mt expansion, meeting the project ore capacity design requirements
- The site topography is undulating and uneven with the natural low point of the site close to the Vorotan River with more extensive earthwork grading required to develop a suitable HLF
- The site is underlain by favorable geotechnical conditions and is elevated 40 meters above the Vorotan River, located just east of the site.

### 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- The presence of high importance archaeological features has been documented immediately adjacent to the site
- Gndevaz water canal/pipeline is located in the northern portion of Site11 and would likely require relocation or avoidance

# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 2, 2012

■ Communal grazing land

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Site 11 looking west-north-west



### PHOTO 2

Site 11 looking east-northeast



### PHOTO 3

Site 11 with full flow in Gndevaz channel (Golder 2011)



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 2, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #12	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~15 °C	<b>Wind:</b>	5-10 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards, Carl Nicholas	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 12 is located 7 km north of Gorayk in Syunik Marz province and 3.5 km due east of the open pits. The site has gently sloping ground averaging ~3 degrees on the east side of the Vorotan River. The high pressure gas pipeline bisects the site to form Sites 12A and 12B, to the west and east of the pipeline, respectively. An ephemeral drainage crosses the site that drains north-south. One buried electric power line is indicated as crossing the site. A fiber-optic communication cable traverses the site parallel to the power lines. An un-surfaced access road bisects the site.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Access to the site would require river crossing by a conveyor
- Access to Site 12B involves crossing the route of the HP gas pipeline
- Favorable access to the site along the road from Gorayk

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- The site has sufficient capacity for ~91 Mt plus based on an existing design, with no relocation of the gas pipeline. Significant additional capacity to >120 Mt exists if the HP gas line can be relocated.
- The site has highly favorable topography but would likely need to be developed as two separate heap leach facilities (12A & 12B) if the HP gas line cannot be relocated
- The site is underlain by favorable geotechnical conditions (basalt foundation) within the central portion on the plateau and is elevated 60 meters above the Vorotan River. There are some perennial drainages within the eastern portion of Site 12A and geotechnical conditions may be less favorable in this area
- Two sets of solutions ponds required, although one event could be utilised

### 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Adjacent to the Vorotan river



# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 2, 2012

- Within the Lake Sevan non-immediate impact zone
- The presence of archaeological features has been documented via field studies on and adjacent to the site
- Communal grazing and grass hay harvesting land

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Looking north into Site 12  
(WAI 2011)



### PHOTO 2

Looking east at Site 12 from  
across the Vorotan River  
(Golder 2011)



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 2, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #13	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~15 °C	<b>Wind:</b>	5-10 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards, Carl Nicholas	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 13 is located north of the Amulsar exploration camp and west of the Vorotan River in Syunik Marz province approximately 4.5 km from the open pits. The site consists of an open bowl-shaped valley with perimeter hillsides. The high-pressure (HP) gas pipeline buffer forms the east boundary of the site. Numerous perennial drainages emanating from springs and seeps are located within Site 13 with artesian conditions present in the eastern lower portion of the valley. Hummocky topography indicating ancestral landslides and clayey foundation conditions exist across the site. An abandoned underground exploration adit, small waste rock pile, and ventilation shafts are located in the western portion of the valley. Documented archaeological features of negligible importance are located on and adjacent to the site.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Access to the site is favorable involving a haul road directly along the ridgeline north of the open pits which may include conveyor route

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- The site has sufficient capacity for 95-Mt plus capacity for increase to 120-Mt expansion based on an existing design
- Adverse geotechnical conditions consisting of deep low-permeability clays in the basin and very clayey weathered andesite porphyry in most interior locations
- Hummocky terrain and indication of slope movement throughout Site 13
- Containment benefits provided by the valley topography

### 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Within the Lake Sevan Non-Immediate Impact Zone
- Numerous seeps and small springs requiring extensive underdrain system
- Communal grazing land and seasonal herders camp located proximal to site

# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 2, 2012

- Visible from the Jermuk ski hill during later stages of development

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Eastern end of Site 13 looking at east end (WAI 2011)



### PHOTO 2

Evidence of localized shallow landslides at the western end of Site 13



### PHOTO 3

Perennial stream flows in the eastern end of Site 13 (Golder 2011)



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 2, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #14	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~15 °C	<b>Wind:</b>	5-10 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards, Carl Nicholas, Fabian Baker	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 14 is located on the western side of Amulsar mountain approximately 2 km due east of Gndevaz in the Vayots-Dzor Marz province, approximately 6 km from the open pits. The site is located on gently to moderately sloping land averaging ~6 degrees, with significant capacity. The site is located south of the Gndevaz channel and is located within the Arpa River catchment. There is a water storage reservoir located down gradient of the site.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Conveyor access would be along the north end of Amulsar mountain then down a west-trending ridgeline, appears to be generally favorable alignment
- Access to the site is from a partially paved road along the road from Gndevaz to Jermuk near the location of the former egg farm at Gndevaz
- High voltage power line is located along the down gradient sector of the site, which would presumably form the downgradient limits of a HLF
- Located downgradient of the Spandaryan-Kechut tunnel, with the tunnel offset likely forming the western limit of the site

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- While a design has not been completed, the site appears to have sufficient capacity for 95 Mt plus capacity for increase to +120Mt expansion
- The site topography is well suited for development of a phased heap leach facility (HLF)
- The site has a moderate degree of topographic relief requiring some grading and a moderate amount of rock excavation will be required.
- The site appears to be underlain by favorable geotechnical conditions.
- The site topography is favorable for eventual water management at closure



# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 2, 2012

## 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- No significant cultural heritage observations were identified
- Water canal, associated water pipelines, and water supply reservoir are located within or downgradient of Site 14. These may require relocation or the provision of alternatives
- No perennial streams, but several ephemeral streams exist
- Outside the limits of the non-immediate impact zone
- Communal grazing and grass hay harvesting land use. Land being ploughed during observation period
- The site has limited visibility from a 300-400 m stretch of road between Gnedevaz and Jermuk
- Gnedevaz channel locally forms the eastern limit of the site

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Site 14 looking west with water supply reservoir and evidence of plowed agricultural lands



### PHOTO 2

Eastern sector of Site 14



# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 2, 2012

## PHOTO 3

Rock piles cleared to permit hay cutting



## PHOTO 4

Downgradient water supply reservoir



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 2, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #15	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~15 °C	<b>Wind:</b>	5-10 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards, Carl Nicholas	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 15 is located on the west side of Amulsar Mountain approximately 4 km from the open pits in Vayots-Dzor Marz province. The site is located on moderately to very steep terrain in a valley with multiple surface water tributaries and a primary drainage. The average slope is greater than 15 degrees with areas greater than 30 degrees. The catchment shows evidence of highly eroded cliff-like slopes and saturated conditions in the valley floors. There is an approximate elevation change of 200 meters across the Site from northeast to southwest. The Site drains into the Darb River drainage basin.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Conveyor access would be challenging to access the lower reaches of the site due to steep topography

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- Medium sized footprint relative to other sites
- The only potential option to develop this site would be as a valley fill. There is very limited access to the lower reaches of the site with no suitable area to develop additional process ponds and process facilities. In addition, a key technical constraint to developing a valley fill is that the side hill slopes cannot exceed 2.5(H):1(V), in order to place the protective overliner material on top of the geomembrane liner system. Sidehill slopes are locally significantly steeper than 2.5(H):1(V) or 40% at this site, which is considered a technical fatal flaw for a valley fill heap leach development.
- Observed unstable hummocky ground conditions, indicative of clayey soils weathered from argillic alteration of the porphyry, with observed large landslide, springs and erosional features
- Steep slopes and unstable ground are considered fatal flaw considerations for HLF development



# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 2, 2012

## 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Outside Lake Sevan Non-Immediate Impact Zone
- No significant cultural observations have been identified
- Communal grazing land in the upper reaches with developed livestock water troughs
- Seeps, springs and perennial streams are located within the central and base of the valley

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Site 15 looking west into the valley with erosional slopes



### PHOTO 2

Perennial stream at base of Site 15



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 2, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Sites #16 - 18	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~15 °C	<b>Wind:</b>	5-10 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards, Carl Nicholas	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITES

Sites 16, 17 & 18 are grouped together as they have similar characteristics. They are located on the west side of Amulsar Mountain on the north side of the A331 (M2) main road in Vayots Dzor Marz approximately 2 km west of the open pits. The three previously identified sites are all similar in characteristics and are located on undulating terrain with gentle to moderately steep slopes. Approximately 50% of the surface area of the slopes on these sites is too steep for a heap leach facility, ranging between 10 to 15 degrees with some slopes in the primary drainage areas greater than 15 degrees. Site 18 is in close proximity to a small pond (Benik pond), a natural pond with recently formed wetland due to dredging and modification works in 2008. The site shows evidence of poor drainage and ancestral slope stability movements. There is an approximate elevation change of 380 meters from northeast to southwest across the sites. They all drain into the Darb drainage basin.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Conveyor access would be relatively favorable due to close proximity to the open pits but moderately difficult due to steeper slopes at the lower portion of the sites

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- Observed unstable ground conditions indicate that the foundations are comprised of weak clayey soils as a result of altered argillic porphyry alteration, with evidence of hummocky terrain and historic landslides
- Steep slopes with no stable lower area to toe-out a HLF as required for stability, with difficult and extensive earthworks grading required to create slopes suitable for leach pad operations
- Small sites with limited HLF storage capacity.
- Multiple valleys requiring separate collection ponds and process areas

# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 2, 2012

## 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Outside Lake Sevan Non-Immediate Impact Zone
- No significant cultural observations
- Seeps and perennial springs at all sites, small pond and modified wetlands at Site 18
- Presence of trees within the lower portions of the valleys
- Community grazing and grass hay harvesting land in the lower reaches of the sites

## 5.0 SELECT PHOTOGRAPHS

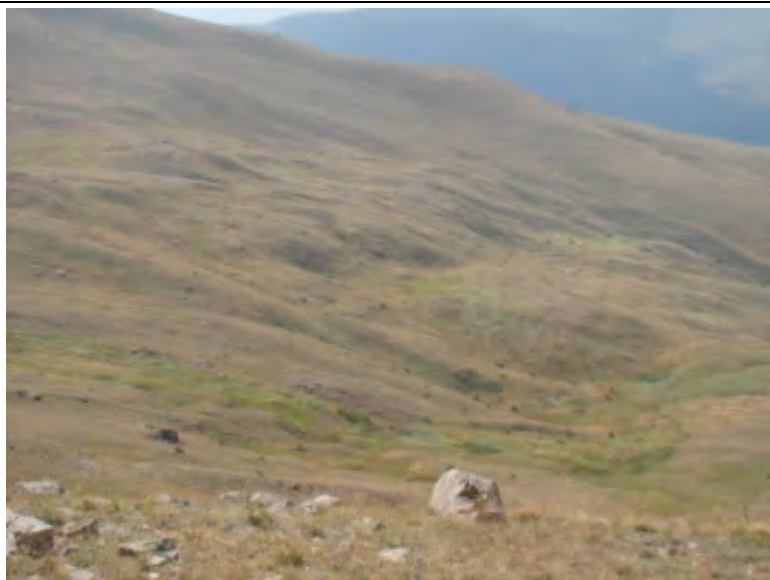
### PHOTO 1

Site 16 with observed hummocky topography and trees in lower portion of the site (Photo by A. Stepanyan)



### PHOTO 2

Site 18 with observed landslide features (Photo by A. Stepanyan)



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 3, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #19	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~15 °C	<b>Wind:</b>	5-10 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Carl Nicholas	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 19 is located on the west side of Amulsar Mountain, east of the A331 (M2) main road between Saralanj and Ughedzor in Vayots-Dzor Marz approximately 2.5 km southwest of the open pits. The site has undulating terrain with moderately steep slopes ranging between 10 to 15 degrees with some slopes in the primary drainage areas greater than 20 degrees. The slopes along the northeastern and eastern limits of the site tend to be moderate to steep. The slopes within the central, western and southwestern portions of the site are generally gentle to moderate. The slopes south of the southern limits of the site tend to be moderate to steep.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Ore conveyor access is anticipated to be challenging due to steep slopes and crossing multiple drainages, although it is a relative short reach due to close proximity to the open pits

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- Observed unstable undulatory ground conditions indicative of historic landslides underlain by altered argillic porphyry
- The northern, western, southwestern and southern sectors of the site indicate evidence of surface cracking and slumping indicating previous ground movement
- Presence of boulder (up to 1.5-m) scree deposits, local outcrops, and eroded valleys in the interior of the site
- Steep slopes with difficult and extensive earthworks grading required to develop slopes suitable for heap leach facility (HLF) operations
- Capacity is anticipated to not be sufficient to accommodate the project requirements of 95-Mt, therefore requiring development of an additional HLF site to meet the project HLF capacity requirements.
- Two high voltage power lines cross the lower sector of the site, with a low voltage power line traversing from top to bottom across the site.



# FIELD RECONNAISSANCE REPORT




Project: 11381597SS.0001

Date: November 3, 2012

## 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Outside of the Lake Sevan Non-Immediate Impact Zone
- Several perennial streams are located within the interior of the site
- High visibility from Ughedzor and the main road
- A number of high importance cultural heritage sites have been identified
- Communal grazing and hay harvesting land

## 5.0 SELECT PHOTOGRAPHS

<p><b>PHOTO 1</b></p> <p>Site 19 at the upper reaches looking southeast</p>	
<p><b>PHOTO 2</b></p> <p>Site 19 looking southeast from central portion of the site</p>	
<p><b>PHOTO 3</b></p> <p>Site 19 – looking south</p>	

## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 3, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #20	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~15 °C	<b>Wind:</b>	5-10 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Carl Nicholas	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 20 is located on the western side of Amulsar Mountain on the north side of the A331 (M2) main road in Vayots-Dzor Marz and approximately 4 km from the open pits. The site is located on undulating terrain with moderate slopes ranging between 5 to 15 degrees with some slopes in the primary drainage areas greater than 15 degrees. Topographic expressions indicate that Site 20 may be a large ancestral slump block, with hummocky terrain and the presence of slumps and surface cracking indicating soil movement throughout the site.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Ore conveyor access is anticipated to be challenging due to steep slopes and crossing multiple drainages, although it is a relative short reach due to close proximity to the open pits

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- Moderate to steep slopes with undulating surface requiring extensive earthworks grading required to create slopes suitable for leach pad operations
- Site 20 appears to be a large historic slump block, which would be a fatal flaw from a stability perspective if confirmed by geotechnical investigations
- Large area with sufficient HLF storage capacity after completion of extensive earthworks noted above
- Generally good ground conditions with only minor observations of localized slope creep
- Situated above a high cliff located immediately above Saravan and Saralanj
- Two high voltage power lines and the local access road bisect the site

### 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Outside of the Lake Sevan Non-Immediate Impact Zone
- High visibility from Saralanj, part of Sarvan, and the main road






# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 3, 2012

- Situated above a high cliff located immediately above Saravan and Saralanj
- No significant cultural heritage issues identified
- Communal grazing and hay harvesting land use
- Two springs noted in the central portion of the site

## 5.0 SELECT PHOTOGRAPHS

<p><b>PHOTO 1</b></p> <p>Site 20 - looking southwest at general view of upper portion of the site</p>	
<p><b>PHOTO 2</b></p> <p>View of Site 20 from across the main road looking northwest</p>	
<p><b>PHOTO 3</b></p> <p>Site 20 looking northwest with view of two power lines and local access road that bisect the site</p>	

<b>Date:</b>	November 3, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #21	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~15 °C	<b>Wind:</b>	5-10 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Carl Nicholas	Lydian

## 1.0 BASIC DESCRIPTION OF THE SITE

Site 21 is located approximately 8 km East to southeast of the Mine Pits, east of the Ghoshabulagh River approximately 2 km north of Highway A331 (M2) in Syunik Marz. It is located within the Sevan Non-immediate impact zone approximately 3 km due north of Lake Spandaryan and 3 km east of Gorayk. The site drains into small rivers and streams that drain directly into Lake Spandaryan. The site has gentle slopes ranging from 3 to 10 percent with the adjacent hillsides over 20 percent.

## 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Conveyor access to the site would require two river crossings (Vorotan and Ghoshabulagh Rivers), a high pressure gas line crossing, and over the local access road.

## 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- This is a large site with sufficient HLF capacity and room for expansion
- Favorable foundation conditions

## 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Within the Lake Sevan Non-Immediate Impact Zone
- No identified cultural heritage sites
- Communal grazing and hay harvesting land use
- Contains a location that has previously been identified as an "indicator location of Egyptian Vulture" from international database (Global Distribution, Birdlife International (2012) Species Factsheet: Neophron Percnopterus. Downloaded from <http://www.birdlife.org> (05/10/2012).
- Visible from the main highway and from Tsghuk (which would be a new affected community)

# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 3, 2012

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Site 21 looking southwest over freshly cut grasslands



### PHOTO 2

Site 21 looking south



<b>Date:</b>	November 1, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #22	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~20 °C	<b>Wind:</b>	0-5 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards, Carl Nicholas	Lydian

## 1.0 BASIC DESCRIPTION OF THE SITE

Site 22 is a large site that is located approximately 12km east-southeast of the mine pits and approximately 1 km north of Highway A331 (M2) in Syunik Marz province. It is located within the Lake Sevan non-immediate impact zone approximately 2 to 3 km northeast of Lake Spandaryan and 2 km north of Tsghuk. The site is located on gentle sloping terrain ranging from 2 to 10 percent toward surface water drainages that drain directly into Lake Spandaryan.

## 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Significant engineering, logistical, and economic considerations related to selection of a conveyor route for this option as the conveyor access would require two river crossings (Vorotan and Ghoshabulagh Rivers), crossing of several river gorges (names unknown), a high pressure gas line crossing, and over local access roads.
- Two high voltage gas lines and multiple gas and water pipelines cross the site

## 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- This is a large site has sufficient HLF capacity for 95 million tonnes (Mt) with room for expansion to 120 Mt
- Geotechnical foundation conditions appear favorable

## 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Within the Lake Sevan Non-Immediate Impact Zone
- Potential cultural heritage sites identified
- Communal grazing and hay harvesting land use
- Visible from the main highway and from Tsghuk, which is ~1km from the site and would be a newly affected community



# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 1, 2012

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Site 22 with view of Lake Spandaryan looking southwest



### PHOTO 2

One of several ravine and stream crossings for conveyor route to Site 22





## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 1, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #23	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~20 °C	<b>Wind:</b>	0-5 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards, Carl Nicholas	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 23 is a large area located approximately 18-km east-southeast of the open pits and approximately 1 km north of Highway A331 (M2) in Syunik Marz province. It is located outside of the Lake Sevan non-immediate impact zone approximately 4 km east Lake Spandaryan and 1-2 km north of Sarnakunk. Two high voltage and one low voltage power lines and multiple gas and water pipelines cross the site. The site is located on gentle sloping terrain ranging from 2 to 10 percent and drains toward surface water drainages within the Vorotan catchment southeast of and away from Lake Spandaryan.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Significant engineering, logistical, and economic considerations exist for selection of a conveyor route for this site as the conveyor access would require two river crossings (Vorotan and Ghoshabulagh Rivers), crossing of several river gorges (names unknown), a high pressure gas line crossing, and over the local access roads.

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- This is a large site with sufficient HLF capacity for 95 million tonnes (Mt) plus expansion, with limitations due to presence of the power lines and high pressure gas pipeline located along the western limits of the site
- Geotechnical foundation conditions appear favorable
- Potentially shallow groundwater based on observed ephemeral stream crossings and localized wetlands
- Undulating terrain would require mass excavation or construction of multiple collection ponds

### 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- No significant cultural heritage sites have been identified
- Communal grazing and hay harvesting land use

# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 1, 2012

- Visible from the main highway and from Samakunk and Spandaryan communities, both of which would be newly affected communities

## 5.0 SELECT PHOTOGRAPHS

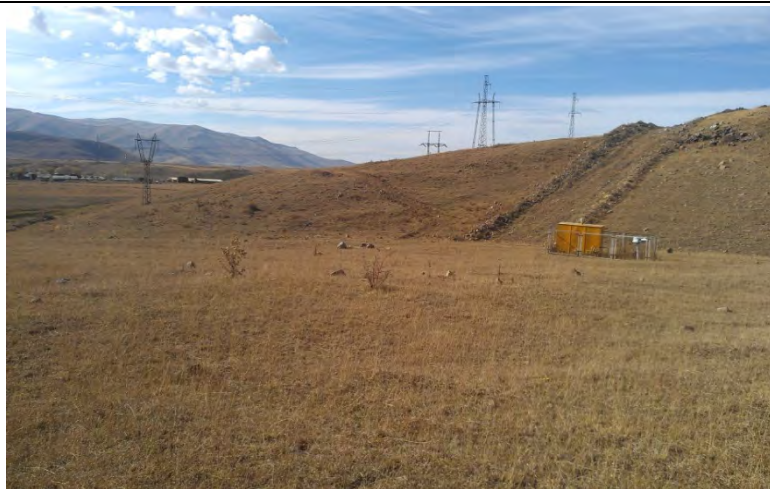
### PHOTO 1

Site 23 looking southeast with view of main power line at the west side of the site



### PHOTO 2

Site 23 looking WSW towards Sarnakunk with view of gas pipeline crossing



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 1 and 3, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #24	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~20 °C	<b>Wind:</b>	0-5 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards (November 1 only), Carl Nicholas	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 24 is located between Ughedzor and Site 1 on the south side of the Darb River in Vayots Dzor Marz province and approximately 6 km from the open pits. The site consists of moderately undulating terrain with a gentle N-NW slope. There is one small perennial stream and several minor ephemeral drainages that cross the site. The site is constrained by the Darb River to the north, a relatively steep 22-26 degree slope to the south, a natural ridge to the west and Ughedzor (>1km) as a nominal eastern boundary.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- The ore conveyor would need to cross the A331 trunk road and Darb River
- Favorable access using Ughedzor road to access the site
- Conveyor route will need to be approximately 15m wide and be routed down the southeast side of Amulsar towards Site 24 and may be challenging as it would need to cross several drainages

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- While a design has not been formally completed, it appears that the site has capacity for the 95 Mt project requirements, subject to further design and evaluation
- The site topography appears to be well suited for development of a phased heap leach facility
- The site has a moderate degree of topographic relief requiring moderate level of site grading
- The site appears to be underlain by favorable geotechnical conditions with shallow groundwater and possible seasonal springs likely in some locations
- The topography provides moderately favorable conditions for closure



# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 1 and 3, 2012

## 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- A portion of Site 24 may be located within 1-km of Ughedzor village, which appears to be largely abandoned. HLF development at this site would likely require relocation of the remaining residents.
- Outside of the Lake Sevan Non-Immediate Impact Zone
- One perennial stream at the western end of the site
- Relatively high biodiversity associated with perennial stream and tree-lined valley
- No significant cultural heritage sites have been identified
- Highly visible from the main road, Saralanj and Ughedzor
- Communal grazing and grass hay harvesting land for much of the site

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Site 24 view from across the A331 (M2) main road looking southwest



### PHOTO 2

Site 24 from the southern ridge looking northwest



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 1, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #25	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	8 °C	<b>High Temp.:</b>	20 °C	<b>Wind:</b>	0-5 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Tim Richards	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 25 is located southeast of Ughedzor and south of the A331 (M2) highway in Vayots-Dzor Marz province, approximately 4.5 km south of the open pits. The site is located outside of the Lake Sevan Non-Immediate catchment zone in the Darb River drainage, near the headwaters of the Darb River.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Ore would need to be transported over the A331 trunk road, with difficult conveyor access that would need to cross multiple drainages and highway A331
- Favorable vehicle access to the site from A331

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- Lacks sufficient HLF storage capacity within the portion of the site that is moderately sloping and suitable for HLF development to contain the project ore requirements, therefore needing an additional HLF site.
- There are multiple seeps and springs requiring extensive underdrains from waters that comprise the headwaters of the Darb River, which is a perennial stream that crosses the site
- The ADR Plant and process ponds would need to be located adjacent to the main road
- The site appears to be underlain by favorable geotechnical conditions

### 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Outside of the Lake Sevan Non-Immediate Impact Zone
- Highly visible from the main road and potentially visible from Ughedzor
- Visual and noise impacts to the local tourist stop
- Potentially significant cultural/archaeological issues identified
- Communal grazing and grass hay harvesting land

# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 1, 2012

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Looking South along the western edge of Site 25



### PHOTO 2

Headwaters of the Darb River in the upper SE section of Site 25



### PHOTO 3

Looking South in the central portion of Site 25





# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 1, 2012

## PHOTO 4

Eastern portion of Site 25  
looking NW towards Highway  
A331 (M2)



## FIELD RECONNAISSANCE REPORT

<b>Date:</b>	November 4, 2012	<b>Project:</b>	Amulsar HLF Site Alternative Assessment
<b>Site:</b>	HLF Site #26	<b>Job No.:</b>	11381597SS.0001

<b>Low Temp:</b>	~8 °C	<b>High Temp.:</b>	~20 °C	<b>Wind:</b>	0-5 km/hr
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<b>Cloud Cover:</b>	Partly Cloudy	<b>Precipitation:</b>	0 mm
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Personnel On Site	Company
Rick Kiel, Brent Bronson, Gareth Digges La Touche	Golder
Carl Nicholas	Lydian

### 1.0 BASIC DESCRIPTION OF THE SITE

Site 26 is located on the western side of Amulsar Mountain approximately 4 km N-NW of the open pits in Vayots-Dzor Marz province. The site is located within the Lake Sevan Non-immediate impact zone and approximately 3 km SE of Kechut and Lake Kechut. The site drains via a minor watercourse directly to Lake Kechut. The site is highly visible from both Kechut and Jermuk.

### 2.0 ACCESS AND CONVEYOR ROUTE CONSIDERATIONS

- Conveyor access would be favorable along the north end of Amulsar mountain then down a west-trending ridgeline, with access to the lower portion of the site moderately difficult

### 3.0 TECHNICAL OPPORTUNITIES AND RISKS

- Potential valley fill heap leach site with unfavorable ground conditions due to presence of late stage basalt blocky flow deposits comprised of significant boulder scree
- Some steep slopes with difficult and challenging earthworks to create slopes suitable for leach pad operations
- Ephemeral drainages in the main east-west valley and in the northern extension
- Water irrigation pipeline and Gndevaz channel are located along the lower (northern) portion of the site

### 4.0 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

- Very high visibility from both Kechut and Jermuk
- No significant cultural heritage issues identified
- Communal grazing and grass hay harvesting land
- Two ephemeral drainages with suspected seasonal springs and seeps within the central and base of the valley
- Potentially in the flight path from the Jermuk landing strip

# FIELD RECONNAISSANCE REPORT

Project: 11381597SS.0001

Date: November 4, 2012

- Gndevaz water supply canal and pipeline cross the toe of the site
- Drains to Lake Kechut

## 5.0 SELECT PHOTOGRAPHS

### PHOTO 1

Site 26 main valley fill location within view of Kechut and Jermuk and noted volcanic scree deposits



### PHOTO 2

Looking northwest from northern edge of Site 26 in line with Jermuk airstrip





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