

|                                                                                                |                  |                      |                                                                                                                                                                     |                                                                                                         |                              |
|------------------------------------------------------------------------------------------------|------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------|
| 03                                                                                             | November 2019    | Approved             | Spea/Dorproject                                                                                                                                                     | L. Deangelis                                                                                            | A. Tanzi / PM                |
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| <b>Republic of Armenia</b><br><b>Ministry of Territorial Administration and Infrastructure</b> |                  |                      |   | <b>Հայաստանի Հանրապետություն</b><br><b>ՀՀ Տարածքային կառավարման և ենթակառուցվածքների նախարարություն</b> |                              |
| <b>NORTH-SOUTH ROAD CORRIDOR INVESTMENT PROGRAM</b>                                            |                  |                      | <b>ՀՅՈՒՄԻՍ-ՀԱՐԱՎ ՃԱՆԱՊԱՐՀԱՅԻՆ ՄԻՋԱՆՑՔԻ ՆԵՐԴՐՈՒՄԱՅԻՆ ԾՐԱԳԻՐ</b>                                                                                                      |                                                                                                         |                              |
| <b>TRANCHE 4 • Section Sisian - Kajaran</b>                                                    |                  |                      | <b>ՏՐԱՆՇ 4. Միսիան-Քաջարան հատված</b>                                                                                                                               |                                                                                                         |                              |
| Consulting services<br>(Contract n° 03-CS-001)                                                 |                  |                      | Խորհրդատվական ծառայություններ<br>(Պայմանագրի n ° 03-CS-001)                                                                                                         |                                                                                                         |                              |
| <b>DETAIL DESIGN</b>                                                                           |                  |                      | <b>ՄԱՆՐԱՄԱՍՆ ՆԱԽԱԳԻԾ</b>                                                                                                                                            |                                                                                                         |                              |
| <i>Final Environmental Impact Assessment Report and Environmental Management Plan (Eng.)</i>   |                  |                      | <i>Շրջակա միջավայրի վրա ազդեցության գնահատման հաշվետվություն և բնապահպանական կառավարման պլան(անգլերեն տարբերակ)</i>                                                 |                                                                                                         |                              |
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| <b>TPIO SNCO</b><br><b>Transport Project Implementation Organization</b>                       |                  |                      |                                                                                  | <b>ՏԾԻԿ ՊՈԱԿ</b><br>Տրանսպորտային Ծրագրերի իրականացման կազմակերպություն                                 |                              |
| <b>Consultant: J/V SPEA Engineering-IRD Engineering</b>                                        |                  |                      |                                                                                  | Խորհրդատու՝ SPEA Engineering-IRD Engineering ՀՀ                                                         |                              |
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## ABBREVIATIONS

|       |                                                           |
|-------|-----------------------------------------------------------|
| ADB   | Asian Development Bank                                    |
| AM    | Accountability Mechanism                                  |
| AP    | Affected Person                                           |
| BOD   | Biochemical Oxygen Demand                                 |
| EA    | Executing Agency                                          |
| EARF  | Environmental Assessment and Review Framework             |
| EIA   | Environmental Impact Assessment                           |
| EIEC  | Environmental Impact Expertise Centre” SNCO               |
| EMI   | Environmental and Mining Inspectorate                     |
| EMP   | Environmental Management Plan                             |
| ERT   | Emergency Response Team                                   |
| ES    | Environmental Specialist                                  |
| GRM   | Grievance Redress Mechanism                               |
| HSE   | Health, Safety & Environment                              |
| IA    | Implementing Agency                                       |
| IUCN  | International Union for Conservation of Nature            |
| LARP  | Land Acquisition and Resettlement Plan                    |
| MFF   | Multi-Tranche Financing Facility                          |
| ME    | Ministry of Environment                                   |
| MESCS | Ministry of Education, Science, Culture and Sport         |
| MOEDI | Ministry of Economic Development and Investment           |
| MTAI  | Ministry of Territorial Administration and Infrastructure |
| MPC   | Maximum Permissible Concentration                         |
| NGOs  | Non-government organizations                              |
| NO    | Nitrogen oxide                                            |
| NO2   | Nitrogen Dioxide                                          |



|                                 |                                                                                                         |
|---------------------------------|---------------------------------------------------------------------------------------------------------|
| TPIO                            | Transport Project Implementing Organization                                                             |
| RA                              | Republic of Armenia                                                                                     |
| RAMSAR<br>Habitat (Ramsar 1971) | Ramsar Convention on Wetlands of International Importance Especially As Waterfowl Habitat (Ramsar 1971) |
| REA                             | Rapid Environmental Assessment (checklist)                                                              |
| SEMP                            | Site-Specific Environmental Management Plan                                                             |
| SNCO                            | State Non-commercial Organization                                                                       |
| SO <sub>2</sub>                 | Sulfur Dioxide                                                                                          |
| SPS                             | Safeguard Policy Statement (2009)                                                                       |
| TOR                             | Terms of Reference                                                                                      |
| UNESCO                          | United Nations Educational, Scientific and Cultural Organization                                        |
| USD                             | United States of America Dollar                                                                         |

## WEIGHTS AND MEASURES

|                   |                              |
|-------------------|------------------------------|
| dBA               | Decibel (A-weighted)         |
| km                | Kilometer(s)                 |
| km <sup>2</sup>   | Square kilometer(s)          |
| l                 | Liter                        |
| m                 | Meter(s)                     |
| mg/m <sup>3</sup> | Milligram(s) per cubic meter |

## 1 EXECUTIVE SUMMARY

### 1.1 Project Background

North-South Road Corridor crosses the territory of Armenia from the South to the North of Armenia including Agarak-Kapan-Yerevan-Gyumri-Bavra highways and road infrastructures and is linked to the road networks of the two neighbors of Armenia: Iran and Georgia. The road corridor will facilitate improving the road connection. The North-South Road Corridor Investment Project is aimed at reconstruction of the 2<sup>nd</sup> -3<sup>rd</sup> category carriageway with a speed limit of 30-90 km/hour that runs 560 km from the Armenian border with Georgia at Bavra to the border with Iran at Agarak and upgrading it to 470 km-long 1st category high-speed carriageway with a speed limit of 100-110 km/hour enabling to cross the mentioned section during decreased time and increasing the comfortability and safety that of by ensuring the fulfillment of the Project goal in regard to making the North-South Road a transit carriageway for passenger and cargo transportation from the East to the West within scope of TRACECA and Silk Road Projects.

Consortium SPEA-IRD, the Consultant for construction supervision of Tranche 3 and feasibility design, preliminary design and 60km detailed design of Tranche 4 of the North-South Road Corridor Investment Program has prepared design for Tranche 4 Sisian-Kajaran 60km road section and according to the design this report is prepared to present environmental, archaeological and socio-economic impacts of the project and necessary mitigation measures that needs to be taken into consideration during all stages of the project.

The detailed design of Tranche 4, 60km Sisian-Kajaran road section is financed by the loan proceeds of Asian Development Bank (ADB). A matter of policy of the Bank requires that all projects supported and to be funded by the ADB must comply with the requirements of the Safeguard Policy Statement (SPS, 2009). Under the SPS 2009, an environmental assessment report is required for all environment category "A" and "B" projects. Its level of detail and comprehensiveness is directly related with the level of potential impacts and risks to the environment. A project is classified as category "A" if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. In that case a full Environmental Impact Assessment (EIA) is required. A project is classified as category "B" if its potential adverse environmental impacts are less adverse than those of category "A". In that case an Initial Environmental Examination (IEE) is required.

This project is classified as a category "A" project based on the Rapid Environmental Assessment (REA) Checklist (see Annex 1). The Environmental Impact Assessment activities for the Tranche 4, 60km Sisian-Kajaran road section, were carried out by the Consortium SPEA-IRD (Consultant).

### 1.2 Screening and Classification

Tranche 4, 60km Sisian-Kajaran road section, under the North-South Road Corridor Investment Project has been screened with the ADB's Rapid Environmental Assessment Checklist (REA). The classification was based on the most environmentally sensitive component of the project, which means that if one part of a project has the potential for significant adverse environmental impacts, then the project is to be classified as environmental category "A" regardless of the potential environmental impacts of other aspects of the project. Based on the REA Checklist, the project is

classified as a Category “A”. According to the Armenian legislation a proposed project is classified as a Category “A” and an EIA report according to Armenian legislation is needed. This EIA report has been prepared to meet ADB SPS (2009) policy and Armenian legislation requirements.

### 1.3 Compliance and Fulfillment of the SPS Policy & Republic of Armenia (RA) Law on EIA

#### 1.3.1 Public Consultation and Participation

According to ADB’s SPS (2009) and RA Law on Environmental Impact Assessment (EIA) (2014) public consultation has been organized. To meet the requirements of ADB SPS and Armenian legislation first consultation meetings have been organized during the project feasibility study in March-April and November 2016. Representatives of the following stakeholders are participated in consultation meetings: governmental authorities and NGOs: Ministry of Territorial Administration and Infrastructure, Transport Project Implementation Organization, Ministry of Environment, Ministry of Economy, Ministry of Education, Science, Culture and Sport and Non-government organizations (NGOs).

The second round of public consultations to disclose the initiative, to present the Project itself and EIA have been organized during development of the design. Public consultations took place on 10 November, 2017 in Kapan community, on 17-18 January, 2018 in Siaian and Qajaran communities. An advertisement was placed in the Hayastani Hanrapetutyun newspaper and on the TPIO website, as well as invitations were sent directly to key stakeholders through Yerevan Aarhus center network. Amongst the attendees were nineteen recorded participants, including representatives of relevant government agencies and NGOs, as well as those from general public.

#### 1.3.2 Information Disclosure

According to the ADB SPS’s information disclosure requirements, the public consultations were held on with project stakeholders, relevant government units, the community, the persons or groups affected by the Project, civil society and NGOs.

The information about the Project was disclosed through the public consultation events a), as well as during series of introductory and follow-up meetings with relevant ministries and other official authorities such as the Ministry of Environment, Ministry of Territorial Administration and Infrastructure and with several NGOs.

For the information disclosure purposes the following documents shall be put on the ADB’s and TPIO’s websites and regularly updated when needed:

- (i) EIA report (including EMP);
- (ii) Bi-annual reports prepared by borrower.

### 1.4 Grievance Redress Mechanism

A grievance redress mechanism has been developed to continuously communicate with affected people during the project implementation in order to receive and address the affected peoples’ concerns, complaints, and grievances about the Project’s environmental performance (see chapter

8). The grievance redress mechanism is designed to address affected people's concerns and complaints promptly, using a simple procedure and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no costs and without retribution. The affected people will be appropriately informed about the mechanism during the public consultation and participation.

## 1.5 Report, Methodology and Scope of the Study

The present study has been undertaken in accordance with the ADB's Safeguard Policy Statement (2009), Environmental Assessment Guidelines (2003) and the Environmental Assessment and Review Framework (EARF) agreed between the Government of Armenia and ADB. Internationally recognized standards and guidelines were applied where local standards were not available. This includes World Bank Group Environmental, Health, and Safety General Guidelines (2007).

The environmental assessment and the preparation of the report and the Environmental Management Plan (EMP) involved the following major activities:

- (i) Gathering of baseline information on the physical, ecological, and socio-cultural and economic environment of the Project area and understanding the technical, social, and institutional aspects;
- (ii) Discussions with specialists of RA Ministry of Environment, RA Ministry of Territorial Administration and Infrastructure, other relevant official authorities; Organization of public consultation events;
- (iii) Identification of impacts, concerns and other potential issues, related to the location, design, construction, and operation to distinguish those that are likely to be significant;
- (iv) Preparation of Environmental Management Plan (EMP) indicating impact areas, recommended mitigation measures, methods of monitoring the impacts, responsible agencies/persons, and associated costs; and
- (v) Proposing the institutional set-up for implementation of the EMP.

The Structure of this EIA report follows the following outline:

- A. Executive Summary
- B. Policy, Legal and Administrative Framework
- C. Description of the Project
- D. Description of the environment (baseline data)
- E. Anticipated environmental impacts and mitigation measures
- F. Analysis of alternative
- G. Information Disclosure, Consultation and Participation
- H. Grievance Redress Mechanism
- I. Environmental management plan (mitigation and monitoring)
- J. Conclusion and recommendations.

The report was also prepared in both Armenian and English languages.

Baseline data and other information were obtained from published and unpublished sources

including climate, topography, geology and soils, natural resources, flora and fauna and socio-economic data and field investigations.

## 1.6 Tasks and Accomplishments

Table 1-1 presents the tasks accomplished and the current actions being undertaken for the Project by the executing and implementing agencies (MTAI and TPIO).

**Table 1-1: Task and Actions**

| Task                                                                                                                                                                                                                                                                      | Response/Action taken                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (i) Prepare environmental screening checklist for classification of the Project.                                                                                                                                                                                          | Environment categorization has been accomplished by ADB.                                                                                                                                          |
| (ii) Ensure that an Environmental Impact Assessment is prepared in compliance with the requirements of the Government of Armenia and ADB, and that adequate consultation with affected people is undertaken in accordance with ADB and Armenian legislation requirements. | The draft EIA report was prepared by the Design Consultant. During final design preparation phase four public consultations were held on according to to ADB SPS (2009) and Armenian legislation. |
| (iii) Obtain necessary permits and/or clearance, as required, from ME and other relevant government agencies, ensuring that all necessary regulatory clearances are obtained before commencing any civil work.                                                            | The necessary applications for permits and/or clearances such as from the MESCS are processed before the EIA is presented to the ME for expertise review and conclusion by the Consultant.        |
| (iv) Submit to ADB the EIA report of Tranche 4 – 60km Sisian–Kajaran Road Section Project including EMP and other documents, as necessary to comply with Public Disclosure.                                                                                               | The final EIA report and the EMP will be disclosed on ADB, ME (Armenian version) and TPIO websites.                                                                                               |
| (v) Ensure that the EMP, including relevant mitigation measures that need to be addressed during the construction stage by the contractor, is included in the bid and contract documents.                                                                                 | The TPIO will ensure that all EMP requirements are included in the bid and contract documents.                                                                                                    |
| (vi) Ensure that contractors have access to the EIA and EMP reports of the Project.                                                                                                                                                                                       | The TPIO shall provide the contractors the bid documents with a copy of the EIA report and EMP of the Project.                                                                                    |
| (vii) Ensure and monitor that the EMP, including an environmental monitoring plan, will be properly implemented.                                                                                                                                                          | The TPIO and the project Supervisor/Engineer will regularly - monitor construction activities to check the compliance to EMP and monitoring plan.                                                 |
| (Viii) In case of the Project constraints need to be adapted during implementation, review the environmental classification, revise it accordingly and identify whether a supplementary EIA study is required.                                                            | An additional EIA shall be carried out in case of major changes in alignment and ROW take place in the Project design.                                                                            |

| Task                                                | Response/Action taken                                        |
|-----------------------------------------------------|--------------------------------------------------------------|
| (ix) Submit bi-annual environmental reports to ADB. | The TPIO will submit environmental bi-annual reports to ADB. |

## 2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

### 2.1 ADB Environmental Assessment Requirements

The Safeguard Policy Statement (SPS) (2009) sets the requirements of environmental assessments for all projects supported by the ADB. At an early stage of project preparation, the policy also requires that the Project's potential risks and their significance are to be identified through the consultation and communication of stakeholders (relevant ministries, members of the community, persons affected by the project, the NGOs, etc.). If potentially adverse environmental impacts and risks are identified, an environmental assessment must be undertaken as early as possible. The assessment should consider all phases of the Project including construction and operation, and impacts should be prevented where possible or mitigation be recommended.

The Public Consultation and Participation method and Grievance Redress Mechanism are described in the chapters 7 and 8.

### 2.2 Armenian Laws Governing Environmental Management and Assessment

After Armenia gained its independence in 1991, the deteriorating environmental condition of the country became more apparent and environmental concerns became high priority political issues and the process of development of environmental legislation was initiated. The 10th Article of the Constitution of the Republic of Armenia (passed in 1995, amended in 2005 and 2015) states the State responsibility for environmental protection, reproduction, and wise use of natural resources. Several laws have been adopted to protect the environment. The relevant national law on environmental impact assessment is:

- (i) Law on Environmental Impact Assessment and Expertise (June 22, 2014)

The set law is the main law administered by the ME. Other pieces of pertinent environmental legislation to be considered are:

- (i) Law on Specially Protected Natural Areas (2006)
- (ii) Law on Ensuring Sanitary-epidemiological Security of the RA Population (1992)
- (iii) Law on Atmosphere Air Protection (1994)
- (iv) Law on Automobile Roads (1996)
- (v) Law on the Protection and Use of Fixed Cultural and Historic Monuments and Historic Environment (1998)
- (vi) Law on Environment and Nature Use Charges (1998)
- (vii) Law on Flora (1999)
- (viii) Law on Fauna (2000)
- (ix) Land Code (2001)



- (x) Law on Hydro-meteorological Activity (2001)
- (xi) Law on Environmental Education (2001)
- (xii) Code on Underground Resources (2011)
- (xiii) Water Code (1992/2002)
- (xiv) Law on Seismic Defense (2002)
- (xv) Law on Water Users' Associations and Federations of the Water Users Associations (2002)
- (xvi) Law on Waste (2004);
- (xvii) Law on Environmental Oversight (2005)
- (xviii) Forest Code (2005)
- (xix) Law on Rates of Environmental Charges (2006)
- (xx) Law on National Water Program (2006)
- (xxi) Law on Oversight of Land Use and Protection (2008)

To satisfy relevant regulations and to gain a positive assessment conclusion from the ME, this EIA report was prepared in accordance with the Law on Environmental Impact Assessment and Expert Examination (June 22, 2014) and the legislative provisions relevant to environmental protection were considered accordingly.

ADB classifies projects into four categories (A, B, C and FI) depending on the nature and scale of the expected impacts, and requires a different level of environmental study for each category. This includes Environmental Impact Assessment (EIA) and Initial Environmental Examination (IEE), which is not represented in the Armenian legislation.

To reduce the differences between Armenian legislation and International environmental policies the new law on Environmental Impact Assessment and Expertise has been approved in July 2014. The new law defines the environmental assessment process. The law requires projects to be assessed according to a two stage process (i) the preliminary stage, which including screening and categorization as category A, B, or C according activity type; and (ii) a main examination phase, where Category A and B projects are further examined. The law provides the list of proposed activities by categories subject to environmental impact expertise and also provides an outline for the EIA report which includes sections on analysis of the project impacts for both physical, biological and social environments, and cumulative impacts. The EIA Law specifies notification, documentation, public consultations, and appeal procedures and requirements.

Despite that the law introduces many improvements over the previous law there are still a number of gaps between the Law and ADB's Safeguard Policy Statement (2009) policy principles. In particular, requirements of environmental management planning and the contents of environmental management plans.

Furthermore, in determining environmental standards for projects it supports, ADB follows the approach set out in the World Bank group's Environment, Health and Safety Guidelines (2007); although emission levels and approaches to pollution prevention/abatement can be adopted if necessary, to better reflect national legislation and local conditions.

Other pieces of pertinent environmental legislation are also considered during the assessment. These include, air basin protection, cultural and historical monuments, flora, fauna, water use, seismic defense, waste, hygiene, and workers' protection such as:

- (i) Law on Specially Protected Natural Areas (2006) outlines the procedures for establishing

protected areas and their management. The Law defines four categories of protected areas in RA: (i) State Reserves; (ii) National Parks; (iii) Sanctuaries; and (iv) Nature Monuments.

- (ii) State Reserves are afforded the highest level of protection. These strictly protected areas allow human incursions for only non-consumptive purposes. Tourists may visit Protected areas but must follow designated routes. Five zones define each National Park: “reserve”, “sanctuary”, “recreation”, “buffer” and “economic”. The law does not specify allowed uses for Sanctuary Zones within National Parks. Recreational zones are established for tourism development. Natural Monuments are objects of scientific, historical, cultural and aesthetic value. The activity within Sanctuaries should not threaten “ecosystem sustainability”. Several Sanctuaries have charters (legal instruments drafted and approved by Government to describe the Sanctuary’s geographic area, conservation and use).
- (iii) Law on the Protection and Use of Fixed Cultural and Historic Monuments and Historic Environment (1998) provides the legal and policy basis for the protection and use of such monuments in Armenia and regulates the relations among protection and use activities. Article 15 of the Law describes procedures for - amongst other things – the discovery and state registration of monuments, the assessment of protection zones around them and the creation of historic-cultural reserves. Article 22 requires the approval of the authorized body (Department of Historic and Cultural Monuments Preservation) before land can be allocated for construction, agricultural and other types of activities in areas containing monuments. The Ministry of Education, Science, Culture and Sport has jurisdiction over archaeological, historical, and cultural sites. It is not, however, involved with the fate of modern monuments erected along the highway by private citizens in commemoration of accident victims. The relocation of those monuments will be coordinated by the respective provincial authority (*marzped*s).
- (iv) Law on Flora (1999) and Law on Fauna (2000) outline Armenia’s policies for the conservation, protection, use, regeneration, and management of natural populations of plants and animals, and for regulating the impact of human activities on biodiversity. These laws aim for the sustainable protection and use of flora/fauna and the conservation of biodiversity. The laws provide for assessing and monitoring species, especially rare and threatened species.
- (v) Law on Atmospheric Air Protection regulates the emission licenses and provides maximum allowed loads/concentrations for atmospheric air pollution, etc. There is secondary legislation that establishes sanitary norms for noise in workplaces, residential and public buildings, residential development areas, and construction sites.
- (vi) Land Code (2001) defines the main directives for use of the lands allocated for energy production, water economy (water supply, water discharge, pumping stations, reservoirs, etc.), and other purposes. The Code defines the lands under the specially protected areas as well as forested, watered, and reserved lands. It also establishes the measures aimed at protection of the lands as well as the rights of state bodies, local authorities, and citizens towards the land.
- (vii) Code on Underground Resources (2011) contains the main directives for use and protection of mineral resources and groundwater, including the sanitary protection zones for the groundwater resources.
- (viii) Water Code (2002) provides the legal basis for the protection of the country’s water resources, the satisfaction of water needs of citizens and economic sectors through effective management of water resources and safeguarding the protection of water resources for future generations. The following regulations and procedures of the Water Code (2002) are relevant: (a) permitting procedures, (b) environmental flows, (c) drainage water, (d) water

alternative accounting, (e) access to information on trans-boundary water, (g) reservation of ground water sources, (h) registration of documents in state water cadaster, and (i) public awareness and publicity of the documents developed by WRMA and other normative documents which provide guidelines directly linked with water and environmental issues.

- (ix) Law on Wastes (2004) provides the legal and economic basis for collection, transportation, disposal, treatment, and re-use as well as prevention of negative impacts of waste on natural resources, human life, and health. The law defines the roles and responsibilities of the state authorized bodies in the waste sector.
- (x) Law on Environmental Oversight (2005) regulates the issues of organization and enforcement of oversight over the implementation of environmental legislation of Armenia and defines the legal and economic bases underlying the specifics of oversight over the implementation of environmental legislation, the relevant procedures, conditions and relations as well as environmental oversight in Armenia. The existing legal framework governing the use of natural resources and environmental protection includes a large variety of legal documents. Government resolutions are the main legal implementing instruments for environmental laws. The environmental field is also regulated by presidential orders, Prime-Minister's resolutions, and ministerial decrees.
- (xi) Forest Code (2005) regulates the conservation, protection, and management of forests. According to Article 21: 1. The forest owners, those in charge of forestry and forest users have the right to protect the forests from arbitrary invasions, illegal cutting, illegal grazing, pollution, wastes and other activities that violate forestry legislation and damage forest biodiversity, which is forbidden by the law. 2. The forest owners, those in charge of forestry and forest users have the following obligations: a) To adhere to/keep fire prevention and safety rules. b) To develop and implement complex programs of fire detection and firefighting measures, including construction and rehabilitation of the roads having firefighting significance. c) In the event of fire detection to alarm and involve specialized firefighting services and the local self-government bodies. 3. Design and relocation of objects, construction and operation in the vicinity of forest lands should ensure prevention of the negative impacts on the condition of the woods. The impacts on the wood lands of the area adjacent to the woods or not, is determined based on the environmental expertise of the given activity. And according to Article 22: 1. Forest owners, those in charge of forestry and forest users are obliged to protect the woods from mass reproduction of harmful organisms, as well as from other natural harmful impacts. 2. Protection of forests from harmful organisms and sicknesses include implementation of the following measures; a) Forest pathology studies b) Prevention of pests and sicknesses of the forests sanitary cutting.

### 2.3 Armenia's Participation in International Environmental Conventions and Protocols

The Republic of Armenia has signed and ratified International Conventions, starting in 1993 with the Ramsar Convention on wetland protection. Of particular significance to this Project is that recently Armenia has decided to adopt the IUCN Red Book in its entirety in favor of its Red Book that was based on the former Soviet Union definitions. This EIA report is based on the IUCN Red Book. Table 2-1 lists the global and regional multilateral international environmental agreements signed and/or ratified by Armenia.

**Table 2-1: Multilateral international environmental agreements signed and/or ratified by**

**Armenia.**

| <b>Title, place and date adopted</b>                                                                                      | <b>Ratified by National Assembly</b>                 | <b>In force for RA</b> |
|---------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|------------------------|
| <b>Global Conventions</b>                                                                                                 |                                                      |                        |
| Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971) - aka Ramsar Convention | Acceded as assignee by the request of MFA RA 1993    | 1993                   |
| UN Convention on Biological Diversity (Rio de Janeiro, 1992)                                                              | 31 Mar 1993                                          | 14 May 1993            |
| Cartagena Protocol on Bio-safety (Montreal, 2001)                                                                         | 16 Mar 2004                                          | 29 Jul 2004            |
| UN Framework Convention on Climate Change (New York, 1992)                                                                | 29 Mar 1993                                          | 21 Mar 1994            |
| Kyoto Protocol (Kyoto, 1997)                                                                                              | 27 Dec 2002                                          | 16 Feb 2005            |
| Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972)                             | Acceded as assignee by the request of MFA RA in 1993 | 1993                   |
| UN Convention to Combat Desertification (Paris, 1994)                                                                     | 23 Jun 1997                                          | 30 Sep 1997            |
| UN Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal (Basel, 1989)             | 26 Mar 1999                                          | 01 Oct 1999            |
| Convention for the Protection of the Ozone Layer (Vienna, 1985)                                                           | 28 Apr 1999                                          | 01 Oct 1999            |
| Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal, 1987)                                             | 28 Apr 1999                                          | 01 Oct 1999            |
| London Amendments to the Montreal Protocol                                                                                | 22 Oct 2003                                          | 26 Nov 2003            |
| Copenhagen Amendments to the Montreal Protocol                                                                            | 22 Oct 2003                                          | 26 Nov 2003            |
| Montreal amendment to the Montreal Protocol                                                                               | 29 Sep 2008                                          | 18 Mar 2009            |
| Beijing amendment to the Montreal Protocol                                                                                | 29 Sep 2008                                          |                        |



|                                                                                                                                                            |                                |             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------|
| Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam, 1998)                 | 22 Oct 2003                    | 26 Nov 2003 |
| Stockholm Convention on Persistent Organic Pollutants (Stockholm, 2001)                                                                                    | 22 Oct 2003                    | 17 May 2004 |
| Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Washington, 1979)                                                 | 10 Apr 2008                    | 21 Jan 2009 |
| Convention on the Conservation of Migratory Species of Wild Animals (Bonn, 1979)                                                                           | 27 Oct 2010                    | 01 Mar 2011 |
| <b>Regional (European) conventions</b>                                                                                                                     |                                |             |
| UNECE Convention on Long-range Trans-boundary Air Pollution (Geneva, 1979)                                                                                 | 14 May 1996                    | 21 Feb 1997 |
| Protocol on Long-term Financing of the Cooperative Program for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe (EMEP) | In the process of ratification |             |
| UNECE Convention on Environmental Impact Assessment in a Trans-boundary Context (Espoo, 1991)                                                              | 14 May 1996                    | 10 Sep 1997 |
| Protocol on Strategic Environmental Assessment (Kiev, 2003)                                                                                                | 25 Oct 2010                    | 24 Apr 2011 |
| The Protocol on Pollutant Release and Transfer Registers (Kiev, 2003)                                                                                      | 21 May 2003                    |             |
| UNECE Convention on Trans-boundary Effects of Industrial Accidents (Helsinki, 1992)                                                                        | 14 May 1996                    | 21 Feb 1997 |
| UNECE Convention on access to information, public participation in decision making and access to justice in environmental matters (Aarhus, 1998)           | 14 May 2001                    | 01 Aug 2001 |
| Protocol on Water and Health (London, 1999)                                                                                                                | In the process of ratification |             |
| Convention on the Prohibition of Military or Any Hostile Use of Environmental Modification Techniques (Geneva, 1976)                                       | 04 Dec 2001                    | 15 May 2002 |
| UNECE Convention for the Protection and Use of Trans-boundary Watercourses and International Lakes (Helsinki, 1992)                                        | 22 Oct 2003                    |             |



|                                                                                                                                 |             |             |
|---------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|
| European Landscape Convention (Florence, 2000)                                                                                  | 23 Mar 2004 | 01 Jul 2004 |
| Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property | 22 Jun 1993 |             |
| Convention Concerning the Protection of World Culture and Natural Heritage                                                      | 22 Jun 1993 |             |
| European cultural convention                                                                                                    | 22 Jun 1993 |             |
| Convention for Protection of Non-material Cultural Heritage                                                                     | 20 Mar 2006 |             |
| Bern Convention - Council of Europe Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1979)       | 26 Feb 2008 | 01 Aug 2008 |

## 2.4 Administrative Framework

### 2.4.1 Governing Council

A Governing Council of the North-South Road Corridor Investment Program is chaired by the Prime Minister. It is comprised of two representatives from the Ministry of Economic Development and Investment, two representatives from Ministry of Territorial Administration and Infrastructure and one representative of each of the following entities: Ministry of Justice, Ministry of Finance and the Real Estate Cadastre Agency. The Governing Council key functions include guiding the overall policy and strategic direction of the MFF program, reviewing and evaluating its performance, and coordinating with other external aid agencies. The Governing Council holds a regular meeting at least once each month.

### 2.4.2 Executing Agency

The Executing Agency (EA) is the Ministry of Territorial Administration and Infrastructure (MTAI). MTAI is a republican body of executive authority, which elaborates and implements the policies of the Republic of Armenia Government in the transport, communication, and information technologies sectors. The EA will oversee the implementation of the Program and the disbursement of the loan.

### 2.4.3 Implementing Agency

The MTAI set up a North-South Road Corridor Investment Project Implementation Unit SNCO to manage day-to-day coordination, implementation, monitoring and administration activities of the project. TPIO includes a Legal and External Impact Unit where External Impact and Resettlement

Coordinator, Environmental 2 Specialists and Social Safeguards Specialist are responsible for the management all environmental and social aspects of the North-South Road Corridor Investment Program and compliance of them to RA legalization and safeguard policies of donor organizations such as ADB's Safeguard Policy.

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#### 2.4.4 Design Engineer

Key responsibilities include:

- (i) Prepare the draft Environmental Impact Assessment (EIA) , along with the relevant Environment Management and Monitoring Plan (EMP), and other documents as required;
- (ii) prepare the final Environmental Impact Assessment (EIA), along with the relevant Environment Management and Monitoring Plan (EMP), and other documents as required;
- (iii) submit the draft and final EIA, EMP for the Executing Agency (MTAI), Implementing Agency (TPIO) and ADB's review and approval;
- (iv) apply for and get a positive environmental expertise conclusion if needed from the "Environmental Impact Expertise Center" SNCO of the RA Ministry of Environment for the EIA report and EMP as prescribed by the Armenian legislation (including agreement on route with the RA Ministry of Education, Science, Culture and Sport, etc.).
- (v) develop Technical Specifications based on mitigation measures defined in the EMP and incorporate environmental clauses into Particular conditions of the tender and contract documents.

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#### 2.4.5 Supervising Engineer

During construction the key tasks of the Supervising Engineer will include the following major key activities:

- (i) supervise and monitor the construction of the Project including the implementation of the Site Specific EMP;
- (ii) ensure that all work associated with the Project are carried out in full compliance with the designs and specifications and following international engineering and quality standards;
- (iii) manage contract changes, contractor claims and scope revisions;
- (iv) monitor the Project performance, benefits and ensure compliance with all social requirements; ensure that environmental, health and safety requirements, road safety and monitoring are carried out in compliance with the relevant safeguards documents, the ADB safeguards policy and the applicable laws of Armenia;
- (v) liaise with government and municipal authorities, program management Consultants, NGO's, civil society, and other stakeholders concerned with the Project implementation to carry out proper consultation;
- (vi) ensure that the construction contractor prepares the detailed site specific EMP;
- (vii) handle the complaints based on GRM;
- (viii) carry out 2 visits during the defects liability period;
- (ix) report to TPIO.



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#### 2.4.6 Contractors

The Contractors' key responsibilities are listed below but are not limited to the following:

- (i) prepare Site-specific environmental management plans (SEMP) and obtain the Engineer approval as a working construction document based on the present EIA report and the EMP, update the SEMP during the construction when needed and obtain the Engineer approval of the updated part;
- (ii) hire the services of one Environment Specialist and one Health & Safety specialist or Environmental Specialist with back ground in Health and Safety as defined in the tender document; hire the services of Archaeological Specialist;
- (iii) implement the SEMP as a special part of the contract and particular conditions; coordinate with the Engineer for the implementation of the various components of the EMP including monitoring;
- (iv) in cases of emergencies and accidents or extraordinary situations notify the Engineer and the relevant emergency authorities immediately;
- (v) obtain permits and approvals from relevant agencies and provides copies to Engineer;
- (vi) report on EMP implementation.

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#### 2.4.7 Asian Development Bank

ADB may carry out periodic project reviews, inspections of the Project throughout the Project cycle in conformity with the principles and requirements embodied in the SPS 2009. ADB will provide assistance to the TPIO in managing the social and environmental impacts and risks, thus contributing to the promotion of the long-term sustainability of investments. To achieve this ADB will ensure that TPIO comply and adhere to the social and environmental safeguard requirements during project preparation and implementation.

ADB will also promote the disclosure of information about the Project through the placing the English version of the EIA report and EMP on the website.

Listed below are roles that ADB will perform through the different phases of the Project:

##### **Pre-Construction:**

- (i) Reviews project screening results and approves project categorization;
- (ii) Reviews and approves IEEs/EIAs on no-objection basis;
- (iii) Discloses IEEs/EIAs to the public through the ADB website;

##### **Construction Phase:**

- (iv) Reviews bi-annual reports and provides necessary advice to the TPIO;
- (v) Undertakes two environmental review missions per annum for environment category "A" and one mission for category "B" projects.

##### **Post-construction Phase:**

- (vi) Undertakes and reviews post construction audit.

The government agencies and their roles that could be involved in the Tranche 4 -60km Sisian–Kajaran Road Section Project are as follows:



#### 2.4.8 Ministry of Environment

The Ministry of Environment (ME) is responsible for the protection, sustainable use, and regeneration of natural resources as well as the improvement of the environment in the Republic of Armenia. In those areas, the ME's authority includes overseeing national policy development, developing environmental standards and guidelines, and enforcement. The ME implements those functions through its structural departments. The key departments within the ME that have administrative authority over the EIA/IEE and the project approval process are:

- (i) The "Environmental Impact Expertise Center" (EIEC) is responsible for reviewing and issuance of assessment conclusion reports and adding conditions when necessary to protect the environment; and

The EIA process and the EMI's power to inspect are the principal tools used by the ME to achieve compliance with environmental protection principles.

The Article 14 of the new law on "Environmental Impact Assessment and Expertise " (22 June, 2014) for "A" category projects that include "construction or reconstruction of new roads with four and more lanes or upgrading of roads with maximum two lanes to four lanes in case the relevant section has continuous length of 10 km or more" an EIA should be submitted to ME for the expertise.

The EIA process and the EMI's power to inspect are the principal tools used by the ME to achieve compliance with environmental protection principles. To satisfy relevant regulations and to gain a positive assessment conclusion from the ME, this EIA report should be prepared in accordance with the Law on Environmental Impact Assessment and Expert Examination (July 22, 2014) and the legislative provisions relevant to environmental protection should be considered accordingly.

The ME is also the Government authorized body in the area of waste management of the RA. Article 8 of the Law on Waste (24.11.2004) sets authorities of the environmental sector. The Ministry of Environment of RA as the state authorized body in the area of waste management is mandated with the following tasks and responsibilities in environmental protection area:

- (i) Develop the state policy for the sector and ensure its implementation;
- (ii) Coordinate activities of the state authorized bodies in the area of waste management;
- (iii) Ensure system of economic incentives for implementation of less-wasteful technologies, waste collection and recycling;
- (iv) Approve waste disposal quotas for legal entities and private entrepreneurs;
- (v) Approve sites for location of waste management objects;
- (vi) Provide a waste inventory, generation, removal (elimination, disinfection, disposal) and recycling procedure;
- (vii) Provide a procedure on licensing of activities in the area of dangerous waste reprocessing, disinfection, storage, transportation and disposal, as well as carry out licensing of those activities;
- (viii) Provide lists of dangerous and restricted waste;
- (ix) Provide a procedure on trans-boundary transportation and removal of waste;
- (x) Ensure establishment of structures for placement of disinfected and non-recyclable waste;
- (xi) Carry out international cooperation in the area of waste management; and

- (xii) Carry out other authorities provided by law.

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#### **2.4.9 Ministry of Territorial Administration and Infrastructure**

The Ministry of Territorial Administration and Infrastructure is the authorized government body who has the jurisdiction over the mineral resources of the RA. The Ministry is tasked with planning, assessment, exploration and implementation of programs and projects relating to mining explorations and operations of the mining industry.

Similarly, with the Agency of Mineral Resources, the goal and objectives of the Subsoil Concession Agency include formulation of plans and programs for the mineral resource exploration, surveys and rationalized utilization and protection of the natural resources, to ensure the provisions of the Mining Law in undertaking exploration and mining projects; approval and opening of borrow pits.

Water Committee of RA Ministry of Territorial Administration and Infrastructure is authorized body of management of water structures

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#### **2.4.10 Environmental protection and Mining Inspection Body**

Environmental protection and Mining Inspection Body was created based on the RA Law on “Inspection bodies”, in the result of restructuring of Environmental Inspectorate of the Ministry of Nature protection and Mining Inspection of the Ministry of Energy Infrastructures and Natural Resources. Environmental protection and Mining Inspection Body is a governmental body that is subject to the Government's control, supervision and other functions as defined by law, which, in the manner prescribed by law, imposes sanctions/ takes responsibility measures, in the fields of environment and the mining.

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#### **2.4.11 Ministry of Education, Science, Culture and Sport**

The Ministry of Education, Science, Culture and Sport (MESCS) has jurisdiction over archaeological, historical, and cultural sites. The Law on preservation and utilization of Immovable Monuments of History and Culture and of the Historic Environment (adopted November 11, 1989)<sup>1</sup>.

Under the law the Project will have to comply with the provisions of the following chapters:

- (i) Chapter 19. Any construction activity in areas containing historical monuments or archaeological sites must be realized in agreement with the authorized body (Ministry of Education, Science, Culture and Sport).
- (ii) Chapter 20. Newly discovered sites obtain immediately protected status by law until they are included in the State Lists.
- (iii) Chapters 21-22. Destruction of historical monuments and its environment is forbidden. Before the realization of any kind of activity at the area of the site the authorized body must study it and give corresponding permits or solutions.

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#### **2.4.12 Ministry of Health**

State Hygienic and Anti-epidemiological Survey of the Ministry of Health of RA is responsible for

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<sup>1</sup> <http://www.parliament.am/legislation.php?sel=show&ID=1641&lang=arm>



the following actions implementation:

- Coordination of all issues related to health (including those on noise and vibration);
- Supervise implementation of sanitary norms, hygienic and anti-epidemiological measures implementation by organizations and citizens.

#### 2.4.13 State Committee of the Real Estate Cadastre

The State Committee of the Real Estate Cadastre adjunct to the RA Government is a republican body of executive authority, which elaborates and implements the policies of the Republic of Armenia Government in the area of maintaining the unified national cadastre of immovable property

### 3 DESCRIPTION OF THE PROJECT

#### 3.5 Type of Project

North-South Road Corridor crosses the territory of Armenia from the South to the North of Armenia including Agarak-Kapan-Yerevan-Gyumri-Bavra highways and road infrastructures and is linked to the road networks of the two neighbors of Armenia: Iran and Georgia. The road corridor will facilitate improving the road connection. The North-South Road Corridor Investment Project is aimed at reconstruction of the 2<sup>nd</sup> -3<sup>rd</sup> category carriageway with a speed limit of 30-90 km/hour that runs 560 km from the Armenian border with Georgia at Bavra to the border with Iran at Agarak and upgrading it to 470 km-long 1st category high-speed carriageway with a speed limit of 100-110 km/hour enabling to cross the mentioned section during decreased time and increasing the comfortability and safety that of by ensuring the fulfilment of the Project goal in regard to making the North-South Road a transit carriageway for passenger and cargo transportation from the East to the West within scope of TRACECA and Silk Road Projects

North-South Road Corridor Investment Program is divided into 6 Tranches. Tranche 4 is the southernmost part of the North-South corridor. It begins from the town of Artashat and ends at the mutual border between the Republic of Armenia and the Islamic Republic of Iran. The new highway will provide significant development opportunities for all the communities from North to South of Armenia.

In the framework of the contract for consulting services for construction supervision of Tranche 3 and feasibility design, preliminary design and 60km detailed design of Tranche 4 of the North-South Road Corridor Investment Program, Consortium SPEA-IRD has prepared design for Tranche 4 Sisian-Kajaran 60km road section.

This EIA refers to Tranche 4 Sisian-Kajaran 60km road section (see Figure 3-1).

#### 3.6 Location of the Project

The Tranche 4, 60km Sisian-Kajaran road section begins from the southern foot of Mount Mets



Ishkhanasar (3550 m), crosses M2 highway, passes through the left - bank mountain slope of the Vorotan River, crosses the Vorotan River through the upper part of Shamb water reservoir, crosses the Bargushat ridge (with spot heights 3000 m and higher) through mountain slope on the left side of the Loradzor tributary, passes through mountain slope on the right side of Voghchi river valley in the vicinities of the community Nor Astghaberd (Geghi), reaches the right-side mountain slope of Kapan - Kajaran road section and continues to the entrance of the town of Kajaran. (see Figure 3-1).

**Figure 3-1: Location of Tranche 4, 60km Sisian-Kajaran road section Project**

### 3.7 Description of the Works

The project comprises the construction of approximately 60 km of single carriageway with 2 lanes in one direction and 1 lane in another direction.

The new road section alignment will be designed and constructed to standards that will result in improved road markings, signage, W-Beam Metal Guardrails, drainage, culverts, overpasses, underpasses, and shoulders. The roadway lighting system only will be provided in interchanges.

There will be a total of

- 3 new grade-separated interchanges, all of which are overpasses. Besides overpasses there is one underpass.



- 4 agricultural underpasses for machinery, pedestrians and animals (km 5+780; km 7+055; km 15+310; km 21+854);

Other reinforced concrete structures comprise:

- 27 bridges, 3 of these bridges cross Vorotan, Loradzor and Geghi rivers and others crosses gorges. 5 bridges are reinforced-concrete and 22 bridges are steel.
- 9 tunnels, total length of the tunnels is about 12.5km. The shortest tunnel length is 359m and the longest tunnel length is 8645 m
- 106 pipelines for surface water and irrigation systems.
- 6295 pre-cast concrete chutes Type B-1-22

The principle quantities of the works to be implemented include:

Excavation: 5 671 476.80 cubic meters,

Top soil stripping: 34 361 cubic meters,

Rock excavation: 9 147 683.2 cubic meters,

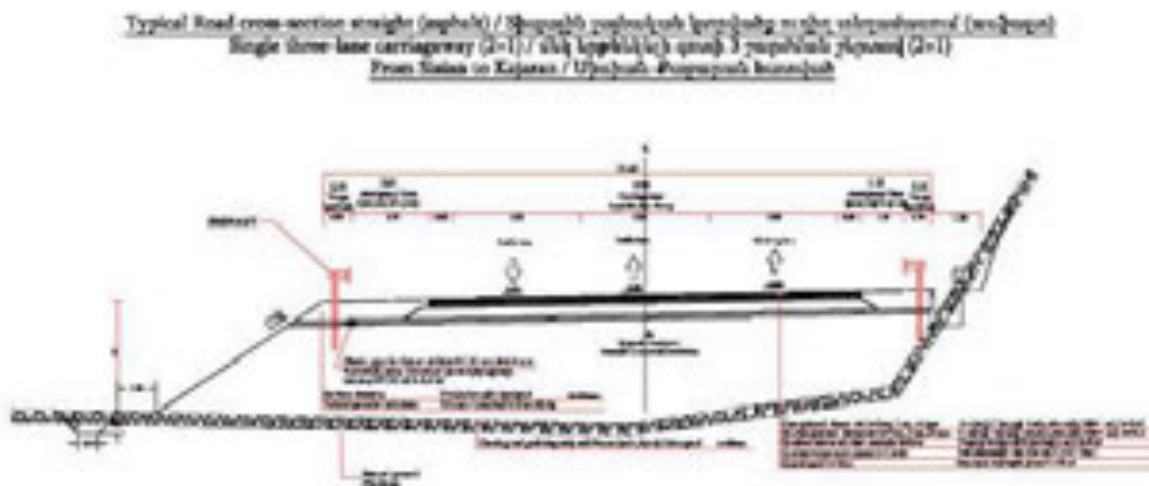
Unsuitable excavation: 1 437 295.30 cubic meters,

Embankment: 3 311 148 cubic meters,

Hot asphalt pavement: 474 612 sq. meters

Due to rocky terrain, grassing of the embankments is not envisaged

A typical road cross-section is shown in Figure 3-2 below.



The road pavement will comprise 10cm thickness of gravel-sand, 30cm of Crushed stone sand course C-5, 8 cm of crushed stone a/c high porosity, 7 cm of course-grained dense a/c I cat B type and 5cm of fine-grained dense a/c I cat A type. Shoulders will be covered with surface dressing.



The road has been designed in accordance with (i) Bridge Design Building Code SNIP 2.05.03.84\*, Construction Norm of Republic of Armenia IV11.05.02-99, AASHTO and Eurocodes. The structural elements of the project have been designed with consideration to the high risk of seismic activity and flooding.

Relocation of Utilities including:

- Drinking water pipelines
- Irrigation channels/pipelines
- Gas Pipelines
- Electricity power lines

It is expected that construction will be undertaken over a period of 5 years.

### 3.8 Screening and Classification

Tranche 4, 60km Sisan-Kajaran road section, under the North-South Road Corridor Investment Project has been screened to determine its environmental category with the ADB's Rapid Environmental Assessment Checklist (REA). The REA checklist completed by the Design Engineer and attached as an Annex 1 of this report. The classification was based on the most environmentally sensitive component of the project, which means that if one part of a project has the potential for significant adverse environmental impacts, then the project is to be classified as environmental category "A" regardless of the potential environmental impacts of other aspects of the project. Based on the REA Checklist - Some sections of the project could be located within a protected area (Zangezur State Sanctuary). Based on the REA Checklist, the project is classified as a Category "A".

According to the Armenian legislation a proposed project is also classified as a Category "A" and an EIA report should be prepared.

This EIA report has been prepared to meet ADB SPS (2009) policy and Armenian legislation requirements.

## 4 DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

This section describes relevant physical, ecological, and socio-cultural and economic conditions within the study area. It also looks at current and proposed development activities within the Project's area of influence, including those not directly connected to the Project. It indicates the accuracy,



reliability, and sources of the data. All information has been gathered from different sources. All appropriate baseline instrumental and field surveys have been implemented for the air, soil, fauna and flora.

## 4.1 Physical Resources

### 4.1.1 Climate

2. The climate of Syunik is influenced by eastern atmospheric masses from the Caspian Sea and dry Iranian plateau and has characteristics of continental climate. When intrusion of humid air masses occurs, they highly transform and dry in the process of overcoming the Zangezur Mountain Range. However, the extreme diversity of the relief brings to great climate diversity as well. Vertical zoning is obvious, thermal conditions normally decrease as altitude increases and rainfall generally increases by altitude: 1) At altitudes of 1000-2300 m the climate is temperate semiarid. The annual number of frost-free days varies by altitude, ranging from 120 to 160 days. Average annual precipitation is 500-650 mm, and average annual relative air humidity - 50-60%. 2) At altitudes of up to 2300 m the average annual precipitation is 550-750 mm, and average annual relative air humidity - 60-70%. 3) The temperate cold climate is typical at altitudes of 2300-2500 m. Annual precipitation is 550-750 mm. Average annual relative air humidity is 70-80%, and the number of frost-free days - 160-280. The average air temperature is in the range of  $(-2)^{\circ}$ - $(-4)^{\circ}$  in January, and  $16-18^{\circ}$  in July. 4) Cold humid mountainous climate is typical at altitudes of 2300-3300 m. The amount of precipitation is larger than evaporation, 700-800 mm (in some places -900 mm) and 250-300 mm, respectively. Excess moisture generates surface flow, which in its turn causes spatial and linear erosion. The average air temperature is  $-10^{\circ}\text{C}$  in January and  $10-12^{\circ}\text{C}$  in July. The length of the frost-free period in a year is 50-80 days. Frosty weathering processes prevail. 5) At altitudes of over 3200-3500 m despite of the intensity of solar radiation and long-lasting sunshine, the solar radiation balance is mostly negative during the year. The climate is severe and cold, with winters lasting 6 months and longer. Annual rainfall is over 800-900 mm. These provide favorable conditions for accumulation of moisture (in form of snow, firn, or ice). Average snow cover is 2 m deep, and annual average days with snow cover amount to 270. Snow cover is preserved all year long in form of snow, firn or ice in specific landforms of periapical and apical areas. Short and cold summers do not provide adequate thermal conditions for the growth of a vegetative cover.

The temperature in Sisian region averages  $8.5^{\circ}\text{C}$ . in a year, the average rainfall is 532 mm. The temperature in Kajaran region averages  $6.9^{\circ}\text{C}$ . in a year, the average rainfall is 686 mm. The average annual relative humidity is 50-60%, and less than 30% at low altitudes (up to 1000 m) as well as 60-80% over 2600 m. Reduction of rainfall is observed in the section from the Vorotan River Valley to Sisian. The annual distribution of precipitation is highly uneven. Most precipitation occurs in the period of March-June. Most clear days are observed in the Sisian region, resulting in a high radiation balance -  $60-62\text{ kcal/cm}^2$ . The longest multiyear annual average sunshine period is observed in Sisian - 2660 hours.

Permanent snow cover starts at altitudes of 1200m.a.s.l. and it lasts for 35-165 days. The snow depth is 15-180 cm. It lasts 1-1.5 months at altitudes of up to 1500 m, and 6.5-7 months at altitudes of 3000 m and higher. The depth of snow cover is 15-20 cm at altitudes of 1300-1500 m and 120-180 cm at altitudes of 3000 m and higher (from place to place from 2 to 3 m thick snow cover is formed, due to winds occurring in concavities).

**Figure 4-2: Climatic zones of the project area**



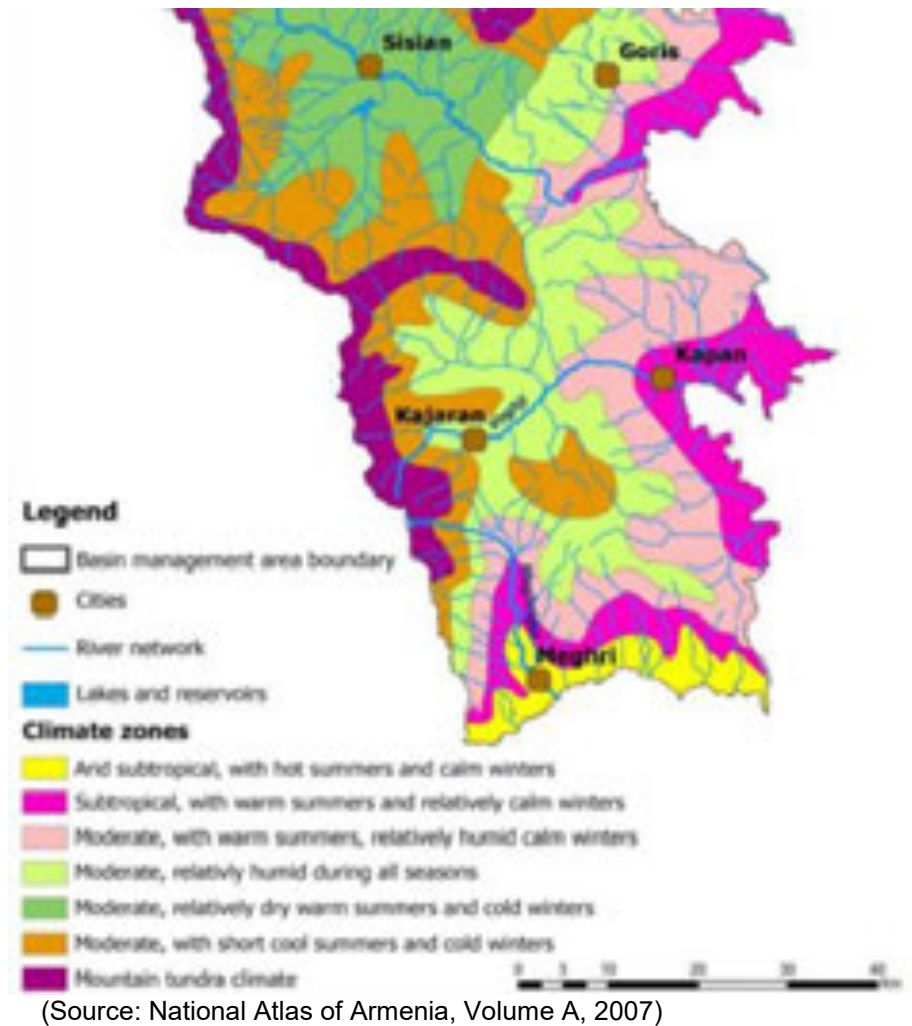
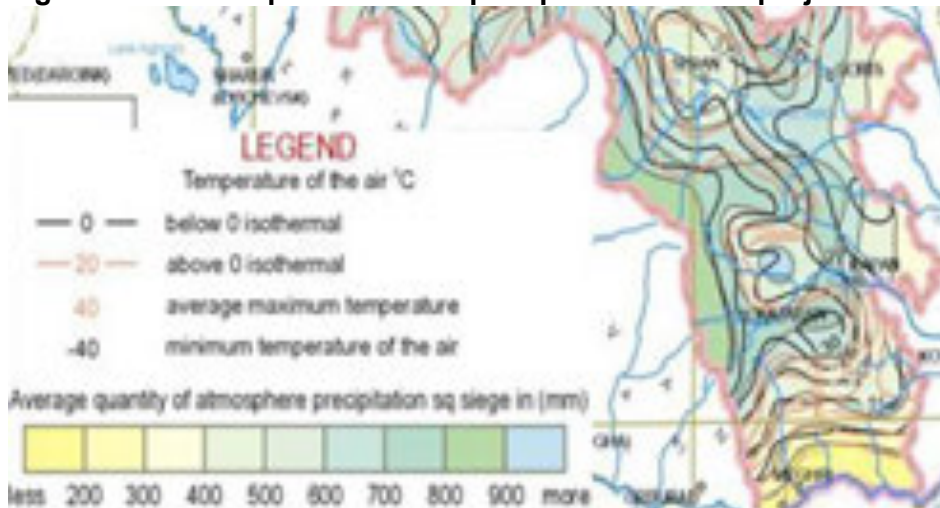


**Figure 4-2: Air temperatures and precipitations of the project area**



(Source Armstat.am, The map was formed and published by the State Committee of the Real Property Cadastre of the Government of RA "Centre of the Geodesy and Cartography" SNCO)

**Table 4-1: Annual and monthly air temperatures**

| Settlement, Station |      | January | February | March | April | May  | June | July | August | September | October | November | December | Average annual, °C | Absolute minimum, °C | Absolute maximum, °C |
|---------------------|------|---------|----------|-------|-------|------|------|------|--------|-----------|---------|----------|----------|--------------------|----------------------|----------------------|
| Sisian              | 1600 | -3.8    | -2.6     | 1.9   | 8.0   | 12.2 | 16.5 | 20.2 | 19.6   | 16.1      | 10.3    | 4.2      | -0.9     | 8.5                | -34                  | 36                   |
| Geghi               | 1558 | -1.1    | -0.2     | 2.3   | 7.5   | 12.0 | 15.3 | 17.8 | 18.3   | 14.7      | 9.8     | 4.7      | 0.4      | 8.5                | -22                  | 34                   |
| Kajaran             | 1843 | -3.2    | -3.0     | 0.3   | 6.1   | 10.0 | 14.2 | 17.0 | 16.7   | 13.5      | 8.2     | 3.2      | -1.3     | 6.9                | -22                  | 34                   |
| Kapan               | 704  | 0.2     | 1.7      | 6.2   | 12.4  | 16.8 | 21.1 | 24.6 | 24.1   | 20.0      | 14.0    | 7.6      | 2.7      | 11.9               | -22                  | 42                   |

(Source: Armenian State Hydrometeorological and Monitoring Service SNCO, RA MTAES)

**Table 4-2: Precipitations**

| Station | Precipitations, mm               |          |       |       |     |      |      |        |           |         |          |          |      |
|---------|----------------------------------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|------|
|         | average monthly / maximum annual |          |       |       |     |      |      |        |           |         |          |          |      |
|         | By months                        |          |       |       |     |      |      |        |           |         |          |          | Year |
|         | January                          | February | March | April | May | June | July | August | September | October | November | December |      |
| Sisian  | 23                               | 30       | 56    | 66    | 87  | 71   | 32   | 31     | 29        | 45      | 35       | 27       | 532  |
| Geghi   | 30                               | 28       | 62    | 72    | 75  | 57   | 28   | 20     | 22        | 46      | 40       | 33       | 523  |



|         |    |    |    |    |         |    |    |    |    |    |    |    |     |
|---------|----|----|----|----|---------|----|----|----|----|----|----|----|-----|
| Qajaran | 42 | 51 | 69 | 80 | 86      | 48 | 22 | 18 | 27 | 52 | 48 | 42 | 686 |
| Kapan   | 26 | 31 | 64 | 75 | 10<br>2 | 65 | 32 | 28 | 38 | 48 | 40 | 26 | 585 |

(Source: Armenian State Hydrometeorological and Monitoring Service SNCO, RA MTAES)

#### 4.1.2 Air quality

Air quality is relatively good in the project corridor. Observations of air quality show that average daily concentration of sulphur dioxide and nitrogen dioxide are in the range of maximum permissible concentrations (MPC) in the atmosphere of Sisian, Shamb, Lor, Geghavanq and Barekamavan.

Table D-3 Average daily concentrations of sulfur dioxide and nitrogen dioxide

| Sampling | Community       | Average daily concentration, mg/m <sup>3</sup> |                                |
|----------|-----------------|------------------------------------------------|--------------------------------|
|          |                 | MPC <sub>av daily</sub> = 0.05                 | MPC <sub>av daily</sub> = 0.04 |
|          |                 | Sulfur Dioxide                                 | Nitrogen Dioxide               |
| 1        | Sisian (204 km) | 0.054                                          | 0.002                          |
| 2        | Shamb HPP       | 0.072                                          | 0.003                          |
| 3        | Lor             | 0.036                                          | 0.003                          |
| 4        | Geghavanq       | 0.010                                          | 0.004                          |
| 5        | Barekamavan     | 0.002                                          | 0.004                          |

(Source: <http://www.armmonitoring.am/>).

Negative air quality impacts will arise during the construction phase, especially from materials transport and handling (excavations, piling, fillings, earth works and movement of lorries). Transport movements on unsealed roads during construction will cause air emissions. There may be possible emissions from use of generators during construction. Air quality shall be controlled by appropriate mitigation measures.

Operational potential source of air pollution (Road traffic) is unlikely to have a significant impact on air quality.



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#### 4.1.3 Noise & Vibration

Noise and vibration data were not taken due to obvious low level of them in the project area. The proposed project alignment is passing close only several dwelling houses and the existing situation could be assessed as no noise source near that houses. There will be an increase in noise from the construction and the expected number of vehicles predicted to use the new road.

Noise and vibration measurements shall be performed before commencement of works as a baseline data and regularly during construction works. The points of measurement will be placed close to determined sensitive receptors located up to 50-100 meters from the road alignment.

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#### 4.1.4 Surface and Ground Water

**Rivers:** The designed road section is passes through river valleys of Vorotan, Shenatagh, Karut, Geghi and Voghji and crossed by the rivers and their numerous tributaries. The rivers are typical mountain with fractured relief and developed hydrographic network in the catchment basin. The rivers at the upper streams have large inclination and are fast flowing.

The Vorotan River is the largest tributary of Araks in the Zangezur area. It begins in the North-Eastern Syunik plateau and eastern slopes of the Zangezur Mountain Range from the small lakes and springs and flows into the River Araks beyond the borders of the Republic of Armenia. The total length of the river is 178 km (111 km within the RA), with a total catchment area of 5650 km<sup>2</sup>, of which 2596.81 km<sup>2</sup> within the Republic of Armenia. The Major tributaries of Vorotan River are Sisian, Loradzor, Goris, Hakari. The designed road section passes through the left-bank mountain slope of the Vorotan River about 10km at the distance 100 - 500m from the river and then crosses the Vorotan River through the upper part of Shamb water reservoir.

The Loradzor starts from the south-west slopes of Bargushat mountain range, flows through Shenatagh, Lor, Getatagh, Darbas, and Ltsen villages and gets into Shambi reservoirs via two-kilometer-long tunnel. Its length is 23 km. It's also called Loraget, Lernashen or Shenatagh in the upper reach and Ltsenaget or Hachenaget in the lower reach. The designed road section after crossing the river will run along the Loradzor River about 8km at the distance 25 - 200m from the river.

Then after crossing the Bargushat ridge the designed road section heads along the Qarot tributary of Geghi River about another 8km at the distance 25 - 100m from the tributary. In upper part of the tributary the road crosses the tributary.

The Geghi River starts from the eastern slopes of Zangezour Mountains at 3130 m and joins the Voghji River on the left. Its length is 30 km. There is a lake Gazana on headwaters of Geghi River at 3150m. It is included in a list of Natural Monuments of RA in 2008. The river catchment area is 308.3km<sup>2</sup>. The designed road section is following the curve of the river valley about 10km at the distance 10 - 100m from the river. The road crosses the river once.

The Voghji River is the second largest river in the Zangezur area. Kaputjugh river, starting from the melt waters of Mt.Kaputjugh (3905m) joins Kajaran river and forms Voghji river which flows into the Araks River from the left bank at 750 m, at the Iranian border passing Kajaran, Kapan, Kavsakan and

Midznavan communities. The river's total length is 82 km (52 km within RA), with the catchment area of 2337 km<sup>2</sup> (1240.47 km<sup>2</sup> within RA). The largest tributary is the Geghi River. Another major river in the basin is Tsav. The relief of the basin forms a disheveled network of hills. The surface of the basin is incised by canyons, valleys and meadows. The basin of the Voghchi River is characterized by strong fragmentation and relatively mild/moderate water-permeability of rocks. Fissure waters, as well as in some parts stratum-fissure or fissure-carstic (in carbonate rocks) waters are common in the weathering area. The designed road section passes through the left-bank mountain slope of the Voghji River about 10km at the distance 10 - 500m from the river and then crosses the Voghji River in Kajaran city.

Most of the small tributaries are mostly small water-scarce and are dried out in summer-time.

**Table 4-3: Major rivers in the project area**

| n  | Rivers   | Length, km | Catchment area in RA, km <sup>2</sup> | Flow, 1mln m <sup>3</sup> /year |
|----|----------|------------|---------------------------------------|---------------------------------|
| 1. | Vorotan  | 178        | 2597                                  | 716                             |
| 2. | Loradzor | 23         | 118                                   | 13                              |
| 3. | Voghji   | 82         | 1241                                  | 366                             |
| 4. | Geghi    | 30         | 308                                   | 145                             |

(Source Armenian State Hydrometeorological and Monitoring Service SNCO, RA MTAES)

Rivers' flows are unevenly distributed during the year. The water regimes are characterized by snowmelt and rainfall floods. More than half of the flow passes during the spring (March-June), while the lowest flows are observed in the winter period (8-17%). About 30% of the total annual rivers' flows occur in the summer-autumn.

The rivers and their tributaries are having mixed feeding sources. Several tributaries of the Vorotan and Voghji Rivers are basically fed by the melting snow. Feeding from the groundwater supply is mostly observed in the middle and lower streams of the Vorotan River - 50-56%. In the upper areas of the Voghji River Basin, due to the large amounts of snow accumulation, presence of snow and firm zones in winter time, feeding of the rivers by the melting is significantly greater -50% and more.

**Lakes, reservoirs:** There are no lakes near the designed road section. Some small mountain lakes are spread at 2300-3500m above sea level far from the road section. There are two reservoirs near to the road section: Shamb and Geghi reservoirs that could be impacted by the project.

The Shamb Reservoir is located on the Vorotan River. The total storage capacity of the reservoir is 13,6 million m<sup>3</sup>, useful capacity is 11.8 million m<sup>3</sup>, while the water table surface area during normal level is 11ha. Reservoir waters are used for hydropower generation and fish production purposes. It is about 150m from the road section.

The Geghi Reservoir is located on the Geghi River. The total storage capacity of the reservoir is 15 million m<sup>3</sup>, usable storage is 12 million m<sup>3</sup>, while the water table surface area during normal level covers 35ha. Reservoir waters are used for hydropower generation, fish production and irrigation.



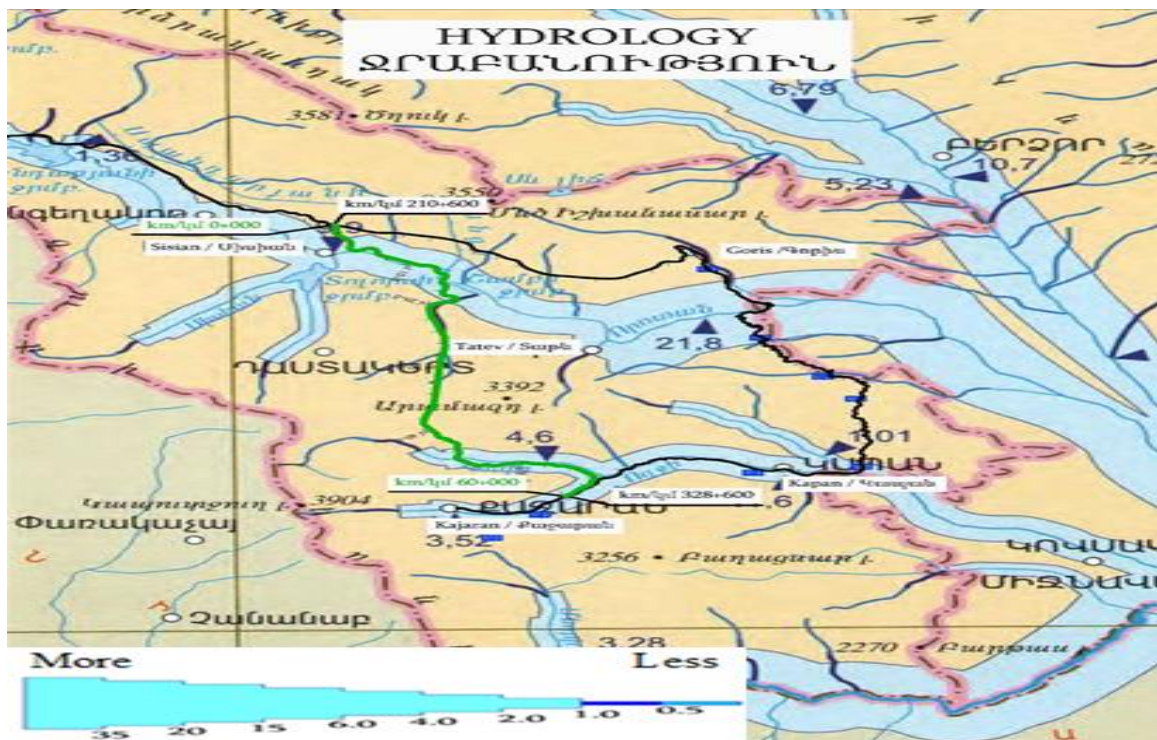
The reservoir with the 90m height dam is next to the road section. The reservoir is in the stage of rehabilitation.

According to hydrological atlas of Armenia river turbidity of Vorotan River is less than  $100 \text{ g/m}^3$  and Vogjhi River is more than  $400 \text{ g/m}^3$ . The 90-95% of the suspended loads are removed in April-June during the spring floods.

RA Government Resolution N75 adopted in January 2011 specifies the requirements for river water quality management: it defines specific surface water quality criteria in five categories for the river basins of Armenia.

Environmental Impact Monitoring Center analyzed water qualities in Vorotan, Loradzor and Geghi rivers. The results showed that the water quality is fair (3<sup>rd</sup> category) in Vorotan River 3km downstream from Sisian city, good (2<sup>nd</sup> category) in Loradzor River, fair (3<sup>rd</sup> category) in estuary of Geghi River.

Figure 4-3: The hydrological map of the project area





**Hydrogeology:** Groundwater resources occur in the weathering crust of various geological rocks and deep cracks, as well as in the pores of alluvial-proluvial formations along the riverbeds. Groundwater reserves 429 million m<sup>3</sup>/year for the Vorotan River Basin and comprises 185.1 million m<sup>3</sup>/year for Voghji River Basin, according to the multiyear average values. The major springs are spread in the Vorotan River valley and slopes of the Syunik Volcanic Plateau, in the upper and middle reaches of the Voghji and Geghi Rivers.

**Table 4-4: Groundwater resources**

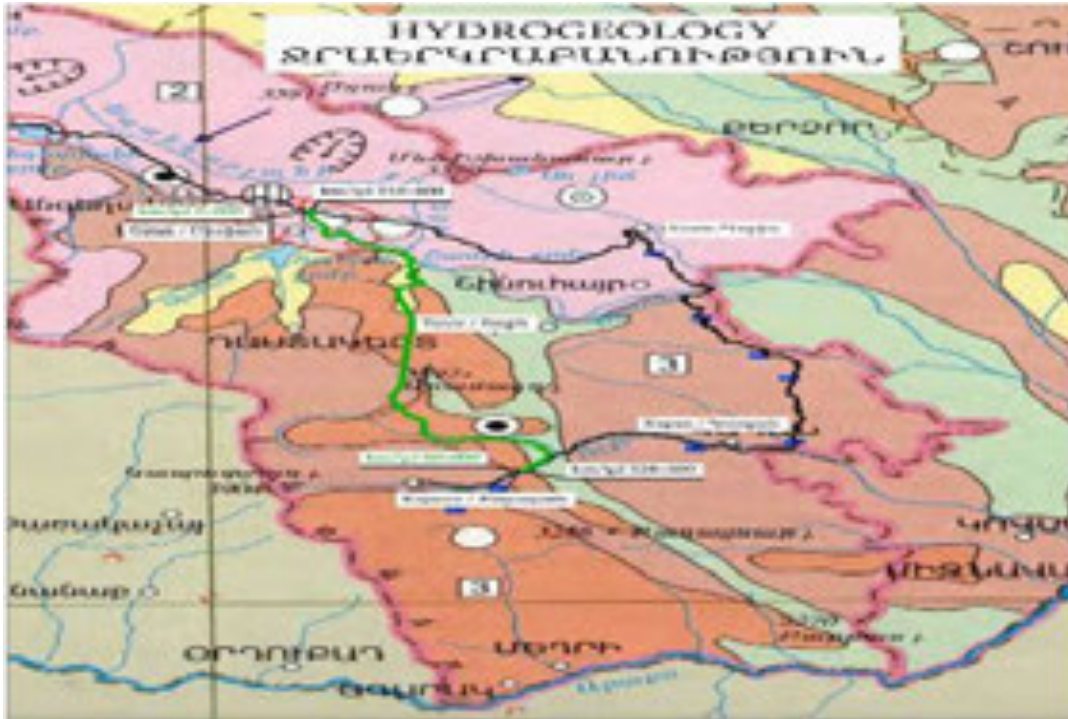
| N/n | River Basin | Groundwater resources by flow components, million m <sup>3</sup> /year |             |               | Deep flow |
|-----|-------------|------------------------------------------------------------------------|-------------|---------------|-----------|
|     |             | Total                                                                  | Spring flow | Drainage flow |           |
| 1   | Vorotan     | 429                                                                    | 114         | 208           | 107       |
| 2   | Voghji      | 185.1                                                                  | 72.2        | 26.5          | 86.486.4  |

From hydrogeological point of view, the area of the designed road section is divided into:

- deep fissure water of volcanic plateaus (foot of Mount Mets Ishkhanasar);
- water of unclassified complex of Quaternary and Upper tertiary volcanogenic formations (transverse zone of the road M2-Meghri (≈3-4 km section));
- surface exposures of powerful waterproof thicknesses, predominantly of Upper Neogene clays (the Vorotan River's littoral zone and Shenatagh River's littoral zone);
- fissure water of various intrusive rocks (the upstream of the Shenatagh River, Geghi River's right-side mountain slope and Kavchut - Kajaran section);
- fissure water of tuffogenes and porphyrites of Paleogene unclassified complex.

**Figure 4-4 Hydrogeological map of Syunik Marz, Figure N8 (National Atlas of RA vol. A, Yerevan 2007)**





#### 4.1.5 Topography, Geology, Soils, Seismology

The territory of the Republic of Armenia occupies the North-eastern part of the Armenian Highlands composed of young folded mountain ranges formed during Alpine orogenic processes and called Lesser Caucasus, and volcanic mountain massifs (Aragats, Ara, Hatis, Geghama, etc.) of the North-eastern portion of the Armenian volcanic plateau. The lowest point is the bank of the Debed River at 375 m (near Bagratashen), and the highest point is Mount Aragats at 4090 m providing ground to consider upward zonality as a climatic criterion.

The terrain of the 60km Sisian-Kajaran road section is entirely located in Syunik Marz. and characterized by highly complex and diverse topography. It combines fold, coulisse-shaped and linearly stretched mountain ranges, volcanic massifs, upland plateaus, intermountain concavities, and river valleys. Mountain slopes are intensively weathered (eroded). The slopes are highly gradient (35° and more), and they are fragmented by the Vorotan, Voghji and Geghi River Valleys. The Bargushat ridge will be crossed by the designed road section. It is located in the hillside of the Zangezur Mountain Range, extends for 42 km amid the Vorotan and Voghji River Basins. The peaks reach over 3000 m, particularly Aramazd - 3392 m, Geghaqar – 3343 m, and Tarkatar - 3277 m. The mountain Range descends south-east (near Kapan). The highest mountain summit adjacent to the section is the peak Aramazd with spot height at 3392m of the Bargushat ridge located to the east from the designed road section. The lowest point is settlement Shamb on the bank of the Vorotan River with altitude marks 1310-1325 m.

The genetic types of relief:

a) slopes and plateaus (1500-2800 m) “armored” with lava sheets; folded structures slightly splitted in the base and rugged with disturbances (section of the southern foot of Mount Ishkhanasar);

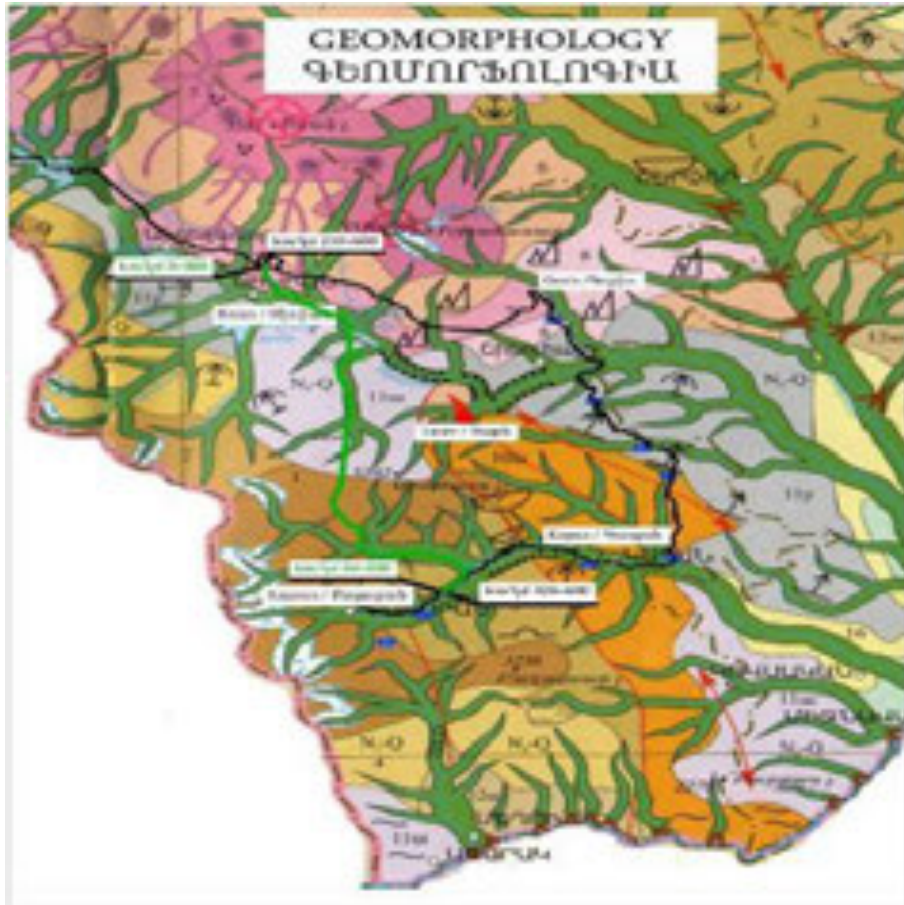


- b) lava - covered marginal plateaus (1100-2200 m) on slightly sloped folded structures (from highway M2-Meghri to Vorotan River gorge);
- c) wide valleys with gully and terraces (wide valley of the Vorotan River, a section adjacent to Shamb reservoir);
- d) V-shaped narrow valleys (valley and tributaries of the Shenatagh River), (valley and tributaries of the Geghi River);
- e) transverse and oblique mountain ranges and plateaus` sedimentary-volcanogenic, with carbonate intensive folded base (the northern mountain slope of the Bargushat ridge beginning from Aramazd mountain summit);
- f) structural erosive relief, high mountains (over 2800 m), represented by forms of snow-glacial relief, severely splitted, sharp and rocky crests, sloping sides up to  $35^{\circ}$  (the southern mountain slope of the Bargushat ridge beginning from Aramazd mountain summit);
- g) with steep slopes (up to  $25^{\circ}$ - $35^{\circ}$ ), slightly wavy watershed, northern, eastern and southern mountain slopes of the eastern mountain arm of the Zangezur ridge (to the north of Kajaran).

The following forms of relief are widespread:

- a) Stratovolcanoes (Mets Ishkhanasar)
- b) Lava flows (clastic type)
- c) Glacial cirques (Western section of the Bargushat ridge)
- d) Partial collapses on areas adjacent to the designed highway
- e) Crest - like caves (on adjacent areas)
- f) Tectonic disturbance lines (disjunctive)
- g) Narrow V-shaped ravines and hollows

**Figure 4-5 Geomorphological map of Syunik Marz (National Atlas of RA vol. A, Yerevan 2007)**



**Geology:** The beginning of the site is Mets Ishkhanasar - Vorotan River section represented by volcanic rocks of Mets Ishkhanasar volcanic massif: Upper Pliocene - Eo-pleistocene period represented by basalts, andesites, dacites, rhyolites, obsidians, perlites, tuff-breccias, travertines (3.3-0.85 the absolute age in million years). In addition to Mount Ishkhanasar, the site is known for numerous volcanic centers. The above - mentioned rocks are mainly covered with quaternary loose deposits: deluvial, proluvial, alluvial, eluvial colluvial, etc.

The bed and washout of the Vorotan River, as well as the terraces is represented by lacustrine, fluvial proluvial and slope deposits of Upper pliocene - pleistocene age (3.3-0.01 the absolute age in million years).

From the Vorotan River valley to Bargushat mountain slope, there partially occur also volcano - sedimentary rocks: andesites, tuff-breccias, tuff sandstones, marl stones, limestones, clays, argillaceous sandstones, aleurolites, lava flows of olivine basalts (65-42 million years).

The Bargushat ridge is represented by comparably large and small granitoid bodies, which become exposed between Voghji and Vorotan Rivers, in the central and western boundaries of the mountain range. It has been studied by many scientists superficially, not in detail. A more detailed study was carried out by T. Tadevosyan in 1953-1956.

The designed road section passes through Shenatagh (northern slope of the mountain range) and Kyurut (southern slope of the mountain range) intrusions or their middle part (if a tunnel is built). Shenatagh intrusion occupies a larger territory (100-120 km<sup>2</sup>), than Kirs - Kyurut intrusion (about 50



km<sup>2</sup>). These two intrusions are represented by similar rocks: gabbro, pyroxenite, gabbrodiorite, monzonite, granodiorite, pink syenites.

Two intrusions (50-60 km<sup>2</sup>) – Kazangel and Geghi – are prominent on the southern mountain slope of the Bargushat ridge. They are represented by porphyrites and limestones of Lower Jurassic age located in the contacting part of powerful normal granite and granodiorite massif. Kazangel intrusion is also represented by Lower Jurassic porphyrites, pink porphyrite granodiorites. Geghi River valley is represented by basalts, andesites, tuff sandstones, tuff-aleurolites, limestones and alluvial (fluvial) deposits of Upper Jurassic - Lower Cretaceous age.

The right-side mountain slope of the Geghi River, as well as the left - side slope of the Voghji up to the entrance of the town of Kajaran is represented by Lower Cretaceous limestones, aleurolites, metamorphic laminated limestones, tuff sandstones, basalts, andesite basalts (135-96 million years), as well as limestones, sandstones, quartz sandstones, clay shales of Devonian - Lower Carbon age (385-315 million years).

On the section near the entrance of Kajaran, there also appear gabbroes, granodiorites, quartz diorites, monzonites, nephelinitic syenites, leucogranites of Upper Eocene age (42-38 million years).

**Figure 4-6: Geological map of Syunik Marz, (National Atlas of RA vol. A, Yerevan 2007).**



**Soils:** Soils are represented by the following types:

- a) Montane-steppe represented by montane-cinnamonic soils (here and there cultivated, irrigable) of dry steppes on altitudes of 1000-2300m. Mountain steppes are covered with brown and gray-shade mountain soils, which are cloddy, with 2-3.5% humus content. Relatively high-power black earth, with 6.5% humus content, appears on the northward slopes of the mountain steppe zone. Alluvial, marshy and marshy-meadow soils (with a high content of organic substances) are common in concavities.
- b) Montane-sylvan brown soils of dry forests and shrubs are on altitudes of up to 2300m. These are dark brown and black-gray mountain soils, with 2-3% humus content. From place to place black earth appears on the northward slopes, with 5-6% humus content. Alluvial sedimentary and marshy-meadow soils, with prairie vegetation, randomly occur in the ravines along the middle and upper reaches of the rivers.
- c) Alpine soils represented by subalpine montane-meadow brown soils located at altitudes of 2300-2500 m. Wet and black earth-type subalpine mountain-meadow soils commonly occur in the upper parts and meadow steppe soils, with chestnut and black earth subtypes soils commonly occur in the lower parts.
- d) Alpine soils represented by Alpine montane-meadow sod - peat soils extend at altitudes of 2300-3300m. They are black earth-type, and sometimes turf and humus rich mountain steppe soils





e) Alpine soils represented by infantile soils close to snow blanket are at altitudes of over 3200-3500 m. Soil cover is thin, only the initial stage of soil formation occurs. Stone deposits are widespread. Agricultural lands do not occupy a large area in these altitudes, only the lower parts of it are used as pastures in summer.

f) Montane-sylvan soils represented by montane-sylvan steppe soils occur at altitudes of up to 2400m. The soil cover is thin; carbonate and lime-free brown soils, with humus composition of 3.6%.

**Seismotectonics:** According to seismic zoning map of the National Atlas of the Republic of Armenia (volume A. Yerevan 2007), the designed road section is located in two seismic zones of different intensity.

a) Beginning of the designed highway - Shenatagh community (the upstream of the Shenatagh River). The horizontal acceleration of the earth is  $g = 0.3-0.4 \text{ m/sec}^2$  (probability of nonexceedance in 500 years - 90%), Y (possible intensity of earthquake) = 9 points.

b) The upstream of the Shenatagh River – Kajaran. The horizontal acceleration of the earth is  $g = 0.3 \text{ m/sec}^2$ , Y (possible intensity of earthquake) = 8-9 points. The highway section passes through the middle part of an intense seismic focus. There are lateral shifts and faults.

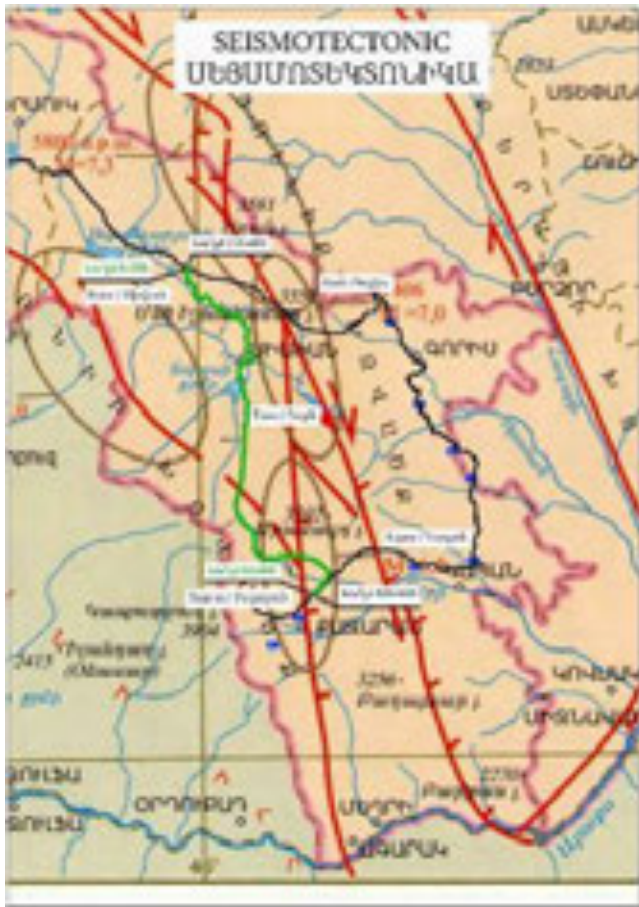


Figure 4-7: RA seismic zoning map of Syunik Marz, National Atlas of RA, volume A. Yerevan 2007.





Figure 4-8: RA seismotectonics map of Syunik Marz, National Atlas of RA, volume A. Yerevan 2007.



#### 4.1.6 Water related Natural Disasters

**Landslides:** Landslides are mainly common in the upper and middle reaches of the Sisian, Voghji and Geghi, Rivers. During geological engineering field investigations and surveys landslide areas have not been identified, but according to designer predictions at km 10+820- km10+980 section of the designed road, the slope is landslide-prone area (H-8 B3 Km10+900).

Figure 4-9 landslide distribution map (Syunik Marz), National Atlas of RA, volume A. Yerevan 2007.



**dfloWS:** The designed road section is entirely in Medium - activity mudflow basins (mudflows recurring once in 3-10 years). The section at km 0+000-km - 8+000 is weak mudflow-bearing, the section at km 8+000-km - 14+000 is not mudflow-bearing, the section at km 14+000 – km 30+000 is moderate mudflow-bearing, the section at km 30+000 – km 64+000 is strong mudflow-bearing.

Figure 4-10 map of mudflows in Syunik Marz, National Atlas of RA, volume A. Yerevan 2007.



**Erosion:** Erosions are mainly anthropogenic. Anthropogenic erosions due to operation of mines are observed in the surroundings of Kajaran town and Ajabaj village in the Geghi River Basin as well as in Loradzor River Basin. The slopes surrounding Shenatagh village are exposed to erosion due to the density of earth roads. Erosions caused by livestock breeding, irregular opening of earth roads, and use of fallow agricultural lands are observed on the slopes close to almost all settlements.

**Snow slides:** Snow slides are observed upstream the Voghji and Geghi rivers, at altitudes of 1400-3400 m. The most damaging snow slide was observed in the Vorotan River Basin in 1988, at a volume of 96 thousand m<sup>3</sup>.

## 4.2 Ecological Resources

#### 4.2.1 Flora

The flora of Syunik is prone to vertical zoning. Zangezour region, Voghji-Geghi area is characterized by mesophytic, eurivalent and xerophytic plants. In the submontane areas the plants are mainly friganoid. Going up the landscapes are dominated by forests (forests cover up to 20% of the marz area). The main tree species are oak and hornbeam, numerous wild fruit trees and shrubs. Subalpine and alpine flora is presented by Gramineae, Poaceae, Papilionacenate and Cyperaceae (feather-glass, brome-grass, cereals, sedge). The biggest world relict grove of plane trees (platanus orientalis) is situated in the Tsav river pass at the south of Kapan town that occupies 60 ha territory (trees age is numbered by centuries). Some tree's diameter of this exceptional park reaches 3 m and the height is 40-45 m. Alpine areas are characterized by alpine meadows with lots of flowers. The number of red-listed plant species is 186.

Vegetation of the site is represented by:

- a) Steppe vegetation represented by gramineae and forb-gramineae steppes
- b) Sylvan vegetation represented by eastern-type dry oak woods
- c) Alpine vegetation represented by Lower Alpine meadows
- d) Alpine vegetation represented by a complex of Alpine meadows, rugs, dense sod groups and tragacanth astragali
- e) Sylvan vegetation represented by oak and oak-hornbeam forests (eastern-type oak)

In October 2016 a floristic survey has been implemented along "Sisian-Kajaran" interstate highway including collection of herbariums of trees, shrubs and herbs species (see Annex 6). Studied plant species along the "Sisian-Kajaran" interstate highway belong to 363 species, 240 genera and 85 families from 5 classes of higher plants. The flora of Dicotyledones dominated by representatives of 299 species, 194 tribes, 63 families. Monocotyledones class is represented by 51 species, 37 species of 15 families. Gymnospermae, Pteridales, Equisetales and Mossestogether make up 3.6% of the species composition of along the M1 "Sisian-Kajaran" interstate highway -13 species.

**The biological spectrum of flora is represented below:**

- Trees - 55species (15.1 % of flora),
- Shrubs and shrublets - 34species (9.4 % of flora),
- Semyshrubs and semysrhublets - 9species (2.5 % of flora),
- Perennial herbs – 185species (51 % of flora),
- Diennial and annual herbs - 80species (22 % of flora).

**Analyze of Red Data book and endemic species:** In the investigated area represented 10 species from Armenian Red Data book of plants which are divided into:

- Critical species (CR B) – 1;
- Endangered species (EN B) – 9.

**Analise of endemic species:** There are 8 species of different categories of endems which are divided into:

- Endems of Armenia - 5;
- Endems of Transcaucasus– 2;
- Endems of South Transcaucasus - 1.

#### 4.2.2 Fauna

T In October 2016 a fauna survey has been implemented along “Sisian-Kajaran” interstate highway. Details are provided in Annex 7.

**Invertebrates:** The Syunik marz is rich with endemic fauna species (See Annex 7). Totally about 70 orders of the invertebrates are known form Syunik province. The most numerous are insects which are represented with 29 orders in researched area. The analysis of different publications on taxonomic groups Armenia fauna is allowed to discover 1735 species for the Syunik region, which belongs to the insects and molluscs (See Annex 7). Data on invertebrate’s fauna of Syunik region is also summarized in Annex 7. From Armenia's Red Book registered 153 rare and endangered invertebrate species, 55 can be found in Syunik region (5 molluscs and 50 insects). 13 of them could be potentially found in the studied area (or their close proximity),

**Amphibians and reptiles:** "Sisian - Kajaran" amphibian species composition is almost not changed throughout the whole territory. It consists of three widespread species, the green toad (*Bufo* / *Pseudopedalia* / *variabilis*), rana ridibunda (*Pelophylax ridibundus*) and Asia Minor frog (*Rana macrocnemis*): In "Geghi - Kajaran" sector (494 + 00 576 + 00) to this type of species joins Savinyii tree frog (*Hyla savignyi*). Listed species belong to the widespread in Armenia, often multiple, amphibians, which areals occupy wide territory. In the monitored area there are numerous reservoirs, which serve as spawning and development places for these species. The rivers and their various tributaries there are 6 types of fish, out of which *Salmo trutta fario* is the most valuable.

Reptile species composition is richer. It includes both as widespread as rare and protected species. Reptiles are much richer in species composition 388 + 00 492 + 00 494 + 00 545 + 00 545 + 00 610 + 00 and 612 + 00 652 + 00 segments. Most of these sectors fall to the rare species.

**Birds:** Based on the literature data and our own research shows that 349 species of birds of Armenia belonging to 18 orders, about 170 species are common and may occur in the territory of Syunik region. Studies conducted in the period from 6 to 10 October 2016. Two areas were examined the expected construction of the highway north-south length of 60 km, Sisian - Kajaran. The width of the buffer zone was 300-400 m. From the analysis of the literature and field observations 68 species of birdshave been pointed. It should be noted that a number of species of birds that live in the Syunik region, have not been included in the list, because their characteristic habitats are not met within the buffer zone on which the study was conducted. The presence of such species, whether in briding period or feedings and migration is unlikely either not typical. 40 species of the selected 68 species belong to the 10 orders and 28 families have been recorded visually. 7 species of them are listed in the Red Book of Armenia.

**Mammals:** Armenia is very rich in mammal species due to diversity of landscapes. Rich biodiversity contains endemic and endangered species which have historical and economic importance. Among 94





species at list 50 were recorded during our survey in target territory, from which 11 are listed in the Red Book of Armenia. There are 6 orders of mammals are distributed in target area: Insectivora -6 species, Chiroptera - 16 species, Rodentia - 12 species, Lagomorpha - 1 species, Carnivora- 11 species, Cetartiodactyla - 4 species.

There are many rocky mountains with a lot of cervices, which are habitats for several bat species: *Rh. hipposideros*, *M. blithy*, *Eptesicus bottae*, *Eptesicus serotinus*, *Rhinolophus ferrumequum*, *Rh. euryale*, *Myotis blythi*, *M. emarginatus*, *Pipistrellus pipistrellus*, *Plecotus macrotis* dwelling in Kitsq to Geghi canyon. Along this Canyon a lot of Porcupine eagles were found. In slopes of mountain near Qarut village camera traps of WWF of Armenia were recorded Bezoar goats (2012-2015). Armenian mouflon Using Kitsq-Geghi canyon of pathing from summer place to wintering place. Target territory also is used by carnivores. Vital signs of foxes, golden jackals, wild cats, brown bear were investigated. Forestry parts of highway path, near to Kavchut village roe deer were observed. Mountain meadows were habit by several small mammals: *Sorex satunini*, *Sorex volnuchini*, *Mesocricetus brandti*, *Chionomys nivalis*, *Ellobius lutescens* and ect.

#### 4.2.3 Specially Protected Natural Areas

The part of the road section passes through Zangezur State Sanctuary of the Zangezur Biosphere Complex through a tunnel from Kitsq village to Geghi (347- 440), site of outstanding natural beauty, site of special scientific interest. According to resolution of RA government N 1465-N dated 19.12.2013, for the sustainable development, preservation, protection, restoration, reproduction of meadow-steppe and meadow natural ecosystems, landscape and biological diversity of the upper part of the Khustup massif forest zone of the southwestern branch of the Meghri mountain range in the Syunik marz, as well as for the sustainable use of natural and recreational resources " Khustup " State Sanctuary with 6946.74 hectares has been founded.

In accordance with the same decision adopted in December 19, 2013, "Zangezur" Biosphere Reserve Complex SNCO has combined the "Shikahogh" State Reserve and "Arevik" National Park, including "Plane Grove", "Zangezur", "Khustup", "Boghaqar" and "Black Lake" state sanctuaries.

The objective of "Zangezur" Biosphere Reserve Complex SNCO is to preserve, protect, reproduce, inventory, observe, make a chronology of "Shikahogh" State Reserve's, "Arevik" National Park's, "Plane Grove", "Zangezur", "Khustup", "Boghaqar" and "Black Lake" state sanctuaries' fauna and flora, natural ecosystems, landscape diversity, nature unique monuments , as well as sustainable development of natural resources.

"Zangezur" Biosphere Reserve Complex SNCO has 3 branches:

a. "Shikahogh" branch, which includes 3 subbranches: "Shikahogh" State Reserve subbranch, "Arevik" National Park subbranch, "Plane Grove" state sanctuary subbranch and "Khustup" state sanctuary subbranch.

b. "Arevik" branch, which includes 2 subbranches: "Arevik" National Park subbranch and "Boghaqar" state sanctuary subbranch.

c. "Zangezur" branch, which includes 2 subbranches: "Zangezur" state sanctuary subbranch and "Black Lake" state sanctuary subbranch /By RA Government decision N 929-N, dated on 08.09.2016.

The route crosses the Zangezur sanctuary through a tunnel(with a depth of 600-1300m) in the Barghushat ridge from km 31+820 to 34+000, runs along the sanctuary border from km 35+700 to km 40+100 at the distance 0-500m from the sanctuary border, passes near from km 40+100 to km 43+500 at the distance 0-200m from the border.

In gorgers of this area are habitats of many endangered species of plants and animals which are





listed in Red Book of Armenia and IUCN red list. Here situated the one of intact enclave of wildlife. In the Annex 7 provided the list of the most endangered species of vertebrates which will be affected from construction and exploitation of new road.

### 4.3 Social and Cultural Resources

Total population of the affected communities is 28151 people of which 21982 are urban population and 6169 are rural population at the end of 2014, including 49.2% male and 50.8% female. There are 2 towns and 20 rural communities. The nationality of the population is almost uniform in composition.

Population number of the communities that will be located nearby to the road section as of January 1, 2015 are shown in Table 4-5.

**Table 4-5: Population number of communities located nearby to the project area**

| N/n | Community                           | Urban Population | Rural Population |
|-----|-------------------------------------|------------------|------------------|
| 1.  | Ishkhanasar                         | -                | 253              |
| 2.  | Sisian                              | 14885            | -                |
| 3.  | Aghitu                              | -                | 409              |
| 4.  | Uyts                                |                  | 603              |
| 5.  | Noravan                             | -                | 554              |
| 6.  | Vaghatin                            | -                | 684              |
| 7.  | Vorotan                             | -                | 316              |
| 8.  | Shamb                               | -                | See Dardas       |
| 9.  | Darbas /settlements: Darbas, Shamb/ | -                | 1180             |
| 10. | Getatagh                            | -                | 203              |
| 11. | Lor                                 | -                | 415              |
| 12. | Shenatagh                           | -                | 404              |
| 13. | Kitsk                               | -                | See Geghi        |



|     |                                                                                        |       |               |
|-----|----------------------------------------------------------------------------------------|-------|---------------|
| 14. | Qarut                                                                                  | -     | See Geghi     |
| 15. | Nor Astghaberd /settlements: Nor Astghaberd, Ajabaj, Getishen, Vocheti/                | -     | 95            |
| 16. | Geghi, /settlements: Geghi, Geghavank, Kard, Kitsk, Verin Geghavank, Qarut/            | -     | 184           |
| 17. | Verin Geghavank                                                                        | -     | See Geghi     |
| 18. | Geghavank                                                                              | -     | See Geghi     |
| 19. | Kavchut                                                                                | -     | See Lernadzor |
| 20. | Musallam                                                                               | -     | See Lernadzor |
| 21. | Lernadzor /settlements: Lernadzor, Kavchut, Musallam, Nerqin Giratagh, Verin Giratagh/ | -     | 869           |
| 22. | Kajaran                                                                                | 7097  | -             |
|     | Total                                                                                  | 21982 | 6169          |

Following independence in 1991 and the subsequent economic decline, the population had fallen mainly as a consequence of labor migration, a decreased birth rate, and a slight increase in the mortality.

The average density of population in affected communities is about 31 people per km<sup>2</sup>. This indicator has also decreased in the last few years, mainly due to low birth rates and migration. The Sisian town is the most densely populated area within the road section with 448.6 people/km<sup>2</sup>, second densely populated community is Kajaran town with 358.9 people/km<sup>2</sup> while the most sparsely populated are the villages located in the catchments of tributaries of the Vorotan and Voghji Rivers, 2-3 people/km<sup>2</sup>.

The working-age population in the affected communities comprised 76% of the population. Infants and retired people comprised 23% and 19.2% of the population. The average life expectancy was 74.3 years (72.1 years for men and 76.5 years for women), which is close to the national figure (74.8 years).

Kajaran is one of the socially most secured cities in Armenia. On the other hand Sisian and other affected communities have high level of poverty, since both the industry and commercial agriculture are rather underdeveloped there.

None of the affected communities have urban development plan.

Along the road section there are abandoned and ruined houses as well as agricultural lands which are not used by anyone.

#### 4.4 Economic Development

The Syunik marz has a great industrial potential, yet it remains a relatively sparsely populated and economically underdeveloped region, facing serious social-economic and demographic problems.



In the road section area, the main branches of industry are mining industry and associated industries servicing the mining companies, as well as production of electric energy. About 83.1% of the industrial output of the Syunik marz is generated in the Voghji River Basin, predominantly in the mining industry and the 2.6% is generated in the Vorotan River Basin.

There is also food, canned fruit, juices, textile products, sewing shops, aluminum and metal products, wood processing and small-scale production of wood products and electrical equipment, as well as mining auxiliary products.

Sisian town economy is mainly specialized in Electricity production. Textile industry was another developed sector. There is “Sisakan” Knitted Wear Factory in Sisian. The cattle breeding, milk-processing, production of cheese and non-metal mineral production are other areas of economy of the town.

Kajaran town is the center of the republican nonferrous metallurgy, based on the exploitation of rare mine that is a powerful mine basis of copper and molybdenum. The main branch of economy is mining industry. Construction also has its part in the economy of the town.

Crop growing and mixed livestock production (cattle, sheep and goats breeding) are the main areas of economic activity of the rural communities.

The main mine in the road section area is the Kajaran mine that is near the Kajaran town, on the right bank of the Voghji River. It is operated by the Zangezur Copper-Molybdenum Combine CJSC and is considered to be the largest mine in the Syunik marz. There is another mine in the vicinity of the road section, Hankasar Copper-Molybdenum mine. The mine is in the catchment area of the Ajabaj Tributary to the Geghi River and is being exploited by Ler-Ex LLC. (Operations of the company were temporarily suspended as of September 2014).

The newly established two settling ponds of the Hankasar Combine are on the Ajabaj right tributary to the Geghi River, 2 km south-east the Ajabaj village. These occupy 1.7 ha area.

There are 6 small HPPs with a cumulative capacity of 3 MW in the Vorotan and Voghji river basins. Three in the Vorotan River Basin and another three in the Voghji River Basin.

7 SHPPs with a cumulative capacity of 15.5 MW are under construction. Five out of the mentioned 7 SHPPs are in the Voghji River Basin.

**Table 4-6: Technical characteristics of operational and under construction SHPPs**

| N/<br>n | Name of<br>the<br>operator         | Name of<br>the small<br>HPP | Capacity,<br>KW | Annual<br>output, | Type of the<br>SHPP | Diversion<br>length, m | Derivation<br>diameter, m | Estimated<br>pressure, m | Estimated<br>discharge, | Watercourse |
|---------|------------------------------------|-----------------------------|-----------------|-------------------|---------------------|------------------------|---------------------------|--------------------------|-------------------------|-------------|
| 1.      | “Hakobjanyan and Galstyan HPP” LLC | Vorotna HPP                 | 1200            | 7.08              | Natural watercourse | 3220                   | 1.4                       | 50.5                     | 3.0                     | Vorotan     |
| 2.      | “Astghik Hovhannes” LLC            | Hoktember                   | 60              | 0.07              | Irrigation systems  | 520                    | 0.4                       | 38.0                     | 0.2                     | Loradzor    |



|     |                             |                           |      |      |                     |      |     |       |      |                                          |
|-----|-----------------------------|---------------------------|------|------|---------------------|------|-----|-------|------|------------------------------------------|
| 3.  | "Afamia" LLC                | Darbas SHHP-2             | 904  | 3.6  | Natural watercourse | 2858 | 0.8 | 79.5  | 1.5  | Loradzor tributary to Vorotan River      |
| 4.  | "Ler-Ex-Energy" LLC         | Ler-Ex-HPP-4              | 285  | 1.77 | Water supply system | 12.0 | 0.5 | 106.3 | 0.4  | Gyard-Ajabaj-Geghi system                |
| 5.  | "Ler-Ex-Energy" LLC         | Ler-Ex-HPP-3              | 256  | 1.95 | Water supply system | 10.0 | 0.5 | 97.6  | 0.4  | Gyard-Ajabaj-Geghi system                |
| 6.  | "Tigran and Ashkhen" OJSC   | Tigran and Ashkhen SHPP-1 | 370  | 2.0  | Irrigation system   | 24.0 | 0.5 | 184.0 | 0.2  | Geghi-Yeghvard irrigation water pipeline |
| 7.  | "Veh Loren" LLC             | Lor HPP-1                 | 650  | 2.4  | Natural watercourse | 2376 | 0.8 | 61.3  | 1.4  | Loradzor                                 |
| 8.  | "Gurgen-Mher" LLC           | Lernashen-1               | 719  | 1.8  | Natural watercourse | 2083 | 0.7 | 128.9 | 0.7  | Leranshen tributary of Vorotan river     |
| 9.  | "Tasman" LLC                | Geghi-1                   | 4090 | 15.4 | Natural watercourse | 6500 | 1.2 | 130   | 3.5  | Geghi River                              |
| 10. | "Kapan Energy" CJSC         | Voghji-1                  | 4690 | 15.8 | Natural watercourse | 6500 | 1.6 | 97.8  | 6.0  | Voghji River                             |
| 11. | "Ler-Ex-Energy" LLC         | Ajabaj-6                  | 1150 | 3.4  | Natural watercourse | 1936 | 0.8 | 124.7 | 1.15 | Ajabaj tributary to Geghi River          |
| 12. | "Zangezur Copper-Molybdenum | Geghi SHHP-1              | 2384 | 8.6  | Water supply system | 355  | 1.4 | 62,5  | 5.0  | Spillway pipeline                        |



|     |                        |         |      |     |                        |          |     |      |     |                                          |
|-----|------------------------|---------|------|-----|------------------------|----------|-----|------|-----|------------------------------------------|
|     | Combine”<br>CJSC       |         |      |     |                        |          |     |      |     | of Geghi<br>Reservoir                    |
| 13. | “Eremir<br>Energy” LLC | Geghi-2 | 1780 | 9.1 | Natural<br>watercourse | 264<br>0 | 1.4 | 49.4 | 4.5 | Geghi<br>tributary<br>to Voghji<br>River |

Water supply for drinking-household use in the Sisian and Kajaran towns as well as in Ishkhanasar, Noravan and Uyts is mainly provided by the south-eastern branch of the Armenian Water and Sewerage CJSC. Water abstraction and supply for drinking-household purposes in the remaining 20 affected communities is provided by the villages. Water supply for drinking-household and industrial purposes in the Vorotan River Basin is mainly performed from groundwater springs and in the Voghji River Basin is mainly performed from surface water sources, mainly from the Geghi River. The households of those villages use yard toilets or have toilets, which are connected to the sewage collector wells constructed in their own territories.

Freight and passenger transportations in the marz are implemented by road, railway. The only transport sector available in the project area is the motor vehicle road M-2 Yerevan-Yeraskh-Goris-Kapan-Meghri-Iran highway as well as local roads. The transport to and from Yerevan, but also within the marz is a problem. Due to long distances between communities, as well as nature of the road coverage the access from one to another community is complicated. This is especially an important problem for non-town communities.

The region is rich with scenic and healthy nature, water springs, forests, mountains, historical and cultural and natural monuments and sights. Numerous early fortress and Christian churches located throughout the road section could become a fascinating tourism attraction sites. One of the obstacles for the development of tourism is lack of hotels that can provide average service conditions. The significant distance from Yerevan and road conditions are also considered as an obstacle. Concepts on regional tourism development are prepared and implemented by Syunik marz Administration and international development programs. Development of tourism and recreation will contribute to the increase of the number of jobs in the service industry and development of the sector itself.

Utilities found within the Project Right-of-way include above ground gas pipes, irrigation pipes, underground electrical cable, water supply pipes and overhead High-tension electricity lines. Diversions for ground gas pipes and overhead High-Tension electricity lines have been planned within the design.

There are operational canals and pipelines in vicinity of the road section which supply irrigation water to agricultural lands. Water losses in the canals constitute 25-40%, as a result extreme wearing-out of the systems.

**Table 4-7: Technical characteristics of canals in vicinity of the road section**

| Canal name | Length, km | Capacity, l/s | Water Abstraction Source |
|------------|------------|---------------|--------------------------|
| Shamb      | 8          | 300           | Tolors Reservoir         |
| Darbas     | 6          | 400           | Tolors Reservoir         |
| Getatagh   | 3          | 300           | Tolors Reservoir         |



|                                |     |     |                  |
|--------------------------------|-----|-----|------------------|
| p/s approach canal of Vaghatin | 4.8 | 600 | Tolors Reservoir |
| Getatagh                       | 3.9 | 65  | Loraget          |
| Lernashen                      | 3.5 | 70  | Loraget          |
| Darbas                         | 2   | 60  | Loraget          |
| Lor                            | 3.2 | 41  | Loraget          |
| Shebatagh-Lor-Getatagh-Darbas  | 12  | 90  | Loraget          |
| Geghi-Eghvard                  | 54  | 280 | Geghi River      |
| Kapan pumping station Canal    | 0.1 | 0.4 | Geghi River      |

Four pump stations taking water at water bodies near the project area for irrigation of agricultural lands.

**Table 4-8: Technical characteristics of pump stations in vicinity of the road section**

| Canal name                   | Pressure, m | Productivity, m <sup>3</sup> /hour | Installed Capacity, KW | Water Source  |
|------------------------------|-------------|------------------------------------|------------------------|---------------|
| Zonal left                   | 300         | 300                                | 400                    | Vorotan River |
| Zonal right                  | 240         | 467                                | 520                    | Vorotan River |
| Kapan 1 <sup>st</sup> degree | 300         | 320                                | 75                     | Geghi River   |
| Kapan 2 <sup>nd</sup> degree | 300         | 320                                | 75                     | Geghi River   |

#### 4.5 Archeological and cultural resources

Survey team consists of three archaeologists and one topographer has implemented intensive survey along the alignment between 01.10.2016 to 24.10.2016 (**Map 2**) and fixed all the potential information by GPS coordinates of the by visible structures, surface finds, and sections, natural formations etc. related directly to the alignment or located in the close vicinity of the future road outline.

**Map 2: Recorded historical-cultural, archaeological and paleontological units along Sisian-Senatagh Section of the alignment as an example**







The investigation results are provided in the report (see Annex 8). Herein are discussed the spectrum of the historical-cultural, archaeological and other barriers, which are recorded during the field investigations and can affect the construction of the highway, while being affected:

1. Large settlements and adjacent tomb fields. Such archaeological complexes and units are rare in the study area. One is recorded in the limits of the Sisian community between km 2.500 – km 3.500 . They require long term excavations and fixation procedure.
2. Separate tomb fields and cemeteries. Such archaeological units are also rare in the targeted area and are present in the limits of Sisian and Uyts communities between km 5.100 – km 5.500, and in Vorotan community (at km 13.250 and km 13.550). The last two which are large medieval cemeteries are representing the occupation of the Vorotnaberd fortress. The excavations of the tomb fields are time consuming. If saving the historical-cultural value of the medieval cemeteries are not so much matter of excavations then numbering and removal of the decorated gravestones is a time consuming issue.
3. Mediaeval settlements can be also serious barriers for the road construction projects. Such barriers are also rare on Sisian-Kajaran alignment. Among the recorded units only the medieval village remains in Vorotan community at km 13.270 is noticeable, which is again related to the time of functioning of the Vorotnaberd fortress.
4. Bronze-Iron-Age and Medieval fortresses. Such kind of archaeological and historical-cultural structures are located along the Sisian-Kajaran such as Syuni-berd fortress, Vorotnaberd, Shenatagh fortress at km 25.650, which are fortunately are not being directly affected. Such only issue is the Sagu Ghala fortress in Shenatagh community at km 26.450, which can be a serious barrier in the frame of the project implementation.
5. Cave dwelling complexes. Such kinds of structures are very wide spread in Syunik Province and are in use even nowadays. Goris and the adjacent villages are the best example, where people lived in the caves up to the 1950-ies. Several such structures are present along the alignment, in Lor and Shenatagh communities, which hopefully are not directly affected.
6. Cultic structures, shrines. There are several such structures (ancient and even modern) along the alignment, which are not directly being affected, but are in close proximity of the alignment. Among them is worth to mention the ones near the city of Sisian (km 2.300), in Darbas community (km 17.700) and in Lor community (km 22.200). Those units need careful protection, because they have important religious meaning for the local inhabitants.
7. Paleontological sites. The middle stream of the Vorotan River basin has preserved rich accumulation of lacustrine origin diatomite sediments, reflecting the history of the paleolake existing in Vorotan Depression in Quaternary Period. These diatomite formations contain rich fossil flora and fauna (leaf imprints, insect and fish imprints and mammals) and are an important source for the geological history of Armenia and the region, for reconstruction of the Pleistocene climate. These fossils are being



studied around 100 years and are known by separate localities among of which the most important are Uyts, Vorotan, Shamb and Darbas groups of localities. Especially Shamb and Darbas which are dated to 1.5-1 Million years and are reflecting the most better preserved paleontological sequence for MIS (Marine Isotope Stage) 31 in the world. Their research is ongoing; meanwhile the road construction project is passing through many diatomite sections, especially in the areas of Uyts, Darbas and Shenatagh. The large amount of the paleontological sites is not a barrier for the road construction activities, but the paleontological sites might be studied and recorded by the specialists and future investigations need to be targeted on proceeding mitigation measures for their protection.

8. Natural monuments. Having a very unique and complicated geological formation, especially rich which Quaternary volcanism, Syunik is home to many beautiful and impressive rock-formations and natural monuments. There are numerous natural monuments which will be directly and indirectly affected by the road construction process. Most of them are not recorded in the State List, but have geological and aesthetic, and even cultural significance as of some of them are objects of ancient cult or used by the humans since Chalcolithic. Protection of such formations will be one of the most problematic issues of the project and the mitigation measures for their protection a matter of heavy decisions.

## 5 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

### 5.1 Introduction

The Projects' impacts to the physical, ecological, archaeological, and socio-cultural and economical resources (negative and positive), including the workers' and community health and safety, in the Project's area of influence were identified. Corresponding mitigating measures were proposed based on significance and occurrence throughout the Project cycle from the engineering design, preconstruction, construction to the operation and maintenance period. Mitigation measures are presented in the EMP (S

|                       |    |       |               |            |       |
|-----------------------|----|-------|---------------|------------|-------|
| 3. Annex<br>Checklist | 1: | Rapid | Environmental | Assessment | (REA) |
|-----------------------|----|-------|---------------|------------|-------|

**Instructions:**

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES), for endorsement by Director, RSES and for approval by the Chief Compliance Officer.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the “without mitigation” case. The purpose is to identify potential impacts. Use the “remarks” section to discuss any anticipated mitigation measures.

**Country/Project Title:****Sector Division:**

| Screening Questions                                                                                                  | Yes                                 | No                                  | Remarks                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A. Project Siting<br>Is the project area adjacent to or within any of the following environmentally sensitive areas? |                                     |                                     |                                                                                                                                                                                                                                                                                                   |
| ▪ Cultural heritage site                                                                                             | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | The initial investigation revealed several archaeological sites near the project alignment. Archaeological sites will be investigated and measures for maximization for their protection will be recommended.                                                                                     |
| ▪ Protected Area                                                                                                     | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | About 100 m of the project alignment is passing through the Zangezour sanctuary. Detailed investigation survey should be implemented to assess the possibility of redesign of the mentioned section. Other ways appropriate mitigation measures should be developed to reduce the project impact. |
| ▪ Wetland                                                                                                            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | Non identified. All remote from alignment.                                                                                                                                                                                                                                                        |
| ▪ Mangrove                                                                                                           | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | N/a                                                                                                                                                                                                                                                                                               |
| ▪ Estuarine                                                                                                          | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | N/a                                                                                                                                                                                                                                                                                               |



| Screening Questions                                                                                                                                                        | Yes                                 | No                                  | Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ▪ Buffer zone of protected area                                                                                                                                            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | N/a                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| ▪ Special area for protecting biodiversity                                                                                                                                 | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | Non identified                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| B. Potential Environmental Impacts<br>Will the Project cause...                                                                                                            |                                     |                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| ▪ encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?                                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | The project encroaches on several archaeological sites. This project will include measures satisfactory to the Ministry of Education, Science, Culture and Sport, to adequately explore the sites and close them. This measures will be described in the IEE/EIA and specified in the EMP.                                                                                                                                                                        |
| ▪ encroachment on precious ecology (e.g. sensitive or protected areas)?                                                                                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | About 100 m of the project alignment encroaches to the Zangezur sanctuary. This project will include measures satisfactory to the Ministry of Environment and according to ADB requirements. Mitigation measures will be described in the EIA and specified in the EMP.                                                                                                                                                                                           |
| ▪ alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site? | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | 27 new bridges are envisaged under the project , 3 of which are passing above 3 rivers. Mitigation measures will be described in the EIA and specified in the EMP.                                                                                                                                                                                                                                                                                                |
| ▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?                                | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | Potential for impact if camps are not adequately managed.<br><br>Mitigation measures will be described in the EIA and specified in the EMP.                                                                                                                                                                                                                                                                                                                       |
| ▪ increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?                                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | (i) Cutting back of unstable slopes will require rock breaking and drilling to fix rockfall protection elements.<br>(ii) construction of tunnels will require rock drilling and rock breaking with potential dust impacts but those sections are remote from sensitive receivers.<br>(iii) Operation of rock crushing and asphalt plan has potential for localized dust impact.<br><br>Mitigation measures will be described in the EIA and specified in the EMP. |



| Screening Questions                                                                                                                                                                                                                                 | Yes                                 | No                                  | Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?</li> </ul>                    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <p>(i) During construction potential for adverse impact due to the construction process (air / noise) on workers and any adjacent sensitive receivers.</p> <p>(ii) During operation potential impact from road operations with increased traffic volume and speed, though it is noted that the improvement of the running surface and vertical and horizontal alignment will assist in reducing emissions and reduce potential for road traffic accidents. Mitigation measures will be described in the EIA and specified in the EMP.</p> |
| <ul style="list-style-type: none"> <li>noise and vibration due to blasting and other civil works?</li> </ul>                                                                                                                                        | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <p>(i) Construction of the tunnels and road will require rock drilling and blasting.</p> <p>(ii) Cutting back of existing steep rock faces and installing slope protection features has potential for adverse impact but these areas are remote from sensitive uses.</p> <p>(iii) Only in 3 sections there are several dwelling houses. Civil works will generate impacts to the residential areas but the impacts will be minimized through EMP</p>                                                                                      |
| <ul style="list-style-type: none"> <li>dislocation or involuntary resettlement of people?</li> </ul>                                                                                                                                                | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | Refer to land acquisition and resettlement plan (LARP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <ul style="list-style-type: none"> <li>dislocation and compulsory resettlement of people living in right-of-way?</li> </ul>                                                                                                                         | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | No change from existing situation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <ul style="list-style-type: none"> <li>disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?</li> </ul>                                                                                          | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | No impact anticipated                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <ul style="list-style-type: none"> <li>other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?</li> </ul>                                       | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | None identified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <ul style="list-style-type: none"> <li>hazardous driving conditions where construction interferes with pre-existing roads?</li> </ul>                                                                                                               | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | The new alignment is not interferes with existing road                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <ul style="list-style-type: none"> <li>poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI's and HIV/AIDS) from workers to local populations?</li> </ul> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <p>Potential for impact if camps are not adequately managed and worker education initiated.</p> <p>Mitigation measures will be described in the EIA and specified in the EMP.</p>                                                                                                                                                                                                                                                                                                                                                         |





| Screening Questions                                                                                                                                                                                                                        | Yes                                 | No                                  | Remarks                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?</li> </ul>                                                                                | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | Historic issue. Armenia attained malaria free status in 2011. Addressed in Site Management Plan.                                                                                                                                                                                                                                                                                 |
| <ul style="list-style-type: none"> <li>accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials?</li> </ul>                                                                             | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | New constructed roads are expected to result in increased traffic volumes, better alignment, surfacing, and signage, together with more efficient and better maintained vehicles are expected to result in overall decrease of accidents                                                                                                                                         |
| <ul style="list-style-type: none"> <li>increased noise and air pollution resulting from traffic volume?</li> </ul>                                                                                                                         | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | (i) During construction there will be increased vehicle movements due to construction traffic.<br>(ii) During operation: New constructed roads are expected to result in increased traffic volumes, better alignment, surfacing, and signage, together with more efficient and better maintained vehicles are expected to result in overall decrease of noise and air pollution. |
| <ul style="list-style-type: none"> <li>increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?</li> </ul>                                                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | (i) During construction potential for adverse impact from construction operations i.e. spills.<br>(ii) During operation, new constructed roads are expected to result in increased traffic volumes, better alignment, surfacing, and signage, together with more efficient and better maintained vehicles are expected to result in overall decrease of accidental spills.       |
| <ul style="list-style-type: none"> <li>social conflicts if workers from other regions or countries are hired?</li> </ul>                                                                                                                   | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | Opportunity for local employment, commercial opportunity can stimulate local economy and ease tensions.                                                                                                                                                                                                                                                                          |
| <ul style="list-style-type: none"> <li>large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?</li> </ul>      | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | Construction camps and working sites on the alignment to be self-contained in terms of provision of water and disposal of solid and liquid wastes                                                                                                                                                                                                                                |
| <ul style="list-style-type: none"> <li>risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?</li> </ul> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | Potential for adverse impact during construction due to storage, transport and use of construction materials. Mitigation through good site management will be described in the EIA and specified in the EMP.                                                                                                                                                                     |



| Screening Questions                                                                                                                                                                                                                                                                                                                                                        | Yes                                 | No                       | Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.</li></ul> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <ul style="list-style-type: none"><li>(i) During construction contractor to ensure that sites are secure and communities are separated from construction activity. Most of the alignment is remote from communities.</li><li>(ii) During operation the design will improve several local communities road safety by giving them access to the new road with appropriate street furniture i.e. signage, central reserves, verges.</li></ul> |



Annex ).

Anticipated impacts on the bio-physical environment of the project (such as soil erosion, increased levels of noise and vibration, air and water quality) will be temporary and are most likely to occur only during the construction period. The impacts are manageable and can be minimized if not eliminated through timely and proper implementation of the mitigating measures proposed in Environmental Management Plan. Environmental protection, safety of the public and the construction workers as well, and hygiene of workers will be fully complied with Armenian legislative regulations in all phases of the Project. Details are presented below.

## 5.2 Positive impacts

The major trans-boundary impact is that the new road section will benefit transportation of goods and people. The Project is envisaged to bolster the economic growth of Armenia with its neighboring countries such as Iran in the southern border and Georgia in the north.

The new road alignment will reduce the driving distance between Sisian and Kajaran by about 60km. The length of the existing road from Sisian to Kajaran is about 123km and new road section from Sisian to Kajaran will be about 64km. Consequently, travel time will be reduced. It will become 45-50 minutes instead of estimated 1hour 50minutes current travel time. The residences of the local communities also will benefit by saving in vehicle operating costs due to road condition improvement.

The project will provide a link between remote communities of Sisian and Kajaran regions. The new road section will play a positive role in enhancing economic growth of those communities, region and the country.

Completion of this road will divert through trans-boundary traffic away from the Kapan city and is expected to improve air quality in the marz center – Kapan city.

The road will be designed and constructed to current high standards, facilitating driver safety (appropriate road markings, signage, safety, drainage, culverts, overpasses, underpasses and shoulders). The structural elements of the Project will be designed with consideration to the seismic activity of the region. Drainage will be incorporated into the road design to control flow, thereby minimizing erosion of soils and local flooding. The design will then enhance the sustainability of the project.

The design will include landscaping and along the shoulders of the road (tree planting, grassing and seeding) in order to avoid erosion. Benefits of landscaping include enhancing ecological value, facilitating infiltration of run-off, stabilizing soil structure, enhancing visual aesthetics of the locality and providing some noise reduction (specially where the road will pass near communities, such as Aghitu, Vaghatin, Shenatagh, Lernadzor and Kajaran).

The scenic and healthy nature, water springs, forests, mountains, historical, cultural and natural monuments and sights located throughout the road section could become a fascinating tourism attraction sites.

Positive impacts may be derived from further excavations of existing archaeological sites and from the new sites discovered during archaeological impact assessment of the design/ EIA preparation phase as well as by chance find procedure of the construction phase that can provide new insights for archeologists and historians.



Temporary employment during construction works may provide additional income to the residences of local communities through the short-term local employment opportunities. Some may improve their situation temporarily while working on the Project. The minority population in the region is unlikely to be affected differently from the whole population, if at all.

### 5.3 Negative impacts and mitigation measures during construction phase

#### 5.3.1 Impacts on Flora

The road passes through 6 vertical landscape zones: low and middle mountain beyond forest, low and middle mountain forest, middle mountain steppe, middle mountain meadow steppe, high mountain subalpine, high mountain alpine and will have direct and indirect impacts on the physical and biological resources of the environment, archaeological/historical sites and cultural monuments.

Major degradation of Flora is expected to occur as a result of the tunnel in the Zangezur State Sanctuary and surface road construction near to the Sanctuary.

During the construction of “**Sisian - Kajaran**” interstate highway will be cutted more than **6000 (6068)** trees. After the pruning and cleaning of the bushes will be cut more than **10000** shrubs.

Most important sections are 4:

- Darbas – Shenatagh-Bargushat ridge tunnel (**354 trees**);
- Karut – Verin Geghavank (**1276 trees**);
- Verin Geghavank – Kavchut (**542 trees**) and
- Lernadzor – Kajaran (**2971 trees**).

A permanent impact on ecology is likely to occur due to the alignment of any unstable section. The work will directly cause minor degradation of the local ecology at major work sites and ancillary sites. During construction, a short-term impact on ecology is likely to occur in and around the quarry sites, material stockpiling areas, and worksites due to vegetation clearance

During investigations it was clarified that there are endangered 10 Flora Red Book species occur along the vicinities of the road alignment.

The protected species in the project area shall have the special attention as provided in Armenia's Law on Flora (1999) and the requirements of the Red Book for Flora (Governmental decree 29.01.2010, N 72-N). The Special mitigation measures have been included in the EMP to minimize the negative impact on flora and to avoid any detrimental effect to Red Book plants.

Where possible, removed trees shall be replanted. The works of replanting of all kind of trees and bushes should be organized either in late autumn following leaf fall or in early spring. If trees are quite old or due to some other reasons the replanting can't be done, some of them shall be cut down during road construction; they should be replaced with new trees and bushes at a ratio of 6:1. The new trees should be maintained for 3 years until they become viable (Note: 80% survival is



considered excellent). It is very important to use local species. Replanting areas will be identified by the construction Contractor and approved by the Supervision Engineer

Contractor should prepare Site Specific Environmental Management Plan for replanting that will contain the planting area, scheme and details on the replanting species, as well as all the permits/approvals from local self-governmental authorities and etc.

Workers will be trained regarding nature protection and the need to avoid cutting down trees during construction. Contractors will be responsible for supplying appropriate fuel in the work camps to prevent wood collection.

The loss of trees from privately owned properties (and any associated business loss) are subject to compensation within the scope of Land Acquisition and Resettlement procedures.

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### 5.3.2 Impacts on Fauna

The project can negatively affect fauna during construction by:

- Disturbing/destroying nesting places, burrows and holes of animals;
- Killing animals during construction;
- Making difficulties for their hunting, migrating and reproduction;
- Creating shocking circumstances by noise, vibration, and air and water pollution.

During investigations it was clarified that there are endangered Fauna Red Book species are living along the vicinities of the road alignment.

The protected species in the area shall have the special attention as provided in Armenia's Law on Fauna (2000) and the requirements of the Red Book for Fauna (Governmental decree 29.01.2010, N 71-N). The Special mitigation measures have been included in the EMP to minimize the negative impact on fauna and to avoid any detrimental effect to Red Book species.

During field visits the locations of possible migration routes were investigated. Possible areas for installation of animal migration passages for crossing the road were revealed.

The chainage of some elements of drainage system (culverts, box culverts) coincides with possible locations of migration passages, so the drainage system to be installed in that areas will also serve as passage to ensure safe migration, hunting, nesting, etc. of animals.

**Invertebrates:** the future status of the invertebrate's fauna biodiversity there is need for further implement of the continuous monitoring.

#### Amphibians and reptiles:

- During the construction where a big number of species are gathered biodiversity specialist should gather the individuals and release them in more suitable and safe territories. The gathering of species must be carried out before the launch of heavy construction machinery.
- Provide some parts of the road (the exact places must be clarified prior to construction activities) underground passageways and fences.

#### Birds:

- During the construction work on the migration routes of animals, where appropriate, should be arranged fencing usually equipped with deterrent devices (reflectors, warning lights, horns, etc.).
- In developing the calendar of construction plans should be taken into account the need for the suspension of work, causing intense physical impacts (noise, vibration, explosion's, light effects, etc.) in certain periods of the environmental authorities lives of animals such as the current period, breeding, hatching, etc. (If necessary, consult with experts). For this reason in forested territory clearance should be carried out, usually in winter.
- It is necessary to register the case, when during the construction inhabited nesting sites will be found (masonry or chicks), make the transfer of nests with the obligatory prior consultation and participation of experts.

**Mammals:**

- During reconstructions the specialist should take out the animals.
- Provide passages for small mammals along the highway (Sisan - Darbas, Darbas - Shenatagh, Kitsq - Geghi) for giving them a chance to pass the road safely.
- The highway should be protected with a wall for avoiding the entrance of animals to the road.
- Green bridges, overpasses/underpasses and/or similar design solutions should be provided in Kitsq - Geghi section, because of rich diversity of endangered large mammals lives there.

To prevent and mitigate possible negative impacts on fauna also the following mitigation measures are included in EMP:

- if Red Book nesting places, burrows, and holes of animals are discovered, the information should be provided to PMU environmental specialist and ME for appropriate future actions,
- during construction temporary protective walls should be erected on the sections where animals often appear,
- using equipment with low noise, vibration and with less exhaustions,
- in the case of an injured animal is found the ME should be notified,
- avoiding construction and blasting works (if any) in the evening and night time, during animal's breeding season, etc.
- protection measures are included in the EMP to avoid negative impact on Red Book protected species of fauna existing in the area.

Potential impacts from construction worker camps include poaching of edible animals and birds in the locality, despite prohibitions. The contractors' environmental health and safety manager and biodiversity expert will be responsible for providing adequate knowledge to workers regarding the protection of fauna.

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**5.3.3 Impacts on protected area**

Minor negative impacts are expected during implementation of the civil works in the protected area. The following large mammals as wild boar, roe deer, wolf, lynx which are not included in Red Book, however need in conservation are distributed on this area. Among the most prone animals which will be affected from road project is Armenian mouflon, because the road will cross the main habitat of





this species (Annex 8). The construction of road will bring the following negative impact on this species: habitat destruction, noise pollution, fragmentation of habitat (the summer places of mouflon mainly situated on Zangezur ridge, but winter places are on Bargushat ridge while the road divide these two ridges), easy access of poachers to localities of mouflons.

Habitat fragmentation occurs when a road cuts through an ecosystem. The sum of the parts created may be less than the value of the initial whole, even when the habitat lost is negligible. Most animal species tend to follow established patterns in their daily and seasonal movement patterns. A road crossing the sanctuary and blocking a wildlife corridor may result in constraints on wild life movements because animals are reluctant to cross the road, increase in mortality due to collisions, or delay in migration patterns. Potential wildlife crossing zones identified via consultations among fauna expert preparing the fauna section of the EIA and specialists of Zangezur State Sanctuary based on which location of wildlife underpasses are identified. The wildlife fencing will be installed along the surface road in the most sensitive areas. A special management plan, road sign, information display board, and roadside fence will mitigate this. The cost of these mitigation measures should be included in the Project budget.

The analysis considered whether there are sufficient buffer zones to protect rare habitats and strict area from human disturbances. Based on the discussion with the protected area and forest department authorities, field visits, and current maintenance practices, it is concluded that there will be no significant impact on the protected area due to the road construction, however, some negative impact is expected during the construction and operation, which will be mitigated by limiting construction activities in the protected section and nearby sensitive areas as well as:

- During highway construction works all vertebrate animals should be caught by the biodiversity specialist Kitsq-Geghi segment of project is passing through high diverse landscape. Daily and seasonal migration ways of animals crosses with future road. prior to commencement of works, to identify/verify migration ways to mitigate impact by building of additional underpasses/overpasses and/or “Green Bridges” for animals.
- To decrease accident with animals on road, highway should be separated with barrier on the edges.

. Prior to construction based on the study in the sensitive areas a special monitoring and management plan should be prepared by the Contractor and approved by the Supervision Engineer to secure the environmental protection in the sensitive areas.

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#### 5.3.4 Impacts related to water resources

The Shamb Reservoir on the Vorotan River is about 150m from the road section and the Geghi Reservoir on the Geghi River with the 90m height dam, which is in the stage of rehabilitation, is next to the road section. Vorotan, Loradzor and Geghi rivers will be crossed by bridges. Each of them will be crossed by one bridge.

Contamination of water is possible during construction activity in case of accidental oil or grease spills, disposal of excavated earth, etc. in existing water sources, rivers, streams, irrigation canals. To protect surface water from oil and oil products penetration, proper working equipment and machinery shall be used. Drip boards and other protection structures must be considered for all specific places of the construction area, for preventing water and humidity penetration.



During the whole construction period, the Contractor shall guarantee that all river beds and drainages in and around the construction site will be maintained in good condition and no excavation material or other particles originated by works will fall in them. The designs of the proposed works will include adequate measures for water drainage. The Contractor shall submit an Action Plan for incidents involving spills of hazardous substances before the actual rehabilitation works may commence.

The measures that are proposed to mitigate/restrict the impact on water quality are:

- water from excavation at tunnels should be drained in the duct by gravity,
- storm water collected on bridges will flow through an oil separator beneath the bridges to retain any pollutant from the road to run off directly into rivers.
- diversion of the polluted superficial drain from the territory of construction site should be carried out through special treatment facilities.
- the water shall not be taken from the protected area.

During construction of tunnels ground water may drip from the roof and the sidewalls of the tunnels due to the jointed and sheared rock masses, and jointed lime-stones and quartzites that can be found in areas of tunnels.

The likely impacts of ground water during construction of tunnels in different stretches of the alignment may be of varying degrees, duration and this will call for specific management measure.

Mitigation measures to avoid degradation of the water quality will include:

- Development of a comprehensive erosion and sediment control plan prior to earth-moving activities,
- Construct settling ponds where silt-laden water can settle before being discharged into natural watercourses,
- Application of erosion and sediment control practices to prevent excessive onsite damage,
- Apply perimeter control practices to protect the disturbed areas from onsite runoff and to prevent sediment damage to areas below the construction site,
- Keeping run-off velocities low and trying to retain much of the run-off on the site,
- Stabilization of the disturbed areas as soon as the final grade has been attained.

The adoption of these measures will be strengthened and supported by:

- Use of oil/ water separators to extract floating oils,
- Proper storage of contaminated liquids and disposal after treatment to bring such liquids within prescribed permissible limits.
- Restricting construction activities near water courses as far practicable during the dry season.
- On site fuelling area of vehicles and equipment will be selected away from water bodies and should be protected by a berm to prevent runoff from leaving the area.

Special Mitigation measures for the tunnels will include:

- Installation of a water proofing system between the initial ground support system and the final concrete lining. This will consist of a PVC membrane with protection layers made from geo-textile material;



- Collection of roadway water in a dedicated drainage system to separate it out from the clean water drainage system. As the tunnel will be open for vehicular traffic, the drainage system will consist of a slotted gutter. This will be connected to the principal longitudinal drains by gully pits containing a siphon system.
- Water collection basins will be put at each end of the portals where drainage water will be collected.

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### 5.3.5 Impacts on project vicinity communities

The alignment links 2 towns and 20 rural communities. In order to overcome any social impacts associated with the severance of communities, there will be constructed a total of 3 new grade-separated interchanges, all are overpasses to provide connection to local roads/communities. Other reinforced concrete structures comprise 4 agricultural underpasses for machinery, pedestrians and animals; 27 bridges, (3 river bridges) and a total of 106 pipelines for surface water and irrigation systems. Gas pipes, irrigation pipes, underground electrical cable and water supply pipes will be relocated.

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### 5.3.6 Impacts on soil, erosion and sedimentation

. The Project is located on a mountain terrain. Therefore the risk of soil erosion will be higher. Soil erosion is expected during earthen works along the banks of rivers which require slope protection that has been made in the design. Silt coming from construction activities can run into rivers causing additional sedimentation. Also, soil erosion can be generated from improper stock piled excavated earth and top soil during heavy rainfall events. These eroded materials ultimately may find their way clogging the canals and drainages. The mitigation measures to prevent and control soil erosion and sedimentation are described in the EMP.

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### 5.3.7 Impacts related to Air quality (dust and exhaust gases)

As ground cover is removed, exposed soils within the site will provide a dust source potentially causing nuisance to nearby receptors. The generation of dust should be mitigated primarily through maintaining vegetation cover as long as practicable and spraying the haul roads with water.

Particulate matter and exhaust gases will be generated by construction vehicle exhaust although the exposure to potential receptors is expected to be insignificant because of the limited level and duration. Nevertheless, exhaust attenuation such as scrubbers or diesel particulate filters will still be applied to vehicles. Excavation at the tunnel portals will be performed within the enclosed work sheds constructed prior to the commencement of works. Tunnel ventilation air during construction will be treated by passing through particulate filter prior to the exit from work sheds to meet the required standards. Artificial ventilation of underground excavations should be applied at all stages of construction works of tunnels. Aggregate, asphalt, and concrete plants as well as borrow pits and quarries shall be located as far away from human settlements and protected area as possible. Special care will be taken to inspect carefully whether all construction vehicles are properly maintained and correctly operated (including the use of dust filters or hoods) during construction in the protected area. Detailed mitigation measures are planned in the EMP.

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### 5.3.8 Impacts related to Noise and Vibration

During construction, noise will be generated from the operation of vehicles and machinery including



excavators, compactors, jackhammers, and other construction-related activities. The most sensitive receptors are occupants of residential properties and other buildings that are adjacent to the road alignment.

Construction noise levels at nearby receptors will vary throughout the construction period depending on the activities carried out, the distance to sensitive receptors, as well as atmospheric conditions. The Contractor will develop an Environmental Protection Plan as a part of SEMP, when actual locations of construction camps are known. Without mitigation, increased noise levels would likely result in significant temporary noise impacts. Mitigation measures that will be applied to minimize noise include:

- siting of construction camps away from residential areas;
- distancing noisier activities away from receptors where practicable;
- scheduling of noisy activities towards the middle of the day and avoiding night time activities;
- minimizing the need for heavy vehicles to pass through residential areas by specifying routes along public roads, site access points, and haul routes;
- installing and maintaining effective exhaust silencing systems on vehicles and equipment; and
- installing temporary soundproofing and sound-absorbing barriers adjacent to tunnels' portals and around noise sources where considered necessary where other mitigation measures are not sufficient or practicable.

During construction, equipment may generate vibration at the properties immediately adjacent to the alignment. Any vibration resulting in nuisance effects will be temporary. Vibration effects will be localized and will unlikely result in structural damage to buildings or walls of the adjacent private properties. However, it is important to note that, some of the houses can be not well insulated and not very well built. Being very close to the right-of-way, inhabitants may experience high sound levels inside their dwellings and house can be more sensitive to vibration. Inventory surveys (seismological survey if needed) will be undertaken by the Contractor prior to construction and again after construction to inspect any damage. Any damage as a result of construction of the Project will either be repaired by the contractor at his own expense or the owners compensated also at the cost of the Contractor. It must be ensured that noise level in the protected area of the roads is kept 55 dBA during construction. Particular care must be exercised to prevent damage from vibration to archaeological/historical/cultural monuments.

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### 5.3.9 Impacts on historical and archaeological monuments

From the point of view of the assessment of the impact of the future construction activities on the resources of historical-cultural, archaeological geological-paleontological and spiritual significance, as well as for saving the historical-cultural and scientific value of those resources and, finally, for realization of the management of the tasks raised during the construction process, the recorded monuments were divided into two categories or groups. Those are sites with direct impact and sites with indirect impact. From that perspective the most important are the sites with direct impact or the units which will stay under Right of Way (RoW), as of those, which will not be directly affected, but can be under the danger of destruction or carry partial damage during the construction activities, are not requiring long-term safeguard-protection procedures. For those only specific protection measures are needed. And for the sites staying under RoW comprehensive and sometimes very complex and long-term protection measures are required, such as excavations, removal, changes in the alignment design or the construction concept, which leaves its own impact on the project implementation.



41 monuments will carry direct impact during the project implementation, including 7 Natural monuments (3 Geological monuments); 4 Historical-architectural and spiritual significance monuments and 27 Archaeological monuments. The given data shows, that 66% of the whole recorded units will be directly affected, from which, correspondingly - 64% of the natural monuments, 33% of the geological monuments, 44% of the historical-architectural and spiritual significance monuments, and 82% of the archaeological monuments. Meanwhile, the largest portion goes to the archaeological sites, which in comparison to the total amount of the recorded sites make up 44%, and to the amount of the sites with direct impact - 61%.

For the historical-architectural and spiritual sites (shrines, chapels, churches, spring-monuments, cemeteries) only the excavation works are not enough as a mitigation measure. There will be a need to carry out additional protection measures, such as removal and reinstallation, building of protection walls, vibration limitation during the construction activities, etc.

In general, final mitigation measures for each directly affected unit will be regulated based on Physical and Cultural Resources (PCR) Preservation Plan prepared by the Contractor prior to the construction works.

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#### 5.3.10 Impacts on agricultural activities

Topsoil in the project's area will be stripped from the agricultural areas acquired under the LARP. Special efforts need to be made to conserve striped topsoil in stockpiles for later use for site restoration. Surplus top soil should be given to the local communities for their further management according to Land Code. Topsoil management shall be implemented in accordance with SEMP, as well as Technical Specifications.

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#### 5.3.11 Impacts on land acquisition and resettlement

The implementation of the Project will cause permanent changes in land use and loss of property and other assets caused by occupation of land for the new road section, temporary changes in land uses caused by short term occupation of land for construction, and changes in accessibility to existing land uses resulting from the temporary or permanent presence of the Project.

Prior to the start of construction, lands and buildings within the right-of-way will need to be acquired and the buildings demolished. The full social impact will be assessed and a Land Acquisition and Resettlement Plan will be prepared. Land acquisition will be undertaken in accordance with the LARP.

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#### 5.3.12 Specific impacts caused by work activities

**Construction Camps.** Locations for any construction camps will be selected by the contractor in consultation with the Engineer Environment Specialists to ensure minimal impact. For each camp, the Contractor will develop a Construction Work Camps Plan as a part of Site-specific EMP with measures listed in EMP.

**Utilities.** There is potential risk for disruption to above and below-ground utilities during construction. This might include above-ground gas mains, water mains, sewers, and electricity lines as well as irrigation facilities. The Contractor prior to construction shall prepare temporary or permanent relocation and/or protection plan. Any disruption to services should be short-term and localized and



will take into account the time of year and time of day. Affected persons should be notified prior to the works. Management of this issue will be implemented in accordance with Utilities Protection and Relocation Plan in EMP.

**Safety.** Construction site safety for workers and residents of the nearby communities is crucial. The impacts relate to occupational health risks like polycyclic aromatic hydrocarbons (PAHs) released during asphaltting, as well as other construction works relevant safety risks. All workers should wear appropriate personal safety equipment, receive instructions on its proper use, and be tested periodically. The Contractor shall take all necessary measures for the safety of the public during construction in accordance with the Occupational Health, and Safety Plan as a part of SEMP. First aid facilities will be provided and emergency response plans prepared prior to the start of construction.

**Employment.** There is potential for the project to generate employment opportunities for locals. It is recommended that recruitment be offered in the local community.

**Environmental and Safety Orientation.** An environmental and safety orientation training program will be developed and implemented during all Project phases. Training program shall include training on environmental and health & safety issues organized by Contractor's Environmental and Safety specialists in accordance with the Safeguard Orientation Plan presented in EMP for all Contractors' Personnel. Engineering staff and workers will be required to attend, an orientation/safety induction course within their first week on site and regularly held trainings for newly recruited workers. On-site workers should be made aware of and trained in standard environmental protection and health & safety requirements.

**Impact on Public.** Potentially sensitive receptors will be notified by the Contractors of upcoming construction activities in their area that may result in increased dust, noise, temporary road closures and traffic diversions. This may include media announcements to the general public. Notifications should provide contact details on who to contact to obtain further information or make a complaint. To be really effective, public awareness campaigns should be enhanced by involving NGOs.

**Excess Spoil.** Some excessive amount of soil material may be generated. If excess spoil is generated from the excavation and grading activities, the spoil will be classified, transported and disposed in accordance with ME requirements. The Armenian Law on Rates of Environmental Charges (2006), Article 3 provides the environmental charge according to waste categorization these are as follows:

- (i) Category 1 first class hazardousness level – \$133/t;
- (ii) Category 2 second class hazardousness level – \$72/t;
- (iii) Category 3 third class of hazardousness level – \$13/t;
- (iv) Category 4 fourth class of hazardousness level – \$4/t;
- (v) Non-hazardous non-toxic – \$2/t); and
- (vi) Non-hazardous produced during land excavation and construction – \$0.2/t.

**Impact on Geology.** Tunnel excavation will require extraction of geological resources consisting of sedimentaries i.e. sandstones, shales, limestone and conglomerates and metamorphic i.e. basalts and andesites, dacites, rhyolites, obsidians, perlites, tuff-breccias.

The blasting operations will lead to rock movement, minor fragmentations and vibrations. Likely impact on the geological resources will occur from the extraction of materials (borrow of earth, granular sub base and aggregates for base courses and bridges.





In case of finding of mineralized zones along the tunnel alignment during excavation, it will be brought to the notice of the Ministry of Territorial Administration and Infrastructure.

Appropriate blasting design will be adopted which will consider safety, blast geometry, free faces, burden, spacing, initiation pattern and angled holes.

**Oil and Fuel Spills.** There is potential for spill or leakage of fuels and oils from inappropriately stored material, during refueling or caused by hose rupture from heavy machinery. This would contaminate the soil and could infiltrate into the groundwater or eventually enter surface water if carried off site through run-off. Mitigation in the EMP sets out measures for avoiding on-site maintenance and refueling where practicable, providing bounded areas for fuel storage and maintenance where on-site maintenance activities cannot be avoided, clean-up of any spill/leak, and reporting to the ME in case of spills and leaks.

**Solid and Liquid Waste.** Solid waste that may be generated during construction includes redundant road surface, excavation material and muck from construction of tunnels, oil filters, material packaging, and solid waste discarded by construction workers. Liquid wastes that will be generated by the Project include construction worker sewage and waste oils. The EMP specifies that waste must be collected, stored, transported, and disposed in accordance with RA legislation and ME regulation.

Excessive soil, oil and fuel spillages and other waste issues are addressed in EMP and will be mitigated by Contractor in accordance with Waste and Material Management Plan as a part of SEMP.

**Vehicle Movements on Local Roads and Altered Access.** The Project will increase heavy vehicle movements on local roads throughout construction from transport of waste, spoil, and construction materials and machinery. There is potential for disruption to public road access, including diversions where the new road section crosses the existing road, and increased road traffic conflict. It will be the duty of the Contractor to define his traffic movements and access to the site. He will also be responsible for choosing his material and product sources (crushed stone, asphalt etc.).

The transportation of material in, from or to the sites of the Project will include approximately 5,671,476.8m<sup>3</sup> of common excavation, 3,311,148m<sup>3</sup> of embankment and hot asphalt for pavement of 474,612 m<sup>2</sup>.

The transportation routes will depend on the location of the quarries and the borrow pits that the Contractor will use. The awarded Contractor shall obtain all necessary permits for traffic movements and shall prepare a Traffic & Access Management Plan as part of the updated EMP. The relevant transportation scheme shall be inserted in the SEMP.

Traffic and Access Management Plan will be prepared by the Contractor as part of his SEMP during the mobilization period to set out safe entry and exit points, enforce strict safety on public roads in conjunction with local police forces, specify timing for deliveries, and, in conjunction with local governments, determine routes on local roads to manage traffic and minimize potential conflict. These plans will require approval from the police authorities.

**SSite Reinstatement.** By the end of construction phase and prior to handover of the site by the Contractor to the MTAI, the Contractor will reinstate the site which will include clearing the site of all construction-related material and waste and transporting them to sites approved by the Engineer, and other affected bodies. Landscaping activities should include grass- seeding and planting native trees and shrubs as will be provided in the design. All removed trees and shrubs that are not from acquired lands will be replaced with native trees and shrubs at a ratio of 6:1, most of which will be in the vicinity



of the alignment consistent with sight distances and available space (e.g. on embankment slopes). The Contractor shall ensure that any plantations are correctly maintained during the works and defects liability period and will engage competent companies to maintain the trees and shrubs following construction. Final payment to the Contractor is subject to the site being restored to satisfaction of the Employer and affected local communities.

## 5.4 Negative impacts and mitigation measures during operation phase

### 5.4.1 Impacts on Flora

**Improper maintenance of re-instated sites** may result in the losses of planted trees and shrubs. To avoid this impact, measures are considered in the EMP.

### 5.4.2 Impacts related to Air quality

The air quality at the closest communities is excellent. The slight deterioration in air quality that may be caused by increased traffic due to the Project is expected to be insignificant.

### 5.4.3 Impacts related to Noise quality

Operational noise levels are predicted to be increased beyond ambient levels in areas close to the Project.

### 5.4.4 Impacts related to water quality

In the period of operation changes in the quality of surface water is expected to be minimal. No adverse impacts on groundwater are anticipated during operation phase.

### 5.4.5 Impacts related to protected area

Negative impacts are expected during operation of the road in the protected area. The road section will increase the accessibility to environmentally sensitive protected area located close to the road and result in increased poaching and transmission of diseases these adverse impacts can largely be avoided or mitigated by careful planning and implementation of an environmental management plan. Wildlife fencing and underpasses are measures to minimize the impact.

## 5.5 Cumulative Environmental Effects

During construction, receptors adjacent to the route will be exposed to short-term construction-related nuisance effects, including noise, dust, and altered access resulting in cumulative effects. These impacts will largely be mitigated to insignificant levels. Construction activities will likely not occur simultaneously and consequently, there will be no adverse combined impacts during construction.



## 6 ANALYSIS OF ALTERNATIVES

The ADB's Safeguard Policy Statement (2009) as well as Armenian legislation requires consideration of feasible alternatives to the Project in terms of project location and design allowing measures to be proposed to avoid or prevent potential environmental impacts.

Consortium SPEA-IRD, the Consultant for construction supervision of Tranche 3 and feasibility design, preliminary design and 60km detailed design of Tranche 4 of the North-South Road Corridor Investment Program, proposed 3 alternatives for improvement for North-South (NS) Road Corridor from Sisian to Kajaran. The alternatives with "Without Project" alternative for existing road were analyzed from financial, technical, economic, social and environmental point of view as well as multi-criteria analysis have been undertaken during Feasibility Study. The pros and cons of alternatives are described in Table 5-1.

The "Without Project" alternative is not considered viable as travel time is long and travel cost is high than for the alternatives, vehicle emissions negative impact on air quality of cities where the highway passes through is high, and safety issues exist both for road users, and for weak users/pedestrians for lack crossing facilities than for alternatives. It would run counter to the development plans of major communities, such as Goris and Kapan.

Taking into account travel performance together with construction costs, geology, hydraulics, environment, territorial economy, social benefits and impacts, natural resources protection/exploitation as well as conclusions of public consultations organized to present the proposed alternatives, the best option is considered the "Alternative 1" for what the EIA is prepared.

While the local people will be impacted by land acquisition and resettlement, they will be benefitted in the long term due to improved access to the markets, health facilities, administrative services etc. On the other hand, the Kapan and Goris cities will be bypassed to improve air quality and safety of the cities.

1<sup>st</sup> and 2<sup>nd</sup> alternative routes will cross the Zangezur State Sanctuary and 3<sup>rd</sup> alternative route will cross forests. Analysis of impacts of alternatives on the protected area and forests shows that less negative impacts have 1<sup>st</sup> alternative due to long tunnel and short (about 700m) surface road will cross the protected mountain alpine region area with wildlife fencing and underpasses. However, the road cannot be moved outside the boundaries of the protected area or forests because of terrain specifications of the project area.

Table 5-1: Comparisons of alternatives

| Alternative                                                                                          | Pros                                                                                                                                                                                                | Cons                                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Without project /Sisian-Kajaran section of the existing M2 Yerevan-Ararat-Yeghegnadzor- Goris-Kapan- | <ul style="list-style-type: none"><li>•No generated traffic due to better infrastructure</li><li>•No Construction traffic and activities that could have a negative effect on air quality</li></ul> | <ul style="list-style-type: none"><li>•Negative impact on air quality in inhabited centers crossed by route</li><li>•No improvements to the public and private transport</li></ul> |



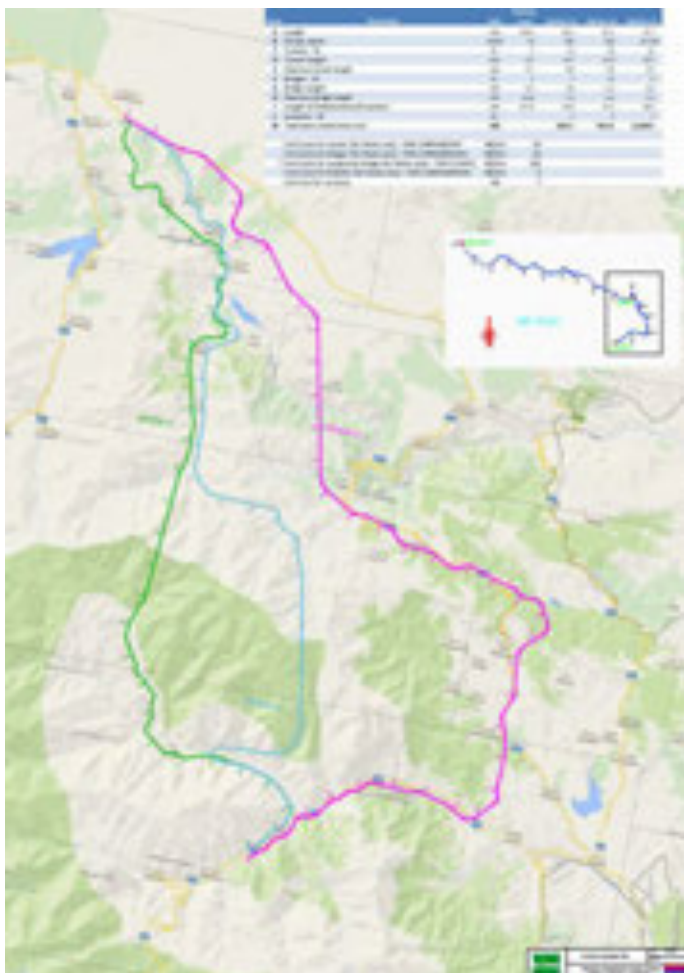
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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Kajaran-Meghri highway /                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>•No impact on indigenous species along existing road</li> <li>•No need of infiltration drainage to compensate for construction of impermeable road surface</li> <li>•Moderate risk from road run-off to surface water and groundwater</li> <li>•No cultural heritage resources are impacted</li> <li>•No agriculture land takes neither expropriation/demolition of private properties</li> <li>•No environmental management system needed during construction</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>infrastructure</p> <ul style="list-style-type: none"> <li>•No Diversion traffic away from the congested urban centers, diminishing journey time, costs and vehicle emissions</li> <li>•Safety issues both for road users along sections with single carriageway, and for weak users/pedestrians for lack crossing facilities</li> </ul> |
| <p>Alternative 1 /west path/</p> <p>The route begins from the southern foot of Mount Mets Ishkhanasar, crosses M2 highway, after Sisian city is developed completely in greenfield on a pretty hilly corridor along the Vorotan River Valley. The Bargushat ridge is crossed through a tunnel and surface road, where Mount Aramazd is located to the west from the designed road. Then the alignment starts to descend in the Karut Valley toward the Geghi River Valley to join again M-2 before reaching Kajaran.</p> | <ul style="list-style-type: none"> <li>•Better geometry of route (minor grades, higher curves radiuses, more constant speed) will reduce impact on local air quality in inhabited centers crossed by route</li> <li>•Potential to plant indigenous species in road areas with embankments</li> <li>•Unlikely that any cultural heritage resources will be significantly impacted</li> <li>•Associated improvements to the public transport infrastructure</li> <li>•Agricultural areas land take is very moderate since the corridor interests steep, with a long tunnel and in general mountainous profiles</li> <li>•Ensure road safety by proper signage, guard rails, safety barriers and road markings</li> <li>•Employment opportunities for construction and maintenance of local labor</li> <li>•Diversion traffic away from the congested urban centers, diminishing journey time, costs and vehicle emissions</li> <li>•replacing a very poor existing road</li> </ul> | <ul style="list-style-type: none"> <li>•Construction traffic and activities will have a temporary negative effect on air quality</li> <li>•The route passes through the forest and protected area</li> <li>•Moderate level of risk from road run-off to surface water and groundwater</li> </ul>                                           |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Alternative 2 /east path/</p> <p>The route begins from the southern foot of Mount Mets Ishkhanasar, crosses M2 highway, after Sisian city is developed completely in greenfield on a pretty hilly corridor along the Vorotan River Valley. The Bargushat ridge is crossed through a tunnel and surface road, where Mount Aramazd is located to the east from the designed road. Then the alignment starts to descend in the Geghi River Valley to join again M-2 before reaching Kajaran</p> | <ul style="list-style-type: none"> <li>• Better geometry of route (minor grades, higher curves radiuses, more constant speed) will reduce impact on local air quality in inhabited centers crossed by route</li> <li>• Potential to plant indigenous species in road areas with embankments</li> <li>• Unlikely that any cultural heritage resources will be significantly impacted</li> <li>• Associated improvements to the public transport infrastructure</li> <li>• Agricultural areas land take is very moderate since the corridor interests steep, with a long tunnel and in general mountainous profiles</li> <li>• Ensure road safety by proper signage, guard rails, safety barriers and road markings</li> <li>• Employment opportunities for construction and maintenance of local labor</li> <li>• Diversion traffic away from the congested urban centers, diminishing journey time, costs and vehicle emissions</li> <li>• Enhance accessibility to tourist valence sites</li> </ul> | <ul style="list-style-type: none"> <li>• Construction traffic and activities will have a temporary negative effect on air quality</li> <li>• The route passes through the forest and protected area</li> <li>• Moderate level of risk from road run-off to surface water and groundwater</li> </ul>                                                                                           |
| <p>Alternative 3 /Trough Goris and Kapan cities/</p> <p>The route begins from the southern foot of Mount Mets Ishkhanasar, crosses M2 highway. The route diverts to the right from the existing road after passing agricultural lands of Noravan village and is developed completely in greenfield between Vorotan</p>                                                                                                                                                                          | <ul style="list-style-type: none"> <li>• Better geometry of route (minor grades, higher curves radiuses, more constant speed) will reduce impact on local air quality in inhabited centers crossed by route</li> <li>• Potential to plant indigenous species in road areas with embankments</li> <li>• Unlikely that any cultural heritage resources will be significantly impacted</li> <li>• Associated improvements to the public transport infrastructure</li> <li>• Ensure road safety by proper signage, guard rails, safety</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>• Construction traffic and activities will have a temporary negative effect on air quality</li> <li>• The route passes through the forests</li> <li>• Moderate level of risk from road run-off to surface water and groundwater</li> <li>• Agricultural areas land take is very important since the corridor interests cultivated highlands</li> </ul> |

|                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                        |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <p>River Valley and existing road. Passing the agricultural lands of the Harchis village the route crosses about 800m deep canyon of the Vorotan River, runs near Tatev village, reaches the town of Kapan by passing through forest areas and around the settlements Tandzaver, Verin Khotanan, and Norashenik, and reaches the entrance of the town of Kajaran in parallel to road M2-Meghri.</p> | <p>barriers and road markings</p> <ul style="list-style-type: none"> <li>•Employment opportunities for construction and maintenance of local labor</li> <li>•Diversion traffic away from the congested urban centers, diminishing journey time, costs and vehicle emissions</li> </ul> |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

**Figure 5-1: Artashat-Sisian Section**







## 7 INFORMATION DISCLOSURE, PUBLIC COMMUNICATION, CONSULTATION AND PARTICIPATION

The Public communication, consultations and participation shall be carried out in compliance with ADB SPS (2009) and Armenian legislation and in accordance with Public Consultation and Communication plan developed in the scope of the present EIA and EMP and updated by the Contractor.

The Public Consultation and Communication plan includes:

- (i) Disclosure of Project related Information to raise the awareness of the public on the Project.
- (ii) Public consultations are implemented to meet the ADB SPS requirements and the requirements of the RA legislation to ensure the participation of the public and APs on the design stage. The further public consultations shall be implemented by Contractor with assistance and participation of the Engineer and TPIO in case of the design or another significant change in project implementation occurred.
- (iii) Grievance Redress Mechanism to ensure the everyday permanent communication with APs for prompt response and resolution of complains and suggestions.

The Public Consultation and Communication plan and relevant mitigation measures are presented in the EMP.

### 7.1 Information Disclosure

The final EIA including EMP will be posted on the ADB and TPIO websites. This will ensure the disclosure of environmental concerns and proposed mitigation measures and made available environmental documents are made available to the public, the relevant authorities and other interested parties.

### 7.2 Consultation and Participation

The Public consultation and participation is the opportunity for the Project to incorporate all relevant views of affected people and other stakeholders into the Project design, mitigation measures, and monitoring plan. The process and activities in the conduct of Public consultation (i.e. program schedule, project information handouts, attendance sheet, complaints, issues and concerns raised by participants), and its results (e.g. agreements, and resolutions) will be documented.

The Public Consultation procedure under the EIA legislation of Armenia is presented hereafter:

- (i) the authorized body – regarding the application submitted by the Initiator for the report and expertise draft conclusion at least 7 working days prior to the public consultations;
- (ii) the Initiator – regarding the conceptual/framework document and the envisaged activities and implementation of their impact assessment activities at least 7 working days prior to the public consultations;
- (iii) territorial administration bodies and the head of the affected community – regarding the conceptual/framework document and the envisaged activities and implementation of their impact assessment activities at least 7 working days prior to the public consultations.



The content of the notification should contain the details of the Initiator, the place of implementation, the summary description of the envisaged activity or the conceptual/framework document, the place of getting acquainted with them and conducting discussions, the conditions, the timeline of providing comments and proposals and other information.

The notification and the design documents should be also placed at the official websites of the authorized body at least 7 working days prior to the public consultations.

Public consultations are carried out by:

- (i) the Initiator – regarding the conceptual/framework document, the envisaged activities and the assessment processes of their impacts,
- (ii) Territorial administration body, the Initiator - regarding the conceptual/framework document and draft report on strategical assessment of their impact,
- (iii) Territorial administration body, the Initiator - regarding the envisaged activity and report on its impact assessment.

The authorized body ensures the participation of its representative in the discussions.

Based on the results of public consultations the Initiator makes a protocol attached with video recording.

The reasonable comments and proposals by the public should be considered by the Initiator and the authorized body. In case of neglecting, justifications should be provided.

The consultation with affected people and other concerned stakeholders, including local persons, will be carried out on an ongoing basis throughout the Project cycle to provide timely disclosure of relevant and adequate information that is understandable and accessible to affected people and responsive to the needs of disadvantaged and vulnerable groups; and should enable to incorporate all relevant views of affected people and other stakeholders into the mitigation measures and implementation issues. The consultation process and its results will be documented.

The ADB SPS 2009 policy on Public Consultation is a process with a requirement to engage with communities, groups, or people affected by the proposed Project and with civil society. It:

- (i) begins early in the Project preparation stage and is carried out on an ongoing basis throughout the Project cycle;
- (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people;
- (iii) is undertaken in an atmosphere free of intimidation or coercion;
- (iv) is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and
- (v) enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

## 8 ACCOUNTABILITY & GRIEVANCE REDRESS MECHANISM

### 8.1 ADB's Accountability Mechanism

ADB website presents the Accountability Mechanism (AM) as a forum where people adversely affected by ADB-assisted projects can voice and seek solutions to their problems and report alleged noncompliance of ADB's operational policies and procedures.

ADB remains firmly committed to the principle of being accountable for complying with its operational policies and procedures, and solving problems of project-affected people and ensures high standards of accountability, transparency, openness, and public participation. The AM policy of 2012 which, as presented in their website (<http://www.adb.org/documents/accountability-mechanism-policy-2012>), is designed to:

- (i) enhance ADB's development effectiveness and project quality;
- (ii) be responsive to the concerns of project-affected people and fair to all stakeholders;
- (iii) reflect the highest professional and technical standards in its staffing and operations;
- (iv) be as independent and transparent as possible; and
- (v) be cost-effective, efficient, and complementary to the other supervision, audit, quality control, and evaluation systems at ADB.

The ADB AM executes the tasks via the **problem solving function** which assists people who are directly, materially, and adversely affected by ADB-assisted projects to find solutions to their problems. Contractor shall inform the APs on the ADB AM as an alternative opportunity for solving of problems.

### 8.2 Grievance Redress Mechanism

#### 8.2.1 Grievance Redress Mechanism

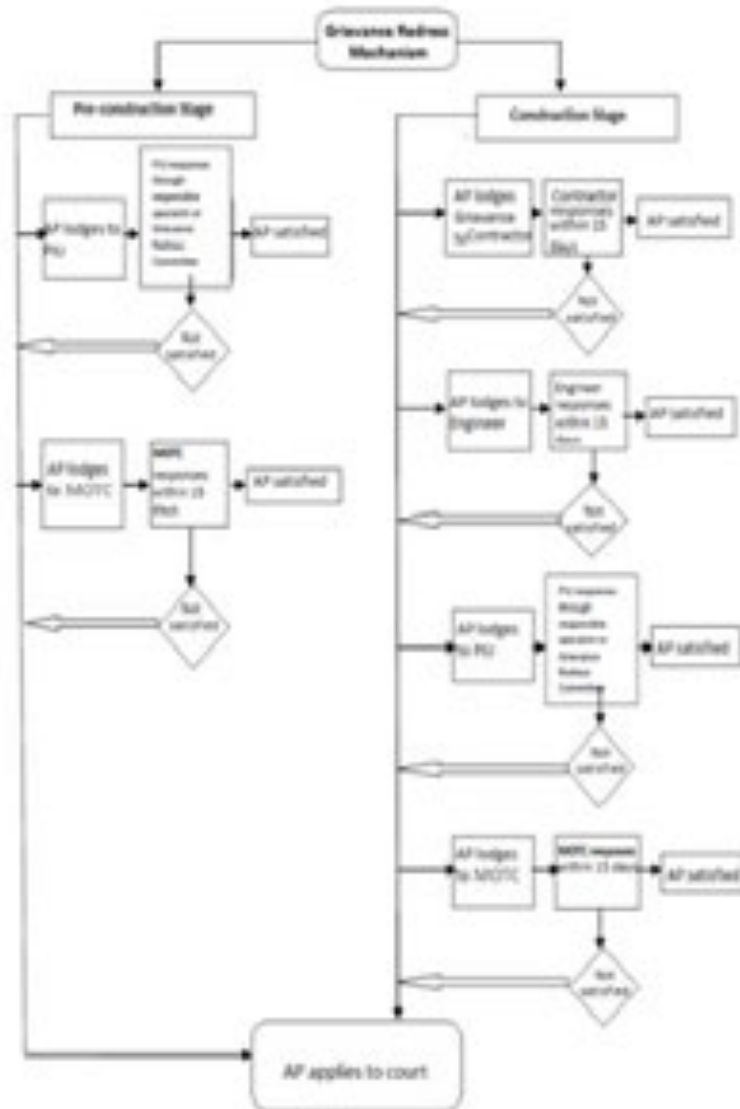
In order to receive and facilitate the resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance an Environmental Grievance Redress Mechanism is proposed for the project. When and where the need arises, this mechanism will be used for addressing any complaints that may arise during the implementation of project. The grievance mechanism is scaled to the risks and adverse impacts of the project. It addresses affected people's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no costs and without retribution. The mechanism is not impeding access to the judicial or administrative remedies. The project proponent will appropriately inform the affected people about the mechanism before start of commencement of any civil works.

#### 8.2.2 Grievance Focal Points, Complaints Reporting, Recording and Monitoring

The process for solving environmental complaints that may arise in the project is the Grievance Redress Mechanism, which will be established at each community in which the various project components will be implemented.

The procedural steps of the Grievance Redress Mechanism for the Project are provided below.

Figure 8-1: Grievance Redress Mechanism Flow-Chart



The following are the procedural steps to file a complaint, pose an inquiry on matters relating to project implementation, environmental concerns and other issues regarding the Project.

**Pre-construction stage:**

Step 1. The person affected by the Project could raise their suggestions/concerns/complaints first of all to the TPIO. The TPIO receives and resolve/replies the APs' grievances.

If an AP is not satisfied with the response or TPIO responsible staff needs additional capacity to response the APs' grievance, the Grievance Review Group (GRG) can be formed to ensure comprehensive, equitable and transparent discussion of the case. To establish legitimacy of the GRG to review and judge on the substantive merit of the AP's complaint, the composition of the GRG should be balanced and include an independent observer to ensure the impartiality and transparency of the complaint review process. The following composition of the GRG is proposed:

| Members                                                | Position    |
|--------------------------------------------------------|-------------|
| (a) Representative of TPIO                             | Chairperson |
| (b) Representative of safeguards team (TPIO)           | Member      |
| (c) Representative of Local Government, as relevant    | Member      |
| (d) Certified technical expert, as relevant            | Member      |
| (e) Representative of Engineer/Contractor, as relevant | Member      |
| (f) Representative of the APs                          | Member      |
| (g) Independent party (for example NGO)                | Observer    |

To make for effective complaint processing, the role and responsibilities of each GRG member should be carefully elaborated and explained to them.

Step 2. If AP is not satisfied with TPIO's decision even after GRG review of the grievance, then s/he can lodge the grievance to the RA Ministry of Territorial Administration and Infrastructure. The MTAI follows Public Administration RA law for registration, revision and resolving the case.

**Construction Stage:**

**Step 1.** The person affected by the Project could raise their suggestions/concerns/complaints first of all to the Contractor's dedicated grievance staff that is an attempt will be made to resolve complaints at the local level. In order to maintain transparency and accountability to affected communities and to make information, assistance and grievance resolution services accessible to the Affected Persons, the Contractor will establish the following GRM as a part of the Project's integral GRM:

- (i) AP's could approach Contractor's representative (construction foreman, engineer, social or environmental specialist) on-site and/ or register their suggestion /complain into the grievance register book kept by Contractor at the field office established in the construction camp located nearby the RoW. The template for recording grievance, content and format of the application shall be specified in the Contractor's SEMP and agreed with Engineer.
- (ii) Contractor ensures the provision of contact information (field office location, operating



hours, names of responsible contact persons, phone numbers, regular mail and email addresses, etc.) via posters and Project informational boards.

Contractor should immediately inform the Engineer and TPIO if AP lodged the grievance and should send the copy of written complaint to them. Contractor should implement appropriate mitigation measures to solve the issue and send the written response/reply to the AP with cc Engineer and TPIO.

Step 2. Should the AP be not satisfied with the Contractors' solution of his/her complain, the further opportunities are available. AP could next apply to the Engineer via lodging the complaint within one month after receiving/not receiving the response from the Contractor.

The incoming suggestions/ complains shall be considered and classified into environmental and social/resettlement items. The social/resettlement safeguard related complains shall be handled in the scope of Engineer and TPIO social specialists.

The environmental specialists of the Engineer in collaboration with the Contractor(s) shall establish an office at the Project site where environmental complaints of Projects' AP regarding EMP and project operations' impacts can be lodged. This Project site office will be used for: supervision of construction, including monitoring of the Contractor's compliance to the EMP to ensure the mitigation measures are timely and properly implemented; disclosing all safeguard documents; and receiving and responding to the comments/feedbacks from the community. The Engineer shall respond to the complaint within 15 days.

Step 3. Should the Engineer fail to satisfy the complaint, AP could apply to TPIO, MTAI and ADB. The complaint in the Construction stage at the TPIO level will be preceded with the same scheme as in the pre-construction stage. All the contact information shall be provided by Contractor on posters and on the Project informational board. Contractor shall serve as an entry point in this stage and provide the necessary explanations and assistance in application to the mentioned entities, if needed through the personal contact with AP.

Finally the AP can always seek attention and interference of the court. However, all the efforts will be made to settle the issues at the Contractor's, the Engineer and TPIO level. If not possible, attempts will be made to resolve the issues at the MTAI level to avoid/minimize litigation as much as possible.

All complaints regardless of the outcome and solutions will be properly documented and made available for review, monitoring and evaluation purposes.



## 9 ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan is prepared to ensure compliance with the ADB's environmental safeguard requirements and all applicable laws, regulations and standards for environmental protection in Republic of Armenia. The EMP contains the measures to mitigate and prevent the unwanted effects that may arise during the Project implementation, as well as the monitoring actions to check the compliance of construction works implementation process to the planned mitigation measures through the whole Project cycle: from the engineering design phase, preconstruction, construction through the operation and maintenance periods. The final EMP as an integral part of the final EIA will be included in the tender and contract documents.

On the other hand, the Contractor will determine his construction practices, working methods, schedule and access to the site. To best reflect the changed and modified conditions the Contractor will be required to complete and update the EMP with more detailed site-specific and activity specific mitigation measures and prepare the Site-specific environmental management plans (SEMP) 28 days prior to works commencement date. The SEMP will be considered as consistent part of Contractor's contractual liabilities.

Contractor will consult with Engineer and decide how many SEMP's are needed for the road section area and will prepare the SEMP based on the following outline:

- (i) Boundaries of the site the SEMP is relevant for are defined;
- (ii) Sensitive receptors and environmental values are identified;
- (iii) Site-specific construction activities are specified;
- (iv) The risk of impacts is assessed;
- (v) Environmental management measures are assigned for the impacts that need to be mitigated as a result of risk assessment;
- (vi) SEMP prepared including the sub plans indicated in EMP;
- (vii) Environmental work plans prepared (maps, drawings, etc.).

### 9.1 Mitigation

The purpose of the Environmental Management Plan is to guide the Contractor and Engineer in the prevention and mitigation of environmental impacts related to implementation of the construction works, as well as to serve as guidance for the MTAI and other relevant authorities, including the SEI during operation and subsequent maintenance period. The Environmental Management Plan will serve as the basis for the following:

- (i) Management of the Project's potential impacts and their prevention or mitigation;
- (ii) Preparation of SEMP's by the Contractor prior to commencement of pre-construction and construction related activities; and
- (iii) Implementation of monitoring program to check compliance with the environmental legislation, regulations and environmental standards.

The Environmental Management Plan summarizes the anticipated environmental impacts. For every identified impact a corresponding mitigation measure is proposed. The mitigation measures will be more specified based on the risk assessment to be conducted during the preparation of the SEMP's. The environmental monitoring activities, the entities responsible for carrying out those activities and



the estimated costs of implementation are also included.

The SEMP's will be prepared by the Contractor based on the specificities of the construction contract and updated upon the need to be adapted to possible changing conditions. It shall be submitted to the Engineer for the review and approval. Any changes or deviations from the SEMP must first be approved by the Engineer.

- (i) According to the recommended Environmental Safeguard Clauses for Civil Works Contracts the Contractor shall undertake the following investigations and activities during the mobilization period:
- (ii) Hire a full time Environmental and Health and Safety specialist (EHSE)
- (iii) Organize environmental and safety training and orientation for workers
  1. Implement a survey of the initial condition of access roads
  2. Implement the measure on identification and protection of existing community trees that might be damaged by construction activities in accordance with SEMP;
  3. Protection and/or relocation of water mains, sewers, electricity lines and other utilities;
  4. Surveys for collection of baseline data for water quality, air quality (dust), noise and vibration, 21 days prior to commencement of works.
- (iv) Submit for approval by the Engineer 28 days prior to start the works the Site-specific Environmental Management Plan.

Beside the above mentioned Contractor will:

- (i) Provide access to the site and to facilities for the EHSE.
- (ii) Allow access to the site for any environmental monitoring and inspection at any time requested,
- (iii) Ensure the everyday implementation of the SEMP, including undertaking of regular monitoring, maintenance, reporting, etc.
- (iv) Execute upon work completion, all the work necessary to reinstate all the used areas of the site close to its original condition to the reasonably acceptable level. This will be approved by the Engineer in written certification of reinstatement.

The provisions set out in the EMP will be implemented by the Contractor EHES and monitored by the Engineer HES in assistance with TPIO ES.

The EMP provides general principles and common mitigation measures and includes the following sub-plans:

- (i) Occupational Health and Safety Plan
- (ii) Public Consultation and Communications Plan
- (iii) Flora & Fauna Protection and Vegetation Clearing Plan
- (iv) Utilities Protection and Relocation Plan
- (v) Physical and Cultural Resources Preservation Plan
- (vi) Environmental Protection Plan
- (vii) Construction Work Camps Plan
- (viii) Site Management Plan (Quarry and borrow pit, dumping sites, blasting works sites concrete batching and asphalt plants)
- (ix) Tunnels construction sites



- (x) Traffic and Access management Plan
- (xi) Emergency Response Plan
- (xii) Waste and Material Disposal Plan
- (xiii) Site Reinstatement, landscaping and Revegetation Plan

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#### 9.1.1 Occupational Health, and Safety Plan

The main purpose of this Plan is to document all the ADB and Armenian legislation requirements to the Contractor to ensure environmental and occupational safety and health protection through the Project implementation.

Contractor will charge the health & safety specialist or environmental specialist with responsibility to design and implement the orientation program on the topics detailed in EMP.

Contractor shall take all measures necessary to safeguard the health, safety and welfare of all persons entitled to be on the Site and shall ensure that the Works are carried out in a safe and efficient manner.

The implementation of the Occupational Health and Safety Plan will require the environmental, archaeological, and occupational health and safety orientation for the whole involved construction personnel. The personnel at all levels have a degree of responsibility in relation to environmental, archaeological, and occupational health and safety issues. As such, orientation for all personnel in relation to environmental issues and the implementation of the EMP aiming to raise awareness and enhance the skills of the construction workforce will be crucial to ensure the effectiveness of the EMP.

Requirements for worker to wear personal protective equipment including hard hats, safety boots, high-visibility vests, gloves, eye-glasses and ear defenders and PAH masks or equivalent, are required.

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#### 9.1.2 Public Consultation and Communications Plan

The purpose of this plan is to document all measures the Contractor is to implement to maintain the project information disclosure and the communications with the stakeholders, the project affected people, NGOs and other interested groups about the project in compliance with the ADB SPS 2009 and with the Armenian legislation.

The plan aims to raise public awareness and interest and stakeholders' involvement through dissemination of information about program including construction works' and related activities' timetable, employment opportunities and benefits of the project.

This plan is developed with the intention of maintaining the constant communication with stakeholders, members of the community where the project is located and to the general public in whole.

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#### 9.1.3 Flora & Fauna Protection and Vegetation Clearing Plan

The purpose of this plan is to document approach of the Contractor, and their workers to minimize impacts on flora and fauna and to protect areas that may contain Red Book or endangered species that might be present in the Project area.

The plan is developed to comply with ME policy and the RA Laws on Flora (23.11.2009) and Fauna (03.05.2000), as well as legislative regulations on the use of chemicals for vegetation clearing works.



Mitigation measures are presented in EMP.

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#### 9.1.4 Utilities Protection and Relocation Plan

The purpose of this sub-plan is to document the approach of the Contractor to protect or relocate identified utilities and to manage the protection or relocation of any utilities encountered during the construction works.

Utility designs will be validated by utility owner. The Utilities Protection and Relocation Plan will be implemented in accordance with Technical Specifications

Mitigation measures are presented in EMP.

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#### 9.1.5 Physical and Cultural Resources (PCR) Preservation Plan

The purpose of this plan is to document the approach of the Contractor and their workers to protect identified archaeological, historical, and cultural sites and monuments and to manage any physical cultural resources that are encountered during the construction works in accordance with Armenian legislative requirements on archaeological and cultural chance finds, as well as to protect the values which are outside but close to the road alignment.

The Project will not be built in any cultural heritage or archaeological sites designated by UNESCO.

The following accidental discovery protocol will be completed by the contractor. If any potential cultural heritage or archaeological sites are identified:

- (i) Work that might adversely affect that site shall stop immediately;
- (ii) The site shall be reported to the Engineer and TPIO, who shall ensure that this discovery is reported to MESCS;
- (iii) The area will be demarcated and MESCS will supervise investigation and carry out salvage operations.
- (iv) Such demarcated sites must be inspected to confirm no inadvertent or unreported damage. The frequency of this inspection shall be commensurate with risk and where appropriate must be undertaken without entry to the heritage site.

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#### 9.1.6 Environmental Protection Plan

The purpose of this plan is to document the approach of the Contractor and their workers in the implementation of measures to protect the soil, air and irrigation canal from the erosion and sedimentation, dust and other emissions, as well as noise and vibration as a result of the construction activities. The Plan contains mitigation measures to reduce the risk of any impacts to an acceptable level for all the used areas: construction sites, camps, haul roads, quarries, borrow pits, dump sites, etc. Particularly the following aspects are addressed:

- (i) Soil erosion and sediment control;
- (ii) Air pollution and dust control;
- (iii) Water pollution control;
- (iv) Noise & vibration control.

Soil erosion and sediment control plan prescribes the appropriate organization of works on-site to



minimize the exposed areas and to avoid soil erosion and origination of sediment-laden runoff,

Plan includes the issues related to topsoil management. Topsoil will be stripped from undisturbed natural landscapes and excavated from embankment areas and borrow sites. Topsoil will be salvaged and temporary stockpiled for further use in cut and fill slopes after completing grading operations. Top soil will be stored for site restoration.

The management measures are developed to minimize potential health and nuisance impacts and air pollution to control dust and gaseous emissions resulting from the construction activities.

The purpose of the noise & vibration control is to minimize and manage the potential impacts of increased levels of noise & vibration causing health and property risks like nuisances, hearing impairment which can impact both construction workers and the nearby leaving residents.

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#### **9.1.7 Construction Work Camps Plan**

The purpose of this Plan is to document the approach of the Contractor, and their workers in the implementation of measures to manage construction work camps that will be implemented in or near the right-of-way.

Issues associated with the design, construction, and use of the camps relate both to the potential environmental impacts of the camps, and the need to suitably plan camps to protect the environment avoid nuisances to adjoining communities and maximize worker health, safety and amenity. The main criteria/principle for the location of facilities for the Contractor's offices, housing of Contractor's personnel, storage of equipment and vehicles is to minimize soil and ground water pollution, and disturbance to nearby residents in order to avoid conflict situation with population and local/central authorities.

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#### **9.1.8 Site Management Plan (Quarry and borrow pit, dumping site, blasting works sites, concrete batching and asphalt plants)**

The purpose of this Plan is to document the approach of the Contractor, and their workers in the implementation of measures to manage the impacts of the construction activities on the quarries, borrow pits, crushing plants, haul roads etc. that may be required for the Works. The management measures in this sub-plan have been developed to minimize potential health and nuisance impacts.

Quarries and Borrow pits, as well as dumping sites recommendations provided in the design documents and will be presented to the Contractor.

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#### **9.1.9 Tunnels construction sites**

The purpose of this Plan is to document the approach of the Contractor, and their workers in the implementation of measures to manage the impacts of the construction activities in tunnels. The management measures in this sub-plan have been developed to minimize potential health and nuisance impacts.

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#### **9.1.10 Traffic and Access Management Plan**

The purpose of this Plan is to document the approach of the Contractor, and their workers in the implementation of measures to manage traffic and access on the construction site during the construction works. The traffic management and access plan will be developed by the Contractor as a part of SEMP and will be approved with police, Engineer and agreed with TPIO, MTAI.



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#### 9.1.11 Emergency Response Plan

The purpose of this Plan is to document the approach of the Contractor, and their workers for the transportation, handling, use, storage, and disposal of chemicals and in the implementation of measures in the event of spills or accidental releases of hazardous materials and any other likely incident or accidents that may rise during construction works. The implementation of the measures envisaged in the EMP will allow reducing the risk of any impacts up to an acceptable level.

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#### 9.1.12 Waste and Material Management Plan

The purpose of this Plan is to document the approach of the Contractor, and their workers in the implementation of measures for the management and disposal of wastes and spoil materials produced during construction and for the management of contaminated soil, in case the construction activities interfere with presumably contaminated soil.

The key waste management philosophy that is applied in this plan is based on the following hierarchy of waste management approaches (highest to lowest priority):

- (i) Avoid waste generation and interference with contaminated soil;
- (ii) Minimize waste generation and interference with contaminated soil;
- (iii) Reuse as much waste as practical;
- (iv) Recycle as much waste as practical; and
- (v) Dispose of any remaining waste and displaced contaminated soil in an environmentally suitable manner in locations assigned by the relevant authorities.

The management of waste, spoil materials and contaminated soil according to the aforementioned principles using proper collection, segregation, storage, disposal and education/training methods will ensure the low level of risk associated with waste generation and contaminated soil manipulation. The proposed mitigation measures are listed in EMP and could be completed by Contractor in SEMP.

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#### 9.1.13 Site Reinstatement, Landscaping, and Re-vegetation Plan

The purpose of this plan is to document an approach of the Contractor, and their workers in the implementation of site cleaning and restoration including restoration, landscaping, and re-vegetation measures as part of the construction works.

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#### 9.1.14 Post-construction phase (Operation and maintenance)

During the Defect liability period Contractor will be responsible for the environmental safeguards compliance to ADB SPS and Armenian legislation for the time period during which Contractor is implementing defect correcting works on-site. For the rest time period during the whole Defect liability period and the following operation period environmental compliance to the requirements of Armenian legislation will be ensured by MTAI.

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### 9.2 Monitoring





Monitoring within the EMP includes baseline monitoring data collection and regular environmental monitoring.

Baseline data collection for water and air quality has been implemented by Engineer during preparation of the EIA and also will be implemented or confirmed by the Contractor 21 days prior to the commencement of works. The Contractor also shall collect baseline data for noise and vibration.

Dust, water, noise and vibration monitoring plan as a component of Environmental Management Plan: monitoring will be developed by Contractor and agreed with Engineer for further regular monitoring with clear indication of location of measurement points, schedule of measurements and thresholds relevant for each measurement point for the comparative analysis. The thresholds for the further regular monitoring will be set based on baseline data and Armenian regulation standards and agreed with Engineer. The costs of baseline data survey will be included in Contractor's budget.

The regular environmental monitoring contains the planned activities that will guide the Contractor to check and/or compare the effectiveness of the mitigation measures for prevention and control of the negative impacts of the Project. It is also used for measurements and comparative analysis of different parameters whether or not the environmental standards and indicators are maintained or exceeded so immediate and appropriate action can be taken. Environmental monitoring can also point and determine the efficacy of mitigation measures to control unwanted impacts of the Project. It will be monitored by the Engineer in determining if the recommended mitigation measures are being implemented effectively. Environmental monitoring results will be documented to record the signs of adverse impacts which are detected in order to undertake the corrective actions at the earliest time practicable. Where monitoring results do not meet the environmental performance indicators, action taken will also be recorded.

Monitoring shall be implemented through the monitoring site visits of environmental specialists of all Project levels. The site visits shall be carried out in accordance with the formal monitoring schedule: Contractor- weekly, Engineer - monthly. The details of environmental monitoring tasks are described in EMP.

### 9.3 Implementation arrangement

Implementation schedule and responsible entities of implementation are provided in the EMP.

#### 9.3.1 Environmental Staffing

Environmental Specialists will be involved at Engineer and Contractor level. The capacity built to ensure compliance of project activities with ADB safeguard policy and Armenian legislation, as well as tasks and responsibilities of environmental units and specialists involved in the Project are also provided in the EMP.

#### 9.3.2 Responsibilities, roles, tasks and frequencies related to monitoring

Regarding the implementation, the supervision and the monitoring of the EMP, responsibilities, roles, tasks and frequencies are as follow:

- (i) The Contractor environmental specialist with a strong background of health and safety has the following responsibilities, roles and tasks:
  - Contractor's supervising team and environmental specialist implement the

- environmental mitigation measures and their related monitoring activities on a daily basis;
  - Environmental specialist monitors baseline data surveys as required in the Technical Specifications and the Environmental Protection Plan;
  - Environmental specialist carries on site's visits and inspections on a weekly basis;
  - Environmental specialist documents monitoring activities and results in a weekly environmental report;
  - In case of inadequate monitoring results, Environmental specialist identifies the necessary corrective actions through a Corrective Action Plan as soon as possible;
  - In cases of accidents (fire, explosion, oil spill, bitumen overflow, etc.), the Contractor must notify the Engineer immediately. Initial notification might be verbal, but must be followed by a written report within 24 hours after the incident or accident happened;
  - Environmental specialist prepares monthly environmental report as part of Contractor's monthly progress report
  - Environmental specialist carries out site visits during the defects liability period and provides a site status report.
- (ii) The Engineer environmental specialist with a strong background of health and safety has the following responsibilities, roles and tasks:
- Supervise, inspect and coordinate, on a daily, weekly and monthly basis, the tasks of the environmental specialist of the Contractor and the Contractor's construction activities;
  - Inspect sites that the Contractor are intending to use for construction camp (s), facilities, storage, parking, waste dumping, health and safety etc. prior the start of operation, prepares the reports on the findings of inspection and submits to the Engineer for approval, as soon as this information is available;
  - Review Corrective Action Plans provided by the Contractor;
  - Inspect and supervise the implementation of corrective actions by the contractor to ensure their effectiveness soon after their implementation;
  - Monitor the effectiveness of the corrective actions;
  - Review the Contractor's weekly monitoring reports to check on proper the data and information of the environmental monitoring activities;
  - Review and approve the documents submitted by Contractor based on consultation with TPIO, updated EMP, report outlines and templates, etc.;
  - handling the complaints of GRM
  - Reviews Contractors site status report during the defects liability period;
  - Prepare a monthly progress report based on contractor monthly progress report, including environmental safeguards and monitoring implementation;
  - Prepare quarterly reports as well as completion report for submission to the TPIO.
- (iii) The Environmental and Mining Inspectorate (EMI) have the authority to inspect the Project's compliance with the environmental protection principles and relevant regulations in accordance with Armenian environmental legislation.



### 9.3.3 Awareness raising and environmental training

The Contractor shall be responsible to arrange general orientation session about project activities and environmental awareness. This session shall focus on the responsibilities for all people/workers working on site about the protection of the environment and the safe handling of social issues during construction period in accordance with ADB SPS (2009), Armenian environmental legislation and EIA and EMP.

A training need assessment will be identified for proper delivery of EMP at field level. Session shall include but not limited to: minimizing waste at source, respecting and protecting wildlife at site, proper handling of the waste, workers' safety measures during work and emergency preparedness in case of incidents, etc. A separate session for nearby impacted communities shall also be arranged to inform on the GRM and to protect people from any incidents during construction period. A special session for truck and machinery drivers shall also be included.

### 9.4 Costs and sources of funding

A specific pay item will be included within the Bill of Quantities to account for the cost for environmental protection estimated at 2% cost of the works. In addition, the environmental related costs (supervision, surveys, trainings, communication with public, reporting) will be foreseen also in the Engineer budgets in the scope of request for proposal.

The costs for the EMP and its related sub-plans form part of the direct costs for implementing the Project. Thus, costs are estimated by the Contractor as marginal costs of the three general phases of the Project: pre-construction, construction & post-construction operation. Indicative costs are presented in EMP. The summary table of the costs is presented below:

**Table 9.1 – Preliminary estimated costs and sources of funding of EMP (subject to revision)**

| Type of activities                                                                                                                | Costs US\$ | Sources of findings                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Implementing and monitoring of the environmental mitigation measures<br>(2 % cost of the works plus cost of utilities relocation) | 15 000 000 | <b><u>Contractor</u></b><br><u>15 000 000 US\$ Included in total construction cost</u><br><b><u>Engineer</u></b><br>Remuneration (2 times per week * 4 weeks * 24 months)<br>Surveys are also included in the budget |
| Strengthening the administration of the EMP                                                                                       | 300 000    | <b><u>Contractor</u></b><br><u>150 000 \$ Included in total construction cost</u><br><b><u>Engineer</u></b><br><u>150 000 \$ included in budget</u>                                                                  |
| Raising the awareness of the                                                                                                      | 15 750     | <b><u>Contractor</u></b>                                                                                                                                                                                             |



| Type of activities        | Costs US\$ | Sources of findings                 |
|---------------------------|------------|-------------------------------------|
| Project staff and workers |            | Included in total construction cost |
| Total US\$                | 15,315,750 |                                     |

## 9.5 Reporting

The environmental safeguards compliance of the Project shall be regularly reported on all project implementation levels: Contractor, Engineer, TPIO / MTAI and ADB.

The following environmental reports shall be submitted by the Contractor to the Engineer:

- (i) Weekly Environmental Reports. – The results and findings from the environmental monitoring activities will be documented in specially developed by Contractor and approved by Engineer monitoring check list. The weekly monitoring report shall include the environmental performance indicator and assessment of the effectiveness of the mitigation measures.
- (ii) Monthly Progress Report- summary environmental report shall be submitted as part of the Contractor's Monthly Progress Report. Monthly reports shall be analytical and provide explanations for anomalies, non-compliance and problems encountered.

The Reports shall comprehensively include all relevant aspects in implementing the mitigation measures of the EMP and SEMP (e.g., what type of mitigation, purpose and object(s), site/location, materials and activities involved, others specify) compliance to any environmental regulations and requirements such as training/orientation, permits, license, etc. undertaken during the period covered by the report. The outline of the reports will be agreed with the Engineer and TPIO and will contain the following parameters to be monitored:

- (i) Work sites;
- (ii) Work Site safety – Site workers and surrounding communities;
- (iii) Material and Waste management and disposal; including hazardous waste;
- (iv) Contractor's facilities and equipment;
- (v) Quarries, borrow pits and excavated material dumping sites;
- (vi) Concrete batching plants; and
- (vii) Public communication and grievances.

In cases of accidents, (fire, explosion, oil spill and bitumen overflow, etc.), the Contractor must notify the Engineer immediately. Initial notification may be verbal and shall be followed by a written report within 24 hours when the incident or accident happened.

The Engineer submits to TPIO monthly monitoring reports on environmental safeguards as part of the Monthly Progress report and quarterly reports. TPIO will submit bi-annual environmental safeguards report to ADB. The bi-annual reports shall be disclosed on the TPIO and ADB websites.



## 10 CONCLUSIONS AND RECOMMENDATIONS

### 10.6 Conclusions

Based on the indication of the Rapid Environmental Assessment in Annex 1 and the findings of the EIA, the classification of the project as Category “A” is confirmed, and detailed EIA will be needed to comply with the environmental policies of the ADB. At the same time according to Armenian EIA legislation the EIA procedure and expertise is required for this project. The potential negative impacts (such as nuisances from dust, noise, traffic and access changes, which are likely to be experienced by nearby communities, the impact on Flora and Fauna are associated with the location and the construction works will be temporary and can be minimized by following the site-specific environmental management plan, providing adequate supervision and ensuring the timely implementation of the mitigating measures outlined in the EMP.

Key benefits of this project include economic benefits.

### 10.7 Recommendations

The construction contractor will consider the present EIA and EMP as part of the Contract.

The Contractor shall prepare the Site-specific Environmental Management Plans (SEMP) with detailed operating environmental management and monitoring measures during the mobilization period, prior to the start of construction works, during the entire length of the construction activities and during the defects liability period based on the EMP and submit for approval by the Engineer.

The Engineer shall monitor and supervise the implementation of mitigation measures by the Contractor as specified in the EMP and issue non-compliance notice if they are not properly implemented in a timely manner. The Engineer may stop all relevant works (at the Contractor's cost) until the requirements of the EIA and EMP have been fulfilled and rectified to the Engineer's satisfaction.

The compliance of construction activities to the ADB safeguards and to Armenian legislation shall be checked through regular monitoring carried out by the Contractor, Engineer and TPIO.

The Contractor's environmental specialist together with Engineer's environmental specialist will survey the location of trees from not-acquired lands and shrubs most likely to be damaged by the construction activities and propose methods to prevent their lost. All trees and shrubs that can be avoided by construction activities but are close to work sites should be protected. All other trees and shrubs that cannot be preserved will be replanted at a 6:1 ratio. The planting of those trees and shrubs for replacement will be performed in locations with suitable soil conditions. Local species will be used. The newly planted trees should be maintained for 3 years until they become viable by the Contractor.

Contractor shall accept the results of the surveys and investigations (tree identification and counting, environmental baseline data, utilities) of the present EIA and EMP. Contractor will perform a baseline data collection for Air Quality, Water Quality, Noise & Vibration, 21 days prior to the commencement date of construction works if the time between this EIA and construction work is too long or the situation has been changed drastically.



## 11 ANNEXESS

## Annex 1: Rapid Environmental Assessment (REA) Checklist

**Instructions:**

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES), for endorsement by Director, RSES and for approval by the Chief Compliance Officer.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title:

Armenia / **Tranche 4 North South Road Corridor Investment Project**

Sector Division:

CWTC

| Screening Questions                                                                                                  | Yes                                 | No                                  | Remarks                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A. Project Siting<br>Is the project area adjacent to or within any of the following environmentally sensitive areas? |                                     |                                     |                                                                                                                                                                                                                                                                                                  |
| ▪ Cultural heritage site                                                                                             | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | The initial investigation revealed several archaeological sites near the project alignment. Archaeological sites will be investigated and measures for maximization for their protection will be recommended.                                                                                    |
| ▪ Protected Area                                                                                                     | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | About 100 m of the project alignment is passing through the Zangezur sanctuary. Detailed investigation survey should be implemented to assess the possibility of redesign of the mentioned section. Other ways appropriate mitigation measures should be developed to reduce the project impact. |
| ▪ Wetland                                                                                                            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | Non identified. All remote from alignment.                                                                                                                                                                                                                                                       |
| ▪ Mangrove                                                                                                           | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | N/a                                                                                                                                                                                                                                                                                              |
| ▪ Estuarine                                                                                                          | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | N/a                                                                                                                                                                                                                                                                                              |





| Screening Questions                                                                                                                                                        | Yes                                 | No                                  | Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ▪ Buffer zone of protected area                                                                                                                                            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | N/a                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| ▪ Special area for protecting biodiversity                                                                                                                                 | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | Non identified                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| C. Potential Environmental Impacts<br>Will the Project cause...                                                                                                            |                                     |                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| ▪ encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?                                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | The project encroaches on several archaeological sites. This project will include measures satisfactory to the Ministry of Education, Science, Culture and Sport, to adequately explore the sites and close them. This measures will be described in the IEE/EIA and specified in the EMP.                                                                                                                                                                       |
| ▪ encroachment on precious ecology (e.g. sensitive or protected areas)?                                                                                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | About 100 m of the project alignment encroaches to the Zangezur sanctuary. This project will include measures satisfactory to the Ministry of Environment and according to ADB requirements. Mitigation measures will be described in the EIA and specified in the EMP.                                                                                                                                                                                          |
| ▪ alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site? | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | 27 new bridges are envisaged under the project , 3 of which are passing above 3 rivers. Mitigation measures will be described in the EIA and specified in the EMP.                                                                                                                                                                                                                                                                                               |
| ▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?                                | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | Potential for impact if camps are not adequately managed.<br><br>Mitigation measures will be described in the EIA and specified in the EMP.                                                                                                                                                                                                                                                                                                                      |
| ▪ increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?                                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | (iv) Cutting back of unstable slopes will require rock breaking and drilling to fix rockfall protection elements.<br>(v) construction of tunnels will require rock drilling and rock breaking with potential dust impacts but those sections are remote from sensitive receivers.<br>(vi) Operation of rock crushing and asphalt plan has potential for localized dust impact.<br><br>Mitigation measures will be described in the EIA and specified in the EMP. |



| Screening Questions                                                                                                                                                                                                                                 | Yes                                 | No                                  | Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?</li> </ul>                    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <p>(iii) During construction potential for adverse impact due to the construction process (air / noise) on workers and any adjacent sensitive receivers.</p> <p>(iv) During operation potential impact from road operations with increased traffic volume and speed, though it is noted that the improvement of the running surface and vertical and horizontal alignment will assist in reducing emissions and reduce potential for road traffic accidents. Mitigation measures will be described in the EIA and specified in the EMP.</p> |
| <ul style="list-style-type: none"> <li>noise and vibration due to blasting and other civil works?</li> </ul>                                                                                                                                        | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <p>(iv) Construction of the tunnels and road will require rock drilling and blasting.</p> <p>(v) Cutting back of existing steep rock faces and installing slope protection features has potential for adverse impact but these areas are remote from sensitive uses.</p> <p>(vi) Only in 3 sections there are several dwelling houses. Civil works will generate impacts to the residential areas but the impacts will be minimized through EMP</p>                                                                                         |
| <ul style="list-style-type: none"> <li>dislocation or involuntary resettlement of people?</li> </ul>                                                                                                                                                | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | Refer to land acquisition and resettlement plan (LARP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <ul style="list-style-type: none"> <li>dislocation and compulsory resettlement of people living in right-of-way?</li> </ul>                                                                                                                         | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | No change from existing situation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <ul style="list-style-type: none"> <li>disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?</li> </ul>                                                                                          | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | No impact anticipated                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <ul style="list-style-type: none"> <li>other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?</li> </ul>                                       | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | None identified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <ul style="list-style-type: none"> <li>hazardous driving conditions where construction interferes with pre-existing roads?</li> </ul>                                                                                                               | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | The new alignment is not interferes with existing road                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <ul style="list-style-type: none"> <li>poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI's and HIV/AIDS) from workers to local populations?</li> </ul> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <p>Potential for impact if camps are not adequately managed and worker education initiated.</p> <p>Mitigation measures will be described in the EIA and specified in the EMP.</p>                                                                                                                                                                                                                                                                                                                                                           |



| Screening Questions                                                                                                                                                                                                                        | Yes                                 | No                                  | Remarks                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?</li> </ul>                                                                                | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | Historic issue. Armenia attained malaria free status in 2011 <sup>2</sup> . Addressed in Site Management Plan.                                                                                                                                                                                                                                                                     |
| <ul style="list-style-type: none"> <li>accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials?</li> </ul>                                                                             | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | New constructed roads are expected to result in increased traffic volumes, better alignment, surfacing, and signage, together with more efficient and better maintained vehicles are expected to result in overall decrease of accidents                                                                                                                                           |
| <ul style="list-style-type: none"> <li>increased noise and air pollution resulting from traffic volume?</li> </ul>                                                                                                                         | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | (iii) During construction there will be increased vehicle movements due to construction traffic.<br>(iv) During operation: New constructed roads are expected to result in increased traffic volumes, better alignment, surfacing, and signage, together with more efficient and better maintained vehicles are expected to result in overall decrease of noise and air pollution. |
| <ul style="list-style-type: none"> <li>increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?</li> </ul>                                                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | (iii) During construction potential for adverse impact from construction operations i.e. spills.<br>(iv) During operation, new constructed roads are expected to result in increased traffic volumes, better alignment, surfacing, and signage, together with more efficient and better maintained vehicles are expected to result in overall decrease of accidental spills.       |
| <ul style="list-style-type: none"> <li>social conflicts if workers from other regions or countries are hired?</li> </ul>                                                                                                                   | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | Opportunity for local employment, commercial opportunity can stimulate local economy and ease tensions.                                                                                                                                                                                                                                                                            |
| <ul style="list-style-type: none"> <li>large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?</li> </ul>      | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | Construction camps and working sites on the alignment to be self-contained in terms of provision of water and disposal of solid and liquid wastes                                                                                                                                                                                                                                  |
| <ul style="list-style-type: none"> <li>risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?</li> </ul> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | Potential for adverse impact during construction due to storage, transport and use of construction materials. Mitigation through good site management will be described in the EIA and specified in the EMP.                                                                                                                                                                       |

<sup>2</sup> <http://www.euro.who.int/en/health-topics/communicable-diseases/vector-borne-and-parasitic-diseases/malaria/country-work/armenia>



| Screening Questions                                                                                                                                                                                                                                                                                                                                                        | Yes                                 | No                       | Remarks                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.</li></ul> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <p>(iii) During construction contractor to ensure that sites are secure and communities are separated from construction activity. Most of the alignment is remote from communities.</p> <p>(iv) During operation the design will improve several local communities road safety by giving them access to the new road with appropriate street furniture i.e. signage, central reserves, verges.</p> |

**Annex 2: Environmental Management Plan of Tranche 4 - 60 km Sisian to Kajaran Road Section**

1. The Environmental Management Plan (EMP) provides the set of mitigation and monitoring measures to be undertaken during project implementation in order to avoid, reduce or mitigate the adverse environmental impacts. It presents the identified potential impacts and their locations and occurrences, proposed mitigation measures, the entities responsible for mitigation and their monitoring activities including the estimated costs.

2. The EMP describes how the mitigation and other measures to enhance the benefits of environmental protection will be implemented and monitored. It explains how the measures will be set up and managed, who will be responsible to implement them, when and where they will be implemented and by whom monitored. The following elements are described in the EMP:

- (i) Project Activities addressed in the EMP;
- (ii) Potential environmental impacts (including impacts on archeological resources);
- (iii) Mitigation measures during pre-construction, construction and operation phases of this Project;
- (iv) Monitoring activities during pre-construction, construction and operation phases of this Project;
- (v) Responsibilities of various entities in the implementation of mitigation and monitoring measures; and
- (vi) Indicative costs of environmental management and mitigation.



**Table 1: Environmental Management Plan: Mitigation**  
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                                                                                                                                                                                                                                              | Potential Environmental Impacts                                                                                                                                                                                                     | Proposed Mitigation Measures                                                                                                                                                                                                 | Responsible Entities                                                                                                                                                                                                                                       | Indicative cost of mitigation (US\$)                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| <b>PRE-CONSTRUCTION PHASE</b>                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                     |                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                            |                                                                               |
| <p>1. Baseline monitoring surveys (Air quality, Water quality, Noise &amp; Vibration),</p> <p>Impacts on and mitigation measures for Flora, Fauna, and archaeological, historical and cultural monuments.</p> <p>Public utilities protection and relocation</p> | <p>Missing baseline information for monitoring during construction phase</p> <p>Impacts on Flora, Fauna, and archaeological, historical and cultural monuments.</p> <p>Interruptions of services due to relocation of utilities</p> | <p>1. Development of the EMP to reflect baseline monitoring surveys information, detail design and incorporate in tender and contract documents</p> <p>2. Include specific requirement in tender and contract documents:</p> | <p><b><u>Design Consultant</u></b></p> <p>Develop EMP and include appropriate clauses in tender and contract documents</p> <p><b><u>TPIO</u></b> Evaluate the bid and award contract documents</p> <p><b><u>ADB</u></b></p> <p>No objection of the EMP</p> | <p>Costs of these activities are included in the Design Consultant budget</p> |



**Table 1: Environmental Management Plan: Mitigation****Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                              | Potential Environmental Impacts                                                                                                                                         | Proposed Mitigation Measures                                                                                                                                                               | Responsible Entities                                                                                                                                                                                                                                                                     | Indicative cost of mitigation (US\$)               |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| 2. Preparation of tender and contract documents | EMP requirements are not taken into consideration in the detailed design leading to adverse environmental impacts during both construction and operation of the Project | 1. Develop Technical Specifications based on mitigation measures defined in the EMP and incorporate environmental clauses into Particular conditions of the tender and contract documents. | <b><u>Design Consultant</u></b><br>Develop Technical specifications and update the tender and contract documents to include appropriate environmental clauses<br><b><u>TPIO</u></b> Review tender and contract documents<br><b><u>ADB</u></b><br>Be informed on results of TPIO's review | Costs are included in the Design Consultant budget |


**Table 1: Environmental Management Plan: Mitigation**
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                        | Potential Environmental Impacts                                                                                      | Proposed Mitigation Measures                                                                                                                                                                                                                              | Responsible Entities                                                                                                                                                                                                                                                                                          | Indicative cost of mitigation (US\$)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CONSTRUCTION PHASE</b>                 |                                                                                                                      |                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 3. Orientation and environmental training | Contractor's non-compliance to the EMP leading to insufficient environmental controls and environmental degradation, | <p>1. Contractor hires Environment and Health &amp; Safety Specialist(s) to manage environmental issues and mitigation.</p> <p>2. Provide training to all staff on Environment and Health &amp; Safety</p> <p>(See sub-plans below for more details).</p> | <p><b><u>Contractor</u></b><br/>Provide specialist (s) and train staff</p> <p><b><u>Engineer</u></b><br/>Provide specialist (s) and train staff</p> <p>Monitor the Contractor, construction workers, environmental parameters and reports to TPIO</p> <p><b><u>TPIO</u></b> Issues non-compliance notices</p> | <p><b><u>Contractor</u></b><br/>Cost of 1 HSE Specialists available full-time during the 60 months construction period is estimated at:<br/><b>US\$ 150 000</b></p> <p><b><u>Engineer</u></b> Cost of 1 HSE Specialist available full-time during the 60 months construction period is estimated at:<br/><b>US\$ 150 000</b></p> <p>Cost of 1 day induction training program on Health, Safety and Environment for 300 construction workers at US\$ 50 per day plus the fees of 10 days of a trainer at US\$ 75 per day, is estimated at:<br/><b>US\$ 15 750</b></p> <p><b><u>Engineer</u></b> cost of 1 training session on Health, Safety and Environment at US\$ 500 per session, 15 training sessions during 60 months, is estimated at:<br/><b>US\$ 7 500</b></p> |
| 4. All site construction                  | Environmental degradation,                                                                                           | Prepare and submit, within mobilization period, a SEMP including the following environmental management sub-plans:                                                                                                                                        | <b><u>Contractor</u></b>                                                                                                                                                                                                                                                                                      | Costs of those plans are accounted for each of the Construction Plans detailed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |


**Table 1: Environmental Management Plan: Mitigation**
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                                                                                | Potential Environmental Impacts                                                                                            | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Responsible Entities                                                                                                                                                                         | Indicative cost of mitigation (US\$)                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| activities<br>(including activities in Right of way, Borrow pits, Dump sites, Construction camps) | Nuisance from dust, air pollution noise & vibration<br><br>Safety and health hazards to workers and community residents    | <ol style="list-style-type: none"> <li>Occupational Health and Safety Plan</li> <li>Public Consultation and Communications Plan</li> <li>Flora &amp; Fauna Protection and Vegetation Clearing Plan</li> <li>Utilities Protection and Relocation Plan</li> <li>Physical and Cultural Resources Preservation Plan</li> <li>Environmental Protection Plan</li> <li>Construction Work Camps Plan</li> <li>Site Management Plan (Quarry and borrow pit, dumping sites, blasting works sites concrete batching and asphalt plants)</li> <li>Tunnels construction sites</li> <li>Traffic and Access management Plan</li> <li>Emergency Response Plan</li> <li>Waste and Material disposal Plan</li> <li>Site Reinstatement, landscaping and Revegetation Plan</li> </ol> <p>i) The sub-plans should be based on the EIA report, bid and contract documents, best international environmental management practices, and as briefly outlined below.</p> | <p>Prepare and implement<br/><b>Engineer</b></p> <p>Review, approve and monitor implementation</p> <p><b>TPIO</b> Supervise the Contractor and the Engineer</p>                              | below.                                                                                                                                                                                                                                     |
|                                                                                                   |                                                                                                                            | <b>1. Occupational Health, and Safety Plan</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                              |                                                                                                                                                                                                                                            |
| 5. All site activities                                                                            | Lack of information on EMP and applicable environmental regulations for the Project may lead to environmental degradations | <ol style="list-style-type: none"> <li>Occupational Health &amp; Safety orientation trainings on the following topics: <ul style="list-style-type: none"> <li>General rules and regulations to be followed on the construction site and camps</li> <li>Construction activity-specific rules and regulations including working on bridges, in tunnels, working with electrical tools, digging</li> </ul> </li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p><b>Contractor</b></p> <p>Implement the Plan and Prepare the orientation program</p> <p><b>Engineer</b></p> <p>Review and approve Plan developed by the Contractor. Assist and monitor</p> | <p>Cost of developing, implementing and managing this plan by the Contractor's HSE specialist is already included in point 3 above.</p> <p>Cost of PPEs for 300 workers at US\$ 250 per worker is estimated at:<br/><b>US\$ 75 000</b></p> |

**Table 1: Environmental Management Plan: Mitigation****Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities | Potential Environmental Impacts                                                                                                                                           | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Responsible Entities                                                                               | Indicative cost of mitigation (US\$)                                                                                |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
|                    | Sickness, injury, or death of workers, road users and other people near the site caused by exposure to hazardous substances; slips, trips and falls; and falling objects. | <p>pits, etc.</p> <ul style="list-style-type: none"><li>• General health and safety awareness program for educating construction workers on sexually transmitted diseases and HIV/AIDS.</li><li>• Illegal trafficking: workers should be made aware that trafficking of humans, wildlife, endangered species, and illegal substances through the road corridor will not be tolerated and be advised of a progressive penalty scheme up to and including dismissal.</li></ul> <p>2. Take all reasonable precautions (tape fencing, guard points, etc.) to prevent unauthorized entry to the Site</p> <p><b>Blasting.</b> Training should include a module on the safety aspects of blasting (if blasting is contemplated). Topics should include:</p> <ol style="list-style-type: none"><li>a. public meetings to introduce the concept of blasting,</li><li>b. signs posted that contain times of blasting,</li><li>c. alarms prior to blasting,</li><li>d. the use of blasting mattresses, and</li><li>e. proper handling and storage of explosives</li></ol> <p>3. Exclude unsafe working practices and unsafe tools from the construction-site.</p> | <p>implementation. Review incident logs</p> <p><b>TPIO</b> Review plan and assist the Engineer</p> | Information on health risks and illegal trafficking is included in the training session accounted in point 3 above. |



**Table 1: Environmental Management Plan: Mitigation**

**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                                      | Potential Environmental Impacts                                                                                                             | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Responsible Entities                                                                                                                                                                                                      | Indicative cost of mitigation (US\$)                                                                                              |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
|                                                         |                                                                                                                                             | <p>4. Fire-extinguisher is available and easily accessible in all operating machinery and in all sections of the construction site.</p> <p>5. Regular medical check-ups of worker's health; Contractor may hire or contract required medical professionals</p> <p>6. Available and easily accessible first aid kits in all operating machinery and in all sections of the construction site</p> <p>7. Season- fit uniform and other PPE provided to workers and other staff. Incentive measures and penalties to enforce the use of PPE.</p> <p>8. Health &amp; safety incidents to be recorded and reported to the Supervision Engineer and to relevant authorities when needed.</p> |                                                                                                                                                                                                                           |                                                                                                                                   |
|                                                         |                                                                                                                                             | <b>2. Public Consultation and Communications Plan</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                           |                                                                                                                                   |
| 6. Public consultation, awareness raising and grievance | Lack of information and understanding by communities and affected parties about the planned works activities and schedule of implementation | <p>1. Develop an application form for public complains and suggestions and receive <b>Engineer</b> approval.</p> <p>2. Install posters or project informational boards with relevant information for the Public: field office location, operating hours, names of responsible contact persons, "hot line" phone numbers, postal address and email addresses, etc.</p>                                                                                                                                                                                                                                                                                                                 | <p><b>Contractor</b></p> <p>Prepare and implement the plan</p> <p>The HSE specialist hired by the Contractor implements awareness and grievance redress program of the Plan</p> <p><b>Engineer</b> Review and approve</p> | Cost of developing, implementing and managing this plan by the Contractor's HSE specialist is already accounted in point 3 above. |


**Table 1: Environmental Management Plan: Mitigation**
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                         | Potential Environmental Impacts                                                               | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Responsible Entities                                                                                                                 | Indicative cost of mitigation (US\$)                                                                                                                                                  |
|--------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                            | can lead to frustration and complaints, which in turn could result in delays for the Project. | <p>3. Keep a grievance register book available at the field office or in any other easily accessible location for affected people.</p> <p>4. Maintain a register of complaints (name, description of the problem, incoming date, response date, further follow-up action and resolution status).</p> <p>5. Allocate personal responsible for dealing with issues raised by the Public and APs.</p> <p>6. Organize regular meetings with community members to discuss newly arisen issues if any.</p> <p>7. Make sure that mechanism of prompt forwarding complains and suggestions to <b>Engineer</b> are in place. The Grievance Redress Mechanism is described in detail in section 8 of the EIA report.</p> | <p>Plan developed by the Contractor. Monitor the implementation</p> <p><b>TPIO</b> Supervise the <b>Engineer</b></p>                 |                                                                                                                                                                                       |
|                                            |                                                                                               | <b>3. Flora &amp; Fauna Protection and Vegetation Clearing Plan</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                      |                                                                                                                                                                                       |
| 7. Earthworks and other construction works | Disturbance and degradation of flora and fauna habitat, especially Red Book species           | 1. Undertake a survey to identify all trees and shrubs which are located close to construction site and could be damaged by construction works;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p><b>Contractor</b></p> <p>Prepare and implement the plan</p> <p>Hire a local Fauna and Flora Biodiversity specialist to assess</p> | <p>Cost of developing, implementing and managing this plan by the Contractor's HSE specialist is already accounted in point 3 above.</p> <p>Cost of hiring during 10 days a local</p> |



**Table 1: Environmental Management Plan: Mitigation**

**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities | Potential Environmental Impacts                              | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Responsible Entities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Indicative cost of mitigation (US\$)                                                        |
|--------------------|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
|                    | Clearing of vegetation at times detrimental to fauna habitat | <p>2. Put in place measures to protect trees and shrubs that may be affected (marking them for being easily recognizable for workers; regulation of traffic movement, waste disposal, etc.)</p> <p>3. Notify the <b>Engineer</b> and relevant organizations and obtain approvals prior to start right-of-way clearing (Trees and shrubs cutting)</p> <p>4. Strictly perform vegetation cutting and clearing works in accordance with Technical Specification Section 401 - Clearing and Grubbing and Section 1003 – Trees and shrubs</p> <p>5. Stop the works in the area where unknown species are encountered and clarify whether these are Red book listed, rare or endangered species</p> <p>6. To include posters in work camps that illustrates the Red Book species likely to be found in various areas of the project</p> <p>7. Develop a progressive penalty plan to discourage the hunting and consuming of wildlife.</p> <p>8. Inform the <b>Engineer</b> environmental specialist for future actions in case rare species are discovered</p> | <p>the occurrence of Red Book species in the project area and provide recommendations to minimize the impact for the protection of those species and monitor the results of those recommendations. Specialist will design the tree planting or replacement after collaboration with authorities of forests through which the road will pass.</p> <p><b>Engineer</b> Review and approve Plan developed by the Contractor and monitor the implementation</p> <p>Report results monthly<br/><b>TPIO</b> Supervise the Engineer</p> | <p>Fauna and Flora specialist at US\$ 75 per day, is estimated at:<br/><b>US\$ 3000</b></p> |



**Table 1: Environmental Management Plan: Mitigation****Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities | Potential Environmental Impacts | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Responsible Entities | Indicative cost of mitigation (US\$) |
|--------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------|
|                    |                                 | <p>9. Inform the Engineer in case of an injured animal is found.</p> <p>10. Undertake the vegetation removal and site clearing preferably during late autumn and/or winter.</p> <p>11. A register of cut trees and shrubs is created and kept available for review.</p> <p>12. For vegetation clearance purposes use only the pesticides that are not listed in the Government decree N293 of 17 March 2005 and exclude the use of POP containing chemicals.</p> <p>13. Ensure that workers are using PPE when using pesticides or other vegetation clearing chemicals.</p> <p>14. Transport cut vegetation to approved waste dump within 2 days.</p> <p>15. Temporarily heap cut vegetation in designated location within the Project right-of-way before transportation to waste dump.</p> <p>16. Cut vegetation shall not be burned.</p> <p>3. For protection of fauna the following actions should be undertaken:</p> <p><b>Invertebrates:</b> the future status of the invertebrate's fauna biodiversity there is need for further implement of</p> |                      |                                      |

**Table 1: Environmental Management Plan: Mitigation****Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities | Potential Environmental Impacts | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Responsible Entities | Indicative cost of mitigation (US\$) |
|--------------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------|
|                    |                                 | <p>the continuous monitoring.</p> <p><b>Amphibians and reptiles:</b></p> <ul style="list-style-type: none"><li>• During the construction where a big number of species are gathered specialist should gather the individuals and release them in more suitable and safe territories. The gathering of species must be carried out before the launch of heavy construction machinery.</li><li>• Provide some parts of the road (the exact places must be clarified) underground passageways and fences.</li></ul> <p><b>Birds:</b></p> <ul style="list-style-type: none"><li>• During the construction work on the migration routes of animals, where appropriate, should be arranged fencing usually equipped with deterrent devices (reflectors, warning lights, horns, etc.).</li><li>• In developing the calendar of construction plans should be taken into account the need for the suspension of work, causing intense physical impacts (noise, vibration, explosion's, light effects, etc.) in certain periods of the environmental authorities lives of animals such as the current period, breeding, hatching, etc. (If necessary, consult with experts). For this reason in forested territory clearance should be carried out, usually in winter.</li></ul> |                      |                                      |

**Table 1: Environmental Management Plan: Mitigation****Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities | Potential Environmental Impacts | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Responsible Entities | Indicative cost of mitigation (US\$) |
|--------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------|
|                    |                                 | <ul style="list-style-type: none"><li>It is necessary to register the case, when during the construction inhabited nesting sites will be found (masonry or chicks), make the transfer of nests with the obligatory prior consultation and participation of experts.</li></ul> <p><b>Mammals:</b></p> <ul style="list-style-type: none"><li>During reconstructions the specialist should take out the animals.</li><li>Provide passages for small mammals along the highway (Sisan - Darbas, Darbas - Shenatagh, Kitsq - Geghi) for giving them a chance to pass the road safely.</li><li>The highway should be protected with a wall for avoiding the entrance of animals to the road.</li></ul> <p>Special mitigation measures like Green bridges, large overpasses and etc should be provided in Kitsq - Geghi section, because of rich diversity of endangered large mammals lives there. For that propose a detailed research in the area to clarify exact pathway of Armenian Mouflons and Bezoar goats should be conducted prior to construction works.</p> |                      |                                      |
|                    |                                 | <b>4. Utilities Protection and Relocation Plan</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                      |                                      |


**Table 1: Environmental Management Plan: Mitigation**
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                                                | Potential Environmental Impacts                                      | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Responsible Entities                                                                                                                                                                                                                                                                                                                                                                                                     | Indicative cost of mitigation (US\$)                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8. Utilities protection and relocation                            | Disruption of services provided by utilities causes impact on APs    | <ol style="list-style-type: none"> <li>1. Implement the protection and relocation of utilities in accordance with Technical Specifications, Section 1200: Relocation of Utilities</li> <li>2. Identify with utility owner the exact location of services and if necessary, carry out trial pits.</li> <li>3. Schedule and implement the works to minimize the temporary disturbance of services</li> <li>4. Notify the potentially APs prior to the start of works that disturbance to services may occur.</li> <li>5. Protect or relocate utilities discovered during construction works that were not identified during the Design stage. Relocation expenses will be paid by the Contractor.</li> <li>6. Contractor shall restore or compensate all the costs should the undiscovered utilities be found or the existing ones damaged during construction works.</li> </ol> | <p><b><u>Contractor</u></b></p> <p>Survey utilities and prepare plan prior to construction</p> <p>Liaise with local representatives, and service providers</p> <p>Hire approved contractors</p> <p><b><u>Engineer</u></b> Review and approve Plan developed by the Contractor.</p> <p>Assist with liaison with local representatives and service providers</p> <p><b><u>TPIO</u></b> Monitor the Engineer and review</p> | <p>Cost of protecting and relocating utilities cannot be strictly accounted as environmental mitigation measures. But for information purposes, the evaluated costs of construction activities related to utilities is estimated at:</p> <p><b>US\$ 2 200 000 (incl. VAT)</b></p> |
|                                                                   |                                                                      | <b>5. Physical and Cultural Resources (PCR) Preservation Plan</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                   |
| 9. Road, Tunnels and bridges construction activities at immediate | Damage to archaeological, historical, cultural and natural monuments | 1. Restrict construction works activities to the road right-of-way by fencing in the vicinity of the Monuments, ban any constructions activities, material deposit or vehicles parking outside of designated construction areas.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p><b><u>Contractor</u></b></p> <p>Engage archaeologist to organize and monitor excavations, prepare and implement chance find</p>                                                                                                                                                                                                                                                                                       | <p><b><u>Contractor</u></b></p> <p>Included in total construction cost, estimated to be maximum 2%.</p> <p><b><u>ADB</u></b></p>                                                                                                                                                  |

**Table 1: Environmental Management Plan: Mitigation****Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                                          | Potential Environmental Impacts | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Responsible Entities                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Indicative cost of mitigation (US\$)                       |
|-------------------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| vicinities of archeological or historical site of Monuments |                                 | <p>3. Ban dumping and disposal of waste, garbage and construction debris in the Monuments site.</p> <p>4. During construction, secure the site outside of the construction area from heavy equipment and construction materials.</p> <p>5. Prohibit the use of soil from the archaeological site for construction needs.</p> <p>6. Prepare archaeological excavation work plan (AEWP) for identified archaeological sites.</p> <p>7. Implement archaeological excavations according to AWP prior to road construction.</p> <p>8. In the event of archaeological fortuitous find, the Contractor follow the hereunder procedure:</p> <ul style="list-style-type: none"> <li>• stop works immediately;</li> <li>• notify the Engineer, TPIO;</li> <li>• isolate the site;</li> <li>• document and photograph the find and the area immediately around it;</li> <li>• inform the MESCS's and hire an experienced and qualified archaeologist to determine whether and how the chance-find should be preserved;</li> <li>• when advised and as directed by TPIO, the</li> </ul> | <p>procedure</p> <p>Wait end of detailed Archeological Investigation and MESCS final approval before beginning construction activities.</p> <p><b><u>Engineer</u></b></p> <p>Prepare AEWP</p> <p>Modify road design to integrate recommendations of detail Archeological Investigation if any.</p> <p>Review recommendations and monitor implementation.</p> <p>Assist with liaison with local representatives and service providers</p> <p><b><u>TPIO</u></b> Monitor the Engineer and review</p> | Included in the corporate environmental due diligence cost |


**Table 1: Environmental Management Plan: Mitigation**
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                                                                                                                               | Potential Environmental Impacts                                                                                                                             | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Responsible Entities                                                                                                                                                                                                                                                                                                                                                               | Indicative cost of mitigation (US\$)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                  |                                                                                                                                                             | <p>Contractor ensure proper implementation of chance-find procedures; employ the services of an archaeologist or appropriate company to provide and ensure proper archaeological excavation procedures in coordination with the concerned government agencies;</p> <ul style="list-style-type: none"> <li>Obtain necessary approvals from MESCS to proceed with construction works where archaeological excavations are finished and recommendations have been provided.</li> </ul>                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                                                                                                                  |                                                                                                                                                             | <b>6. Environmental Protection Plan</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <p>10. Earthworks</p> <p>Materials hauling</p> <p>Roads works</p> <p>Hauling and transport of materials</p> <p>Other construction activities</p> | <p>Erosion of soil</p> <p>Excessive dust and air pollution due to vehicle emissions</p> <p>Excessive noise and vibration due to construction activities</p> | <p>Environmental Protection Plan is developed as a part of the SEMP.</p> <p>Location and frequency of regular monitoring of Dust, Air, Water, Noise &amp; Vibration are specified below:</p> <p><b>Soil erosion and sediment control</b></p> <ol style="list-style-type: none"> <li>Implement the erosion control in accordance with Technical Specifications Section 1001 – Erosion Control</li> <li>Preserve existing soil layer where practicable.</li> <li>Provide temporary cover such as fast-growing grass species in areas where soil layer is removed and the ground is exposed for a long period.</li> </ol> | <p><b>Contractor</b></p> <p>Prepare Environmental Protection Plan and implement, Collect baseline data for dust, air, noise, &amp; vibration, prepare Dust, Air, Water, Noise &amp; Vibration Plan.</p> <p>Coordinate disposal of surplus soil and excess topsoil with heads of local communities according to RA legislation.</p> <p>Hire local water trucks for dust control</p> | <p>The following costs are related specifically to the protection of the environment:</p> <ol style="list-style-type: none"> <li>Cost treating sediment-laden runoff generated by construction activities prior discharge into Rivers and gorges is estimated at:<br/><b>US\$ 135 000</b></li> <li>Cost of the installation of an Oil separator is estimated at:<br/><b>US\$ 36 000</b></li> <li>Cost of extraction, stockpiling and reuse of approximately 34 361 m<sup>3</sup> of topsoil at US\$ 3 per m<sup>3</sup> is estimated at:</li> </ol> |



**Table 1: Environmental Management Plan: Mitigation**

**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities | Potential Environmental Impacts | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Responsible Entities                                                                                                                                                                                        | Indicative cost of mitigation (US\$)                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |                                 | <p>4. Take the necessary measures to prevent soil erosion and to ensure slopes stability.</p> <p>5. Perform the topsoil stripping and stockpiling in accordance with Armenian legislation and Technical Specifications Section 1002 - Topsoil</p> <p>6. Manage topsoil to keep its chemical and biological qualities. Reuse it for planting trees, shrubs and for other landscaping needs.</p> <p>7. Seed grass on surfaces where topsoil is exposed to erosion risks (steep slopes, high embankments, etc.).</p> <p>8. Seed grass as soon as possible to avoid long period during which the ground is barren.</p> <p><b><i>Air pollution and dust control</i></b></p> <p>1. Minimize dust emissions through regular water spraying of construction works surfaces;</p> <p>2. Minimize the amount of excavated material held on site and cover all materials wherever possible to prevent dust emissions.</p> <p>3. Regulate the speed level of vehicles and machinery to minimize dust emissions.</p> <p>4. Use electricity or battery power where possible (or practical) for hand tools rather than diesel.</p> | <p>Report results monthly</p> <p><b><u>Engineer</u></b></p> <p>Review and approve Plan developed by the Contractor and monitor implementation</p> <p><b><u>TPIO</u></b> Monitor the Engineer and review</p> | <p><b>US\$ 103 083</b></p> <p>b) Cost of spraying water on barren ground and construction tracks to prevent dust emission during 20 months (600 days) out of the 60 months of the construction timeline, at US\$ 100 per day is estimated at:<br/><b>US\$ 600 000</b></p> <p>c) Cost of hiring a specialized contractor for collecting baseline data for surface water, air, noise &amp; vibration levels is estimated at:<br/><b>US\$ 16 000</b></p> |





**Table 1: Environmental Management Plan: Mitigation**  
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities | Potential Environmental Impacts | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Responsible Entities | Indicative cost of mitigation (US\$) |
|--------------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------|
|                    |                                 | <p>5. Avoid the use of diesel or petrol powered generators where practicable</p> <p>6. Provide to workers and vehicle drivers with dust protective masks and ensure they are using it.;</p> <p>7. Regularly collect data on dust emissions at sensitive receptors and collect data from the same location to describe changes in Air quality.</p> <p><b><i>Water quality and sediment control</i></b></p> <p>1. Schedule construction activities being performed in close vicinity to Geghi Reservoir and the Loradzor, Vorotan and Gehi Rivers during the low water period (15<sup>th</sup> June to 30<sup>th</sup> September);</p> <p>2. Locate Works, facilities and equipment generating pollution and dust as far as possible from the Rivers water bodies.</p> <p>3.Regular checking run off from construction work camps as well as runoff from waste disposal areas and construction work areas, effluent from quarries, crushing plant, and concrete batch plant (if any), as well as workers' potable water</p> |                      |                                      |

**Table 1: Environmental Management Plan: Mitigation****Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities | Potential Environmental Impacts | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Responsible Entities | Indicative cost of mitigation (US\$) |
|--------------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------|
|                    |                                 | <p>3. Construct oil- and other substances –separators to strictly control the discharge of solid and liquid wastes into the Rivers;</p> <p>4. Prevent untreated discharge of storm water from all construction sites.;</p> <p>5. Regularly monitor water quality of Rivers and temporary water flows in the gorges if construction will take place in water period.-Locate Monitoring points approximately 50 m upstream and 50 m downstream from the construction works site.</p> <p>6. Prevent run off from all construction sites including: construction camps, quarries, crushing, and concrete batch plant, waste disposal site, etc.</p> <p>7. Treat runoff flows originated by construction activities to clean from sediments prior discharge into Rivers;</p> <p>8. Install netting or sheeting beneath the bridge during construction to catch any materials that may be dropped</p> <p>9. Install an oil separator facility at bridges' drainage outlets to prevent discharge of pollutants from the road into Rivers</p> <p>10. Regularly inspect, repair or maintain drainage structures to avoid sedimentation especially after rainfall events.</p> |                      |                                      |



**Table 1: Environmental Management Plan: Mitigation**  
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities | Potential Environmental Impacts | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Responsible Entities | Indicative cost of mitigation (US\$) |
|--------------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------|
|                    |                                 | <p>11. Clean ditches, drains and culverts from sediments coming from construction activities.</p> <p>12. Perform concrete casting, joints sealing, application of water-proofing paint or protective systems, curing agents, etc. during the dry season to avoid pollution of water bodies and gorges</p> <p>13 Clean all operating machinery and undertake refuelling at safe distance from water bodies</p> <p>14. Install petrol/oil Interceptors at each outfall.</p> <p>15. Install penstock or similar restriction devices at all facilities to prevent pollution in the event of accidental spillage.</p> <p>16. Provide sufficient stream flow in Rivers to ensure that fish can swim unrestricted ..</p> <p>17. Build a bund along the Rivers on 10m distance from the water stream to control suspended soils laden runoff from construction.</p> <p>18. Install sediment catching mats at streams outflow in order to reduce risk of discharge of silt laden runoff to the streams.</p> <p><b>Noise &amp; vibration control</b></p> <p>1. Comply with construction activities related noise &amp; vibration national legislation.</p> |                      |                                      |



**Table 1: Environmental Management Plan: Mitigation**

**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                      | Potential Environmental Impacts | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Responsible Entities                                       | Indicative cost of mitigation (US\$)                                                                                  |
|-----------------------------------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
|                                         |                                 | <p>2. Avoid locating construction activities, camps, machinery and equipment near sensitive receptors such as forests, protected areas, poorly insulated houses, schools, and other public and residual areas.</p> <p>3. Schedule noisy activities towards the middle of the day whenever it is practicable.</p> <p>4. Regularly collect baseline data on noise and vibration at sensitive receptors and collect data from the same location to describe changes in Noise levels.</p> <p>5. Ensure that all pieces of machinery are equipped with proper silencers and exclude those that are improper state for minimizing noise generation at source.</p> <p>6. Ensure workers and drivers are provided with appropriate PPE including ear protective equipment.</p> <p>7. Ensure that vibration levels at sensitive receptors (Poorly insulated houses, archaeological remains) are regularly controlled.</p> |                                                            |                                                                                                                       |
|                                         |                                 | <b>7. Construction Work Camps Plan</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                            |                                                                                                                       |
| 11.Accommodation of workers, equipment, | Adverse health effects on work  | 1. Obtain an approval of official authorities and TPIO for camps' locations prior to their establishment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b><u>Contractor</u></b><br>Prepare and implement the plan | Cost of developing, implementing and managing this plan by the Contractor is already included in general construction |


**Table 1: Environmental Management Plan: Mitigation**
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                            | Potential Environmental Impacts                                                                                                                     | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Responsible Entities                                                                                               | Indicative cost of mitigation (US\$)                                                                                                         |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| material storage, machinery and parking       | force<br>Nuisances on nearby residents<br>Soil compaction of temporary parking areas<br>Pollution of groundwater<br>Dirtying of ambient environment | 2. Locate camps as far as possible from residential areas to avoid disturbing people living along the Project.<br>3. Avoid installing construction site buildings, vehicle and machinery parking and other facilities on undisturbed natural landscape and on surfaces covered with vegetation.<br>4. Ensure that workers and other staff have access to proper comfort stations (toilets, hand sinks, showers, etc.), canteen and offices.<br>5. Sewage water will be collected and transported to appropriate sewage treatment facilities.<br>6. Collect garbage and dispose at designated and approved dumps.<br>7. Ensure the safety and the cleanliness of the camp.<br>8. Restore the natural surfaces that have been compacted after removal of construction facilities. | <b>Engineer</b> Review and approve plan and monitor implementation.<br><b>TPIO</b> Monitor the Engineer and review | costs.<br>Implementation of this plan will be supervised by the Contractor's HSE specialist. Its cost is already accounted in point 3 above. |
|                                               |                                                                                                                                                     | <b>8. Quarry and borrow pits, dumping site, blasting works sites, concrete batching and asphalt plants' Management Plan</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                    |                                                                                                                                              |
| 12.Quarrying<br>Concrete batching and asphalt | Noise and dust related nuisance,<br>Impacts on Physical Cultural                                                                                    | 1. Develop this Plan before starting site implementation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Contractor</b><br>Prepare and implement the plan<br><b>Engineer</b> Review and approve                          | Cost of developing, implementing and managing this plan by the Contractor is already included in general construction costs.                 |

**Table 1: Environmental Management Plan: Mitigation****Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities | Potential Environmental Impacts                                                                                                                                                                                                                                                                                                                                                                         | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Responsible Entities                                                                       | Indicative cost of mitigation (US\$)                                                                                                                        |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| plants             | Resources (PCR) include impacts by the project on the environment and on archaeological, historical, cultural sites and monuments, losses to aesthetics, disruption of local livelihood and communications patterns, presence of and interaction with the construction work force, pressure on surrounding natural resources and humanservices. Other direct impacts such as erosion and sedimentation, | <p>2. Give preference to existing quarries, concrete batching and asphalt plants, instead of opening new ones.</p> <p>3. Obtain all permits and approvals from relevant authorities and TPIO for using the site for operation of quarries; borrow pits, dump sites, concrete batching and asphalt plants.</p> <p>6. In the event, that new concrete batching and asphalt plants are needed, the potential impacted receptors will be identified and mitigation measures developed based on the risk assessment.</p> <p>7. In the event, that concrete batching and asphalt plants are opened; they will be implemented by the Contractor, as far from residential areas as possible to avoid disturbing the local population.</p> <p>8. Avoid installing concrete batching and asphalt plants on undisturbed natural landscape and on surfaces covered with vegetation.</p> <p>9. Explosives will be stored, Handled and used as per applicable laws.</p> <p>10. Controlled and Slow Blasting will be carried out to minimize the damage.</p> | <p>Plan developed by the Contractor</p> <p><b>TPIO</b> Monitor the Engineer and review</p> | Implementation of this plan (and related permitting) will be supervised by the Contractor's HSE specialist. Its cost is already accounted in point 3 above. |

**Table 1: Environmental Management Plan: Mitigation****Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities         | Potential Environmental Impacts                                                    | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Responsible Entities                                                                                                                                     | Indicative cost of mitigation (US\$)                                                                    |
|----------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
|                            | road damage, spoil and other waste disposal, noise and dust generation.            | <p>11.Areas near the blasting site will be given prior information of blasting;</p> <p>12.Flagmen will be stationed near the site.</p> <p>9. Apply all the mitigation measures planned above to minimize impact on air, water quality, flora and fauna, drainage and other utilities, as well as population of nearby residential areas.</p> <p>9. Prepare Traffic management plan for access and operation of machinery.</p> <p>10. Prepare waste management plan to address all the issues related to waste generation.</p> <p>11. Prepare and submit for TPIO approval the Method statement of works for operation of quarries and borrow pits, dumping sites, concrete batching asphalt plants, as well as blasting works.</p> |                                                                                                                                                          |                                                                                                         |
|                            |                                                                                    | <b>9. Tunnels construction sites</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                          |                                                                                                         |
| 13. 9 Tunnels construction | Impact on environmental, historical and cultural sites by improper spoil disposal, | <p>Develop this Plan before starting site implementation.</p> <p>Reuse spoils as embankment /sub grade or other facilities of the project</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p><b><u>Contractor</u></b></p> <p>Prepare and implement the plan</p> <p><b><u>Engineer</u></b> Review and approve Plan developed by the Contractor.</p> | <p><b><u>Contractor</u></b></p> <p>Included in total construction cost, estimated to be maximum 2%.</p> |





**Table 1: Environmental Management Plan: Mitigation**  
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities | Potential Environmental Impacts                                                                                                                      | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Responsible Entities                               | Indicative cost of mitigation (US\$) |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|--------------------------------------|
|                    | <p>Blast impact on community, safety concern;</p> <p>Impact on wildlife</p> <p>Disturbance of rock formations, rock movements and fragmentations</p> | <p>Consultation with local government and community as to reuse spoils for urban or community infrastructure construction.</p> <p>Proper disposal of remain spoils in the identified spoils' sites after getting Local Self-Governing Bodies approval/agreements.</p> <p>Geological advanced probe boring and prediction will be adopted.</p> <p>Grouting should be used to seal the leakage, and water discharge should be limited.</p> <p>Tunnel liner shall be timely and properly installed.</p> <ul style="list-style-type: none"><li>• Sedimentation and filtration ponds shall be adopted at tunnel construction sites to treat wastewater before discharge to nearby water ditches</li><li>• Strictly follow blast operation, method statement and safety codes.</li><li>• Prior blasting works notice about it to local communities</li><li>• If needed implementation of Initial safety inspection of nearby buildings for determination of blasting method and dosage.</li><li>• Pre-splitting blasting, perimeter blasting and millisecond blasting technique shall be used for tunnels</li></ul> | <p><b>TPIO</b> Monitor the Engineer and review</p> |                                      |


**Table 1: Environmental Management Plan: Mitigation**
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                                | Potential Environmental Impacts                                                                                                                                                                                               | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Responsible Entities                                                                                                                                                                      | Indicative cost of mitigation (US\$)                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                   |                                                                                                                                                                                                                               | in sensitive areas to minimize blasting impact on wildlife.<br><br>• Blast time arranged in daytime to minimize disturbance on wildlife.                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                            |
|                                                   |                                                                                                                                                                                                                               | <b>10. Traffic and Access Management Plan</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                            |
| 14.Vehicle movements on and off construction site | Non fluidity of traffic<br><br>Hazards and safety issues related to traffic<br><br>Damage to roads by construction heavy equipment and vehicles<br><br>Dust, Noise & vibration<br><br>Dirt and mud carried onto public roads, | 1. Organize the movement of vehicles and machinery in a manner creating least interference to the flow of traffic.<br><br>2. Ensure 24h per day access of public to houses, shops, business, etc.<br><br><b>Vehicle management on and off-site</b><br><br>1. Obtain approvals from governmental organizations and local self-governing bodies for the construction traffic routes.<br><br>2. Locate entrances and exits of the construction sites so that they cause minimal disturbance to general traffic and that they do not compromise public safety. | <b>Contractor</b><br>Prepare, implement and manage the plan<br><br><b>Engineer</b> Review and approve Plan developed by the Contractor<br><br><b>TPIO</b> Monitor the Engineer and review | Cost of developing, implementing and managing this plan by the Contractor is already included in general construction costs.<br><br>Implementation of this plan (and related permitting) will be supervised by the Contractor's HSE specialist.<br><br>Cost of spraying water on construction dirt roads and tracks is already accounted in point 6 above. |

**Table 1: Environmental Management Plan: Mitigation****Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities | Potential Environmental Impacts | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Responsible Entities | Indicative cost of mitigation (US\$) |
|--------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------|
|                    |                                 | <ul style="list-style-type: none"><li>3. Undertake a Pre-Construction Road and Property Condition Survey to document the condition of the road and possible affected properties.</li><li>4. Train drivers on TMP and safety</li><li>5. Locate parking of machinery in designated sites only.</li><li>6. Implement an appropriate construction signage scheme including direction signs, markings, traffic signals, lighting, clearly visible solid barriers to channel traffic, flagmen and maintenance of diversions.</li><li>7. Reinforce speed limits.</li><li>8. Schedule the movement of vehicles to avoid rush hours where practicable.</li><li>9. Ensure that the vehicles are provided with and are using covering loads when carrying sand, soil, spoil and waste material and when leaving construction site,</li><li>10. Ensure that vehicles are equipped with exhaust attenuators, silencers,</li><li>11 Check that vehicles are regularly maintained to prevent fuel and oil leakages and to meet national regulative requirements.</li></ul> |                      |                                      |



**Table 1: Environmental Management Plan: Mitigation**

**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                                                                            | Potential Environmental Impacts                                                                   | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Responsible Entities                                                                                                                                                                                                  | Indicative cost of mitigation (US\$)                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                               |                                                                                                   | <p>12. Stop the operation of leaking machinery and replace with those in proper working condition.</p> <p>13. Provide measures on cleaning the tires (gravelled surfaces and vehicle wash facilities at site provided with suitable runoff protection) before the leaving of the construction site to prevent the construction dirt and mud be spread out</p> <p>14. Check regularly dirt and mud accumulation coming from the construction sites on adjacent roads. Sweep and clean whenever is required and when it is safe to do so.</p> <p>15. Set speed limits on construction sites to prevent any safety issue and for controlling dust emission.</p> |                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                        |
|                                                                                               |                                                                                                   | <b>11. Emergency Response Plan</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                        |
| 15. Handling hazardous substances and other emergency situations (incidents, accidents, etc.) | Leakage or spillage of diesel fuel, oil or other toxic substances entering soil, and groundwater. | <p>1. Provides to the Engineer the list of substances which contain hazardous elements e.g., diesel, waste oil, paints, herbicides, etc.</p> <p>2. Develop and implement procedures to ensure safe handling and storage of hazardous substances, Keep the material safety data sheets, posters with emergency response procedures, and clean-up tools</p>                                                                                                                                                                                                                                                                                                    | <p><b><u>Contractor</u></b></p> <p>Prepare and implement the plan</p> <p>Dispose of Hazardous Materials per ME directive</p> <p><b><u>Engineer</u></b></p> <p>Review and approve Plan developed by the Contractor</p> | <p>Cost of developing, implementing and managing this plan by the Contractor is already included in general construction costs.</p> <p>Implementation of this plan (and related permitting) will be supervised by the Contractor's HSE specialist. Its cost is already accounted in point 3 above.</p> |



**Table 1: Environmental Management Plan: Mitigation**

**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities | Potential Environmental Impacts | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Responsible Entities                                                               | Indicative cost of mitigation (US\$)                                                                                                                                                             |
|--------------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |                                 | <p>readily available on site and train the workers on their proper use.</p> <p>3. Store equipment for cleaning up spillages properly to ensure it is easily available when needed.</p> <p>4.Designate an Emergency Response Team (ERT) as a part of the Environmental team response-ready at any time.</p> <p>5. Ensure that the ERT receives emergency response training.</p> <p>6. Ensure that the ERT and all personnel handling chemicals and hazardous substances receive hazard and risk management training.</p> <p>7. Clean the area of spillage immediately to prevent potential contamination of soil and groundwater using a dedicated absorbent material. Remove the pollutant, together with the contaminated soil and the absorbent materials and discard to a site approved by ME.</p> <p>8. Manage hazardous wastes in accordance with Armenian regulation.</p> <p>9. Use chemicals, hazardous substances, and fuel only when necessary. Those substances should be stored on site, within a covered, secure and naturally ventilated area with an impervious floor and impervious</p> | <p><b>TPIO</b> Provide liaison with ME.</p> <p>Monitor the Engineer and review</p> | <p>Cost of 3 days of training of the 40 members of the Emergency Response Team at US\$ 50 per day, plus the fees of 3 days of a trainer at US\$ 75, is estimated at:</p> <p><b>US\$ 6225</b></p> |


**Table 1: Environmental Management Plan: Mitigation**
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                                                                  | Potential Environmental Impacts                                                                                                                                          | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Responsible Entities                                                                                                                                                                                                                                              | Indicative cost of mitigation (US\$)                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                     |                                                                                                                                                                          | <p>bund around it. The bund should have a capacity of at least 150% of the capacity of the largest tank.</p> <p>10. Locate the storage area away from drainage lines and danger areas.</p> <p>11. Provide all construction sites with emergency contact information, responsible persons &amp; safety officer name(s), telephone numbers, etc.</p> <p>12. Develop an Accident report form with the Engineer.</p> <p>13. Inform the Engineer on any accidents (incidents) immediately and report by filling in the accident report form.</p> |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                        |
|                                                                                     |                                                                                                                                                                          | <b>12. Waste and Material Disposal Plan</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                        |
| <p>16.All site activities</p> <p>Road construction sites and construction camps</p> | <p>Spoil disposed in inappropriate locations.</p> <p>Waste and materials pollutants entering drainage system and/or infiltrating groundwater</p> <p>Potential safety</p> | <p>1. Develop the WMP as a part of the SEMP.</p> <p>2. Record in the waste register, at the beginning of every month, the type and the quantity of waste generated by the construction activities.</p> <p>3. Organize a training program on waste management for the Contractor's Personnel.</p> <p>4. Remove construction waste, garbage and rubbish from the site regularly to avoid dust and long-term accumulation of the litter. The frequency of removal as</p>                                                                       | <p><b><u>Contractor</u></b></p> <p>Prepare and implement the plan</p> <p><b><u>Engineer</u></b></p> <p>Review and approve Plan developed by the Contractor</p> <p><b><u>TPIO</u></b> Provide liaison with ME.</p> <p>Monitor the Engineer and review</p> <p>.</p> | <p>Cost of developing, implementing and managing this plan by the Contractor is already included in general construction costs.</p> <p>Implementation of this plan (and related permitting) will be supervised by the Contractor's HSE specialist. Its cost is already accounted in point 3 above.</p> |

**Table 1: Environmental Management Plan: Mitigation****Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities | Potential Environmental Impacts                                                  | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Responsible Entities | Indicative cost of mitigation (US\$) |
|--------------------|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------|
|                    | hazards related to construction materials not cleared from the construction site | <p>a threshold for monitoring purposes will be specified by Contractor in the SEMP.</p> <p>5. Not encroach or place construction waste in Sisian consumer waste dump site near the project alignment. Hold sewage in sealed tanks for proper disposal.</p> <p>6. Categorize, spoil and other construction wastes by types: solid, liquid, dangerous and hazardous, as well as recyclable material.</p> <p>7. Apply to the Waste Research Center SNCO in ME for categorization of the construction wastes, as well as for obtaining licenses when needed.</p> <p>8. Obtain all permits for waste disposal and dispose only in permitted sites.</p> <p>9. Obtain the hazardous waste disposal approvals from ME.</p> <p>10. Apply to the Engineer for waste disposal dump sites investigation and approval.</p> <p>11. Install special containers for garbage collection which are timely emptied. Construction waste should be removed from the site daily or even more frequently to avoid any stockpiles that may become impediment for the traffic. No waste should be left on site by the end of the working day. Facilities for rubbish and garbage</p> |                      |                                      |





**Table 1: Environmental Management Plan: Mitigation**

**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                   | Potential Environmental Impacts                                  | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Responsible Entities                                                   | Indicative cost of mitigation (US\$)                                                                                                                 |
|--------------------------------------|------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                      |                                                                  | <p>accumulation and removal are installed and emptied regularly.</p> <p>12. Keep a waste register available on-site for all types of waste (concrete, asphalt, soil and sand) and allocate responsible personnel.</p> <p>13. Transport waste, contaminated soil and materials in accordance with the Traffic and Access Plan.</p> <p>14. Spoil should be disposed of in locations approved by governmental and local authorities.</p> <p>15. Collect wastewater in special reservoirs and properly treat it from oil and fuel before entering the water bodies.</p> <p>16. Collect excessive amounts of oil, lubricants and fuel to avoid spillages and to dispose of in proper disposal sites. Solvents and volatile materials shall be handled according to the procedures prescribed by EMP, Armenian legislative orders and best international practices.</p> |                                                                        |                                                                                                                                                      |
|                                      |                                                                  | <b>13. Site Reinstatement, Landscaping, and Re-vegetation Plan</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                        |                                                                                                                                                      |
| 17. Site re-instatement of all areas | Construction waste and materials are not removed and are left on | 1. Develop the Site Reinstatement, Landscaping, and Re-vegetation Plan as a part of SEMP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <p><b><u>Contractor</u></b></p> <p>Provide landscaping design Hire</p> | Costs are related to trees and shrubs from not-acquired lands only. Costs of affected by the Project trees, shrubs and crops from acquired lands are |



**Table 1: Environmental Management Plan: Mitigation**

**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities             | Potential Environmental Impacts                                                                                                                                                                                                                                         | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Responsible Entities                                                                                                                                                                                                                                                                                                                                                                                                  | Indicative cost of mitigation (US\$)                                                                                                                                                                                                                                                                                                                     |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Re-vegetation, and landscaping | <p>construction sites</p> <p>Refers to construction sites, constructor's camps and facilities, dump sites, borrow pit and quarries, concrete and asphalt plant areas</p> <p>Cleared vegetation and trees are not fully recompensed by vegetation restoration works.</p> | <p>2. Remove all construction-related materials and equipment from the site including machinery, wastes, unused materials, fencing etc.</p> <p>3. Reinstate natural drainage and other utilities.</p> <p>4. Restore the soil layer and loosen soil caused by heavy machinery.</p> <p>5. Clean the construction site from the litter and traces of oil and fuel spillages if any.</p> <p>6. Restore the state of construction tracks up to the previous state.</p> <p>7. Implement check-list prepared for final sign-off by TPIO.</p> <p>8. Perform the vegetation restoration works according to the Landscaping plans specifically developed for each site.</p> <p>9. Requirements for re-vegetation work which includes planting, maintenance and monitoring to ensure high survival rate and fast growth of trees, shrubs and other plants are presented hereunder. Requirements will be provided in the landscape design or instructed by the Engineer.</p> <ul style="list-style-type: none"> <li>Replant trees, shrubs and bushes according to the landscape design provided by the Engineer</li> </ul> | <p>approved landscape contractor to implement plan, collaborate with authorities of forests &amp; the Zangezur State Sanctuary through which the road will pass.</p> <p><b>Engineer</b> Review and approve Plan developed by the Contractor. Monitor tree and other plants survival during works and defects liability</p> <p><b>TPIO</b> Monitor the <b>Engineer</b> and monitor trees and other plants survival</p> | <p>compensated as part of the LARP.</p> <p>According to the survey, trees and shrubs that will be potentially cut down due to the road construction activities are 6068 trees and about 10000 shrubs</p> <p>Cost of planting 36000 seedlings of Trees at US\$ 50 and 60000 seedlings of Shrubs at US\$ 5, is estimated at:<br/><b>US\$ 2 100 000</b></p> |

**Table 1: Environmental Management Plan: Mitigation****Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                                              | Potential Environmental Impacts | Proposed Mitigation Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Responsible Entities                             | Indicative cost of mitigation (US\$)                                      |
|-----------------------------------------------------------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------|
|                                                                 |                                 | <p>and agreements with heads of affected communities, Hayantar SNCO and Zangezur State Sanctuary.</p> <ul style="list-style-type: none"> <li>Plant seedlings of trees / shrubs at a ratio of 1:6 i.e. 6 seedling trees / shrubs for every tree or shrub cut down from not-acquired lands in the project right of way. According to the survey trees and shrubs that will be potentially cut down due to the road extension and the construction activities 6068 trees and about 10000 shrubs are concerned, therefore 36408 seedlings of trees and 60000 shrubs should be planted to respect the ratio between existing trees and shrubs affected by the Project.</li> <li>Maintain tree and shrub seedlings as well as other plants during the construction. After the defect liability period the maintenance responsibility shall be transferred to the local communities, Hayantar SNCO and Zangezur State Sanctuary, depends on whom territory the trees/shrubs are planted (Note that defect liability period will continue through the initial period of the Operation phase).</li> </ul> |                                                  |                                                                           |
| <b>POST-CONSTRUCTION PHASE<br/>(Operation and maintenance )</b> |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                  |                                                                           |
| 18.Defect correction works                                      | All the impacts identified in   | 1. Activity-specific mitigation measures envisaged in the Construction Phase                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Contractor</b><br>Implements the EMP and SEMP | Cost of long term monitoring by the Contractor cannot be evaluated at the |



**Table 1: Environmental Management Plan: Mitigation**

**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities                                                         | Potential Environmental Impacts                | Proposed Mitigation Measures                                                                                                                                                 | Responsible Entities                                                                                                                                                                                                                  | Indicative cost of mitigation (US\$)                                                           |
|----------------------------------------------------------------------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
|                                                                            | Construction Phase                             |                                                                                                                                                                              | for the time period the Contractor has implemented defect correction works and provides environmental safeguard reports<br><br><b><u>MTAI / TPIO</u></b><br>Implements works on road maintenance ensuring cleanliness and safety      | moment.                                                                                        |
| 19. Water run-off from bridges into the Loradzor, Vorotan and Geghi Rivers | Road pollutants are discharged into the Rivers | 1. Maintain an oil separator facility at bridge drainage outlets to prevent discharge of pollutants from road into Rivers                                                    | <b><u>Contractor</u></b><br>During the time period when defect correction works are being implemented<br><b><u>MTAI / TPIO</u></b><br>Maintain the facility during the rest of the defect liability period and during operation phase | Cost of long term monitoring by the MTAI cannot be evaluated at the moment.                    |
| 20. Re-vegetation                                                          | Vegetation does grow as expected               | 1. Monitor the growth and health state of trees, shrubs, other plants and lawn. Replace any death damaged or unhealthy specimens. Reseed incorrectly grown surfaces of lawn. | <b><u>Contractor</u></b><br>During the time period when defect correction works are being implemented<br><b><u>MTAI / TPIO</u></b><br>Maintain trees shrubs and lawns during the operation phase or handover to Armforest SNCO        | Cost of long-term maintenance by the MTC and Armforest SNCO cannot be evaluated at the moment. |



**Table 1: Environmental Management Plan: Mitigation**

**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Project Activities      | Potential Environmental Impacts | Proposed Mitigation Measures                                                   | Responsible Entities | Indicative cost of mitigation (US\$)                        |
|-------------------------|---------------------------------|--------------------------------------------------------------------------------|----------------------|-------------------------------------------------------------|
| 21. Environmental Audit |                                 | 1. Post-construction environmental audit will be prepared and submitted to ADB | <b>MTAI / TPIO</b>   | Cost of environmental audit will be included in TPIO budget |

**Table 2: Environmental Management Plan: Monitoring**

**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Location / Activity / Phase (as relevant)                                                                                                                                         | Parameters to be Monitored                       | Monitoring Location/s                                                                        | Instruments & Method                                                                                             | Environmental Performance Indicator                                                       | Responsible Entities                                                                                                                                                                                                                                     | Frequency (formal monitoring)                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| <b>CONSTRUCTION PHASE</b><br>(To be updated by the Contractor with the assistance of the Engineer Environment Specialist prior to begin construction and thereafter, as required) |                                                  |                                                                                              |                                                                                                                  |                                                                                           |                                                                                                                                                                                                                                                          |                                                                                                                            |
| 1. Work opportunities for local workers, unskilled workers and women                                                                                                              | local workers, unskilled workers and women hired | All Construction sites<br><br>(Including Right of way, Borrow pits, Dump sites, Construction | Documentation review including number of effective job postings intended to local workers, unskilled workers and | Number of local workers, unskilled workers and women that have been hired on the project. | <b>Contractor</b><br>Development of an hiring program for local workers, unskilled workers and women<br><br><b>Engineer</b><br>Environmental Specialist reviews the Contractor's hiring program.<br>Supervision cost will be included in Engineer budget | Shall be set when the Contractor is planning its recruitment<br><br>Review in the ramp-up phase of construction activities |



**Table 2: Environmental Management Plan: Monitoring**  
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Location / Activity / Phase (as relevant) | Parameters to be Monitored                                                                                                       | Monitoring Location/s                                | Instruments & Method                                                                                                                                                                                        | Environmental Performance Indicator                                                                                                                                                                                                                                                           | Responsible Entities                                                                                                                                                                                                                                                                                                                                              | Frequency (formal monitoring)                                                                                                                                              |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                           |                                                                                                                                  | camps)                                               | women by Contractor                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                               | <b>TPIO</b> Supervise the Engineer                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                            |
| 2. Occupational Health and Safety         | <p>Trainings on Health&amp; safety provided</p> <p>Uniform and safety equipment provided</p>                                     | All construction sites                               | <p>Inspection of Occupational Health &amp; Safety Documentation</p> <p>Inspection of construction sites</p> <p>Inspection of Register of incidents and/or accidents</p> <p>Ask questions random workers</p> | <p>The Occupational Health &amp; Safety Plan is available on every construction site</p> <p>List of attendees to the training session is available</p> <p>Reports of Construction sites' inspections are available</p> <p>Reports describing incidents and/or accidents are available</p>     | <p><b>Contractor</b><br/>Development of the Occupational Health &amp; Safety Plan<br/>Monitoring cost to be included in Contractor's budget</p> <p><b>Engineer</b><br/>Environmental Specialist reviews and monitors the Occupational Health and Safety Plan<br/>Supervision cost to be included in Engineer budget</p> <p><b>TPIO</b> Supervise the Engineer</p> | <p>According to regular monitoring schedule</p> <p>Plan must be developed and validated prior the commencement of construction activities</p>                              |
| 3. Public Consultation and Communication  | <p>Information of the General Public about construction stages</p> <p>Signboard around the sites,</p> <p>Complaints register</p> | Contractor's field office and all construction sites | <p>Documentation review</p> <p>Construction sites' inspections</p> <p>Public consultations</p> <p>Review of the register of complaints</p>                                                                  | <p>The Public Consultation and Communication Plan is available on all construction sites</p> <p>A Grievance Redress Mechanism has been implemented which follows requirements, procedures and indicators described in section 8 of the EIA, Complaints logged.</p> <p>Minutes of Meetings</p> | <p><b>Contractor</b><br/>Development and management of the Public Consultation and Communication Plan</p> <p><b>Engineer</b><br/>Environmental Specialist reviews and supervise the Public Consultation and Communications Plan</p> <p>Supervision cost to be included in Engineer budget</p> <p><b>TPIO</b> Supervise the Engineer</p>                           | <p>According to regular formal monitoring schedule</p> <p>The Plan must be developed as a part of SEMP and validated prior the commencement of construction activities</p> |



**Table 2: Environmental Management Plan: Monitoring**  
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Location / Activity / Phase (as relevant)        | Parameters to be Monitored                                                                                       | Monitoring Location/s  | Instruments & Method                                                                                          | Environmental Performance Indicator                                                                                                                                                                                                                                                   | Responsible Entities                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Frequency (formal monitoring)                                                                                                                                             |
|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------|------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                  |                                                                                                                  |                        |                                                                                                               | <p>organized by Contractor's HSE specialist with Community representatives are available at the Contractor's field office.</p> <p>Signboards are posted around construction sites.</p>                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                           |
| 4. Flora & Fauna Protection, Vegetation Clearing | <p>Vegetation clearing is minimized to the extent possible.</p> <p>Vegetation near Works' sites is protected</p> | All construction sites | <p>Review of all documentation related to vegetation clearing</p> <p>Construction sites' inspections</p>      | <p>The Flora &amp; Fauna Protection and Vegetation Clearing Plan is available</p> <p>Mitigation measures are put in place for protecting Fauna or Flora species discovered just before construction activities commence.</p> <p>The register of cut trees and shrubs is available</p> | <p><b><u>Contractor</u></b></p> <p>Development and monitors of the Flora &amp; Fauna Protection and Vegetation Clearing Plan as a part of SEMP</p> <p>Monitoring cost to be included in contractor budget</p> <p><b><u>Engineer</u></b></p> <p>Environmental Specialist reviews and supervises the Flora &amp; Fauna Protection and Vegetation Clearing Plan</p> <p>Supervision cost to be included in Engineer budget</p> <p><b><u>TPIO</u></b> Supervise the Engineer.</p> | <p>According to regular monitoring schedule</p> <p>The Plan (with schedule of works) must be developed and validated prior to commencement of construction activities</p> |
| 5. Utilities Protection and Relocation           | <p>Cases of disruption of services impacting end users</p> <p>Re-located of utilities is implemented</p>         | All construction sites | <p>Review of all documentation related to Utilities Protection and Relocation</p> <p>Construction site(s)</p> | <p>The Utilities Protection and Relocation Plan is available</p> <p>Number and severity of complaints logged in the Register of Complaints</p> <p>Utilities discovered during construction works did not</p>                                                                          | <p><b><u>Contractor</u></b></p> <p>Development and monitors of the Utilities Protection and Relocation Plan as a part of SEMP</p> <p>Monitoring cost to be included in Contractor's budget</p> <p><b><u>Engineer</u></b></p> <p>Environmental Specialist reviews and supervise</p>                                                                                                                                                                                           | <p>According to regular monitoring schedule</p> <p>The Plan must be developed, validated and implemented prior the commencement of construction</p>                       |





**Table 2: Environmental Management Plan: Monitoring**  
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Location / Activity / Phase (as relevant) | Parameters to be Monitored                                                                                                                                                    | Monitoring Location/s                                                                                                                                                                                                                             | Instruments & Method                                                                                                                                                                                                                                           | Environmental Performance Indicator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Responsible Entities                                                                                                                                                                                                                                                                                                                                                                                             | Frequency (formal monitoring)                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                           | where needed                                                                                                                                                                  |                                                                                                                                                                                                                                                   | inspections<br>Review register of complaints                                                                                                                                                                                                                   | lead to interruption of service to end users                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | the Utilities Protection and Relocation Plan<br>Supervision cost to be included in Engineer budget<br><b>TPIO</b> Supervise the Engineer.                                                                                                                                                                                                                                                                        | activities                                                                                                                                                                                                                                                                                                                                                                                                    |
| 6. Protection of the Environment          | Erosion and weed invasion of barren ground<br>Sediment run-off<br>Topsoil stockpiles<br>Emission of dust & other air pollutants<br>Noise & Vibration level<br>Water Pollution | All construction sites<br>Sensitive receptors for Dust, Water, Noise & Vibration located at 50 m or less from construction activities<br>Monitoring points identified in Dust, Water, Noise & Vibration baseline data and regular monitoring plan | Visual review through the construction sites' inspections<br>Review of the register of complaints<br>Air quality instrumented measurements<br>Noise instrumented measurement<br>Vibration instrumented measurements<br>Water quality instrumented measurements | The Environmental (Dust, water, noise and vibration) Protection Plan is available<br><br>Number and severity of complaints logged in the Register of Complaints<br><br>Visits of construction sites sensitive to erosion, drainage sedimentation, as well as topsoil stockpiling sites.<br><br>Dust emissions, noise & vibration measurements nearby sensitive receptors located at 50m distance from the construction sites. In the case asphalt or concrete plant operation measurement points located at nearby residential and public buildings<br><br>Dust emission levels are within current Armenian regulative standards (RA law on Atmospheric Air Protection of 1994, amended in 2007) | <b>Contractor</b><br>Development and monitors of the Environmental Protection Plan.<br>Monitoring cost to be included in Contractor's budget<br><br><b>Engineer</b><br>Environmental Specialist reviews and supervise the Environmental Protection Plan and follows Contractor's actions to protect the environment.<br>Supervision cost to be included in Engineer budget<br><b>TPIO</b> Supervise the Engineer | According to monitoring schedule specified by Contractor in Dust, Water, Noise & Vibration monitoring plan<br><br>The Plan must be developed and approved by TPIO prior to the commencement of construction activities<br><br>Baseline data to be collected 21 days before works commencement date.<br><br>Measurements of dust emissions at least every two weeks and more frequently during dry conditions, |



**Table 2: Environmental Management Plan: Monitoring**  
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Location / Activity / Phase (as relevant)                                 | Parameters to be Monitored                                                               | Monitoring Location/s                                                  | Instruments & Method                           | Environmental Performance Indicator                                                                                                                                                                                                                                                                                           | Responsible Entities                                                                                                                                                                                                                                                                                                                                                                 | Frequency (formal monitoring)                                                                                                                     |
|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                           |                                                                                          |                                                                        |                                                | Noise and vibration levels are within current Armenian regulative standards (RA decree N° 138 of 2002)                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                      | depending on complaints received<br><br>Measurements of noise & vibration at least every two weeks, or based on complaints received               |
| 7. Construction Work Camps                                                | Location, layout and management of work camps<br>Security fence                          | Work camps, Boundary of construction sites/camos                       | Documentation review<br><br>Work camps' visits | The Construction Work Camps Plan is available.<br><br>The location and the layout of the Construction Work Camp(s) comply with location and layout that has been previously agreed by authorities<br><br>Number and severity of complaints logged in the Register of Complaints<br><br>Security fence properly set and intact | <b><u>Contractor</u></b><br><br>Development and monitors of the Construction Work Camps Plan<br><br>Monitoring cost to be included in contractor budget<br><br><b><u>Engineer</u></b><br><br>Environmental Specialist reviews and supervise the Construction Work Camps Plan<br><br>Supervision cost to be included in Engineer budget<br><b><u>TPIO</u></b> Supervise the Engineer. | According to regular formal monitoring schedule<br><br>The Plan must be developed and validated prior the commencement of construction activities |
| 8. Quarry, borrow pit, concrete batching, asphalt plants and dumping site | Location, layout and management of Quarry, borrow pit, concrete batching, asphalt plants | Quarry, borrow pit, concrete batching, asphalt plants and dumping site | Documentation review<br><br>Sites' visits      | The Sites Management Plan is available<br><br>The layout of the Construction Work Camp(s) complies with specifications of the Plan                                                                                                                                                                                            | <b><u>Contractor</u></b><br><br>Development and monitors of the Sites Management Plan<br>Monitoring cost to be included in contractor budget<br><br><b><u>Engineer</u></b><br><br>Environmental Specialist reviews and supervise the                                                                                                                                                 | According to regular formal monitoring schedule<br><br>The Plan must be developed and validated prior the commencement of                         |



**Table 2: Environmental Management Plan: Monitoring**  
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Location / Activity / Phase (as relevant) | Parameters to be Monitored                                                                                                                 | Monitoring Location/s                                                                        | Instruments & Method                  | Environmental Performance Indicator                                                                                                                                                                                               | Responsible Entities                                                                                                                                                                                                                                                                                                                                   | Frequency (formal monitoring)                                                                                                                 |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
|                                           | and dumping site<br>Nuisances to affected communities                                                                                      |                                                                                              |                                       | Number and severity of complaints logged in the Register of Complaints                                                                                                                                                            | Sites Management Plan<br>Supervision cost to be included in Engineer budget<br><b>TPIO</b> Supervise the Engineer.                                                                                                                                                                                                                                     | construction activities                                                                                                                       |
| 9. Traffic and Access management          | Itineraries and accesses location<br>Nuisances and safety issues related to communities<br>Damages to road and utilities (mainly drainage) | Roads use for transportation of equipment, and material<br>Accesses to the construction site | Documentation review<br>Sites' visits | The Traffic and Access management Plan is available for review<br>Itineraries and access locations and layouts complies with specifications of the Plan<br>Number and severity of complaints logged in the Register of Complaints | <b>Contractor</b><br>Development and monitors of the Traffic and Access management Plan<br>Monitoring cost to be included in contractor budget<br><b>Engineer</b><br>Environmental Specialist reviews and monitors the Traffic and Access management Plan<br>Supervision cost to be included in Engineer budget<br><b>TPIO</b> Supervise the Engineer. | According to regular formal monitoring schedule<br>The Plan must be developed and validated prior the commencement of construction activities |
| 10. Handling hazardous substances         | Accidental or chronic leakage or spillage of diesel fuel, oil or other toxic substances<br>Diesel, asphalt, mixed bitumen, used            | All Construction sites,<br>Designated hazardous material storage areas                       | Documentation review<br>Sites' visits | The Emergency Response Plan is available for review<br>Accident report forms are completed whenever an accident happened<br>All accidents are treated in compliance with the Plan<br>The Emergency Response Team members have     | <b>Contractor</b><br>Development of the Emergency Response Plan<br>Monitoring cost to be included in contractor budget<br><b>Engineer</b><br>Environmental Specialist reviews the Emergency Response Plan<br>Supervision cost to be included in Engineer budget<br><b>TPIO</b> Supervise the Engineer                                                  | According to regular formal monitoring schedule<br>The Plan must be developed and validated prior the commencement of construction activities |



**Table 2: Environmental Management Plan: Monitoring**  
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Location / Activity / Phase (as relevant) | Parameters to be Monitored                                        | Monitoring Location/s                                          | Instruments & Method                      | Environmental Performance Indicator                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Responsible Entities                                                                                                                                                                                                                                                                                                           | Frequency (formal monitoring)                                                                                                                                                                                                                          |
|-------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------------------|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                           | oil and grease                                                    |                                                                |                                           | received their training<br><br>Appropriately stored in designated areas, Hazardous materials inventory up-to-date and tallies                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                        |
| 11. Waste and other material              | Management of waste and construction material during construction | All Construction sites,<br><br>Designated waste disposal sites | Documentation review<br><br>Sites' visits | The Waste and Material Management Plan is available<br><br>Waste Research Center SNCO in ME has provided the categorization of the construction wastes.<br><br>Engineer has approved waste disposal sites and all permits for waste disposal are obtained<br><br>Garbage, rubbish and improper construction materials are managed in compliance with Plan's instructions.<br><br>A waste register has been developed and is correctly completed<br><br>No waste outside designated areas | <b><u>Contractor</u></b><br>Development of the Emergency Response Plan<br>Monitoring cost to be included in contractor budget<br><br><b><u>Engineer</u></b><br>Environmental Specialist reviews the Emergency Response Plan<br>Supervision cost to be included in Engineer budget<br><b><u>TPIO</u></b> Supervise the Engineer | According to regular formal monitoring schedule<br><br>The Plan must be developed and validated prior the commencement of construction activities<br><br>The waste register and eventually the Plan itself, is updated at the beginning of every month |



**Table 2: Environmental Management Plan: Monitoring**  
**Tranche 4 - 60 km Sisian to Kajaran Road Section**

| Location / Activity / Phase (as relevant)              | Parameters to be Monitored                                                                                                                                                                                               | Monitoring Location/s                                                 | Instruments & Method                                                          | Environmental Performance Indicator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Responsible Entities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Frequency (formal monitoring)                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12. Site Reinstatement, Landscaping, and Re-vegetation | <p>Construction site is cleaned, no material and waste is on-site</p> <p>Restoration of all surfaces (including quarries and borrow pits) that were used temporarily during construction</p> <p>Site is re-vegetated</p> | <p>All Construction sites</p> <p>Identified areas for landscaping</p> | <p>Sites' inspections</p> <p>Counting of number of planted and dead trees</p> | <p>The Site Reinstatement, Landscaping, and Re-vegetation Plan is available</p> <p>All surfaces (including quarries and borrow pits) that were used temporarily during construction are restored to their original state</p> <p>Site Reinstatement check list is approved by TPIO</p> <p>Location and number of trees and shrubs planted is complies with the landscape design documents</p> <p>Trees and shrubs seedlings have survived the liability period.</p> <p>Maintenance and monitoring the health of trees until viable within 3 years and replacement as required</p> | <p><b><u>Contractor</u></b></p> <p>Development of the Site Reinstatement, Landscaping, and Re-vegetation Plan</p> <p>Restoration of all surfaces</p> <p>Vegetation restoration works</p> <p>Maintain landscape areas over the period specified in the contract</p> <p>Monitoring cost to be included in contractor budget</p> <p><b><u>Engineer</u></b></p> <p>Environmental Specialist reviews Site Reinstatement, Landscaping, and Re-vegetation Plan</p> <p>Monitors vegetation developments</p> <p>Supervision cost to be included in Engineer budget</p> <p><b><u>TPIO</u></b> Supervises the Engineer</p> | <p>According to regular formal monitoring schedule</p> <p>The Plan must be developed and validated prior the commencement of construction activities</p> <p>Restoration of all surfaces must be finished before the project is handover to MTAI</p> <p>Health state and growth of shrubs and trees is checked twice every year, in late spring and early fall during the liability period</p> |
| 13. Records and reporting                              | <p>Site inspection checklists,</p> <p>Site inspection minutes,</p> <p>Register books</p> <p>Consultation records,</p>                                                                                                    | Recorded information                                                  | Review                                                                        | All available, recorded correctly, any follow-up has been carried out as required                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p><b><u>Contractor</u></b></p> <p>Completes and monitors checklists, logs, consultation records, training records</p> <p>Obtains Licenses, and Permits</p> <p><b><u>Engineer</u></b></p> <p>Ensure compliance,</p>                                                                                                                                                                                                                                                                                                                                                                                             | <p>The Contractor submits a weekly monitoring report and monthly progress report to the Engineer</p> <p>Engineer submits</p>                                                                                                                                                                                                                                                                  |



Table 2: Environmental Management Plan: Monitoring  
Tranche 4 - 60 km Sisian to Kajaran Road Section

| Location / Activity / Phase (as relevant) | Parameters to be Monitored              | Monitoring Location/s | Instruments & Method | Environmental Performance Indicator | Responsible Entities                                                          | Frequency (formal monitoring)                                                                            |
|-------------------------------------------|-----------------------------------------|-----------------------|----------------------|-------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
|                                           | Training records, Licenses, and Permits |                       |                      |                                     | Report to TPIO<br><b>TPIO</b><br>Review the Engineer reports<br>Report to ADB | monthly progress report<br>End of Phase report<br>Audit report<br>TPIO prepare a bi-annual report to ADB |



Table 2: Environmental Management Plan: Monitoring  
Tranche 4 - 60 km Sisian to Kajaran Road Section

| Location / Activity / Phase<br>(as relevant)                                                                         | Parameters to be Monitored        | Monitoring Location/s                               | Instruments & Method | Environmental Performance Indicator           | Responsible Entities                                                                                                                                                                              | Frequency (formal monitoring)                                                        |
|----------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------------------------------|----------------------|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <b>OPERATION PHASE</b><br>(To be updated by the of TPIO Environment Specialist prior to start operation if required) |                                   |                                                     |                      |                                               |                                                                                                                                                                                                   |                                                                                      |
| 15. Landscaping                                                                                                      | Normal growth of trees and shrubs | All surfaces where landscaping works were performed | Site's visits        | Sanitary state and growth of trees and shrubs | <b><u>Contractor</u></b><br><b><u>MTAI / TPIO</u></b><br>Landscaping control the sanitary state and growth of trees and shrubs during the operation period before handover to the Armforest SNCO. | As required at the end of works and defects liability until signed off as acceptable |
| 16. Safety                                                                                                           |                                   | Project right of way                                |                      |                                               | <b><u>Safety is controlled by Police.</u></b>                                                                                                                                                     |                                                                                      |



### Annex 3: Climate data

| Description                                     | Data                 |                      |                     |
|-------------------------------------------------|----------------------|----------------------|---------------------|
|                                                 | Sisian               | Kajaran              | Kapan               |
| Climatic zone                                   | III                  | 1980-III             | I - 705             |
| Altitude marks                                  | 1580 –<br>1950 m     | 2200-2490<br>m       | 800-1150            |
| Weather in summer                               | Cool                 | cool                 | hot and dry         |
| Weather in winter                               | severely cold        | severely cold        | cold windless       |
| Annual average air temperature                  | 8.5 <sup>0</sup> C   | 6.9 <sup>0</sup> C   | 11.9 <sup>0</sup> C |
| Average temperature in the coldest month        | - 4.8 <sup>0</sup> C | - 2.7 <sup>0</sup> C | 0.8 <sup>0</sup> C  |
| Average temperature in the warmest month        | 17.9 <sup>0</sup> C  | 16.6 <sup>0</sup> C  | 23.3 <sup>0</sup> C |
| Passage of temperature through 0 <sup>0</sup> C | March - November     | March - December     | February - December |
| Absolute maximum temperature in summer          | 36 <sup>0</sup> C    | 34 <sup>0</sup> C    | 42 <sup>0</sup> C   |
| Minimum temperature in winter                   | - 34 <sup>0</sup> C  | - 22 <sup>0</sup> C  | - 22 <sup>0</sup> C |



|                                                |              |                |                       |
|------------------------------------------------|--------------|----------------|-----------------------|
| Annual dominating wind directions in summer    | Western      | western        | west and south - west |
| Annual dominating wind directions in winter    | North/ East. | western        | west and south - west |
| Annual average wind speed                      | 2.4m/sec     | 1.6 m/sec.     | 1.1 m/sec.            |
| Annual precipitation                           | 532 mm       | 686 mm         | 585 mm                |
| Maximum water content in snow                  | 90 mm        | 242 mm         | 70 mm                 |
| Formation of snow blanket                      | November     | December       | December              |
| Melting of snow blanket                        | March        | March          | February              |
| Number of days with snow blanket               | 70           | 150            | 30                    |
| Rated height of snow blanket with 5% provision | 26cm         | 90 cm /Lichk/  | 29 cm                 |
| Number of snow-stormy days                     | 5-10         | 5-10           | -                     |
| Glaze                                          | 0.5-10       | 2-3 days       | -                     |
| Maximum depth of soil freezing                 | 92cm         | 92 cm /Sisian/ | 14 cm                 |

**Annex 4: Water quality analysis****Vorotan River**

Պատվիրատու՝ «Հաննախագիծ» ինստիտուտ ՍՊԸ  
Պայմանագրի համար՝ № 12/16 (05.10.2016)  
Լուծի ստացման ամսաթիվը՝ 01.10.2016թ.  
Արդյունքների տրամա ամսաթիվը՝ 13.10.2016թ.  
Լուծի անվանումը՝ Ոլոտան  
(3 կմ ք. Սիսիանից ներքև)

ՀԱՍՏԱՏՈՒՄ ԵՄ  
«Շրջակա միջավայրի վերականգնման  
մոնիթորինգի կենտրոն» ՊՈԱԿ-ի տնօրեն  
Ս. Մանակյան

Ջրի լուծի ֆիզիկաքիմիական փորձագնեման արդյունքները

| N  | Ցուցանիշի անվանում                        | Միավոր               | Զտված արժեք | Օդադրժեղած միջակայ    |
|----|-------------------------------------------|----------------------|-------------|-----------------------|
| 1  | Կախված մասնիկներ                          | մգ/լ                 | 31.6        | Գրավիմետրիկ           |
| 2  | Ջրածնային ջուլի                           | քՖ                   | 6.7         | Պոտենցիոմետրիկ        |
| 3  | Հիդրոկարբոնատներ                          | մգ/լ                 | 134.244     | Հեմոլոգրաֆ տիտրում    |
| 4  | Սուլֆատ իոն                               | մգ/լ                 | 47.936      | ԻՔ                    |
| 5  | Քլորիդ իոն                                | մգ/լ                 | 10.756      | ԻՔ                    |
| 6  | Լիտրոն իոն                                | մգ/լ                 | 5.357       | ԻՔ                    |
| 7  | Նիտրոն իոն                                | մգ/լ                 | 0.058       | Սպեկտրոֆոտոմետրիկ     |
| 8  | Ամոնիում իոն                              | մգ/լ                 | 0.121       | Սպեկտրոֆոտոմետրիկ     |
| 9  | Հոմոլոգրաֆում                             | մգ/լ                 | 211         | Էլեկտրոքիմիական       |
| 10 | Ֆոսֆատներ                                 | մգ/լ                 | 0.341       | Սպեկտրոֆոտոմետրիկ     |
| 11 | Սիլիկատներ                                | մգ/լ                 | 19.044      | Սպեկտրոֆոտոմետրիկ     |
| 12 | Թթվածնի 5-օրյա<br>կենսաքիմիական պահանջարկ | մգՕ <sub>2</sub> /լ  | 1.4         | Էլեկտրոքիմիական       |
| 13 | Թթվածնի քիմիական<br>պահանջարկ             | մգ Օ <sub>2</sub> /լ | 18          | Օքսիդացում բիքրոմատով |
| 14 | Էլեկտրահաղորդականություն                  | մկՍմ/սմ              | 325         | Էլեկտրաքիմիական       |
| 15 | Li                                        | մգ/լ                 | 0.0131      | ԻԿՊ-ՄՄ                |
| 16 | Be                                        | մգ/լ                 | 0.00001     | ԻԿՊ-ՄՄ                |
| 17 | B                                         | մգ/լ                 | 0.21425     | ԻԿՊ-ՄՄ                |
| 18 | Na                                        | մգ/լ                 | 20.9289     | ԻԿՊ-ՄՄ                |
| 19 | Mg                                        | մգ/լ                 | 10.3035     | ԻԿՊ-ՄՄ                |
| 20 | Al                                        | մգ/լ                 | 0.0712      | ԻԿՊ-ՄՄ                |
| 21 | P                                         | մգ/լ                 | 0.1940      | ԻԿՊ-ՄՄ                |
| 22 | K                                         | մգ/լ                 | 4.1610      | ԻԿՊ-ՄՄ                |
| 23 | Ca                                        | մգ/լ                 | 31.1663     | ԻԿՊ-ՄՄ                |
| 24 | Ti                                        | մգ/լ                 | 0.00767     | ԻԿՊ-ՄՄ                |
| 25 | V                                         | մգ/լ                 | 0.01650     | ԻԿՊ-ՄՄ                |
| 26 | Cr                                        | մգ/լ                 | 0.0007      | ԻԿՊ-ՄՄ                |
| 27 | Fe                                        | մգ/լ                 | 0.1109      | ԻԿՊ-ՄՄ                |



| N  | Ցուցանիշի անվանում | Միավոր | Չափված արժեք | Օգտագործված մեթոդ |
|----|--------------------|--------|--------------|-------------------|
| 28 | Mn                 | մգ/լ   | 0.0076       | ԻԿԳ-ՄՄ            |
| 29 | Co                 | մգ/լ   | 0.0001       | ԻԿԳ-ՄՄ            |
| 30 | Ni                 | մգ/լ   | 0.00097      | ԻԿԳ-ՄՄ            |
| 31 | Cu                 | մգ/լ   | 0.00093      | ԻԿԳ-ՄՄ            |
| 32 | Zn                 | մգ/լ   | 0.0024       | ԻԿԳ-ՄՄ            |
| 33 | As                 | մգ/լ   | 0.00690      | ԻԿԳ-ՄՄ            |
| 34 | Se                 | մգ/լ   | 0.00062      | ԻԿԳ-ՄՄ            |
| 35 | Sr                 | մգ/լ   | 0.23649      | ԻԿԳ-ՄՄ            |
| 36 | Mo                 | մգ/լ   | 0.0016       | ԻԿԳ-ՄՄ            |
| 37 | Cd                 | մգ/լ   | 0.00001      | ԻԿԳ-ՄՄ            |
| 38 | Sn                 | մգ/լ   | 0.00002      | ԻԿԳ-ՄՄ            |
| 39 | Sb                 | մգ/լ   | 0.00008      | ԻԿԳ-ՄՄ            |
| 40 | Ba                 | մգ/լ   | 0.01017      | ԻԿԳ-ՄՄ            |
| 41 | Pb                 | մգ/լ   | 0.00003      | ԻԿԳ-ՄՄ            |

Օգտագործված մեթոդը: ԻԿ-իոնային ջրահոսոդրաֆիա, ԻԿԳ-ՄՄ-խեղուկցիոն կոսպված պլազմայով մաս-սպեկտրոմետրիա:

Ներկայացված չուրը «միջակ» որակի է (3-րդ դաս)՝ պայմանավորված ֆուֆուս խոնով

Գիտաարտադրական խորհրդով սնորենի տեղակալ՝

Գ. Նախճատրյան

Ինֆորմացիայի վերլուծության և պատկանության բաժնի պետ՝

Լ. Բուշիկյան



Client: "Dorproject" institute LLC

I confirm

Contract number: 12/16 (05.10.2016)

S. Sahakyan

13.10.2016

Sampling date: 01.10.2016

Director

Results providing date: 13.10.2016

"Environmental Impact Monitoring Center"  
SNCO

Name of Sampling: Vorotan

(3 km downstream from Sisian City)

## Physical-Chemical Water Sample Study Results

| <i>N</i> | <i>Sampling</i>                  | <i>Unit</i>         | <i>Measured Value</i> | <i>Method Used</i> |
|----------|----------------------------------|---------------------|-----------------------|--------------------|
| 1.       | Suspended Particles              | mg/l                | 31.6                  | Gravimetric        |
| 2.       | Hydrogen Index                   | pH                  | 6.7                   | Potensiometric     |
| 3.       | Hydrocarbonates                  | mg/l                | 134.244               | Contact Titration  |
| 4.       | Sulfate ion                      | mg/l                | 47.936                | IC                 |
| 5.       | Chloride ion                     | mg/l                | 10.756                | IC                 |
| 6.       | Nitrate ion                      | mg/l                | 5.357                 | IC                 |
| 7.       | Nitrite ion                      | mg/l                | 0.058                 | Spectrophotometric |
| 8.       | Ammonium ion                     | mg/l                | 0.121                 | Spectrophotometric |
| 9.       | Mineralization                   | mg/l                | 211                   | electrochemical    |
| 10.      | Phosphates                       | mg/l                | 0.341                 | Spectrophotometric |
| 11.      | Silicates                        | mgSi/l              | 19.044                | Spectrophotometric |
| 12.      | 5 days biochemical oxygen demand | mgO <sub>2</sub> /l | 1.4                   | electrochemical    |
| 13.      | Chemical oxygen demand           | mgO/l               | 18                    | oxide bikromat     |
| 14.      | Electrical conductivity          | μS/cm               | 325                   | electrochemical    |



|     |           |             |                |               |
|-----|-----------|-------------|----------------|---------------|
| 15. | <i>Li</i> | <i>mg/l</i> | <i>0.0131</i>  | <i>ICP-MS</i> |
| 16. | <i>Be</i> | <i>mg/l</i> | <i>0.00001</i> | <i>ICP-MS</i> |
| 17. | <i>B</i>  | <i>mg/l</i> | <i>0.21425</i> | <i>ICP-MS</i> |
| 18. | <i>Na</i> | <i>mg/l</i> | <i>20.9289</i> | <i>ICP-MS</i> |
| 19. | <i>Mg</i> | <i>mg/l</i> | <i>10.3035</i> | <i>ICP-MS</i> |
| 20. | <i>Al</i> | <i>mg/l</i> | <i>0.0712</i>  | <i>ICP-MS</i> |
| 21. | <i>P</i>  | <i>mg/l</i> | <i>0.1940</i>  | <i>ICP-MS</i> |
| 22. | <i>K</i>  | <i>mg/l</i> | <i>4.1610</i>  | <i>ICP-MS</i> |
| 23. | <i>Ca</i> | <i>mg/l</i> | <i>31.1663</i> | <i>ICP-MS</i> |
| 24. | <i>Ti</i> | <i>mg/l</i> | <i>0.00767</i> | <i>ICP-MS</i> |
| 25. | <i>V</i>  | <i>mg/l</i> | <i>0.01650</i> | <i>ICP-MS</i> |
| 26. | <i>Cr</i> | <i>mg/l</i> | <i>0.0007</i>  | <i>ICP-MS</i> |
| 27. | <i>Fe</i> | <i>mg/l</i> | <i>0.1109</i>  | <i>ICP-MS</i> |
| 28. | <i>Mn</i> | <i>mg/l</i> | <i>0.0076</i>  | <i>ICP-MS</i> |
| 29. | <i>Co</i> | <i>mg/l</i> | <i>0.0001</i>  | <i>ICP-MS</i> |
| 30. | <i>Ni</i> | <i>mg/l</i> | <i>0.00097</i> | <i>ICP-MS</i> |
| 31. | <i>Cu</i> | <i>mg/l</i> | <i>0.00093</i> | <i>ICP-MS</i> |
| 32. | <i>Zn</i> | <i>mg/l</i> | <i>0.0024</i>  | <i>ICP-MS</i> |
| 33. | <i>As</i> | <i>mg/l</i> | <i>0.00690</i> | <i>ICP-MS</i> |
| 34. | <i>Se</i> | <i>mg/l</i> | <i>0.00062</i> | <i>ICP-MS</i> |
| 35. | <i>Sr</i> | <i>mg/l</i> | <i>0.23649</i> | <i>ICP-MS</i> |
| 36. | <i>Mo</i> | <i>mg/l</i> | <i>0.0016</i>  | <i>ICP-MS</i> |
| 37. | <i>Cd</i> | <i>mg/l</i> | <i>0.00001</i> | <i>ICP-MS</i> |



|     |           |             |                |               |
|-----|-----------|-------------|----------------|---------------|
| 38. | <i>Sn</i> | <i>mg/l</i> | <i>0.00002</i> | <i>ICP-MS</i> |
| 39. | <i>Sb</i> | <i>mg/l</i> | <i>0.00008</i> | <i>ICP-MS</i> |
| 40. | <i>Ba</i> | <i>mg/l</i> | <i>0.01017</i> | <i>ICP-MS</i> |
| 41. | <i>Pb</i> | <i>mg/l</i> | <i>0.00003</i> | <i>ICP-MS</i> |

*Method Used: IC- ion chromatography, ICP-MS - Inductively coupled plasma mass spectrometry*

*The presented water is “fair” quality (3<sup>rd</sup> Category) conditioned by Phosphate Ion*

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Loradzor River





Պատվարան: «Նահանգային ինստիտուտ ԱԳՈ»  
 «Գյուղատնտեսական համակարգի համար» № 12/14 (05.10.2014)  
 Նմուշն առաքման ամսաթիվը՝ 01.10.2014թ.  
 Արդյունքների արժանի ամսաթիվը՝ 13.10.2014թ.  
 Նմուշն անվանումը՝ Լաքուս

ՀԱՅԿՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅԱՆ  
 «Զբոսայգի, մշակույթի և պատմության  
 մեթոդական կենտրոն» հիմնադրամ  
 Ս. Սահակյան  
 13.10.2014թ.

Լճակայանի քանի նմուշն ինքնակազմակերպ փորձարկման արդյունքները

| N  | Ուղղանկյուն անվանում                   | Միավոր | Չափված արժեք | Օրոշակային միավոր |
|----|----------------------------------------|--------|--------------|-------------------|
| 1  | Նստված մանրէներ                        | մգ/լ   | 26.2         | Պատվարակ          |
| 2  | Քլորոֆիլի քանակ                        | քմ     | 7.7          | Պատվարակ          |
| 3  | Հիդրոկարբոնատներ                       | մգ/լ   | 290.180      | Շատաքանակ         |
| 4  | Սուլֆատ խոն                            | մգ/լ   | 36.926       | ԻՊ                |
| 5  | Քլորիդ խոն                             | մգ/լ   | 8.094        | ԻՊ                |
| 6  | Կարբոն խոն                             | մգ/լ   | 6.847        | ԻՊ                |
| 7  | Կալցիում խոն                           | մգ/լ   | 2.034        | Մակրոարժեքավոր    |
| 8  | Մանգանիում խոն                         | մգ/լ   | 0.022        | Մակրոարժեքավոր    |
| 9  | Հանքային                               | մգ/լ   | 307          | Էնդոարժեքավոր     |
| 10 | Ֆոսֆատներ                              | մգ/լ   | 0.118        | Մակրոարժեքավոր    |
| 11 | Միջիններ                               | մգ/լ   | 2.083        | Մակրոարժեքավոր    |
| 12 | Միջիններ 5-րդ<br>կետային խոնի արժեքներ | մգ/լ   | 1.8          | Էնդոարժեքավոր     |
| 13 | Միջիններ քանակ<br>արժեքներ             | մգ/լ   | 12           | Օրոշակային քանակ  |
| 14 | Էնդոարժեքավոր քանակ                    | մգ/լ   | 472          | Էնդոարժեքավոր     |
| 15 | Ca                                     | մգ/լ   | 0.0014       | ԻՊ/Ն-ՄՊ           |
| 16 | Mg                                     | մգ/լ   | 0.0001       | ԻՊ/Ն-ՄՊ           |
| 17 | P                                      | մգ/լ   | 0.00017      | ԻՊ/Ն-ՄՊ           |
| 18 | Na                                     | մգ/լ   | 12.1818      | ԻՊ/Ն-ՄՊ           |
| 19 | K                                      | մգ/լ   | 8.9840       | ԻՊ/Ն-ՄՊ           |
| 20 | Al                                     | մգ/լ   | 0.0000       | ԻՊ/Ն-ՄՊ           |
| 21 | F                                      | մգ/լ   | 0.0001       | ԻՊ/Ն-ՄՊ           |
| 22 | Cl                                     | մգ/լ   | 3.0001       | ԻՊ/Ն-ՄՊ           |
| 23 | Ca                                     | մգ/լ   | 81.9950      | ԻՊ/Ն-ՄՊ           |
| 24 | Cl                                     | մգ/լ   | 0.0001       | ԻՊ/Ն-ՄՊ           |
| 25 | P                                      | մգ/լ   | 0.0001       | ԻՊ/Ն-ՄՊ           |
| 26 | Ca                                     | մգ/լ   | 0.0001       | ԻՊ/Ն-ՄՊ           |
| 27 | Ca                                     | մգ/լ   | 0.0001       | ԻՊ/Ն-ՄՊ           |
| 28 | Ca                                     | մգ/լ   | 0.0001       | ԻՊ/Ն-ՄՊ           |





## Physical-Chemical Water Sample Study Results

| <i>N</i> | <i>Sampling</i>                         | <i>Unit</i>              | <i>Measured Value</i> | <i>Method Used</i>        |
|----------|-----------------------------------------|--------------------------|-----------------------|---------------------------|
| 1.       | <i>Suspended Particles</i>              | <i>mg/l</i>              | 26.2                  | <i>Gravimetric</i>        |
| 2.       | <i>Hydrogen Index</i>                   | <i>pH</i>                | 7.7                   | <i>Potensiometric</i>     |
| 3.       | <i>Hydrocarbonates</i>                  | <i>mg/l</i>              | 250.182               | <i>Contact Titration</i>  |
| 4.       | <i>Sulfate ion</i>                      | <i>mg/l</i>              | 36.928                | <i>IC</i>                 |
| 5.       | <i>Chloride ion</i>                     | <i>mg/l</i>              | 8.094                 | <i>IC</i>                 |
| 6.       | <i>Nitrate ion</i>                      | <i>mg/l</i>              | 6.847                 | <i>IC</i>                 |
| 7.       | <i>Nitrite ion</i>                      | <i>mg/l</i>              | 0.034                 | <i>Spectrophotometric</i> |
| 8.       | <i>Ammonium ion</i>                     | <i>mg/l</i>              | 0.022                 | <i>Spectrophotometric</i> |
| 9.       | <i>Mineralization</i>                   | <i>mg/l</i>              | 307                   | <i>electrochemical</i>    |
| 10.      | <i>Phosphates</i>                       | <i>mg/l</i>              | 0.119                 | <i>Spectrophotometric</i> |
| 11.      | <i>Silicates</i>                        | <i>mgSi/l</i>            | 2.683                 | <i>Spectrophotometric</i> |
| 12.      | <i>5 days biochemical oxygen demand</i> | <i>mgO<sub>2</sub>/l</i> | 1.8                   | <i>electrochemical</i>    |
| 13.      | <i>Chemical oxygen demand</i>           | <i>mgO/l</i>             | 12                    | <i>oxide bikromat</i>     |
| 14.      | <i>Electrical conductivity</i>          | <i>μS/cm</i>             | 472                   | <i>electrochemical</i>    |
| 15.      | <i>Li</i>                               | <i>mg/l</i>              | 0.0214                | <i>ICP-MS</i>             |
| 16.      | <i>Be</i>                               | <i>mg/l</i>              | 0.00001               | <i>ICP-MS</i>             |
| 17.      | <i>B</i>                                | <i>mg/l</i>              | 0.25327               | <i>ICP-MS</i>             |
| 18.      | <i>Na</i>                               | <i>mg/l</i>              | 12.1814               | <i>ICP-MS</i>             |
| 19.      | <i>Mg</i>                               | <i>mg/l</i>              | 8.5849                | <i>ICP-MS</i>             |
| 20.      | <i>Al</i>                               | <i>mg/l</i>              | 0.0200                | <i>ICP-MS</i>             |



|     |           |             |         |               |
|-----|-----------|-------------|---------|---------------|
| 21. | <i>P</i>  | <i>mg/l</i> | 0.0681  | <i>ICP-MS</i> |
| 22. | <i>K</i>  | <i>mg/l</i> | 3.0651  | <i>ICP-MS</i> |
| 23. | <i>Ca</i> | <i>mg/l</i> | 49.9463 | <i>ICP-MS</i> |
| 24. | <i>Ti</i> | <i>mg/l</i> | 0.00410 | <i>ICP-MS</i> |
| 25. | <i>V</i>  | <i>mg/l</i> | 0.00194 | <i>ICP-MS</i> |
| 26. | <i>Cr</i> | <i>mg/l</i> | 0.0009  | <i>ICP-MS</i> |
| 27. | <i>Fe</i> | <i>mg/l</i> | 0.0326  | <i>ICP-MS</i> |
| 28. | <i>Mn</i> | <i>mg/l</i> | 0.0022  | <i>ICP-MS</i> |
| 29. | <i>Co</i> | <i>mg/l</i> | 0.0002  | <i>ICP-MS</i> |
| 30. | <i>Ni</i> | <i>mg/l</i> | 0.00147 | <i>ICP-MS</i> |
| 31. | <i>Cu</i> | <i>mg/l</i> | 0.00206 | <i>ICP-MS</i> |
| 32. | <i>Zn</i> | <i>mg/l</i> | 0.0018  | <i>ICP-MS</i> |
| 33. | <i>As</i> | <i>mg/l</i> | 0.00274 | <i>ICP-MS</i> |
| 34. | <i>Se</i> | <i>mg/l</i> | 0.00043 | <i>ICP-MS</i> |
| 35. | <i>Sr</i> | <i>mg/l</i> | 0.45248 | <i>ICP-MS</i> |
| 36. | <i>Mo</i> | <i>mg/l</i> | 0.0025  | <i>ICP-MS</i> |
| 37. | <i>Cd</i> | <i>mg/l</i> | 0.00004 | <i>ICP-MS</i> |
| 38. | <i>Sn</i> | <i>mg/l</i> | 0.00003 | <i>ICP-MS</i> |
| 39. | <i>Sb</i> | <i>mg/l</i> | 0.00006 | <i>ICP-MS</i> |
| 40. | <i>Ba</i> | <i>mg/l</i> | 0.05606 | <i>ICP-MS</i> |
| 41. | <i>Pb</i> | <i>mg/l</i> | 0.00016 | <i>ICP-MS</i> |

Method Used: IC- ion chromatography, ICP-MS - Inductively coupled plasma mass spectrometry



*The presented water is “good” quality (2<sup>nd</sup> Category)*

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Geghi River



Կատարում է «Հանախաղճի» ինստիտուտ ՍՊԸ  
Պայմանագրի համար՝ № 12/16 (05.10.2016)  
Նմուշի տեսցման ամսաթիվը՝ 01.10.2016թ.  
Արդյունքների տրման ամսաթիվը՝ 13.10.2016թ.  
Նմուշի անվանումը՝ Գեղի (գետաբերան)

ՀԱՍՏԱՏՈՒՄ ԵՄ

«Երջակա միջավայրի վրա ներգործության  
մոնիտորինգի կենտրոն» ՊԲԸ

Ս. Մահակյան



Ջրի նմուշի ֆիզիկաքիմիական փորձազննման արդյունքները

| N  | Ցուցանիշի անվանում                        | Միավոր               | Չափված արժեք | Օգտագործված մեթոդ     |
|----|-------------------------------------------|----------------------|--------------|-----------------------|
| 1  | Կախված մասնիկներ                          | մգ/լ                 | 18.9         | Գրավիմետրիկ           |
| 2  | Տքածուային ցուցիչ                         | քՖ                   | 7.0          | Պոտենցիոմետրիկ        |
| 3  | Հիդրոկարբոնատներ                          | մգ/լ                 | 170.856      | Հետադարձ տիտրում      |
| 4  | Մուխաս իոն                                | մգ/լ                 | 27.308       | ԻՔ                    |
| 5  | Քլորիդ իոն                                | մգ/լ                 | 4.317        | ԻՔ                    |
| 6  | Նիտրատ իոն                                | մգ/լ                 | 1.828        | ԻՔ                    |
| 7  | Նիտրիտ իոն                                | մգ/լ                 | 0.012        | Սպեկտրոֆոտոմետրիկ     |
| 8  | Ամոնիում իոն                              | մգ/լ                 | 0.027        | Սպեկտրոֆոտոմետրիկ     |
| 9  | Հանքայնացում                              | մգ/լ                 | 204          | Էլեկտրաքիմիական       |
| 10 | Ֆոսֆատներ                                 | մգ/լ                 | 0.015        | Սպեկտրոֆոտոմետրիկ     |
| 11 | Սիլիկատներ                                | մգՏե/լ               | 5.232        | Սպեկտրոֆոտոմետրիկ     |
| 12 | Թթվածնի 5-օրյա<br>կենսաքիմիական պահանջարկ | մգՕ <sub>2</sub> /լ  | 1.3          | Էլեկտրաքիմիական       |
| 13 | Թթվածնի քիմիական<br>պահանջարկ             | մգ Օ <sub>2</sub> /լ | 10           | Օքսիդացում բիքրոմատով |
| 14 | Էլեկտրաաղդրականություն                    | մկՍմ/սմ              | 314          | Էլեկտրաքիմիական       |
| 15 | Li                                        | մգ/լ                 | 0.0044       | ԻԿԴ-ՄՄ                |
| 16 | Be                                        | մգ/լ                 | 0.00000      | ԻԿԴ-ՄՄ                |
| 17 | B                                         | մգ/լ                 | 0.09780      | ԻԿԴ-ՄՄ                |
| 18 | Na                                        | մգ/լ                 | 8.3008       | ԻԿԴ-ՄՄ                |
| 19 | Mg                                        | մգ/լ                 | 8.0219       | ԻԿԴ-ՄՄ                |
| 20 | Al                                        | մգ/լ                 | 0.0080       | ԻԿԴ-ՄՄ                |
| 21 | P                                         | մգ/լ                 | 0.0321       | ԻԿԴ-ՄՄ                |
| 22 | K                                         | մգ/լ                 | 2.0745       | ԻԿԴ-ՄՄ                |
| 23 | Ca                                        | մգ/լ                 | 49.8340      | ԻԿԴ-ՄՄ                |
| 24 | Ti                                        | մգ/լ                 | 0.00170      | ԻԿԴ-ՄՄ                |
| 25 | V                                         | մգ/լ                 | 0.00082      | ԻԿԴ-ՄՄ                |
| 26 | Cr                                        | մգ/լ                 | 0.0003       | ԻԿԴ-ՄՄ                |
| 27 | Fe                                        | մգ/լ                 | 0.0513       | ԻԿԴ-ՄՄ                |
| 28 | Mn                                        | մգ/լ                 | 0.0117       | ԻԿԴ-ՄՄ                |



| №  | Չափանիշի անվանում | Միավոր | Մասնական արժեք | Արտադրողի անուն |
|----|-------------------|--------|----------------|-----------------|
| 27 | Ca                | մգ/լ   | 0.0001         | ԻՆՎ-ՄԵ          |
| 28 | Fe                | մգ/լ   | 0.00116        | ԻՆՎ-ՄԵ          |
| 29 | Co                | մգ/լ   | 0.00061        | ԻՆՎ-ՄԵ          |
| 30 | Zn                | մգ/լ   | 0.0003         | ԻՆՎ-ՄԵ          |
| 31 | As                | մգ/լ   | 0.00134        | ԻՆՎ-ՄԵ          |
| 34 | Se                | մգ/լ   | 0.00068        | ԻՆՎ-ՄԵ          |
| 35 | Br                | մգ/լ   | 0.27952        | ԻՆՎ-ՄԵ          |
| 36 | Mn                | մգ/լ   | 0.0196         | ԻՆՎ-ՄԵ          |
| 37 | Cr                | մգ/լ   | 0.0009         | ԻՆՎ-ՄԵ          |
| 38 | Sr                | մգ/լ   | 0.0009         | ԻՆՎ-ՄԵ          |
| 39 | Nb                | մգ/լ   | 0.00177        | ԻՆՎ-ՄԵ          |
| 40 | Sn                | մգ/լ   | 0.23445        | ԻՆՎ-ՄԵ          |
| 41 | Pb                | մգ/լ   | 0.0000         | ԻՆՎ-ՄԵ          |

Արտադրողի անունը: ԻՆՎ-ՄԵ խնամակալություն: ԻՆՎ-ՄԵ խնամակալության կողմից պատրաստված աղյուսակներ:

Լաբորատորիան ընտրվել է համաձայն հետևյալի: (3-րդ դրու: համաձայնագրի մեջ նշված է և մեղմված)

Համաձայնագրի կողմից անցկացվող աշխատանք:

Ռ. Շահնազարյան

Բնակավայրի մշակութային և պատմության թանգարան:

Ս. Շահնազարյան





Client: "Dorproject" institute LLC

I confirm

Contract number: 12/16 (05.10.2016)

S. Sahakyan

13.10.2016

Sampling date: 01.10.2016

Director

Results providing date: 13.10.2016

"Environmental Impact Monitoring Center"  
SNCOName of Sampling: Geghi (estuary of the  
river)

## Physical-Chemical Water Sample Study Results

| N   | Sampling                         | Unit                | Measured Value | Method Used        |
|-----|----------------------------------|---------------------|----------------|--------------------|
| 1.  | Suspended Particles              | mg/l                | 18.9           | Gravimetric        |
| 2.  | Hydrogen Index                   | pH                  | 7.0            | Potensiometric     |
| 3.  | Hydrocarbonates                  | mg/l                | 170.856        | Contact Titration  |
| 4.  | Sulfate ion                      | mg/l                | 27.308         | IC                 |
| 5.  | Chloride ion                     | mg/l                | 4.317          | IC                 |
| 6.  | Nitrate ion                      | mg/l                | 1.828          | IC                 |
| 7.  | Nitrite ion                      | mg/l                | 0.012          | Spectrophotometric |
| 8.  | Ammonium ion                     | mg/l                | 0.027          | Spectrophotometric |
| 9.  | Mineralization                   | mg/l                | 204            | electrochemical    |
| 10. | Phosphates                       | mg/l                | 0.015          | Spectrophotometric |
| 11. | Silicates                        | mgSi/l              | 5.232          | Spectrophotometric |
| 12. | 5 days biochemical oxygen demand | mgO <sub>2</sub> /l | 1.3            | electrochemical    |
| 13. | Chemical oxygen demand           | mgO/l               | 10             | oxide bikromat     |
| 14. | Electrical conductivity          | μS/cm               | 314            | electrochemical    |
| 15. | Li                               | mg/l                | 0.0044         | ICP-MS             |



|     |           |             |         |        |
|-----|-----------|-------------|---------|--------|
| 16. | <i>Be</i> | <i>mg/l</i> | 0.00000 | ICP-MS |
| 17. | <i>B</i>  | <i>mg/l</i> | 0.09780 | ICP-MS |
| 18. | <i>Na</i> | <i>mg/l</i> | 8.3008  | ICP-MS |
| 19. | <i>Mg</i> | <i>mg/l</i> | 8.0219  | ICP-MS |
| 20. | <i>Al</i> | <i>mg/l</i> | 0.0080  | ICP-MS |
| 21. | <i>P</i>  | <i>mg/l</i> | 0.0321  | ICP-MS |
|     | <i>K</i>  | <i>mg/l</i> | 2.0745  | ICP-MS |
| 22. | <i>Ca</i> | <i>mg/l</i> | 49.8340 | ICP-MS |
| 23. | <i>Ti</i> | <i>mg/l</i> | 0.00170 | ICP-MS |
| 24. | <i>V</i>  | <i>mg/l</i> | 0.0082  | ICP-MS |
| 25. | <i>Cr</i> | <i>mg/l</i> | 0.0003  | ICP-MS |
| 26. | <i>Fe</i> | <i>mg/l</i> | 0.0513  | ICP-MS |
| 27. | <i>Mn</i> | <i>mg/l</i> | 0.0117  | ICP-MS |
| 28. | <i>Co</i> | <i>mg/l</i> | 0.0001  | ICP-MS |
| 29. | <i>Ni</i> | <i>mg/l</i> | 0.00116 | ICP-MS |
| 30. | <i>Cu</i> | <i>mg/l</i> | 0.00281 | ICP-MS |
| 31. | <i>Zn</i> | <i>mg/l</i> | 0.0033  | ICP-MS |
| 32. | <i>As</i> | <i>mg/l</i> | 0.00154 | ICP-MS |
| 33. | <i>Se</i> | <i>mg/l</i> | 0.00069 | ICP-MS |
| 34. | <i>Sr</i> | <i>mg/l</i> | 0.27952 | ICP-MS |
| 35. | <i>Mo</i> | <i>mg/l</i> | 0.0194  | ICP-MS |
| 36. | <i>Cd</i> | <i>mg/l</i> | 0.00003 | ICP-MS |
| 37. | <i>Sn</i> | <i>mg/l</i> | 0.00003 | ICP-MS |



|            |           |             |                |               |
|------------|-----------|-------------|----------------|---------------|
|            | <i>Sb</i> | <i>mg/l</i> | <i>0.00019</i> | <i>ICP-MS</i> |
| <b>38.</b> | <i>Ba</i> | <i>mg/l</i> | <i>0.03446</i> | <i>ICP-MS</i> |
| <b>39.</b> | <i>Pb</i> | <i>mg/l</i> | <i>0.00009</i> | <i>ICP-MS</i> |

*Method Used: IC- ion chromatography, ICP-MS - Inductively coupled plasma mass spectrometry*

*The presented water is “good” quality (2<sup>nd</sup> Category)*

*Deputy Director Research and Development      G. Shahnazaryan*

*Head of Information Analysis and Protection Division      A. Zatikyan*

Armenia, 0012, Yerevan Komitasi Ave., 29 Phone: +37410272007, +37410266196

## Annex 5: Legends of maps

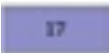
### Geomorphology map legend

| TYPES OF RELIEF                                                                     |                                                                                                                                                                                  |                                                                                                                                   |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| STRUCTURAL EROSIVE RELIEF                                                           |                                                                                                                                                                                  |                                                                                                                                   |
| High mountains (over 2800 m)                                                        |                                                                                                                                                                                  |                                                                                                                                   |
|    | With snow-glacial relief forms, severely splitted, sharp and rocky crests, sloping sides up to 35°/                                                                              | With intensive folded base of massive clastic and volcanogenic-sedimentary rocks of intrusive rocks                               |
|    | With steep slopes (up to 25° - 35°), slightly wavy watershed                                                                                                                     |                                                                                                                                   |
| Medium-height mountains (1500-2800 m)                                               |                                                                                                                                                                                  |                                                                                                                                   |
|    | With steep slopes (up to 25° - 35°), slightly wavy watershed                                                                                                                     | With intensive, partially moderate folded base of volcanogenic-clastic and continental carbonate rocks complicated with intrusive |
|  | With moderately steep slopes<br>(up to 25° - 35°), slightly wavy watershed                                                                                                       | With folded clastic structures of intrusive and volcanogenic-sedimentary rocks                                                    |
| II. TECTONIC-VOLCANIC AND VOLCANO-EROSIVE LANDFORM                                  |                                                                                                                                                                                  |                                                                                                                                   |
|  | Shield-shaped elevated (over 2800 m), mountain massifs covered with lava and folded clastic structures heterogeneous in the base, levelled, complicated by tectonic disturbances |                                                                                                                                   |
|  | Slopes and plateaus (1500-2800 m) “armoured” with lava sheets, slightly splitted in the base, folded structures complicated with disturbances                                    |                                                                                                                                   |
|  | Marginal plateaus (1100-2200 m) covered with lava, on slightly sloped folded structures                                                                                          |                                                                                                                                   |
|  | Lithosculpture plateaus and slopes composed of pyroclastic (volcanoclastic, loose) molasses                                                                                      |                                                                                                                                   |
|  | Tuff covers with slightly folded base                                                                                                                                            |                                                                                                                                   |



| III. EROSION (DEVELOPED) LANDFORM                                                   |                                                                                       |                                                                                          |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Medium-height mountains (1500-2800 m)                                               |                                                                                       |                                                                                          |
|    | Inverted                                                                              | a) intensive folded base of volcanogenic-carbonate suites                                |
|                                                                                     |                                                                                       | b) volcanoclastic-proluvial strata with slightly folded base                             |
|    | Transverse and oblique mountain ranges and plateaus                                   | a) sedimentary-volcanogenic, with carbonate intensive folded base                        |
|                                                                                     |                                                                                       | b) slightly sloped or monoclinally folded base of volcanogenic, carbonate rocks          |
| Low mountains, plateaus and foothills (up to 1500 m)                                |                                                                                       |                                                                                          |
|  | a) Eroded, split                                                                      | With folded, partially slightly folded base of carbonate, sedimentary-volcanogenic rocks |
|                                                                                     | b) Arid eroded, severely split                                                        | With folded base of heterogeneous rocks                                                  |
|  | Monoclinal piedmont plateaus with accumulative (boulder - sand - crushed stone) cover | With slightly folded base                                                                |
| IV. ACCUMULATIVE (SEDIMENTARY, ALLUVIAL) LANDFORM                                   |                                                                                       |                                                                                          |
| Plains                                                                              |                                                                                       |                                                                                          |
|  | Alluvial-deluvial, tableland                                                          |                                                                                          |
|                                                                                     | Alluvial-deluvial, tableland                                                          |                                                                                          |
|  | Alluvial                                                                              |                                                                                          |
|  | Alluvial-proluvial foothills, slightly oblique                                        |                                                                                          |



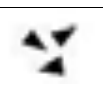
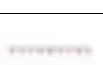
|                                                                                   |                            |  |
|-----------------------------------------------------------------------------------|----------------------------|--|
|  | Lacustrine                 |  |
|  | Lacustrine-fluvial-glacial |  |
| N <sub>2</sub> -Q <sub>2</sub>                                                    | Age of morphostructures    |  |

| LANDFORMS                                                                           |                                      |  |
|-------------------------------------------------------------------------------------|--------------------------------------|--|
| 1. SNOW-GLACIAL                                                                     |                                      |  |
|    | Cirques (kars)                       |  |
|   | Troughs (trough valleys)             |  |
|  | Moraines                             |  |
|  | Exaration forms                      |  |
| 2. HYDROEROSIVE AND HYDROACCUMULATIVE                                               |                                      |  |
|  | Hollows                              |  |
|  | V-shaped narrow valleys              |  |
|  | Wide valleys with gully and terraces |  |
|  | Canyons                              |  |
|  | Deep gorges                          |  |



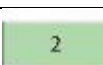
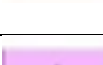
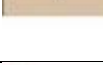
|                                                                                     |                            |  |
|-------------------------------------------------------------------------------------|----------------------------|--|
|    | Alluvial cones             |  |
| 3. EROSION                                                                          |                            |  |
|    | Archaic peneplain surfaces |  |
|    | Cuestas                    |  |
|    | Relicts                    |  |
|    | "Soil pyramids"            |  |
|    | Denudation (bad lands)     |  |
|    | Karst caves                |  |
|  | Suffosion forms            |  |
| 4. BENT UNDER LOAD                                                                  |                            |  |
|  | Collapses                  |  |
|  | Landslides                 |  |
| 5. VOLCANIC                                                                         |                            |  |
|  | Stratovolcanoes            |  |
|  | Extrusive mountain massifs |  |
|  | Slag cones                 |  |



|                                                                                   |                               |            |
|-----------------------------------------------------------------------------------|-------------------------------|------------|
|  | a) wavy                       | Lava flows |
|  | b) clastic                    |            |
|  | Placers                       |            |
|  | Axes of anticlinal structures |            |
|  | Disjunctive disturbance lines |            |
|  | Axes of synclinal structures  |            |

### Geology Map Legend

*(the absolute age in million years is presented in parentheses)*

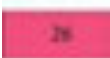
|                                                                                     |                                                                                                                        |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
|  | Holocene basalts, andesites (0.01)                                                                                     |
|  | Neo-Pleistocene - Holocene basalts, andesites (0.85-0.01)                                                              |
|  | Upper pliocene - pleistocene lacustrine, fluvial, proluvial, slope deposits (3.3-0.01)                                 |
|  | Neo-Pleistocene basalts, andesites, trachyandesites, dacites (0.85-0.01)                                               |
|  | Upper Eo-pleistocene basalts, andesites, trachyandesites, dacites (1.2-0.85)                                           |
|  | Yerevan, Ani, Artik, Byurakan and other various types of ignimbrite tuffs of Eo-pleistocene age, tuff lava (1.78-0.85) |





|    |                                                                                                                                                                             |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7  | Upper pliocene - Eo-pleistocene basalts, andesites, dacites, rhyolites, obsidians, perlites, tuff-breccias, travertines (3.3-0.85)                                          |
| 8  | Upper pliocene dolerite basalts (3.6-1.7)                                                                                                                                   |
| 9  | Upper Miocene - Lower pliocene andesite basalts, andesites, dacites, rhyolites, obsidians, perlites, tuff-breccias, tuff-sandstones, pumice basins (7.1-3.6)                |
| 10 | Middle - Upper Miocene sandstones, clays, gypsum, rock - salt, petroliferous shales (14.4-5.3)                                                                              |
| 11 | Upper oligocene - Lower Miocene clays, sandstones, conglomerates, petroliferous shales, brown coals, andesites, sanidine trachytes, tuff-breccias, ignimbrite tuffs (24-14) |
| 12 | Lower Oligocene clays, sandstones, marl stones, conglomerates, reef limestones (38-33)                                                                                      |
| 13 | Upper Eocene basalts, andesites, tuff-breccias, tuff-sandstones, clays, aleurolites, marl stones, limestones (42-38)                                                        |
| 14 | Middle Eocene andesites, tuff-breccias, tuff-sandstones, tuff-aleurolites, volcanogenic-sedimentary flysch, marl stones, limestones (50-42)                                 |
| 15 | Paleocene - Lower Eocene clays, argillaceous sandstones, aleurolites, marl stones, laminated limestones, lava flows of olivine basalts (65-53)                              |
| 16 | Upper Cretaceous conglomerates, sandstones, marl stones, limestones, radiolarite, tuff-breccias, basalts, spilites, diabases (96-65)                                        |
| 17 | Lower Cretaceous limestones, aleurolites, metamorphic laminated limestones, aleurolites, tuff-sandstones, basalts, andesite basalts (135-96)                                |
| 18 | Upper Jurassic - Lower Cretaceous basalts, andesites, tuff-sandstones, tuff-aleurolites, limestones (154-135)                                                               |
| 19 | Upper Jurassic basalts, andesites, tuff-breccias, tuff-sandstones, limestones, dolomites, sandstones, clay shales (175-135)                                                 |
| 20 | Lower - Middle Jurassic aleurolites, sandstones, hard coal strata, basalts, andesites, rhyolites, tuff-breccias, tuff-sandstones (203-135)                                  |



|                                                                                     |                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | Upper Permian - Triassic dolomites, clay shales, sandstones, hard coal and petroliferous shales strata (258-203)                                                                                       |
|    | Devonian - lower carboniferous limestones, sandstones, quartz sandstones, clay shales (385-315)                                                                                                        |
|    | Carboniferous metamorphic rocks, various shales (~315)                                                                                                                                                 |
|    | Upper Proterozoic metamorphic rocks, various shales, phyllites, amphibolites, marbles, dolomites, metamorphic volcanogenic formations (600-800)                                                        |
| INTRUSIVE FORMATIONS                                                                |                                                                                                                                                                                                        |
|    | Upper oligocene - Lower Miocene porphyraceous granites, granodiorites (24-14)                                                                                                                          |
|    | Upper Eocene - Lower Oligocene granodiorites, granites, granosyenites, nephelinic and alkaline syenites, monzonites, gabbroes (38-33)                                                                  |
|   | Upper Eocene gabbroes, granodiorites, quartz diorites, monzonites, nephelinic syenites, leucogranites (42-38)                                                                                          |
|  | Middle Eocene granodiorites, quartz diorites, gabbroes (50-42)                                                                                                                                         |
|  | Mesozoic (pre - Upper Cognac) ophiolite complex: gabbroes, troctolites, plagiogranites, quartz diorites (28), peridotites, harzburgites, lherzolites, pyroxenites, dunites, serpentinites (29) (96-65) |
|  | Upper Jurassic - Lower Cretaceous tonalites, quartz diorites, leucogranites (154-135)                                                                                                                  |
|  | Middle Jurassic plagiogranites, leucogranites (203-175)                                                                                                                                                |
|  | Upper Proterozoic trondhjemites, gneissose granites, albitites, serpentinites, gabbroes                                                                                                                |
|  | Quaternary volcanic centers                                                                                                                                                                            |
|  | Central crater of the Aragats multigenic volcano                                                                                                                                                       |

| FRACTURES                                                                         |                             |
|-----------------------------------------------------------------------------------|-----------------------------|
|  | 1-Primary                   |
|                                                                                   | a) actual<br>b) presumptive |
|  | 2-Secondary                 |
|                                                                                   | a) actual<br>b) presumptive |

### Landslide map legend

|                                                                                     |                                        |
|-------------------------------------------------------------------------------------|----------------------------------------|
|    | Landslides                             |
|    | Large landslide areas                  |
| Zones of weathering                                                                 |                                        |
|  | Thermochemical                         |
|  | Thermobiochemical                      |
|  | Thermofrost                            |
|  | Isolines of neotectonic upheavals (km) |
|  | Tectonic disturbances                  |
| Borders of basins                                                                   |                                        |
|  | Lake Sevan                             |
|  | Fluvial, second category               |
|  | Fluvial, third category                |
|  | Fluvial, fourth category               |

### Mudflows Map Legend

The maximum volume of solid phase from 1 km<sup>3</sup> of active area of mudflow formation In case of one mudflow (thous. m<sup>3</sup>/km<sup>3</sup>/)



|                                                                                     |                                                  |
|-------------------------------------------------------------------------------------|--------------------------------------------------|
|    | Strong (15-35)                                   |
|    | Medium (5-15)                                    |
|    | Weak (up to 5)                                   |
| SITES                                                                               |                                                  |
|    | Accumulation of the solid phase of mudflow       |
|    | Potential in the past, mudflow-bearing currently |
|    | Potential mudflow-bearing                        |
|  | Not mudflow-bearing                              |
| TYPE OF MUDFLOW AND DENSITY OF THE MASS , ( $\gamma_d$ - kg/m <sup>3</sup> )        |                                                  |
| Mud-stone                                                                           |                                                  |
|  | $\gamma_d=1700$                                  |
| Sedimental                                                                          |                                                  |
|  | $\gamma_d=1500-1700$                             |
|  | $\gamma_d=1300-1500$                             |
|  | $\gamma_d=1100-1200$                             |



| MUDFLOW SOURCES<br>(supply of solid materials to water flow before formation of mudflow) |                                                              |
|------------------------------------------------------------------------------------------|--------------------------------------------------------------|
|         | Relicts of washouts and accumulative terraces near riverbeds |
|         | Glacial cirques, moraine formations                          |
|         | Landslide massifs                                            |
|         | Collapses, corroding rocks                                   |
|         | Screes                                                       |
|         | Outcrops: active weathering                                  |
|       | Anthropogene                                                 |

### Granulometric Composition Of The Solid Phase Of Mudflow

| Clastic nature of mudflow mass                                                                         | Composition of mudflow mass (%)       |                       |                                          |                    |
|--------------------------------------------------------------------------------------------------------|---------------------------------------|-----------------------|------------------------------------------|--------------------|
|                                                                                                        | Lithoclasts, pebble, boulder d>250 mm | Boulders d=100-250 mm | Crushed stone, gravel, sand d=0.1-100 mm | Fine soil d<0.1 mm |
|  Water - stone      | 40                                    | 40                    | 10-15                                    | 5-10               |
|  Water-stone-debris | 15                                    | 30-35                 | 40-45                                    | 10-15              |



|                                                                                                |              |       |              |              |
|------------------------------------------------------------------------------------------------|--------------|-------|--------------|--------------|
|  Mud - debris | less than 15 | 15-20 | more than 55 | less than 30 |
|  Mud          | -            | -     | less than 40 | more than 60 |

### Legend of Seismic zoning map

Possible intensity of earthquake ( j ) and maximum horizontal accelerations of rivers ( g )  
(probability of no exceedance in 500 years - 90% )

|                                                                                        | Possible intensity<br>of earthquake<br>( j ) | Maximum horizontal<br>accelerations of rivers<br>( g ) |
|----------------------------------------------------------------------------------------|----------------------------------------------|--------------------------------------------------------|
|      | 10 and more                                  | 0.4-0.5                                                |
|     | 9                                            | 0.3-0.4                                                |
|     | 8-9                                          | 0.2-0.3                                                |
|     | 8                                            | 0.1-0.2                                                |
| g - m/sec. <sup>2</sup> in the international system of units<br>J - point ( MSK - 64 ) |                                              |                                                        |

### Legend of Seismotectonics map



|                               |                         |
|-------------------------------|-------------------------|
|                               | Lateral shifts          |
|                               | Faults                  |
|                               | Upthrow faults          |
|                               | Intense seismic focuses |
| M=7.3 Magnitude of earthquake |                         |
| 1988 Date of earthquake       |                         |

### Legend of Hydrogeology map

#### Main Water-Bearing Horizons And Complexes

|                          |                                                            |
|--------------------------|------------------------------------------------------------|
|                          | Alluvial-proluvial and lacustrine-fluvial deposits         |
|                          | Sheets, flows and beds of lavas and their clastic versions |
|                          | Complex of volcanogenic-sedimentary, volcanogenic rocks    |
|                          | Limestone-marl rocks                                       |
|                          | Transformed rocks of crystal base                          |
|                          | Intrusive rocks of different composition                   |
| SUBSURFACE WATER SOURCES |                                                            |
|                          | up to 20 l/sec. (basic)                                    |



|                                                                                     |                                                                                                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
|    | 20-25 l/sec.                                                                                            |
|    | 26-50 l/sec.                                                                                            |
|    | 51-100 l/sec.                                                                                           |
|    | 101-1000 l/sec.                                                                                         |
|    | 1001 l/sec. and more                                                                                    |
|    | Powerful water flows of inter-lava and sublava oxbow valleys                                            |
|    | Confined ground water distribution limits                                                               |
|   | Underground water distribution limits                                                                   |
|  | Limits of water-bearing horizons and complexes                                                          |
|  | Subsurface water flow course                                                                            |
| Main sources of water supply by<br>subsurface water types                           |                                                                                                         |
|  | pore-confined and crevice-confined waters of artesian basins of inter-montane kettles and river valleys |
|  | Inter-lava and sublava water flows                                                                      |
|  | Fissure water of weathering crust                                                                       |
| Hydrogeological cores                                                               |                                                                                                         |





| (by drilling data)                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                           | <p>Section established by boreholes</p> <p>The implied part of the section in dash line</p> <p>N, Pg Age of water-containing rocks</p> <p>Q Exploited basic water-bearing horizon</p> <p>200 Thicknes of aquifer (m)</p> <p>Numbers on the left side of the column express the chemical composition of subsurface waters</p> <p>1 Hydrocarbonate calcium</p> <p>2 Chloride sodium</p> <p>3 Mixed composition waters</p> |
| Potential dominating exploitation water quantity of boreholes and mineralization of subsurface water (g/l) in the central part of the core |                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                         | 10 l/sec. and more                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                                         | 5-10 l/sec.                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                                         | up to 5 l/sec.                                                                                                                                                                                                                                                                                                                                                                                                          |
|                                                         | waterproof rocks                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                         | fresh water up to 1 g/l                                                                                                                                                                                                                                                                                                                                                                                                 |



|                                                                                   |                             |
|-----------------------------------------------------------------------------------|-----------------------------|
|  | brackish water 1-3 g/l      |
|  | light salted water 3-10 g/l |



## Annex 6: Air quality analysis

Պատվիրատու՝ «Հանրային» ինստիտուտ ՍՊԸ  
Պայմանագրի համար՝ № 15/16 (11.10.2016)  
Նմուշառման ամսաթիվ՝ 12-19.10.2016թ.  
Արդյունքների տրման ամսաթիվ՝ 21.10.2016թ.

ՀԱՍՏԱՏՈՒՄ ԵՄ  
«Երջակա միջավայրի վրա ներգործության  
մոնիթորինգի կենտրոն» ՊՈԱԿ-ի տնօրեն

Ս. Մահակյան

21.10.2016թ.

Մթնոլորտային օդի որակի ուսումնասիրության արդյունքները

| Նմուշի<br>անվանումը | Համայնք         | Միջին օրական կոնցենտրացիա մգ/մ³ |                            |
|---------------------|-----------------|---------------------------------|----------------------------|
|                     |                 | ՍՑ-Կ <sub>մթն</sub> = 0.05      | ՍՑ-Գ <sub>մթն</sub> = 0.04 |
|                     |                 | Շմբի երկօրյալ                   | Ազոտի երկօրյալ             |
| 1                   | Միսիան (204 կմ) | 0,054                           | 0,002                      |
| 2                   | Շամբի ԳՀՍ       | 0,072                           | 0,003                      |
| 3                   | Լոբ             | 0,036                           | 0,003                      |
| 4                   | Գեղափանք        | 0,010                           | 0,004                      |
| 5                   | Բարեկամության   | 0,002                           | 0,004                      |

ՍՑԿ-առնչումը բաղադրվել է կոնցենտրացիա

Գիտաարտադրական հարցերով տնօրենի տեղակալ՝

Ինֆորմացիայի վերլուծության և պահպանման բաժնի պետ՝

Գ. Շահնազարյան

Ա. Ջառիկյան

ՀՀ, ք. Երևան 0012, Կոմիտաս 29 հեռ. +37410 272007, +37410266196

*Client: "Dorproject" institute LLC**I confirm*

Contract number: 15/16 (11.10.2016)

*S. Sahakyan*

21.10.2016

Sampling date: 12-19.10.2016

*Director*

Results providing date: 21.10.2016

*"Environmental Impact Monitoring Center"*  
*SNCO**Air quality study results*

| Sampling | Community       | Average daily concentration, mg/m <sup>3</sup> |                                |
|----------|-----------------|------------------------------------------------|--------------------------------|
|          |                 | MPC <sub>av daily</sub> = 0.05                 | MPC <sub>av daily</sub> = 0.04 |
|          |                 | Sulfur Dioxide                                 | Nitrogen Dioxide               |
| 1        | Sisian (204 km) | 0.054                                          | 0.002                          |
| 2        | Shamb HPP       | 0.072                                          | 0.003                          |
| 3        | Lor             | 0.036                                          | 0.003                          |
| 4        | Geghavanq       | 0.010                                          | 0.004                          |
| 5        | Barekamavan     | 0.002                                          | 0.004                          |

*MPC – maximum permissible concentration**Deputy Director Research and Development*     *G. Shahnazaryan**Head of Information Analysis and Protection Division*     *A. Zatikyan*

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## Annex 7: Flora and Fauna

### INTRODUCTION

Sisian – Qajaran 60 km part of "NORTH-SOUTH ROAD CORRIDOR" is starting from Sisian Ishkhanasar crossroad and last till Qajaran city. The aim of the biodiversity surveys was study the area of 60 km road in order to avoid and minimize negative impact of new road on flora and fauna.

Extensive survey was conducted along road between Sisian- Qajaran cities, where a new highway is planned to construct. Standard field methods for assessment and evaluation of plants, insects, amphibians, reptiles, birds and mammals were used.



Fig. 1. Tracks of our trips

## PLANTS

### Introduction

M1 “**Sisian - Qajaran**” interstate highway (Fig. 1) is a strategic and will be vitally important corridor to Armenia imports and exports, and also for local transportation. It will connect Sisian and Qajaran cities as well as Iran with Georgian Black Sea ports, the CIS, Europe and other countries.

M1interstate highway goes along the canyon Vorotan and Geghi with Voghji Rivers. The highway cross the Bargushat mountain ridge from North to South and runs alongside the small roads from Sisian city to Darbas and Lernashen villages and from Qarut and Geghi villages to Qajaran city at several sections with numerous tunnels and bridges.

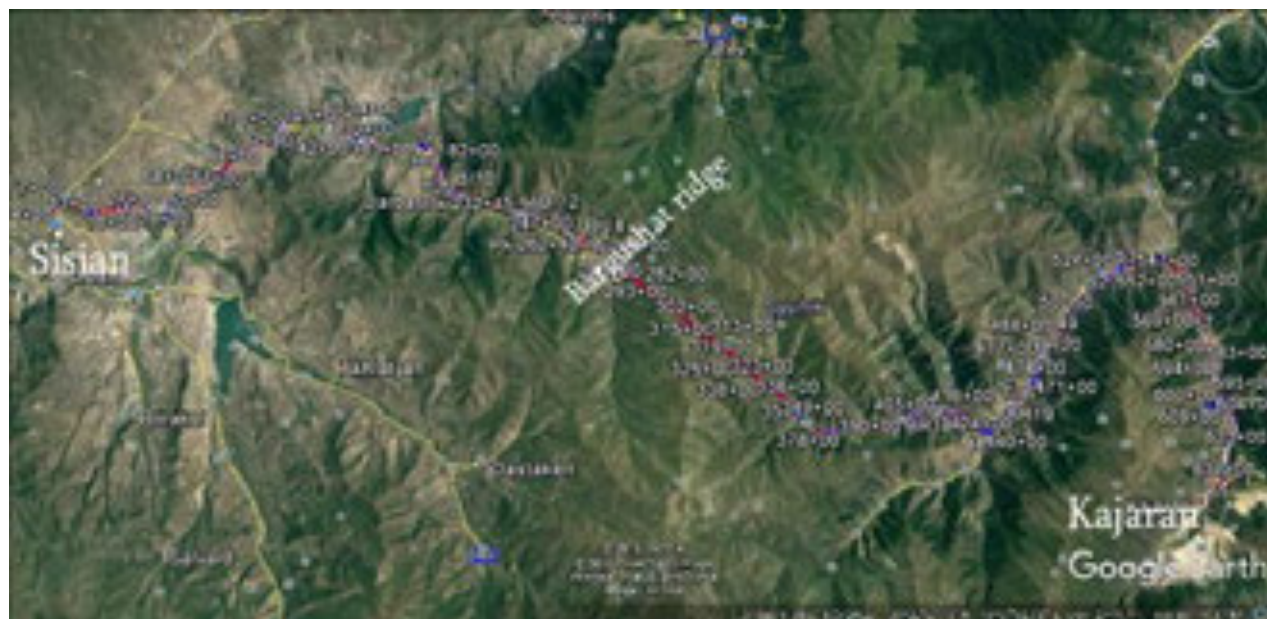


Fig. 1. On the aerial photograph of Google Earth is shown the common corridor of road project

Existing roads partly are very sinuous; curvature radii often do not meet minimum standards of interstate highway and partly there are planning build new roads which will connect north and south slopes of Bargushat ridge.

The proposed interstate road crossing completely true to the Syunik region which flora and vegetation are very rich and diverse. The flora includes about 2200-2500 species of vascular plants, which are presented in a number of rare, endangered and endemic plants, wild relatives of crops and other useful plants, food, medical herbs, ornamental, technical species and so on. The area of investigation is typical for the Syunik region. There are presented almost all types of vegetation as well as semi-desert and desert, meadow and steppe



vegetation, mixed deciduous forests, arid sparse forests, sub-alpine and alpine vegetation, wetland vegetation, vegetation of rocky habitats, etc.

## Material and Methods

### Material

The total length of M1 “Sisian-Kapan” interstate highway is about 65km. There are 28 bridges (most part of which are more than 100 meters in long) and 7 tunnels along the road.

In October 2016, along “Sisian-Lernashen-Gekhi-Kajaran” interstate highway we have fulfilled floristic survey. Vegetation was studied in terms of the planned road about 200-300 meters wide zones. In some places, up to 500 m wide belt is made, where possible, the vegetation will be covered with rocks.

For the study the interstate road divided by as into 8 separate sections, each of which has its own botanical and geomorphology characteristics.

### Methods

All studies were made in accordance with classical geobotanical methods. Field studies were carried out using the routing method. Were made floristic notes, collected of herbariums of some trees, shrubs and herbs species. Were made photos for exploration of the current state of flora and vegetation of studied area (Fig. 14).

For the data analysis were used quantitative analysis methods of flora by L.I. Malisheva (1975).

Source for determination of species has served Flora of Armenia (11 volumes, 1954-2009), Plants Red Book of Armenia (2010) and etc. Scientific plant names have been corrected according to methodical manual by S. Tcherepanov (Tcherepanov, 1995) and etc.

Geographic coordinates recorded by the Garmin-2 GPS device.



Fig. 2. Vicinity of the Ishkhansar village (beginning of survey).

## Sections

The total length of M1 “Sisian-Kapan” interstate highway is about 65 km. It is divided into 8 separate sections, each of which has its own botanical and geomorphology characteristics.

### SECTION 1 (Fig. 3, 4). Ishkhanasar - Aghitu (0 – 5.2km)



Fig. 3. The beginning of M1 “Sisian-Kapan” interstate highway



Fig. 4. Nursery of *Pinus sylvestris* in the mountain steppe

- *Road*: Beginning of the territory of interstate highway M1 (0 km– **5.2 km**) near the Ishkanasar village.



**SECTION2.**

**Aghitu – Shamb reservoir – Beginning of the bridge (5.2 – 15.7 km) (Fig. 5),**



Fig. 5. Vorotan river and gardens near the Shamb reservoir

- *Road:* After city Sisian the road curving to Vorotan river canyon where the road pass left slopes. After river interstate highway crossing the gardens and going to bridge.

**SECTION3.**

**End of the bridge - Darbas–Shenatagh-Tunnel (16.0 - 27.1 km) (Fig. 6, 7),**



Fig. 6. A. Shenatagh river canyon in the vicinity of Darbas village; B. *Juniperus polycarpus*



Fig. 7. *Berberis vulgaris* and *Rosa spinosissima* bushes near the Darbas village

- *Road*: After bridge the interstate highway turn to beginning of very narrow and beautiful Shenatagh river canyon from left side of river then passing the river and going mainly true right slopes of river up to tunnel after the Shenatagh village. Tunnel crossing the Bargushat mountain ridge from North to South.

#### SECTION 4.

**Tunnel - Qarut–Verin Geghavank (35.7 – 49.2 km)** (Fig. 8, 9, 10),



Fig. 8. Near the Qarut village





Fig 9. *Pyrus zangezourain* vicinity of Qarut village

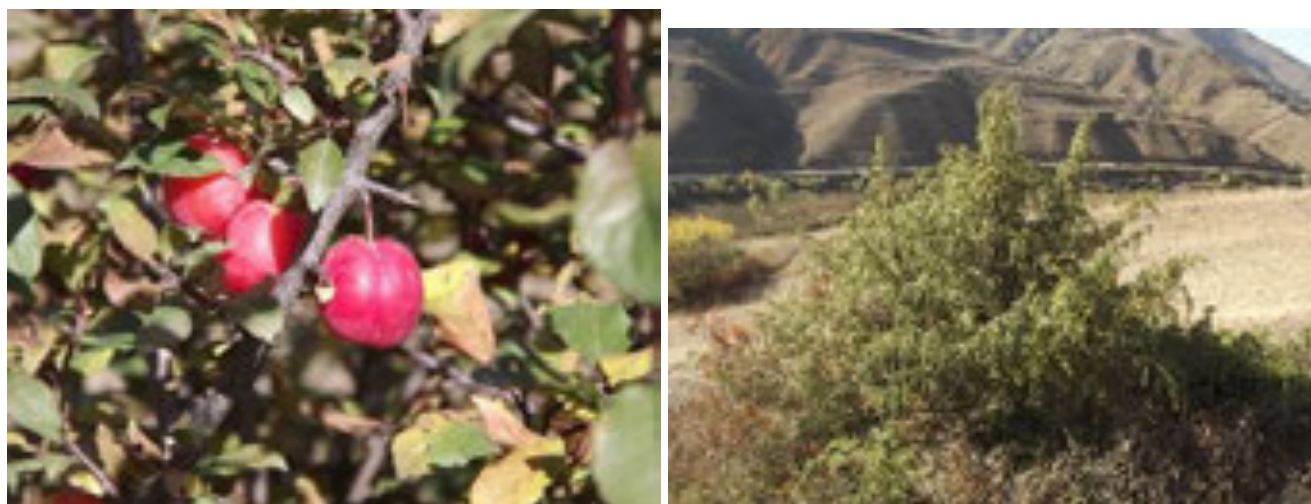


Fig. 10. A. *Prunus divaricata* in Geghi river gorge; B. *Juniperus oblonga*

- *Road*: Interstate highway M1 is beginning from south slopes of ridge before the Qarut village into the Verin Geghavank village.

## SECTION 5.

### Verin Geghavank - Kavchut– Tunnel (49.4 – 54.4 km) (Fig. 11),

- *Road*: After Verin Geghavank highway turn to right slopes of Geghi river before the cross of Kapan-Qajaran road.



Fig. 11. Before the cross of Kapan-Qajaran road (Tigran with *Lonicera iberica*).

### SECTION 6.

**Tunnel –cross of the Kapan-Qajaran road – Lernadzor (54.8 – 61.0 km) (Fig. 12),**



Fig. 12. A. Before the Lernadzor village; B. *Juniperus oblonga*

- *Road:* From the cross of Kapan-Qajaran road the interstate highway going on left slopes of Voghji river then passing the river.

### SECTION 7.

**Lernadzor - Qajaran (61.2 – 63.7 km) (Fig. 13),**

Fig. 13. *Carpinus betulus* and *Quercus macranthera* forest between Lernadzor village and Qajaran town.

- *Road:* After the Lernadzor village the interstate highway going on right slopes of river on the north slopes of Meghri ridge up to Qajaran town.

**SECTION 8.****Qajaran (63.8 – 65.2 km) (Fig. 14).**

- *Road:* From the east edge of Qajaran city the highway curving to up and south and then going to the Meghri (Tashtun) pass.





Fig. 14. Sambucus ebulus in Qajaran town

## Results

### The botanical description of sections 1-8

- **Section 1` Ishkhanasar - Aghitu (0 – 5.2 km)** (Fig. 2, 3): *Botanical part.* In the beginning of the territory of interstate highway M1 situated the steppe vegetation. At the Soviet Union time there was a Pinenursery. There are *Pinus sylvestris* trees about 10-30 cm diameter, 12 which of them will be cut during the road constructing. There are also 36 trees of *Pyrus salicifolia* (8), *Malus orientalis* (3), *Prunus divarivata* (17), *Elaeagnus angustifolia* (5), *Ulmus* (2), *Cerasus mahaleb* (1), etc, that will be to cut. Near roadsides also need regular pruning and cleaning the bushes of *Rosa spinosissima*, *Caragana arborescens*, ect.

- **Section 2` Aghitu – Shamb reservoir – Beginning of the bridge (5.2 – 15.7 km)** (Fig. 4): *Botanical part.* In the canyon there is mountain steppe vegetation with bushes and riparian forests in the lover part. It is necessary to cut 90 trees of *Salix excelsa* (70), *Prunus divarivata* (5), *Malus domestica* (3), *Juglans regia* (3), *Elaeagnus angustifolia* (2), *Populus bolleana* (1), *P. nigra* (3), *Cerasus vulgaris* (1), *Armeniaca vulgaris* (1), *Acer negundo* (1) and carry out pruning work of different shrubs (*Rhamnus spathulifolia*, etc.). Near roadsides also need regular pruning and cleaning the bushes of *Berberis vulgaris*, *Rosa sp.*, *Caragana arborescens*, ect.

- **Section 3` End of the bridge - Darbas – Shenatagh-Tunnel (16.0 - 27.1 km)** (Fig. 5, 6): *Botanical part.* After bridge the interstate highway cross true the slopes with very rich vegetation of mountain steppe with bushes. Then highway mainly crossing the ligh forests with Juniper trees where will be cut 354 trees of *Juniperus oblonga* (19), *J. polycarpus* (19), *Amygdalus fenzliana* (80), *Acer campestre* (7), *Quercus macranthera* (17), *Juglans regia* (6), *Fraxinus excelsior* (7), *Cerasus avium* (5), *Cerasus vulgaris* (15), *Cerasus mahaleb* (7), *Prunus divaricata* (33), *Pyrus caucasica* (4), *P. salicifolia* (8), *Populus nigra* (13), *Salix excels* (47), *S. triandra* (22), *Ulmus minor* (10), etc.. Near roadsides also need regular pruning and cleaning the bushes of *Ephedra procera*, *Berberis vulgaris*, *Hippophae rhamnoides*, *Rhamnus cathartica*, *Lonicera iberica*, *Rosa iberica*, *Cotoneaster sp.*, *Crataegus sp.*, ect.

- **Section 4` Tunnel - Karut – Verin Geghavank (35.7 – 49.2 km)** (Fig. 7-9):

*Botanical part.* The highway will cross the meadow steppe vegetation with bushes then will cross mountain steppe with Juniper light forests and bushes and nursery op Pine trees. There will cut **1276** trees of *Pinus sylvestris* (250), *Juniperus oblonga* (242), *J. polycarpus* (362), *J. foetidissima* (10), *Acer campestre* (42), *A. ibericum* (3), *Quercus macranthera* (109), *Fraxinus excelsior* (12), *Malus orientalis* (2), *Prunus divaricata* (70), *Pyrus zangezura* (35), *Populus nigra* (1), *Salix excelsa* (42), *Celtis caucasica* (31), etc. Near roadsides also need regular pruning and cleaning the bushes of *Cotinus coggygria*, *Rhamnus pallasii*, *Berberis vulgaris*, *Rosa sp.*, etc.

- **Section 5` Verin Geghavank - Kavchut – Tunnel (49.4 – 54.4 km)** (Fig. 10):

*Botanical part.* The highway will cross the light forests with Juniper then forests with oak trees. There will cut **542** trees of *Juniperus oblonga* (50), *J. polycarpus* (90), *J. foetidissima* (110), *Acer campestre* (50), *A. ibericum* (40), *Quercus macranthera* (71), *Cornus mas* (10), *Juglans regia* (10), *Fraxinus excelsior* (20), *Ailanthus altissima* (45), etc. Near roadsides also need regular pruning and cleaning the bushes of *Lonicera iberica*, *Cotinus coggygria*, *Amygdalus fenzliana*, *Crataegus sp.*, *Rosa sp.*, etc.

- **Section 6` Tunnel – cross of the Kapan-Kajaran road – Lernadzor (54.8 – 61.0 km)** (Fig. 11): *Botanical part.* There the vegetation of mountaine steppe and bushes with Juniper, *Cotinus*, *Quercus* etc. There will cut **167** trees of *Juniperus foetidissima* (20), *Carpinus betulus* (50), *Quercus macranthera* (10), *Fraxinus excelsior* (30), *Cerasus avium* (1), *Pyrus salicifolia* (1), *Salix alba* (30), *S. excelsa* (20), *Ulmus glabra* (3), etc. Near roadsides also need regular pruning and cleaning the bushes of *Lonicera orientalis*, *L. iberica*, *Cotinus coggygria*, *Berberis vulgaris*, *Rosa sp.*, etc.

- **Section 7` Lernadzor - Kajaran (61.2 – 63.7 km)** (Fig. 12): *Botanical part.* Here the highway will cross the forests with oak, hornbeam, etc. There will cut the most cuantitate of high and thick trees in deep leafy forests - **2971** trees of *Acer campestre* (150), *A. hyrcanum* (70), *A. ibericum* (20), *Carpinus betulus* (400), *Corylus avellana* (70), *Cornus mas* (110), *Robinia pseudoacacia* (30), *Quercus macranthera* (900), *Fraxinus excelsior* (100), *Cerasus avium* (40), *Malus orientalis* (50), *Prunus divaricata* (250), *Pyrus caucasica* (70), *Sorbus aucuparia* (50), *Ulmus glabra* (70), etc.

• **Section 8` Kajaran (63.8 – 65.2 km)** (Fig. 13): *Botanical part*. Near the town and inside of it will cut many deep forest species and gardens. There will cut **620** trees of *Juniperus polycarpus* (1), *Carpinus betulus* (60), *Cornus mas* (7), *Quercus macranthera* (100), *Fraxinus excelsior* (30), *Salix excelsa* (80), *Ulmus glabra* (30), etc.

### The analyses of flora and vegetation of the territory along of the M1 “Sisian-Kajaran” interstate highway

The studied area belongs to Zangezur floristic region (Caucasian sub province, Tsirkumboreal province, Boreal Floral subkingdom, Holarctic kingdom) (Takhtajan, 1978). The vegetation of investigated sections has expressed mezo-xerophilous and mesophilic character, is specific steppes, steppes-meadows, forests, also riparian forests (Fig. 3-14). In some places of territory expressed scrub and rocky vegetation. In the southern part of study area, the flora is mainly woody. In the upper parts of the area expressed in perennial grasses, in the northern part and on middle altitudes the flora mainly expressed in light forests with different species of Juniper, Jerusalem thorn bushes, wild plams, etc. In roadsides mostly developed secondary vegetation.

### The Sisian-Kajaran roadside flora

Along the M1 “Sisian-Qajaran” interstate highway studied plant species belong to 363 species, 240 genera and 85 families from 5 classes of higher plants.

The flora of Dicotyledones dominated by representatives of 299 species, 194 tribes, 63 families. Monocotyledones class is represented by 51 species, 37 species of 15 families. Gymnospermae, Pteridales, Equisetales and Mossestogether make up 3.6% of the species composition of along the M1 “Sisian-Qajaran” interstate highway -13 species (Table 1).

| Table 1.<br>The main taxonomy units of along the M1 “Sisian-Qajaran” interstate highway |              |               |                    |                  |                   |
|-----------------------------------------------------------------------------------------|--------------|---------------|--------------------|------------------|-------------------|
| Main taxonomy units                                                                     |              |               | Number of families | Number of genera | Number of species |
| Kingdom                                                                                 | Division     | Class         |                    |                  |                   |
| Plants                                                                                  | Mosses       |               | 1                  | 1                | 1                 |
|                                                                                         | Equisetales  |               | 1                  | 1                | 2                 |
|                                                                                         | Pteridales   |               | 2                  | 4                | 4                 |
|                                                                                         | Gymnospermae |               | 3                  | 3                | 6                 |
|                                                                                         | Angiospermae | Dicotyledones | 63                 | 194              | 299               |





|              |  |                        |           |            |            |
|--------------|--|------------------------|-----------|------------|------------|
|              |  | <b>Monocotyledones</b> | <b>15</b> | <b>37</b>  | <b>51</b>  |
| <b>TOTAL</b> |  |                        | <b>85</b> | <b>240</b> | <b>363</b> |



## Sisian-Kajaran roadside plant list

### PLANTAE

#### Class. BRYOPSIDA

##### Fontinalaceae

Fontinalis antipyretica Hedw.

#### Class. EUISETOPSIDA

##### Equisetaceae

Equisetum ramosissimum Dsf.

Equisetum arvense L.

#### Class. PTEROPSIDA

##### Aspleniaceae

Asplenium septentrionale (L.) Hoffm.

Ceterach officinarum W.

##### Dryopteridaceae

Dryopteris filix-mas (L.) Shott.

Polystichum lonchitis (L.) Roth

#### Class. GYMNOSPERMAE

##### Cupressaceae

Juniperus depressa Stev.

Juniperus foetidissima Willd.

Juniperus oblonga Bieb.

Juniperus polycarpos K. Koch.

##### Ephedraceae

Ephedra procera Fisch. et C.A. Mey.

##### Pinaceae

Pinus silvestris L

#### Class. ANGIOSPERMAE

##### Order. Monocotyledones

##### Alliaceae

Allium flavum L.

Allium fuscoviolaceum Fomin

Allium jajlae Vved.

Allium szovitsii Regel

##### Amaryllidaceae

Galanthus transcausicus Fomin

##### Araceae

Arum orientale M. Bieb.

##### Asparagaceae

Asparagus officinalis L.

Asparagus persicus Baker

Asparagus verticillatus L.

##### Asphodelaceae

Eremurus spectabilis N. Bieb.

**Colchicaceae**

Colchicum speciosum Steven  
Merendera trigyna (Steven ex Adam) Stapf

**Convallariaceae**

Polygonatum verticillatum (L.) All.

**Cyperaceae**

Carex caucasica Stev.  
Carex melanostachya M. Bieb. ex Willd.  
Carex capillaris L.  
Carex supina Willd. ex Wahlenb.

**Hyacinthaceae**

Ornithogalum montanum Cirillo  
Scilla caucasica Misch.

**Iridaceae**

Crocus speciosus M. Bieb.  
Gladiolus hajastanicus Gabrielian  
Iris imbricata Lindl.  
Iris lineolata (Trautv.) Grossh.

**Juncaceae**

Juncus inflexus L.

**Liliaceae**

Gagea bulbifera (Pall.) Salisb.  
Tulipa sosnowskyi Achv. et Mirzoeva

**Orchidaceae**

Cephalanthera longifolia (L.) Fritsch  
Dactylorhiza urvilleana (Steud.) H. Baumann et Kunkele  
Orchis mascula (L.) L.  
Platanthera chlorantha (Custer) Rchb.

**Poaceae**

Aegilops cylindrica Host  
Aegilops tauschii Coss.  
Agrostis capillaris L.  
Alopecurus textilis Boiss. subsp. textilis  
Avena fatua L.  
Briza elatior L.  
Bromus japonicus Thunb. subsp. japonicus  
Catabrosa aquatica (L.) P. Beauv.  
Dactylis glomerata L.  
Elytrigia repens (L.) Nevski  
Festuca chalcophaea V. I. Krecz. et Bobrov  
Festuca ruprechtii (Boiss.) V. Krecz. Et Bobr.  
Hordeum bulbosum L.  
Hordeum geniculatum All.  
Hordeum violaceum Boiss. et Huet  
Phragmites altissimus (Benth.) Nabil  
Poa bulbosa L.



*Poa pratensis* L.  
*Secale vavilovii* Grossh.  
*Sorghum halepense* (L.) Pers.

**Typhaceae**

*Typha latifolia* L.

**Order. Dicotyledones****Aceraceae**

*Acer campestre* L.  
*Acer hyrcanum* Fisch. et C.A. Mey.  
*Acer ibericum* Bieb.  
*Acer negundo* L.  
*Acer trautvetteri* Medw.

**Amaranthaceae**

*Amaranthus retroflexus* L.

**Anacardiaceae**

*Cotinus coggygria* Scop.

**Apiaceae**

*Astrantia maxima* Pall.  
*Astrodaucus orientalis* (L.) Drude  
*Bupleurum exaltatum* Bieb.  
*Bupleurum polyphyllum* Ledeb.  
*Chaerophyllum aureum* L.  
*Chaerophyllum macrospermum* (Willd. ex Spreng.) Fisch. et C.A. Mey.  
*Daucus carota* L.  
*Eryngium billardieri* Delaroche  
*Eryngium caucasicum* Trautv.  
*Falcaria vulgaris* Bernh.  
*Heracleum schelkovnikovii* Woronow  
*Heracleum sosnowskyi* Manden.  
*Heracleum trachyloma* Fisch. et C.A. Mey.  
*Hippomarathrum microcarpum* (Bieb.) V. Petrov  
*Prangos ferulacea* (L.) Lindl.

**Apocinaceae**

*Vinca herbacea* W. K.

**Asclepiadaceae**

*Cynanchum acutum* L.  
*Vincetoxicum amplifolium* K. Koch

**Asteraceae**

*Achillea millefolium* L.  
*Arctium lappa* L.  
*Artemisia absinthium* L.  
*Artemisia annua* L.  
*Artemisia fragrans* Willd.  
*Artemisia incana* (L.) Druce  
*Artemisia scoparia* Waldst. et Kit.  
*Artemisia vulgaris* L.



*Centauera depressa* Bieb.  
*Centaurea rhizantha* C.A. Mey.  
*Chondrilla juncea* L.  
*Cichorium intybus* L.  
*Cirsium esculentum* (Siev.) C.A. Mey.  
*Conyza canadensis* (L.) Cronq.  
*Crepis sonchifolia* (Bieb.) C. A. Mey.  
*Echinops pungens* Trautv.  
*Galinsoga parviflora* Cav.  
*Grossheimia macrocephala* (Muss.-A525Puschk. ex Willd.) Sosn. et Takht.  
*Helichrysum pallasii* (Spreng.) Ledeb.  
*Hieracium cymosum* L.  
*Hieracium piloselloides* Vill.  
*Inula germanica* L.  
*Inula helenium* L.  
*Lactuca serriola* L.  
*Leontodon asperimus* (Willd.) Boiss. ex Ball  
*Psephellus zangezuri* Sosn.  
*Senecio lorentii* Hochst.  
*Senecio othonnae* Bieb.  
*Senecio vernalis* Waldst. et Kit.  
*Sonchus asper* (L.) Hill  
*Tanacetum balsamitoides* (Nabel.) Chandjian  
*Tanacetum canescens* DC.  
*Tanacetum chiliophyllum* (Fisch. et C.A. Mey. ex DC.) Sch. Bip.  
*Tanacetum parthenium* (L.) Sch. Bip.  
*Tanacetum vulgare* L.  
*Tanacetum zangezuricum* Chandjian  
*Taraxacum officinale* Wigg.  
*Tripleurospermum disciforme* (C.A. Mey) Sch. Bip.  
*Tussilago farfara* L.  
*Xanthium italicum* Moretti  
*Xanthium spinosum* L.  
*Xanthium strumarium* L.  
*Xeranthemum squarrosum* Boiss.

**Berberidaceae**

*Berberis vulgaris* L.

**Betulaceae**

*Betula pendula* Roth.  
*Carpinus betulus* L.  
*Corylus avellana* L.

**Boraginaceae**

*Anchusa arvensis* (L.) Bieb.  
*Anchusa azurea* Mill.  
*Cerinthe minor* L.  
*Echium vulgare* L.



Lappula squarrosa (Retz.) Dumort.  
Myosotis arvensis (L.) Hill.  
Myosotis sylvatica Ehrh. ex Hoffm.  
Onosma microcarpa Stev. ex DC.  
Symphytum asperum Lepech.

#### **Brassicaceae**

Aethionema arabicum (L.) Lipsky  
Alyssum alyssoides (L.) L.  
Alyssum desertorum Stapf.  
Alyssum persicum Boiss.  
Alyssum tortuosum Waldst. et Kit. ex Willd.  
Capsella bursa-pastoris (L.) Medik.  
Crambe orientalis L.  
Draba bruniifolia Stev.  
Erysimum gelidum Bunge  
Hesperis matronalis L.  
Lepidium campestre (L.) R. Br.  
Nasturtium officinale R. Br.  
Thlaspi perfoliatum L.  
Turritis glabra L.

#### **Campanulaceae**

Campanula glomerata L.  
Campanula zangezura (Lipsky) Kolak. et Serdjuk.  
Campanula latifolia L.  
Michauxia laevigata Vent.

#### **Capparaceae**

Cleome ornithopodioides L.

#### **Caprifoliaceae**

Lonicera orientalis Lam.  
Lonicera iberica Bieb.  
Sambucus ebulus L.  
Viburnum lantana L.

#### **Caryophyllaceae**

Arenaria steveniana Boiss.  
Cerastium holosteam Fisch.  
Cerastium purpurascens Adams.  
Dianthus cretaceus Adams  
Dianthus crinitus Smith  
Dianthus orientalis Adams  
Gypsophila elegans Bieb.  
Herniaria incana Lam.  
Melandrium latifolium (Poir.) Maire  
Petrorhagia alpina (Habl.) P.W.Ball et Heywood  
Sagina procumbens L.  
Silene bornmulleri Freyn  
Silene cephalantha Boiss.



*Silene chlorifolia* Smith  
*Silene ruprechtii* Schischk.

#### **Celastraceae**

*Euonymus latifolia* (L.) Mill.

#### **Chenopodiaceae**

*Atriplex tatarica* L.  
*Ceratocarpus arenarius* L.  
*Chenopodium album* L.  
*Chenopodium botrys* L.  
*Chenopodium foliosum* Aschers.  
*Salsola dendroides* Pall.

#### **Convolvulaceae**

*Convolvulus arvensis* L.

#### **Cornaceae**

*Cornus mas* L.  
*Swida australis* (C.A. Mey.) Pojark. ex Grossh.

#### **Crassulaceae**

*Rosularia sempervivum* (Bieb.) Berger  
*Sedum caucasicum* (Grossh.) A. Bor.  
*Sedum oppositifolium* Sims.  
*Sedum sempervivoides* Fisch.  
*Sempervivum transcaucasicum* Muirhead

#### **Cucurbitaceae**

*Bryonia alba* L.

#### **Cuscutaceae**

*Cuscuta cesattiana* Bertol.

#### **Dipsacaceae**

*Cephalaria gigantea* (Ledeb.) Bobr.  
*Dipsacus laciniatus* L.  
*Scabiosa caucasica* Bieb.

#### **Elaeagnaceae**

*Elaeagnus angustifolia* L.  
*Hippophae rhamnoides* L.

#### **Euphorbiaceae**

*Euphorbia iberica* Boiss.  
*Euphorbia sequierana* Neck.

#### **Fabaceae**

*Alhagi pseudalhagi* (Bieb.) Desv.  
*Astragalus aureus* Willd.  
*Astragalus microcephalus* Willd.  
*Astragalus xiphidium* Bunge  
*Caragana arborescens*  
*Genista tinctoria* L.  
*Medicago coerulea* Less. ex Ledeb.  
*Lathyrus pratensis* L.  
*Lotus caucasicus* Kuprian. ex Juz. կապյան



Medicago coerulea Less. ex Ledeb.  
Medicago rigidula (L.) Desr.  
Melilotus officinalis (L.) Pall.  
Onobrychis cornuta (L.) Desv.  
Robinia pseudoacacia L.  
Trifolium alpestre L.  
Trifolium arvense L.  
Trifolium campestre Schreb.  
Trifolium medium L.  
Trifolium pratense L. var geniculatum R. et F.  
Trifolium trichocephalum Bieb.  
Vicia alpestris Stev.  
Vicia grandiflora Scop.  
Vicia nissoliana L.

**Fagaceae**

Quercus macranthera F. et M. ex Hohen.

**Fumariaceae**

Fumaria officinalis L.

**Gentianaceae**

Gentiana umbellata Bieb.

**Geraniaceae**

Erodium cicutarium (L.) L'Her.  
Geranium sylvaticum L.

**Grossulariaceae**

Ribes biebersteinii Berl.

**Hypericaceae**

Hypericum armenum Jaub. et Spach  
Hypericum perforatum L.

**Juglandaceae**

Juglans regia L.

**Lamiaceae**

Ajuga chia Schreb.  
Betonica macrantha K. Koch  
Lamium album L.  
Mentha longifolia (L.) Huds.  
Nepeta mussinii Spreng.  
Nepeta noraschenica Grossh.  
Origanum vulgare L.  
Prunella vulgaris L.  
Salvia armeniaca (Bordz.) Grossh.  
Scutellaria orientalis L.  
Sideritis montana L.  
Stachys spectabilis Choisy ex DC.  
Teucrium polium L.  
Thymus collinus Bieb.  
Thymus kotschyanus Boiss. et Hohen.



Thymus transcaucasicus Ronn.  
Ziziphora rigida (Boiss.) Stapf

**Linaceae**

Linum nervosum Waldst. et Kit.

**Loranthaceae**

Arceuthobium oxycedri (DC.) Bieb.

**Malvaceae**

Alcea rugosa Alef.  
Malva neglecta Wallr.  
Malva sylvestris L.

**Oleaceae**

Fraxinus excelsior L.  
Fraxinus oxycarpa Willd.  
Jasminum fruticans L.  
Ligustrum vulgare L.

**Onagraceae**

Chamaenerion angustifolium (L.) Scop.  
Epilobium hirsutum L.

**Orobanchaceae**

Diphelipaea coccinea (Bieb.) Nicolson  
Orobanche gamosepala Reut.

**Papaveraceae**

Papaver commutatum Fisch. et C.A. Mey.  
Papaver fugax Poir.  
Papaver macrostomum Boiss. et Huet  
Papaver orientale L.

**Peganaceae**

Peganum harmala L.

**Plantaginaceae**

Plantago lanceolata L.  
Plantago major L.  
Plantago media L.

**Plumbaginaceae**

Acantholimon bracteatum (Girard) Boiss.

**Polygalaceae**

Polygala transcaucasica Tamamsch.

**Polygonaceae**

Atraphaxis spinosa L.  
Polygonum aviculare L.  
Polygonum carneum K. Koch  
Rumex acetosa L.  
Rumex acetoselloides Bal.  
Rumex crispus L.  
Rumex obtusifolius L.  
Rumex tuberosus L.

**Portulacaceae**



*Portulaca oleracea* L.

**Primulaceae**

*Primula macrocalyx* Bunge

**Ranunculaceae**

*Thalictrum foetidum* L.

*Thalictrum minus* L.

**Resedaceae**

*Reseda lutea* L.

**Rhamnaceae**

*Paliurus spina-christ* (Mill) A.C. Sch.

*Rhamnus cathartica* L.

*Rhamnus pallasii* Fisch. et C.A. Mey.

*Rhamnus spathulifolia* Fisch et C.A. Mey.

**Rosaceae**

*Alchemilla retinervis* Bus.

*Amygdalus fenzliana* (Fritsch) Lipsky

*Armeniaca vulgaris* Lam.

*Cerasus avium* (L.) Moench

*Cerasus incana* (Pall.) Spach

*Cerasus vulgaris* Mill.

*Cerasus mahaleb* (L.) Mill.

*Cotoneaster integerrimus* Medik.

*Cotoneaster saxatilis* Pojark.

*Crataegus monogyna* Jacq.

*Crataegus orientalis* Pall. ex Bieb.

*Crataegus pentagyna* Waldst. et Kit.

*Cydonia oblonga* Mill.

*Filipendula ulmaria* (L.) Maxim.

*Fragaria viridis* (Duch.) Weston

*Geum urbanum* L.

*Malus domestica* Borkh.

*Malus orientalis* Uglitzk.

*Persica vulgaris* Mill.

*Potentilla recta* L.

*Prunus divaricata* Ldb.

*Prunus domestica* L.

*Prunus spinosa* L.

*Pyrus caucasica* Fed.

*Pyrus communis* L.

*Pyrus pseudosyriaca* Gladkova x *P. salicifolia* Pall.

*Pyrus salicifolia* Pall.

*Pyrus voronovii* Rubtzov

*Pyrus zangezura* Maleev

*Rosa canina* L.

*Rosa iberica* Stev. ex Bieb.

*Rosa spinosissima* L.



Rubus armeniacus Focke.  
Rubus caesius L.  
Sorbus aucuparia L.  
Sorbus dualis Zinserl.  
Sorbus graeca (Spach) Hedl.  
Spiraea crenata L.  
Spiraea hypericifolia L.

#### **Rubiaceae**

Asperula molluginoides (Bieb.) Reichenb.  
Galium aparine L.  
Galium verum Scop.

#### **Salicaceae**

Populus bolleana Lauche  
Populus italica (Dur.) Moench  
Populus nigra L.  
Salix alba L.  
Salix caprea L.  
Salix elbursensis Boiss.  
Salix excelsa S. G. Gmel.  
Salix triandra L.

#### **Sambucaceae**

Sambucus ebulus L.

#### **Scrophulariaceae**

Bungea trifida (Vahl) C. A. Mey.  
Pedicularis sibthorpii Boiss.  
Schrophularia cinerascens Boiss.  
Schrophularia olympica Boiss.  
Verbascum songaricum Schrenk ex Fisch. et C. A. Mey.

#### **Simaroubaceae**

Ailanthus altissima (Mill.) Swingle

#### **Solanaceae**

Datura stramonium L.  
Hyoscyamus niger L.

#### **Ulmaceae**

Celtis caucasica Willd.  
Ulmus glabra Huds.  
Ulmus minor Mill.

#### **Urticaceae**

Parietaria judaica Strand.  
Urtica dioica L.

#### **Valerianaceae**

Valeriana alliariifolia Adams  
Valeriana officinalis L.

#### **Violaceae**

Viola odorata L.

#### **Zygophyllaceae**



*Tribulus terrestris* L.

### The biological spectrum of flora

The following ratio of different biomorphs of flora:

Trees – 55 species (15.1 % of flora),

Shrubs and shrublets – 34 species (9.4 % of flora),

Semyshrubs and semysrhublets – 9 species (2.5 % of flora),

Perennial herbs – 185 species (51 % of flora),

Diennial and annual herbs – 80 species (22 % of flora):

In the studied area there are also lianas - 3 species and parasite and semyparasite plants - 2species:

Thus, in the flora dominated perennial herbs – 185 species (51%) and diennial/annual herbs – 80 species (22%). Trees are 15.1% (55 species) in flora and shrubs with semishrubs are – 9.4% (34 species).

### Tipes of the vegetation and azonal vegetation

In the flora of investigated area dominated mountain steppe type vegetation with frigana and tragacant steppe formations. Also, a big area is covered by meadow-steppes, meadows and subalpine meadows. On the North and West slopes represented forests with oaks (*Quercus macranthera*) and hornbeam (*Carpinus betulus*). The light forests covers some East and South slopes with uniper species (*Juniperus polycarpus*, *J. oblonga*, *J. foetidissima*). Riparian forests along the rivers consist mainly of willow species (*Salix excels*, *S. alba*, etc) with poplar and elm species. In the small wetlands growing up *Typha*, *Pragmites* species, on rocky growing up species from *Crassulacea*, etc families.

### Analise of Red Data book and endemic species

In the investigated area represented 10 species from Armenian Red Data Book of plants which are divided into:

Critical species (CR B) – 1 (*Hypericum armenum* Jaub.et Spach);

Endangered species (EN B) – 9(*Polystichum lonchitis* (L.) Roth, *Psephellus zangezuri* Sosn., *Tanacetum zangezuricum* Chandjian, *Campanula zangezura* (Lipsky) Kolak. et

Serdjuk., *Astragalus xiphidium* Bunge, *Gladiolus hajastanicus* Gabrielian, *Iris lineolata* (Trautv.) Grossh., *Tulipa sosnowskyi* Achv. et Mirzoeva, *Pyrus voronovii* Rubtzov).

Most part of species from Red Data book growing in the Section 3 of Shenatagh river canyon: in vicinity of Darbas village and between Darbas and Lor villages. *Polystichum lonchitis* and *Tanacetum zangezuricum* growing near the Qajaran town. The other species spreaded in all region from Sisian to Qajaran.

### **Analise of endemic species:**

There are 8 species of different categories of endems which are divided into:

Endems of Armenia—4 (*Psephellus zangezuri* Sosn., *Cerastium holosteam* Fisch., *Pyrus voronovii* Rubtzov, *Pyrus zangezura* Maleev);

Endems of Transcaucasus— 2(*Galanthus transcausicus* Fomin, *Tanacetum zangezuricum* Chandjian);

Endem of South Transcaucasus –1 (*Tulipa sosnowskyi* Achv. et Mirzoeva);

Endem of South Transcaucasus and NW Iran—1(*Campanula zangezura* (Lipsky) Kolak. et Serdjuk.).

Most part of endem species growing in the Section 4 of Geghi river canyon: in the «Zangezur state reserve». *Cerastium holosteam*, *Galanthus transcausicus* and *Tanacetum zangezuricum* growing near the Qajaran town. The other species of endems spreaded in all region from Sisian to Qajaran.

### **Action plan for conservation of species**

We do not discuss the conservation plans of individual species because it is desirable to keep the entire ecosystem. It will include 2 main directions:

1. Destroyed habitats cultivation, juniper and other species regeneration;
2. Protection of rare ecosystems.

Additional research is necessary prior to construction to develop additional rare ecosystems and a plan of action and timetable for the conservation of species.

### **Analise of localities of fossil plants**

On the way from Sisian to Darbas situated several localities of fossil plants and animals. This layers content the Early Pleistocene lake sediments of diatomaceous clays and diatomites. There was found the fossil imprints (1.2-0.9 mln. year old) of leaves, fruits, etc, also remains of fossil fishes and insects. During the works is needed the presence of palaeobotanists and paleozoologists, that will do the monitoring of fossiliferous layers of diatomaceous clays. There was found mor than 300 species of fossil plants and animals.

## The sections and trees which will be cut

The sections of forests which will be cut are belonging to Sisian and Kapan state forestries.

We calculate the trees which mostly have more than 8-10 cm trunk diameter on 130 cm height of the tree. In some cases, calculated the trees, which naturally have a low height and, accordingly, the smaller diameter of the trunk.

In the 8 sections of the road described above were will be cut more than 6000 (6068) trees which are belong to 55 species.

After roadside cleaning will be cut also more than 10,000 shrubs belonging to the 34 species.

On the botanical point of view, the most interesting are the Juniper forests (mostly in Geghi River Valley(**Section 4, picket 357+00 – 492+00**) (Fig. 7, 8, 9). Here will be cut 1026 trees (**the tree species see in the chapter 4.1.- the botanical description of sections 1-8**).

The number of trees is more vulnerable on the right bank of the Voghji River – in the Lernadzor - Qajaran section (**Section 7, picket 612+00 - 637+00**) (Figure 12). Here will be cut 2971 trees(**the tree species see in the chapter 4.1.- the botanical description of sections 1-8**).

## Conclusions

- Along the M1 “Sisian-Kajaran” interstate highway studied plant species belong to 363 species, 240 genera and 85 families from 5 classes of higher plants.
- In the investigated area represented **10** species from Armenian Red Data book of plants. Most part of species from Red Data book growing in the Section 3 - in Shenatagh river canyon near the Darbas village, and in Section 8 - near the Kajaran town.
- There are 8 species of endems (endems of Armenia - 5; endems of Transcaucasus– 2; endems of South Transcaucasus – 1).

- During the construction of the 8 sections of M1 “**Sisian - Qajaran**” interstate highway will be cut more than **6000 (6068)** trees. After the pruning and cleaning of the bushes will be cut more than **10,000** shrubs.

- Most important sections are 4: Darbas – Shenatagh-Bargushat ridge tunnel (**354 trees**); Qarut – Verin Geghavank (**1276 trees**); Verin Geghavank – Kavchut (**542 trees**) and Lernadzor – Qajaran (**2971 trees**).

- On the botanical point of view, the most interesting are the Juniper (614 trees of *Juniperus polycarpus*, *J. foetidissima*, *J. oblonga*) light forests mostly in Geghi River Valley (**picket 357+00 – 492+00**). From Armenian endemics here growing *Pyrus voronovii* and *Pyrus zangezura*. In this section will be cut 1026 trees (**the tree species see in the chapter 4.1.**).

- The number of trees are more vulnerable on the right bank of the Voghji River – in the Lernadzor - Kajaran section (**picket 612+00 – 637+00**). Here will be cut **2971 trees** (**the tree species see in the chapter 4.1.**).

- Additional studies are needed prior to construction works to further develop an action plan and timetable for the conservation of rare species and ecosystems.

- During the works is needed the presence of palaeobotanists and paleozoologists, that will do the monitoring of fossiliferous layers of diatomaceous clays in Vorotan river basin.

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## TERRESTRIAL INVERTEBRATES

### Introduction

The first stage of every faunistic study is the identification of living animals in area.

Invertebrate animals in Syunik region are highly unequal, so full analysis of fauna is impossible and inappropriate in short period of time. Our studied area is divided into 2 parts, Sisian region and Vokhchi river basin.

During the preparatory work the analysis of all available published data on terrestrial (relatively well-studied higher taxonomic groups (taxa) for the Syunik region will be done, including rare and endangered species of fauna.

Totally about 70 orders of the invertebrates are known from Syunik province. The most numerous are insects which are represented with 29 orders in researched area.

The analysis of different publications on taxonomic groups Armenia fauna is allowed to discover 1735 species for the Syunik region, which belongs to the insects and molluscs (Tab. 1).

Data on invertebrate's fauna of Syunik region is also summarized in Table 1 below.

### Overview of the invertebrates fauna of the Syunik region (Sisian and Voghchi river basin parts)

**Table 1**

| Taxon                                                   | Number of species |        |                     | Sources of information                       |
|---------------------------------------------------------|-------------------|--------|---------------------|----------------------------------------------|
|                                                         | Syunik region     | Sisian | Voghchi river basin |                                              |
| Molluscs (Phylum <i>Mollusca</i> ) (only terrestrial)   | 71                | 31     | 54                  | Акрамовский, 1967 [6]                        |
| An Arthropods (Phylum <i>Arthropoda</i> )               |                   |        |                     |                                              |
| Insects (Class <i>Insecta</i> )                         |                   |        |                     |                                              |
| Orthoptera (Order <i>Orthoptera</i> )                   |                   |        |                     |                                              |
| Katyids or bush crickets (Family <i>Tettigoniidae</i> ) | 26                | 8      | 14                  | Авагян, 1984 [5]<br>Eades, D.C..., 2016 [22] |
| Grasshoppers (Superfamily <i>Acridoidea</i> )           | 66                | 18     | 23                  | Авагян, 1975 [4]                             |



|                                                            |     |     |     |                                                  |
|------------------------------------------------------------|-----|-----|-----|--------------------------------------------------|
|                                                            |     |     |     | Eades, D.C., 2016 [22]                           |
| <b>Suborder Homoptera</b>                                  |     |     |     |                                                  |
| Scale insects (Superfamily <i>Coccoidea</i> )              | 38  | 18  | 17  | Борхсениус, 1949 [8],<br>Тер-Григорян, 1973 [15] |
| * Dendrophilous Homoptera                                  | 61  | 21  | 32  | Мирзоян, 1977 [12]                               |
| <b>Order True bugs (Hemiptera)</b>                         |     |     |     |                                                  |
| Dendrophilous true bugs                                    | 5   | 2   | 4   | Мирзоян, 1977 [12]                               |
| <b>Beetles (Coleoptera)</b>                                |     |     |     |                                                  |
| Ground beetles (Family <i>Carabidae</i> , pars.)           | 120 | 57  | 59  | Яблоков-Хнзорян, 1976 [20]                       |
| Superfamily <i>Scarabaeoidea</i>                           | 119 | 52  | 72  | Яблоков-Хнзорян, 1967 [19]                       |
| Click beetles (Family <i>Elateridae</i> )                  | 49  | 10  | 21  | Марджанян, 1986 [11]                             |
| Հնտանիք երկարաբեղիկներ ( <i>Cerambycidae</i> )             | 175 | 56  | 80  | Плавильщиков, 1949 [14]                          |
| Blister beetles (Family <i>Meloidae</i> )                  | 31  | 16  | 16  | Яблоков-Хнзорян, 1983 [21]                       |
| Comb-clawed beetles (Family <i>Alleculidae</i> )           | 20  | 7   | 10  | Яблоков-Хнзорян, 1983 [21]                       |
| Seed beetles (Family <i>Bruchidae</i> )                    | 36  | 6   | 11  | Карапетян, 1985 [10]                             |
| Snout beetles (Family <i>Curculionidae</i> )               | 160 | 102 | 122 | Тер-Минасян, 1947 [16]                           |
| * Dendrophilous beetles                                    | 126 | 36  | 56  | Мирзоян, 1977 [12]                               |
| <b>Butterflies (Lepidoptera)</b>                           |     |     |     |                                                  |
| Day butterflies ( <i>Rhopalocera</i> )                     | 126 | 54  | 84  | Tuzov (ed.), 1997, 2000 [23, 24]                 |
| The geometer moths (Family <i>Geometridae</i> )            | 170 | 65  | 116 | Վարդիկյան, 1980 [3]                              |
| The owlet moths (Family <i>Noctuidae</i> ) (dendrophilous) | 136 | 71  | 101 | Мирзоян, 1991 [13]                               |



|                                                                  |             |            |            |                     |
|------------------------------------------------------------------|-------------|------------|------------|---------------------|
| * other dendrophilous species of <i>Heterocera</i>               | 59          | 15         | 32         | Мирзоян, 1977 [12]  |
| <b>Order <i>Diptera</i> (flies and midges)</b>                   |             |            |            |                     |
| Black flies (Family <i>Simuliidae</i> )                          | 28          | 7          | 14         | Тертерян, 1968 [17] |
| * Dendrophilous diptera                                          | 2           | 2          | 2          | Мирзоян, 1977 [12]  |
| <b>Order <i>Hymenoptera</i> (sawflies, wasps, bees and ants)</b> |             |            |            |                     |
| Ants (Family <i>Formicidae</i> )                                 | 65          | 16         | 19         | Аракелян, 1994 [7]  |
| Parasitic wasps (Family <i>Encyrtidae</i> )                      | 9           | 2          | 2          | Эртевцян, 1986 [18] |
| * Dendrophilous Hymenoptera                                      | 37          | 14         | 29         | Мирзоян, 1977 [12]  |
| <b>Total</b>                                                     | <b>1735</b> | <b>686</b> | <b>990</b> |                     |

## Rare and endangered species

In Armenia Red Book [1] from registered 153 rare and endangered invertebrate species, 55 can be found in Syunik region (5 molluscs and 50 insects). 13 of them potentially can be found in our studied areas (or their close proximity), the list of which is presented below.

### List of invertebrates from the Red Book of Animals of the RA

#### Molluscs

1. *Columella columella* (Martens, 1853)

#### Insects

##### Order *Odonata*

2. *Coenagrion vanbrinkae* Lohman, 1993
3. *Onychogomphus assimilis fulvipennis* (Schneider, 1845)

##### Order *Orthoptera*

4. *Phytodrymadusa armeniaca* Ramme, 1939

##### Order *Coleoptera*

5. *Procerus scabrosus fallettianus* Cavazzutti, 1997
6. *Cortodera kaphanica* Danilevsky, 1985



7. *Cerambyx cerdo acuminatus* Motschulsky, 1852

**Order *Lepidoptera***

8. *Parnassius apollo kashtshenkoi* Sheljuzhko, 1908

9. *Brenthis ino schmitzi* Wagener, 1983

10. *Maculinea alcon monticola* (Staudinger, 1901)

11. *Maculinea arion zara* Jachontov, 1935

12. *Agrodiaetus huberti* Carbonell, 1993

13. *Proserpinus proserpina* (Pallas, 1772)

From the listed species butterflies *Proserpinus proserpina* Pall., *Parnassius apollo* L., *Maculinea arion* L. and beetle *Cerambyx cerdo* L. are included in IUCN Red List [2].

## Material and Methods

For identification of insect species composition the study samples were taken at various stations on the route. The sampling points are presented in accordance with numbers in the provided maps points.

For the identification of species composition, we used different entomological research methods: hand-gathering under the stones from the soil surface, using entomological net (including the mowing of vegetation along the way) [9]. The collected samples were determined using published scientific literature.

Registration for the majority of species of butterflies and dragonflies was done through observations directly from the field, some difficult species were caught in and determined later in the laboratory.

During the field trip, the photos of some species and interesting sites and so on were taken. The data of the collected invertebrate's species composition by researched points are summarized in Tab. 2.

**Table 2**

***Terrestrial invertebrate's species composition observed in the studied areas***

| No | Species                                         | Sampling points* |
|----|-------------------------------------------------|------------------|
|    | <b>Terrestrial pulmonate gastropod mollusks</b> |                  |



| Mollusca                                                     |                                                                                                                             |                           |
|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------------------|
| <b>Family Cochlicopidae</b>                                  |                                                                                                                             |                           |
| 1                                                            | <i>Cochlicopa lubricella</i> (Porro, 1838)                                                                                  | N513+00                   |
| <b>Family Valloniidae</b>                                    |                                                                                                                             |                           |
| 2                                                            | <i>Vallonia costata</i> (O.F.Müller, 1774)                                                                                  | N588+00, N613+00          |
| 3                                                            | <i>Vallonia pulchella</i> (O.F.Müller, 1774) - 23                                                                           | N513+00                   |
| <b>Family Pupillidae</b>                                     |                                                                                                                             |                           |
| 4                                                            | <i>Pupilla (Pupilla) inops</i> (Reinhardt, 1877)                                                                            | N17+00                    |
| <b>Family Hygromiidae</b>                                    |                                                                                                                             |                           |
| 5                                                            | <i>Xeropicta derbentina</i> (Krynicky, 1836)                                                                                | N362+00, N474+00, N546+00 |
| 6                                                            | <i>Stenomphalia (Diplobursa) pisiformis</i> (L.Pfeiffer, 1846)<br>Background species of the study area. – 7, 23, 25, 26, 32 | N07+00, N17+00, N538+00   |
| <b>Family Helicidae</b>                                      |                                                                                                                             |                           |
| 7                                                            | <i>Helix lucorum</i> Linnaeus, 1758                                                                                         | N462+00, N422+00          |
| <b>Class Insecta- Insects</b>                                |                                                                                                                             |                           |
| <b>Order Mantodea</b>                                        |                                                                                                                             |                           |
| <b>Family Mantidae- Praying mantises</b>                     |                                                                                                                             |                           |
| 8                                                            | <i>Mantis religiosa</i> (Linnaeus, 1758)                                                                                    | N177+00                   |
| 9                                                            | <i>Bolivaria brachyptera</i> Pallas, 1773                                                                                   | N176+00                   |
| <b>Order Odonata - Dragonflies and the damselflies</b>       |                                                                                                                             |                           |
| <b>Family Libellulidae- The skimmers or perchers</b>         |                                                                                                                             |                           |
| 10                                                           | <i>Sympetrum vulgatum decoloratum</i> Selys, 1884                                                                           | N373+00                   |
| <b>Order Orthoptera- Grasshoppers, katydids and crickets</b> |                                                                                                                             |                           |
| <b>Family Acrididae- Short-horned Grasshoppers</b>           |                                                                                                                             |                           |
| 11                                                           | <i>Chorthippus macrocerus</i> (Fischer von Waldheim, 1846)                                                                  | N027+00, N194+00          |
| 12                                                           | <i>Stenobothrus wernerii</i> Adelung, 1907                                                                                  | N194+00, N362+00          |
| 13                                                           | <i>Omocestus petraeus</i> (Brisout de Barneville, 1856)                                                                     | N362+00                   |
| 14                                                           | <i>Calliptamus tenuicercis</i> Tarbinsky, 1930                                                                              | N027+00                   |



|                                               |                                                      |                           |
|-----------------------------------------------|------------------------------------------------------|---------------------------|
| 15                                            | Chorthippus brunneus (Thunberg, 1815)                | N195+00, N362+00, N614+00 |
| 16                                            | Chorthippus dichrous (Eversmann, 1859)               | N025-00, N495+00, N614+00 |
| 17                                            | Oedipoda caerulescens (Linnaeus, 1758)               | N027+00, N362+00          |
| 18                                            | Acrotylus insubricus (Scopoli, 1786)                 | N362+00, N178+00          |
| 19                                            | Pseudoceles persa (Saussure, 1884)                   | N027+00                   |
| <b>Order Coleoptera - Beetles and weevils</b> |                                                      |                           |
| <b>Family Scrabaeidae-Scarab beetles</b>      |                                                      |                           |
| 20                                            | Aphodius fimetarius (Linnaeus, 1758)                 | N194+00, N349+00          |
| 21                                            | Aphodius erraticus (Linnaeus, 1758)                  | N194+00                   |
| 22                                            | Onthophagus gibbulus rostrifer Reitter, 1892         | N194+00, N349+00          |
| 23                                            | Oniticellus fulvus (Goeze, 1777)                     | N194+00                   |
| <b>Family Carabidae-Ground beetles</b>        |                                                      |                           |
| 24                                            | Harpalus rufipes (Degeer, 1774)                      | N026-00                   |
| 25                                            | Brachinus explodens Duftschmid, 1812                 | N175+00, N195+00          |
| <b>Family Tenebrionidae-Darkling beetles</b>  |                                                      |                           |
| 26                                            | Blaps lethifera pterotapha Fisch. von Waldheim, 1832 | N027+00                   |
| 27                                            | Opatrum geminatum Brullé, 1832                       | N175+00                   |
| <b>Family Meloidae-Blister beetles</b>        |                                                      |                           |
| 28                                            | <i>Meloe proscarabaeus</i> Linnaeus, 1758            | N176+00                   |
| <b>Family Coccinellidae-Ladybugs</b>          |                                                      |                           |
| 29                                            | Coccinella septempunctata (Linnaeus, 1758)           | N176+00                   |
| <b>Family Staphylinidae-Rove beetles</b>      |                                                      |                           |
| 30                                            | <i>Ocypus olens</i> (O. Müller, 1764)                | N027+00, N195+00          |
| 31                                            | Staphylinus erythropterus Linnaeus 1758              | N025+00                   |
| 32                                            | Staphylinus ruficornis O. Costa 1839                 | N194+00                   |
| 33                                            | Philonthus longicornis Stephens, 1832                | N195+00                   |
| 34                                            | Aleochara lata Gravenhorst, 1802                     | N195+00                   |



| Order Lepidoptera-Butterflies                  |                                                |                                             |
|------------------------------------------------|------------------------------------------------|---------------------------------------------|
| Family Sphingidae-Hawk moths                   |                                                |                                             |
| 35                                             | Hyles euphorbiae (Linnaeus, 1758)              | N176+00, N178+00                            |
| Family Pieridae-True butterflies               |                                                |                                             |
| 36                                             | Pieris rapae (Linnaeus, 1758)                  | N176+00, N177+00, N463+00, N362+00, N497+00 |
| 37                                             | Pieris brassicae (Linnaeus, 1758)              | N176+00, N497+00                            |
| 38                                             | Colias sareptensis Staudinger, 1871            | N362+00, N424+00, N473+00                   |
| 39                                             | Pontia chloridice (Hübner, 1813)               | N424+00, N177+00                            |
| 40                                             | Leptidea sinapis (Linnaeus, 1758)              | N177+00, N362+00                            |
| Family Nymphalidae- Brush-footed butterflies   |                                                |                                             |
| 41                                             | Melitaea phoebe (Denis & Schiffermüller, 1775) | N175+00, N349+00                            |
| Family Hesperidae- Skippers                    |                                                |                                             |
| 42                                             | Pyrgus armoricanus (Oberthür, 1910)            | N542+00                                     |
| 43                                             | Pyrgus sidae (Esper, 1784)                     | N178+00, N542+00                            |
| 44                                             | Carcharodus alceae (Esper, 1780)               | N542+00                                     |
| Family Lycaenidae- Gossamer-winged butterflies |                                                |                                             |
| 45                                             | Polyommatus bellargus (Rottemburg, 1775)       | N178+00, N536+00                            |
| 46                                             | Lycaena phlaeas (Linnaeus, 1761)               | N176+00, N394+00, N536+00                   |

\*- sampling points according by numbers provided on maps

## Results of field survey

It should be noted that in a so short period was not possible to discover all the major taxonomic groups represented in research area. During the expedition there were gathered 19 family-owned species of 7 molluscs (*Mollusca*) and 39 species of insects (*Insecta*):

In the terms of the richest the most diverse presented 2 groups of the beetles (*Coleoptera*-15 species) and butterflies (*Lepidoptera*-12 species). According to them descending were follow locusts



(Orthoptera, Acrididae-6 species), praying mantises (Mantodea-2 species) and 1 species of the dragonfly (Odonata).

During our studies, no rare and endangered invertebrates species included in the the Red Book of animals of RA was registered.

## Recommendations

Taking into consideration the richness and diversity of insect fauna in the studied areas there is need of more attention to save them during performing construction and related activities for maximum preservation still not destroyed and less disturbed parts of ecosystems.

For understanding, the future status of the invertebrate's fauna biodiversity there is need for further implement of the continuous monitoring.

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## Illustrations of Terrestrial invertebrates

*Some of the sampling points in the studied areas*



Crossing Ishkhansar-Sisian (N01+00-27+00)





Shamb (N154+00)



Shenatakh (N275+00)





Ltsen (N194+00-195-00)



Geghi-Qarut-Kitsq (N362+00)





Praying mantis-*Mantis religiosa* (Linnaeus, 1758)



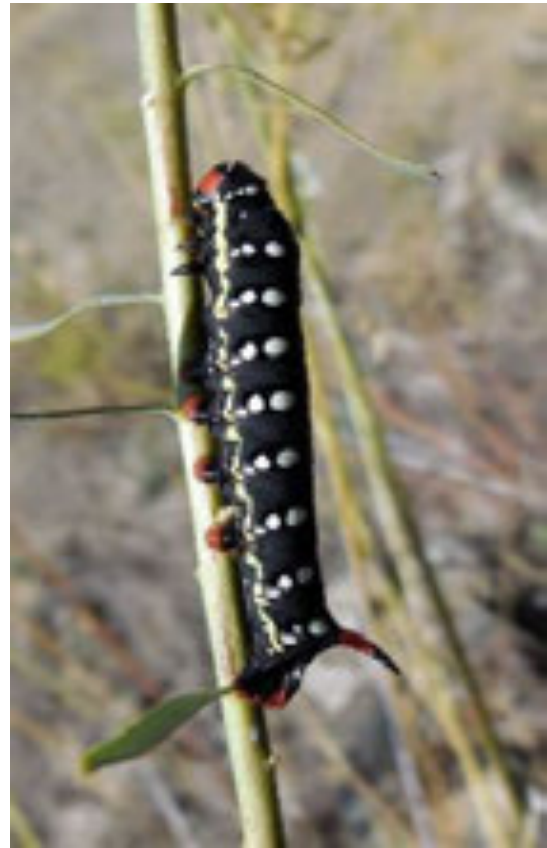


Praying mantis-*Bolivaria brachyptera* Pallas, 1773



The couple of the vagrant darter-*Sympetrum vulgatum decoloratum* Selys, 1884





Caterpillar of the butterfly *Hyles euphorbiae* (Linnaeus, 1758)





The Adonis blue-*Polyommatus bellargus* (Rottemburg, 1775)



The small copper-*Lycaena phlaeas* (Linnaeus, 1761)



Oberthur's Grizzled Skipper-*Pyrgus armoricanus* (Oberthür, 1910)



Mallow skipper-*Carcharodus alceae* (Esper, 1780)

## AMPHIBIANS AND REPTILES

### Introduction

Armenia is very rich in reptile species. Among 51 species at least 30 species was recorded during survey in June, 2015. The some notes and record is possible to find in work of Chernov (1939), Dahl (1954), candidate thesis of I.S. Darevsky (1957), A. Aghasyan (1996), A. Aslanyan (2004). and in Herpetofauna of Armenia and Nagorno-Karabakh” of Arakelyan et al., 2011.

### Materials and methods

A standard methodology was used for reptile and amphibian surveys. The animals were looked both during day and evening times. Transects have been used for reptiles that commonly bask during sunny periods. A transect was walked, and all reptiles seen were identified and recorded. The diurnal active reptiles have been noted during walk while hiding species was found by checking of suitable for reptiles' shelters. The GPS point, description of biotope with photo of landscape was recorded. The sex of individuals, age status was also marked. Reptile surveying and monitoring usually is problematic due to reptiles are active, shy creatures, and do not aggregate for breeding as do amphibians. Their behavior is also heavily influenced by the weather.

The surveyed area was divided into several unequal parts, which are characterized by similar landscape zones. Such segments typically specific to certain species of reptiles and amphibians that have similar preference biotic and abiotic environmental conditions. This division is to some extent subjective and may not reflect the views of mammals, birds and other animals with environmental groups.

The landscape zone, as well as biotic and similarity abiotic conditions of the observed area we divided it into 8 sections: 0 + 00 - 177 + 00, 177 + 00 - 281 + 00, 296 + 00 - 302 + 00, 350 + 00 - 388 + 00, 388 + 00 - 492 + 00, 494 + 00 - 545 + 00, 545 + 00 - 610 + 00, 612 + 00 - 652 + 00.

### Results

#### AMPHIBIANS

"Sisian - Qajaran" amphibian species composition is almost not changed throughout the whole territory. It consists of three widespread species, the green toad (*Bufotus variabilis*), marsh frog (*Pelophylax ridibundus*) and Asia Minor frog (*Rana macrocnemis*): In "Geghi - Qajaran" sector (494 + 00 – 576 + 00) to this type of species joins Savignyi tree frog (*Hyla savignyi*) See Table below.

Listed species belong to the widespread amphibians in Armenia, which area occupy wide territory. In the studied area there are numerous reservoirs, which serve as spawning and development places for these species. Some of them, as well as reservoirs adjacent habitats may be damaged during



the road construction. Except the threat of destroying biotopes and spawnings there is possibility of annihilation of amphibians by the construction machines.

After the launch of the road a large number of individuals of amphibian can be killed on the road during migration and dislocation.

Thus, despite the fact that these species are not rare and are widespread in Armenia the road construction and the operation can significantly decrease their number, which will have a negative impact on natural ecosystems. In order to minimize the damage can be expected to propose the following measures:

- During the construction where amphibians are abundant, by specialists hired by Construction Contractors should gather the individuals and release them in more suitable and safe territories. Moreover, the gathering of amphibians must be carried out before the launch of heavy construction machinery.
- The most valuable conservation areas must be discussed with the engineers and experts of the company which does the construction of the road.
- Provide some parts of the road (the exact places must be clarified) underground passageways and fences.

## REPTILES

Reptile species composition is rich. It includes both widespread, and rare and protected species. Reptiles are much richer in species composition 388 + 00 - 492 + 00, 494 + 00 - 545 + 00, 545 + 00 - 610 + 00 and 612 + 00 - 652 + 00 segments (Table). Most of these sectors fall to the rare species. During the construction of the road the destruction of biotopes and these types of habitat is expected and direct destruction of individuals (particularly snakes).

## Conclusions

To reduce damage to biotopes and the number of rare species following measures can be carried out:



- During the construction where a big number of species are gathered by specialists hired by Construction Contractors should gather the individuals and release them in more suitable and safe territories. Moreover, the gathering of species must be carried out before the launch of heavy construction machinery.

- The most valuable conservation areas must be discussed with the engineers and experts of the company which does the construction of the road.

- Provide some parts of the road (the exact places must be clarified) underground passageways and fences.

The above mentioned measures are necessary to carry out "Geghi - Qajaran" section, where several species of rare and protected individuals live. It should be noted that Bargushat picks' biodiversity is the most valuable and rich part of the country. Therefore, it needs exceptional saving treatment.

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### Amphibians and reptiles species composition





| № | Sections                                                                           | Section 0 – 177 | Section 177 -281 | Section 296 - 302 | Section 350 - 388 | Section 388 - 492 | Section 494 -545 | Section 545 - 610 | Section 612 - 652 | RA Red book<br>ՀՀ Կարմիր գիրք | IUCN RED LIST |
|---|------------------------------------------------------------------------------------|-----------------|------------------|-------------------|-------------------|-------------------|------------------|-------------------|-------------------|-------------------------------|---------------|
|   | Species                                                                            |                 |                  |                   |                   |                   |                  |                   |                   |                               |               |
|   | <b>Amphibians</b><br><b>Երկկենցաղներ <i>Amphibia</i></b>                           |                 |                  |                   |                   |                   |                  |                   |                   |                               |               |
|   | Variable green toad<br>կանաչ դոդոշ <i>Bufo</i><br><i>variabilis</i>                | +               | +                | +                 | +                 | +                 | +                | +                 | +                 |                               |               |
|   | Caucasian brown frog<br>փոքրասիական գորտ <i>Rana</i><br><i>macrocnemis</i>         | +               | +                | +                 | +                 | +                 | +                | +                 | +                 |                               | LC            |
|   | Eurasian marsh frog<br>լճագորտ <i>Pelophylax</i><br><i>ridibundus</i>              |                 | +                |                   |                   |                   | +                | +                 | +                 |                               | LC            |
|   | Savigny's treefrog<br>ծառագորտ <i>Hyla savignyi</i>                                |                 |                  |                   |                   |                   |                  | +                 | +                 |                               | LC            |
|   | <b>Reptiles</b> Սողուններ<br><b><i>Reptilia</i></b>                                |                 |                  |                   |                   |                   |                  |                   |                   |                               |               |
|   | Caspian turtle կասպիական<br>կրիա <i>Mauremys caspica</i>                           |                 |                  |                   |                   |                   |                  | +                 | +                 |                               |               |
|   | Caucasian rock agama<br>կովկասյան ագամա <i>Laudakia</i><br><i>caucasia</i>         | +               | +                |                   |                   | +                 | +                | +                 | +                 |                               |               |
|   | Colchican slow worm<br>իլիկամողես <i>Anguis colchica</i> **                        |                 |                  |                   |                   |                   | +                | +                 | +                 |                               |               |
|   | Eurasian glass lizard<br>դեղնափորիկ <i>Pseudopus</i><br><i>apodus</i>              | +               | +                |                   |                   |                   |                  | +                 |                   |                               |               |
|   | Radde's rock lizard Ռադդեի<br>ժայռային մողես <i>Darevskia</i><br><i>raddei</i>     | +               | +                |                   |                   |                   | +                | +                 | +                 |                               | LC            |
|   | Five-streaked green lizard<br>շերտավոր մողես <i>Lacerta</i><br><i>strigata</i>     |                 | +                |                   |                   |                   |                  | +                 | +                 |                               | LC            |
|   | Oriental three-streaked green<br>lizard միջին մողես <i>Lacerta</i><br><i>media</i> | +               | +                | +                 |                   | +                 | +                | +                 | +                 |                               | LC            |



|                                                                                             |   |   |   |  |   |   |   |   |    |  |    |
|---------------------------------------------------------------------------------------------|---|---|---|--|---|---|---|---|----|--|----|
| Snake-eyed lizard<br>օճաչք մողես <i>Ophisops elegans</i> **                                 |   | + |   |  |   |   |   |   |    |  |    |
| Two-streaked snake-eyed<br>skink շերտավոր մերկաչք<br><i>Ablepharus bivittatus</i>           | + | + | + |  |   | + | + |   |    |  |    |
| Southern grass skink<br>նսկեգույն մաքույա<br><i>Trachylepis septemtaeniata</i> **           | + |   |   |  |   |   |   |   | +  |  |    |
| Western sand boa արևմտյան<br>վիշապիկ <i>Eryx jaculus</i> **                                 |   |   |   |  |   | + | + |   |    |  | LC |
| Smooth snake պղնձօձ<br><i>Coronella austriaca</i>                                           | + | + | + |  |   | + | + |   |    |  | LC |
| Schmidt's whip snake<br>շահմար / կարմրավոր<br>սահնօձ <i>Dolichophis schmidtii</i> **        |   |   |   |  |   |   | + |   |    |  | LC |
| Ring-Headed dwarf snake<br>խաղաղ էյրենիս <i>Eirenis modestus</i>                            |   |   |   |  | + | + | + |   |    |  | LC |
| Dotted dwarf snake հայկական<br>էյրենիս <i>Eirenis punctatolineatus</i> **                   |   |   |   |  |   | + | + | + |    |  | LC |
| Blotched ratsnake<br>Պալլասի մագլցող սահնօձ<br><i>Elaphe sauromates</i>                     |   |   |   |  |   | + | + |   |    |  |    |
| Spotted racer or spotted whip<br>snake բազմագույն սահնօձ<br><i>Hemorrhois ravergieri</i> ** |   |   |   |  |   |   | + |   |    |  |    |
| Grass snake<br>սովորական լորտու <i>Natrix natrix</i> **                                     | + |   |   |  |   |   | + |   |    |  | LC |
| Dice snake ջրային լորտու<br><i>Natrix tessellata</i>                                        | + | + |   |  |   | + | + | + |    |  | LC |
| Slender whip snake<br>ձիթապտղագույն սահնօձ<br><i>Platyceps najadum</i>                      |   | + |   |  |   |   |   |   |    |  | LC |
| Cat snake<br>կատված <i>Telescopus fallax</i>                                                |   |   |   |  |   | + | + | + | VU |  | LC |
| Transcaucasian rat snake<br>անդրկովկասյան սահնօձ<br><i>Zamenis hohenackeri</i>              |   |   |   |  |   | + | + | + | VU |  | LC |
| Levantine viper                                                                             |   |   |   |  |   |   | + |   |    |  |    |





|   |                                                                       |  |  |  |  |   |   |   |   |    |    |
|---|-----------------------------------------------------------------------|--|--|--|--|---|---|---|---|----|----|
|   | գլուղա <i>Macrovipera lebetina</i>                                    |  |  |  |  |   |   |   |   |    |    |
| . | Radde's viper Ռադդեի կամ<br>հայկական իծ <i>Montivipera<br/>raddei</i> |  |  |  |  |   | + | + | + | VU | NT |
| . | <i>Vipera eriwanensis</i>                                             |  |  |  |  | + | + | + | + | VU | VU |

\*\* - Species that are not viewed by us (given by literary sources)

### Footnote

#### Categories:

EX (Extinct) — the last individual died;

EW(Extinct in the wild) — An extinct in the wild (EW) [species](#) is one which has been [categorized](#) by the [International Union for Conservation of Nature](#) as only known by living members kept in captivity or as a naturalized population outside its historic range due to massive habitat loss.

CR (Critically endangered) — is the highest risk category.

EN (Endangered) — "Endangered" is the second most severe [conservation status](#) for wild populations

VU (Vulnerable)— Natural populations are characterized by a high degree of risk of extinction

NT (Near threatened) — may be considered [threatened](#) with [extinction](#) in the near future

LC (Least Concern) — they do not qualify as [threatened](#), [near threatened](#);

LR (Low risk);

DD (Data deficient);

NE (Not Evaluated) — species as not having been studied by the [International Union for Conservation of Nature](#).

([www.iucnredlist.org](http://www.iucnredlist.org))

## 7. Illustrations of Amphibians and Reptiles



1. Variable green toad *Bufo variabilis*



2. Eurasian marsh frog *Pelophylax ridibundus*



3. Caucasian brown frog *Rana macrocnemis*



4. Caspian turtle *Mauremys caspica*



5. Caucasian rock agama *Laudakia caucasia*



6. Caucasian rock agama *Laudakia caucasia*

7. Radde's rock lizard *Darevskia raddei*8. Radde's rock lizard *Darevskia raddei*9. Five-streaked green lizard *Lacerta strigata media*10. Oriental three-streaked green lizard *Lacerta media*11. Schmidt's whip snake *Dolichophis schmidtii* (juv.)  
by car on the road12. Levantine viper *Macrovipera lebetina*. Killed  
by car on the road

## BIRDS

### Introduction:



Based on the literature data and our own research shows that 349 species of birds of Armenia belonging to 18 orders, about 170 species are common and may occur in the territory of Syunik region, where our observations were done. However, taking into account a number of factors, we have reduced the list to 68 species. We paid attention on directly selected areas of the territory and buffer zones, where it is planned of future construction. We do not aim to study the whole bird fauna of Syunik region. Among the above mentioned factors, we include a number of features of the location of all the studied area and the lack of narrowly specific habitats.

Studies conducted in the period from 6 to 10 October 2016. Two areas were examined the expected construction of the highway north-south length of 60 km, Sisian - Qajaran. The width of the buffer zone was 300-400 m.

### **Methods of collecting material:**

Currently, in most countries, the following main groups of methods of accounting birds:

- The technique of linear transects
- The technique of point counts
- The methodology for mapping areas or platform counts.

All these groups of techniques approved by the International Committee for counting birds for them developed international standards. However, point counts, and counts on a circular platform, used in a highly fragmented habitat in the mountainous areas, where the line transect methods are effective, were not used by us because of the limited duration of the study. This method allows to register 2/3 species of birds for the first 20 minutes on a circular platform. However, re-registrations are important in the same locations that was not possible due to time constraints. In addition, the observation period was the least successful because of birds' general activity degree. It is advisable to conduct such studies in the period from May to July; the highest activity of birds observed at this time, as well as on the territory presents migrant, breeding-visitors birds which leave the territory of the republic by the end of September.

Bird watchings were mostly accidental. Also traces of their activities were noted. In the course of the route is fixed directly meeting noted the presence or absence of traces of their life, tabulating, sockets, etc. If possible, a record of birds' voices were kept. During the observation binoculars were used, were taken photographs of animals and their habitats. Various traces of animal were taken to distribute to groups. The basis of such a distribution put vital functions of animals and their relationship with the environment. Traces of life are the following: 1) the footprints on the ground or in the snow, 2) must be related to animal nutrition, 3) the pellets and droppings, 4) asylum. Registration of observations carried out directly in the course of their

conduct with the location and time of the meeting. When the case was conducted by the definition of bird nests found.

Accounts routes are laid in such a way that as far as possible the most complete coverage of all types of habitats in this area and all types of habitats within the study area.

It should be noted that for the optimum width of the strip us of accounting has been adopted deliberately set the width of the buffer zone of 300-400 m. Different species and even individual birds due to ecological features respond differently to the record-keeper, so it is advisable during the accounting move continuously at optimum in relation to the conditions of the account (the terrain, visibility birds); It is subject to the need for a more precise definition of bird species, number of individuals, and so on.

All surveys are conducted mainly in the morning. Routes at medium speed travel accounting from 0.8 to 2.5 km / h, preferably without prolonged (more than 0.5 min.) stops. Taking into account all met individuals indicating the detection range (radial distance), so the distance from the record-keeper to a bird or group of birds in the moment when they first attracted attention, and the perpendicular distance from the birds (bird groups) to the line of the accounting course. Distances are determined by eye.

The species encountered in this locality, but strips out of the buffer zone is also added to the list, as their presence and potentially they may subsequently summed in the study area.

### **Method of data processing:**

All data on each account, indicating the type, number of individuals, the nature of the activity, date, geographic location, habitat type, length of the route, recorded time compared with the previously obtained information and data in the literature, on which the final result is based.

### **Results and evaluation of the general state of bird fauna:**

From the analysis of the literature and our own observations, for the studied areas we pointed 68 species of birds.

It should be noted that a number of species of birds that live in the Syunik region, we did not include in the list, because their characteristic habitats are not met within the buffer zone on which the study was conducted. The presence of such species, whether in briding period or feedings and migration is unlikely either not typical.

40 species of the selected 68 species belonging to 10 orders and 28 families, we recorded visually. 7 species of them are listed in the Red Book of Armenia.

All data on bird fauna of studied areas merged into a table, as, in spite of the different habitats and height, many species are found in all survey areas. The most typical for the area throughout the site, should be regarded the representatives of passerine (Passeriformes), with the largest number of as families as species totally. The following common representatives:

Family *Laniidae* - shrike (*Lanius collurio*), *Emberizidae* family - rock bunting (*Emberiza cia*), *Corvidae* family – black-billed magpie (*Pica pica*), carrion crow (*Corvus corone*), raven (*Corvus corax*), *Ploceidae* family - house sparrow (*Passer domesticus*), *Paridae* family - great tit (*Parus major*), *Motacillidae* family - white wagtail (*Motacilla alba*), *Turdidae* family - blackbird (*Turdus merula*).

The biotopes of both studied areas are mainly represented with mountain-step area, but in both zones there is the insertion of garden and forest formations. The representatives of woodpeckers, great spotted woodpecker – *Dendrocopos major*, are common for forest covered areas between the villages of Kitsq and Geghavank. In the garden plantation areas of Shamb – Getatagh villages were found winter wren - *Traglodytes troglodytes*, as well as goldfinch - *Carduelis carduelis*. From nocturnal predators scops owl - *Otus scops*, from the prey, the buzzard - *Buteo buteo* (for both areas), long-tailed tit - *Aegithalos caudatus* (lawn and shrubs and forest covered fate near the village Lor, Shenatagh, Qarut, Geghi, Geghavank and surroundings of Qajaran).

In mountain-step habitats of both areas the common species are following: Tawny pipit - *Anthus campestris*, wheatear - *Oenanthe oenanthe* and a common redstart *Phoenicurus phoenicurus*.

Along the riverbed of Geghi River and its tributaries, white-troated dipper - *Cinclus cinclus* are commone.

On rocky formations along the section Kitsq - Geghi, a western rock-nuthatch - *Sitta neumayer* found.

In the area between the villages Aghitu – Lor, representatives of *Galliformes* are common, which are presented firstly turn, the gray partridge - *Perdix perdix*, and common quail - *Coturnix coturnix*.

Number of species of birds of prey in this area is not large, it is likely due to the lack of places for hiding and nesting, but in the passage was marked such a large predator as the bearded vulture - *Gypaetus barbatus*, as well as the common buzzard - *Buteo buteo*, Sparrowhawk - *Accipiter nisus* and common kestrel - *Falco tinnunculus*. These types of pray birds hunt on this area, where the rodents, small birds and reptiles are met.

In areas where livestock is held also eurasian hoopoe - *Upupa epops* were found.



The areas bordering close to the Shamb water reservoir are different from previous territories. Besides above mentioned species following species are possibly can be found where in addition to the above types of species present, tending to aquatic habitats, the possible presence of little ringed plover - *Charadrius dubius*, and noted Armenian gull - *Larus armenicus*.

Table 1.

| Order                  | Family       | Species: Lat./English                                 | Literature | Own observ. | Arm. Red Book | (IUCN) |
|------------------------|--------------|-------------------------------------------------------|------------|-------------|---------------|--------|
| <b>Ciconiiformes</b>   | Ardeidae     | <i>Ardea cinerea</i> - Grey Heron                     | +          |             |               | LC     |
|                        |              | <i>Ardeola ralloides</i> - Squacco Heron              | +          |             |               | LC     |
| <b>Falconiformes</b>   | Accipitridae | <i>Pernis apivorus</i> – European Honey-buzzard       | +          |             |               | LC     |
|                        |              | <i>Milvus migrans</i> - Black Kite                    | +          |             |               | LC     |
|                        |              | <i>Aquila chrysaetos</i> – Golden Eagle               | +          |             | VU            | LC     |
|                        |              | <i>Neophron percnopterus</i> - Egyptian Vulture       | +          | +           | EN            | EN     |
|                        |              | <i>Gypaetus barbatus</i> - Bearded Vulture            | +          | +           | VU            | NT     |
|                        |              | <i>Buteo buteo</i> - Eurasian Buzzard                 | +          | +           |               | LC     |
|                        |              | <i>Buteo rufinus</i> - Long-legged Buzzard            | +          |             |               | LC     |
|                        |              | <i>Accipiter nisus</i> – Eurasian Sparrowhawk         | +          |             |               | LC     |
|                        |              | <i>Accipiter gentilis</i> - Northern Goshawk          | +          |             | VU            | LC     |
|                        |              | <i>Circaetus gallicus</i> - Short-toed Snake-eagle    | +          |             | VU            | LC     |
|                        | Falconidae   | <i>Falco tinnunculus</i> - Common Kestrel             | +          | +           |               | LC     |
| <b>Galliformes</b>     | Phasianidae  | <i>Coturnix coturnix</i> - Common Quail               | +          | +           |               | LC     |
|                        |              | <i>Perdix perdix</i> – Grey Partridge                 | +          | +           |               | LC     |
| <b>Charadriiformes</b> | Charadriidae | <i>Charadrius dubius</i> - Little Ringed Plover       | +          |             |               | LC     |
|                        |              | <i>Actitis hypoleucos</i> - Common Sandpiper          | +          |             |               | LC     |
|                        | Laridae      | <i>Larus armenicus</i> – Armenian Gull                | +          | +           | VU            | NT     |
| <b>Columbiformes</b>   | Columbidae   | <i>Columba livia</i> - Rock Dove                      | +          | +           |               | LC     |
|                        |              | <i>Streptopelia decaocto</i> – Eurasian collared-Dove | +          | +           |               | LC     |
| <b>Cuculiformes</b>    | Cuculidae    | <i>Cuculus canorus</i> - Common Cuckoo                | +          | +           |               | LC     |
| <b>Stringiformes</b>   | Stringidae   | <i>Otus scops</i> - Eurasian Scops-owl                | +          |             |               | LC     |





|                      |               |                                                        |   |   |    |    |
|----------------------|---------------|--------------------------------------------------------|---|---|----|----|
| <b>Coraciiformes</b> | Meropidae     | <i>Merops apiaster</i> - European Bee-eater            | + | + |    | LC |
|                      | Coraciiformes | <i>Coracias garrulus</i> - European Roller             | + |   | VU | LC |
|                      | Upupidae      | <i>Upupa epops</i> – Common Hoopoe                     | + | + |    | LC |
| <b>Piciformes</b>    | Picidae       | <i>Dendrocopos major</i> - Great Spotted Woodpecker    | + | + |    | LC |
| <b>Passeriformes</b> | Alaudidae     | <i>Alauda arvensis</i> - Eurasian Skylark              | + | + |    | LC |
|                      |               | <i>Eremophila alpestris</i> – Horned Lark              | + |   |    | LC |
|                      | Hirundinidae  | <i>Delichon urbica</i> - Northern House-martin         | + | + |    | LC |
|                      | Motacillidae  | <i>Motacilla alba</i> - White Wagtail                  | + | + |    | LC |
|                      |               | <i>Anthus campestris</i> – Tawn pipit                  | + | + |    | LC |
|                      |               | <i>Anthus trivialis</i> - Tree Pipit                   | + | + |    | LC |
|                      |               | <i>Anthus spinoletta</i> - Water Pipit                 | + |   |    | LC |
|                      | Laniidae      | <i>Lanius collurio</i> – Red-backed Shrike             | + | + |    | LC |
|                      | Troglodytidae | <i>Troglodytes troglodytes</i> – Winter Wren           | + | + |    | LC |
|                      | Cinclidae     | <i>Cinclus cinclus</i> – White-throated Dipper         | + | + |    | LC |
|                      | Turdidae      | <i>Oenanthe oenanthe</i> - Northern Wheatear           | + | + |    | LC |
|                      |               | <i>Monticola saxatilis</i> - Rufous-tailed Rock-thrush | + |   |    | LC |
|                      |               | <i>Turdus merula</i> - Eurasian Blackbird              | + | + |    | LC |
|                      |               | <i>Turdus viscivorus</i> – Mistle Thrush               | + |   |    | LC |
|                      |               | <i>Turdus pilaris</i> – Fieldfare                      | + |   |    | LC |
|                      |               | <i>Phoenicurus ochrurus</i> - Black Redstart           | + | + |    | LC |
|                      |               | <i>Phoenicurus phoenicurus</i> - Common Redstart       | + | + |    | LC |
|                      |               | <i>Saxicola torquata</i> - Common Stonechat            | + |   |    | LC |
|                      |               | <i>Saxicola rubetra</i> - Whinchat                     | + | + |    | LC |
|                      | Sylviidae     | <i>Acrocephalus palustris</i> - Marsh Warbler          | + |   |    | LC |
|                      |               | <i>Phylloscopus collybita</i> - Common Chiffchaff      | + |   |    | LC |
|                      |               | <i>Phylloscopus trochiloides</i> - Greenish Warbler    | + |   |    | LC |
|                      |               | <i>Sylvia communis</i> – Greater Whitethroat           | + | + |    | LC |
|                      | Paridae       | <i>Parus major</i> - Great Tit                         | + | + |    | LC |
|                      |               | <i>Parus caeruleus</i> - Blue Tit                      | + |   |    | LC |



|  |                   |                                                      |   |   |  |    |
|--|-------------------|------------------------------------------------------|---|---|--|----|
|  | Paradoxornithidae | <i>Panurus biarmicus</i> – Bearded Reedling          | + |   |  | LC |
|  | Aegithalidae      | <i>Aegithalos caudatus</i> - Long-tailed Tit         | + | + |  | LC |
|  | Sittidae          | <i>Sitta neumayer</i> - Western Rock-nuthatch        | + | + |  | LC |
|  | Emberizidae       | <i>Emberiza melanocephala</i> - Black-headed Bunting | + | + |  | LC |
|  |                   | <i>Emberiza cia</i> - Rock Bunting                   | + | + |  | LC |
|  |                   | <i>Emberiza citrinella</i> - Yellowhammer            | + |   |  | LC |
|  | Fringilidae       | <i>Carduelis carduelis</i> - European Goldfinch      | + | + |  | LC |
|  |                   | <i>Carduelis cannabina</i> – Eurasian Linnet         | + | + |  | LC |
|  |                   | <i>Carpodacus erythrinus</i> - Common Rosefinch      | + | + |  | LC |
|  |                   | <i>Fringilla coelebs</i> – Chaffinch                 | + | + |  | LC |
|  |                   | <i>Carduelis flavirostris</i> – Twite                | + |   |  | LC |
|  | Ploceidae         | <i>Passer domesticus</i> - House Sparrow             | + | + |  | LC |
|  |                   | <i>Petronia petronia</i> - Rock Sparrow              | + |   |  | LC |
|  | Corvidae          | <i>Pica pica</i> - Black-billed Magpie               | + | + |  | LC |
|  |                   | <i>Garrulus glandarius</i> - Eurasian Jay            | + | + |  | LC |
|  |                   | <i>Corvus corax</i> - Common Raven                   | + | + |  | LC |
|  |                   | <i>Corvus corone</i> - Carrion Crow                  | + | + |  | LC |

(\*) - Breeding or visitor bird, not a year-round resident.

### Planning for conservation and ecosystem activities:

- During the construction work on the migration routes of animals, where appropriate, should be arranged fencing usually equipped with deterrent devices (reflectors, warning lights, horns, etc.).
- In developing the calendar of construction plans should be taken into account the need for the suspension of work, causing intense physical impacts (noise, vibration, explosion's, light effects, etc.) in certain periods of the environmental authorities lives of animals such as the current period, breeding, hatching, etc. (If necessary, consult with experts). For this reason in forested territory clearance should be carried out, usually in winter.
- It is necessary to register the case, when during the construction inhabited nesting sites will be found (masonry or chicks), make the transfer of nests with the obligatory prior consultation and participation of experts.

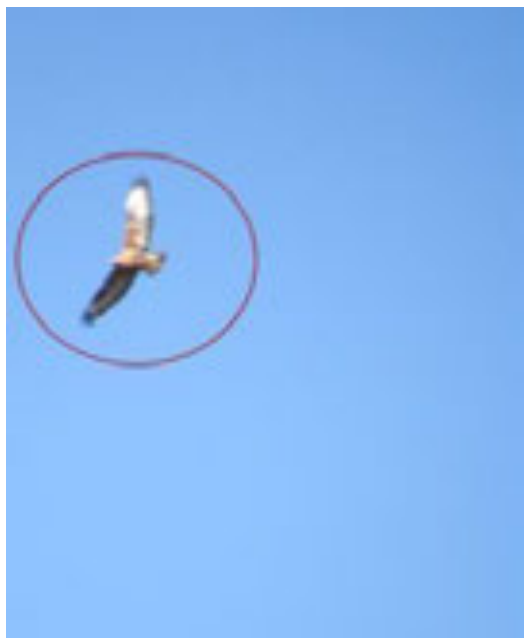


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## Illustration of Birds



1 Buteo rufinus



2 Sitta neumayer



3 Turdus merula



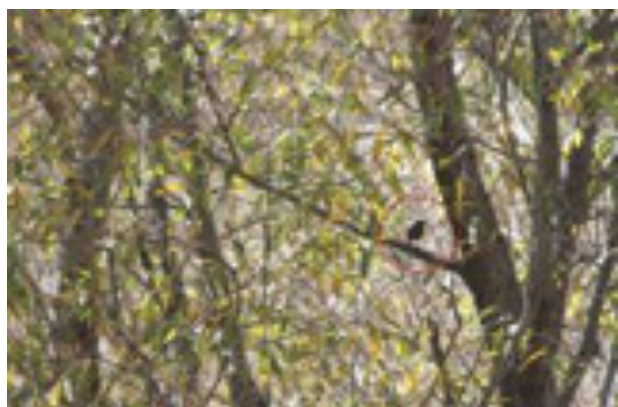
4 Denroscopus major



5 *Carduelis carduelis*



6 *Emberiza cia*



7 *Fringilla coelebs*



8 *Pica pica*



9 *Oenanthe oenanthe*



10 *Motacilla alba*

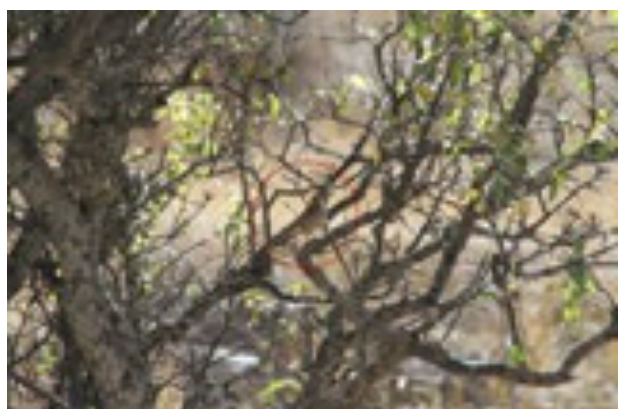




11 Saxicola ruberta



12 Aegithalos caudatus



13 Anthus campestris



14 Corvus corax



15 Larus armenicus



16 Strptophelia decaocto

## MAMMALS

### Introduction

Armenia is very rich in mammal species due to diversity of landscapes. Rich biodiversity contains endemic and endangered species which have historical and economic importance.

Diversity of small mammals (Insectivora, Rodentia, Chiroptera) in southern parts of Armenia were studied by several scientists (Yavruyan 2003, 2006, 2010, Papov 2003, Baloyan 2008, Avagyan 2009, Ghazaryan 2010, Hayrapetyan 2014, Ghazaryan 2016). As for large mammals, only few scientists were investigated (Malkhasyan et al. 2013, Ghasabian 2014). Target area as a part of Syunik region is characterized by rich and unique diversity of animals, cultural and natural heritage sites.

### Material and methods

Line transect methods were used during surveys in target area to estimate abundance and distribution of mammals.

Rodents and Insectivores were caught mainly by hand and live-traps. Acoustic detection was used for bats identification. Simultaneous detection with Pettersson D230, D240x was done. Vital signs of large mammals: dung, footprints on a soil left on the territorial designations of the tracks, were investigated. Camera traps Bestok B200 also were used.

During the route counts the starting point and the trajectory of the route are recorded by a GPS device. We recorded all locations where animals, their dens and permanent resorts were noted. Information on trapped or observed animals was recorded on data sheets. When possible, specimens were photographed.

### Results

Among 94 species at least 50 were recorded during our survey in target territory, from which 11 are listed in the Red Book of Armenia. There are 6 orders of mammals distributed in target area: Insectivora - 6 species, Chiroptera - 16 species, Rodentia - 12 species, Lagomorpha - 1 species, Carnivora - 11 species, Cetartiodactyla - 4 species.

There are many rocky mountains with a lot of cervices, which are habitats for several bat species: *Rh. hipposideros*, *M. blithy*, *Eptesicus bottae*, *Eptesicus serotinus*, *Rhinolophus ferrumequum*, *Rh. euryale*, *Myotis blythi*, *M. emarginatus*, *Pipistrellus pipistrellus*, *Plecotus macrotis* dwelling in Kitsq to Geghi canyon. Along this Canyon a lot of Porcupine eagles were found. In slopes of mountain near Qarut village camera traps of WWF of Armenia were recorded Bezoar goats (2012-2015). Armenian mouflon using Kitsq-Geghi canyon for pathing from summer place to wintering place. Target territory also is used by carnivores. Vital signs of foxes, golden jackals, wild cats and brown bear were investigated. Forestry parts of highway path, near to Kavchut village roe deer were observed. Mountain meadows





were habit by several small mammals: *Sorex satunini*, *Sorex volnuchini*, *Mesocricetus brandti*, *Chionomys nivalis*, *Ellobius lutescens* and ect.

During our work we find a lot of rodents and insectivores' nests along the road. Some of them will be destroyed during works. High density of rodents and insectivores allure carnivores. Decreasing amount of small mammals can push carnivores attack domestic animals. Ungulates are mostly localized on Kitsq-Geghi part, which means that this place is prey for carnivores such as lynx, wolf, bear and leopard.

The list of mammals are presented in table.

| Order              | Species                     | English Name                       | IUCN | Red Book Armenia | Sections |   |   |   |   |   |   |
|--------------------|-----------------------------|------------------------------------|------|------------------|----------|---|---|---|---|---|---|
|                    |                             |                                    |      |                  | 1        | 2 | 3 | 4 | 5 | 6 | 7 |
| <b>Insectivora</b> | <i>Erinaceus concolor</i>   | Southern white - breasted hedgehog | LC   |                  | +        | + | + | + | + | + | + |
| <b>Insectivora</b> | <i>Sorex satunini</i>       | Caucasian shrew                    | LC   |                  | +        | + | + | + |   | + |   |
| <b>Insectivora</b> | <i>Sorex volnuchini</i>     | Caucasian pygmy shrew              | LC   |                  | +        | + | + | + |   | + | + |
| <b>Insectivora</b> | <i>Neomys Teres</i>         | Transcaucasian water shrew         | LC   | EN<br>B1a+<br>2a | +        |   | + |   | + |   |   |
| <b>Insectivora</b> | <i>Crocidura suaveolens</i> | Lesser shrew                       | LC   |                  | +        |   | + | + |   |   | + |
| <b>Insectivora</b> | <i>Crocidura leucodon</i>   | Bicolored shrew                    | LC   |                  |          |   | + | + | + |   |   |



|                   |                                  |                                            |    |                   |   |   |   |   |   |   |   |
|-------------------|----------------------------------|--------------------------------------------|----|-------------------|---|---|---|---|---|---|---|
| <b>Chiroptera</b> | <i>Rhinolophus ferrumequinum</i> | Greater horseshoe bat                      | LC |                   | + | + | + |   |   |   | + |
| <b>Chiroptera</b> | <i>Rhinolophus euryale</i>       | Mediterranean horseshoe bat                | NT | VU<br>B1ab<br>+2a | + | + | + |   |   |   |   |
| <b>Chiroptera</b> | <i>Rhinolophus hipposideros</i>  | Lesser horseshoe bat                       | LC |                   |   |   |   |   |   |   |   |
| <b>Chiroptera</b> | <i>Myotis blythi</i>             | Lesser mouse-eared bat                     | LC |                   | + | + | + | + | + | + | + |
| <b>Chiroptera</b> | <i>Myotis emarginatus</i>        | Geoffroy's bat                             | LC |                   |   |   | + | + |   |   | + |
| <b>Chiroptera</b> | <i>Myotis mystacinus</i>         | Whiskered bat                              | LC |                   | + | + | + | + | + | + | + |
| <b>Chiroptera</b> | <i>Myotis aurascense</i>         | Stepp whiskered bat, eastern whiskered bat | LC |                   | + |   | + | + | + | + | + |
| <b>Chiroptera</b> | <i>Nictalus noctula</i>          | Noctule bat                                | LC |                   |   |   | + |   |   |   | + |
| <b>Chiroptera</b> | <i>Nyctalus leiseri</i>          | Lesser noctule                             | LC |                   | + |   | + |   |   |   | + |
| <b>Chiroptera</b> | <i>Eptesicus serotinus</i>       | Serotine                                   | LC |                   |   |   | + | + |   |   | + |
| <b>Chiroptera</b> | <i>Pipistrellus pipistrellus</i> | Common pipistrelle                         | LC |                   | + |   | + | + |   |   | + |



|                   |                                 |                                             |    |                                  |   |   |   |   |   |   |   |
|-------------------|---------------------------------|---------------------------------------------|----|----------------------------------|---|---|---|---|---|---|---|
| <b>Chiroptera</b> | <i>Pipistrellus kuhlii</i>      | Kuhl's pipistrelle                          | LC |                                  | + | + | + | + |   |   |   |
| <b>Chiroptera</b> | <i>Plecotus macrobullaris</i>   | Mountain long-eared bat                     | LC |                                  | + |   | + | + | + | + |   |
| <b>Chiroptera</b> | <i>Plecotus auritus</i>         | Common long-eared bat, brown long-eared bat | LC |                                  |   |   | + | + | + |   | + |
| <b>Chiroptera</b> | <i>Miniopterus schreibersii</i> | Schreiber's bat, common bent-winged bat     | NT | VU<br>B1ab<br>(iii)+2<br>ab(iii) |   |   |   | + |   |   | + |
| <b>Rodents</b>    | <i>Allactaga williamsi</i>      | Williams' jerboa                            | LC |                                  | + | + | + |   |   |   |   |
| <b>Rodents</b>    | <i>Ellobius lutescens</i>       | Transcaucasian mole vole                    | LC |                                  | + |   |   |   |   |   |   |
| <b>Rodents</b>    | <i>Chionomys nivalis</i>        | European snow vole                          | LC |                                  |   | + | + | + | + |   |   |
| <b>Rodents</b>    | <i>Microtus majori</i>          | Major's pine vole                           | LC |                                  |   |   |   |   |   | + | + |
| <b>Rodents</b>    | <i>Microtus arvalis</i>         | Common vole                                 | LC |                                  | + | + | + | + | + | + | + |
| <b>Rodents</b>    | <i>Mesocricetus brandti</i>     | Brandt's hamster                            | NT |                                  | + |   |   |   |   |   |   |
| <b>Rodents</b>    | <i>Arvicola terrestris</i>      | European water vole                         | LC |                                  | + |   |   |   | + |   |   |
| <b>Rodents</b>    | <i>Cricetulus migratorius</i>   | Gray dwarf hamster                          | LC |                                  | + | + |   |   |   |   |   |



|                   |                               |                                     |    |                            |   |   |   |   |   |   |   |
|-------------------|-------------------------------|-------------------------------------|----|----------------------------|---|---|---|---|---|---|---|
| <b>Rodents</b>    | <i>Apodemus<br/>witherbyi</i> | Steppe field<br>mouse               | LC |                            | + |   | + | + |   | + | + |
| <b>Rodents</b>    | <i>Apodemus<br/>uralensis</i> | Pygmy field<br>mouse                | LC |                            | + |   |   |   |   | + | + |
| <b>Rodents</b>    | <i>Dryomys<br/>nitedula</i>   | Forest<br>dormouse                  | LC |                            |   |   |   |   |   | + | + |
| <b>Rodents</b>    | <i>Hystrix<br/>indica</i>     | Indian<br>porcupine                 | LC | VU<br>B2a                  | + |   | + | + |   |   |   |
| <b>Lagomorpha</b> | <i>Lepus<br/>europaeus</i>    | European<br>hare                    | LC |                            | + | + | + | + | + | + | + |
| <b>Carnivora</b>  | <i>Martes foina</i>           | beech<br>Marten,<br>Stone<br>Marten | LC |                            |   |   |   |   |   | + | + |
| <b>Carnivora</b>  | <i>Meles<br/>meles</i>        | Eurasian<br>badger,<br>Badger       | LC |                            | + | + | + | + | + | + | + |
| <b>Carnivora</b>  | <i>Mustela<br/>nivalis</i>    | Leas weasel                         | LC |                            | + | + | + | + | + | + | + |
| <b>Carnivora</b>  | <i>Vormella<br/>peregusna</i> | Marbled<br>polecat                  | VU | VU<br>A2c+<br>B1<br>b(iii) | + | + | + |   |   |   |   |
| <b>Carnivora</b>  | <i>Ursus<br/>arctos</i>       | Brown bear                          | LC | VU<br>B1<br>b(iii)         |   |   | + |   | + | + | + |
| <b>Carnivora</b>  | <i>Canis lupus</i>            | Gray wolf                           | LC |                            | + | + | + |   |   | + |   |
| <b>Carnivora</b>  | <i>Canis<br/>aureus</i>       | Golden<br>jackal                    | LC |                            | + | + | + | + | + | + | + |
| <b>Carnivora</b>  | <i>Vulpes<br/>vulpes</i>      | Red fox                             | LC |                            | + | + | + | + | + | + | + |



|                        |                                 |                   |            |                     |   |  |   |   |  |  |   |   |
|------------------------|---------------------------------|-------------------|------------|---------------------|---|--|---|---|--|--|---|---|
| <b>Carnivora</b>       | <i>Felis silvestris</i>         | Wild cat          | LC         | VU<br>B1ab<br>(iii) |   |  |   |   |  |  | + | + |
| <b>Carnivora</b>       | <i>Pantera pardus saxicolor</i> | Leopard           | NT         | CR                  | + |  | + | + |  |  |   | + |
| <b>Cetartiodactyla</b> | <i>Capra aegagrus</i>           | Wild goat         | VU<br>A2cd | VU                  |   |  | + | + |  |  |   |   |
| <b>Cetartiodactyla</b> | <i>Capreolus capreolus</i>      | European roe deer | LC         |                     |   |  |   |   |  |  | + | + |
| <b>Cetartiodactyla</b> | <i>Sus scrofa</i>               | Wild boar         | LC         |                     |   |  | + | + |  |  |   |   |
| <b>Cetartiodactyla</b> | <i>Ovis orientalis gmelini</i>  | Mouflon           | VU         | EN                  |   |  | + | + |  |  |   |   |

1. 0- 177 Sisian - Darbas
2. 177 - 272 Darbas - Shenatagh
3. 347 - 440 Kitsq - Geghi
4. 440 - 545 Geghi - Geghavanq
5. 495 - 545 Geghavanq - Kavchut
6. 545-610 Kavchut - Lernadzor
7. 612-650 Lernadzor - Qajaran

## Conclusions

According to mentioned above we conclude:

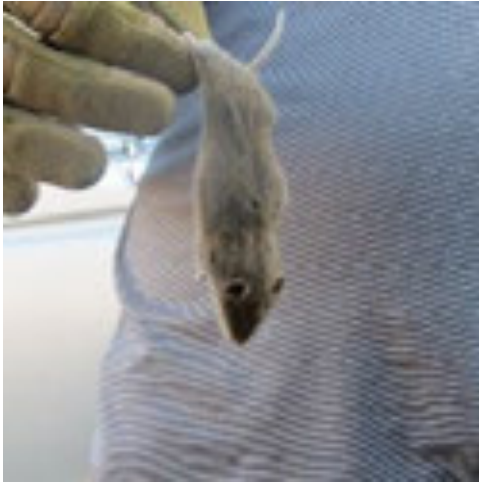
1. During construction phase the biodiversity specialist should attend for helping take out the animals upon need.
2. We also suggest to make passages for small mammals along the highway (Sisan - Darbas, Darbas - Shenatagh, Kitsq - Geghi) for giving them a chance to pass the road safely.
3. Recommended places on highway should be protected with high wall for avoiding the entrance of animals to the road due to the additional survey conducted prior the construction works.
4. Based on the additional survey mentioned above, the additional mitigation measures might be required like Green bridges, overpasses and etc in Kitsq - Geghi part, because of rich diversity of endangered large mammals' liveing there. For that we suggest to make a detailed research in small area to find exact pathway of Armenian Mouflons and Bezoar goats.

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## Illustrations of Mammals

***Microtus arvalis******Burrows of voles*****Killed fox on a road*****Vulpes vulpes*****Feaces of *Martes foina*****Feaces of Golden jackal**



**Killed by car hedgehog on a road**



***Erinaceus concolor***



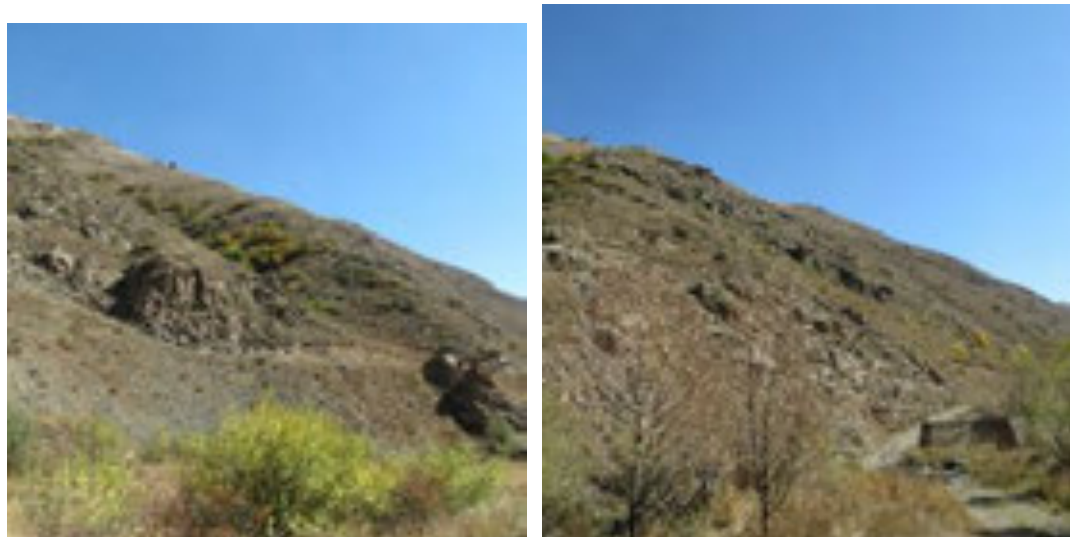
**Feaces of wild boar**



**Lying places of wild boar**

## THE MOST VULNARABLE PART OF ROAD

The part of road from Kitsq village to Geghi (347- 440), site of outstanding natural beauty, site of special scientific interest.



In gorgers of this area are habitats of many endangered species of plants and animals which are listed in Red Book of Armenia and IUCN Red list. Here situated the one of intact enclave of wildlife. Below the list of the most endangered species of vertebrates which will be effected from construction and exploitation of new road.

| Species (Latin name)                    | Species (English name) | Category in Red Book of Armenia* | Category of IUCN* | Notes                                                                  |
|-----------------------------------------|------------------------|----------------------------------|-------------------|------------------------------------------------------------------------|
| <b>Mammals</b>                          |                        |                                  |                   |                                                                        |
| <b><i>Panthera pardus saxicolor</i></b> | Persian leopard        | CR                               | EN                | Two cats was poached in 1999 in Darmanadzor gorge                      |
| <b><i>Ovis orientalis gmelinii</i></b>  | Armenian mouflon       | EN                               | VU                | The Bargushat and Zangezur ranges is a core main population in Armenia |
| <b><i>Capra aegargus</i></b>            | Bezoar Goat            | VU                               | VU                |                                                                        |
| <b><i>Ursus arctos syriacus</i></b>     | Syrian Brown Bear      | VU                               | LC                |                                                                        |



|                                         |                          |    |    |  |
|-----------------------------------------|--------------------------|----|----|--|
| <b><i>Felis silvestris</i></b>          | Wild cat                 | VU | LC |  |
| <b><i>Hystrix indica</i></b>            | Indian porcupine         | VU | -  |  |
| <b>Birds</b>                            |                          |    |    |  |
| <b><i>Tetrao galluscaspius</i></b>      | Caspian snowcock         | VU | NT |  |
| <b><i>Tetrao mlokosiewiczi</i></b>      | Caucasian black grouse   | VU | NT |  |
| <b>Reptiles</b>                         |                          |    |    |  |
| <b><i>Zamenishohenackeri</i></b>        | Transcaucasian rat snake | VU | LC |  |
| <b><i>Eumecesschneideri</i></b>         | Schneider's skink        | VU | LC |  |
| <b><i>Trachylepisseptemtaeniata</i></b> | Golden grass mabuya      | VU | DD |  |
| <b><i>Montivipera raddei</i></b>        | Armenian viper           | VU | NT |  |
| <b><i>Vipera eriwanensis</i></b>        | Armenian steppe viper    | VU | VU |  |

\*see list of abbreviation. The status abbreviation is gotten according to [IUCN Red List Categories and Criteria](#) (IUCN, 2015)

Moreover, the following large mammals as wild boar, roe deer, wolf, lynx which are not included in Red Book, however need in conservation, are distributed on this area.

Among the most prone animal which will be effected from road project is Armenian mouflon, because the road will cross the main habitat of this species (Fig 1). The construction of road will bring the following negative impact on this species: habitat destruction, fragmentation of habitat (the summer places of mouflon mainly situated on Zangezur ridge, but winter places are on Bargushat ridge while the road divide these two ridges) and may be it will facilitate access of poachers to localities of mouflons.



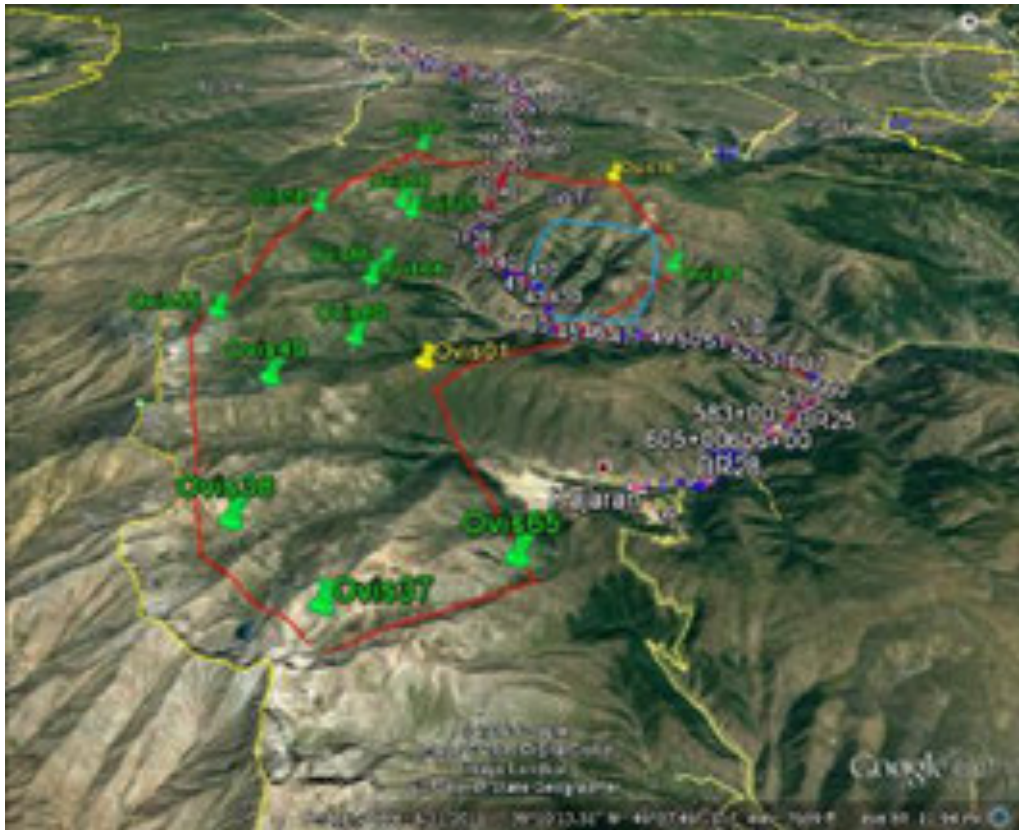


*Fig 3. Distribution and habitate area of Armenian mouflon*

The complete destruction of rocky slopes with polycarpous juniper will bring to chain destruction in ecosystem. The junipers are at the bottom of the food chain and main habitat for many animals that is supporting a variety of species and ecosystem healthy. The planting of juniper is not easy because its growth very slow. Thus, the road passing through the rocky slopes with junipers will fully destroy the vulnerable ecosystem with many rare species.

The following measures have to be done to mitigate the negative impact of road:

1. It is important to plan the special mitigation measures: green bridges large overpasses or underpasses, because more dangerous factors from road construction is the fragmentation of the distribution area of large mammals. Additional survey of the best places for this have to be done prior to construction works.
2. The construction of road on this part have to be done under monitoring of relevant specialist.

## RECOMMENDATION TO PROTECT BIODIVERSITY

For protection the unique and rich biodiversity of Armenia more attention to the environmental impact of new road network with aim mitigate negative effect on ecosystems

have to be done. The parts of road pass through vulnerable places, which are important feeding and breeding areas and migration routes for birds and large mammals. This area supports high index of biodiversity and endemic species. The new road will cause of direct impacts include road kills (mostly mammals), disturbance (cutting down of roadside trees, etc.), spills and contaminated runoff. Most of such impacts occur during the construction stage, or result from vehicle operations. Indirect impacts are generally more critical for biodiversity, as improved access to remote areas frequently leads to unsustainable resource exploitation, and land-use and population change.

We suggest following measures to mitigate the negative impact on biodiversity

1. Environmental management plan should be updated by the Contractor to ensure mitigation of road construction on key endangered species and sites should be composed based on periodically screening of area by specialists in zoology and botany.
2. Rehabilitation of habitat of some endangered species of plants away from the construction sites to offset lost and disturbed habitat should be done. "Exchange" of disturbed land for healthy habitat for some endemic and rare species
3. Construction activities should be timed to avoid sensitive periods of animals, e.g. bird, mammals breeding seasons, migration period of large mammals and should be carried out according to an Environmental Management Plan.
4. To reduce the number of individuals (vertebrate, protected species of plants) likely will be killed during construction activities they should be collected by the specialists and transported to the area typical for the species.
5. The construction of underpasses, large overpasses and/or "Green Bridges" for animals is important to support the daily and seasonal migration ways of animals through road to prevent the fragmentation of distribution area of animals.
6. Recommended places of the highway should be protected with high borders on the edges for avoiding the entrance of animals to the road due to additional survey done prior to construction.

## Illustrations of field work















*Annex 8: Study of Historical-Cultural and Archaeological Resource***Study of the Component of the Resources having Historical-Cultural, Spiritual, Archaeological and Geological Significance for Tranche 4 - Sisian-Kajaran Road Section.  
Final report**

While studying the historical-cultural and archaeological resources along the alignment of the Sisian-Kajaran road section construction project (North-South Road Corridor Investment Program, Tranche 4) three different information sources were used: 1) State List of the Immovable Monuments of History and Culture of the Republic of Armenia, Syunik Province (RA Government's decision on 15th March 2007, №385-N); 2) the results of several archaeological missions carrying out research in the study area since 1990-ies; 3) the results of field investigations or survey implemented along the alignment with an aim to record the sources of historical-cultural, archaeological, paleontological and spiritual significance in the area of the alignment design.

Before discussing the methods and the results, as well as analyzing the information collected during the field investigations, it would be important to present in brief the history of Syunik and geographic description of its area, as of the collected data is strongly related to it. Syunik Province is one of the most picturesque parts of Armenia ([Images 21 and 22](#)), and is home to some of the most important historical and cultural remains. Little explored archaeologically, the region is a wilderness of high mountains cut by huge, deep river gorges.

Important destinations in Syunik include Tatev Monastery, the spectacularly sited religious capital of Southern Armenia, Vorotnavank, Vahanavank, the standing stones near Sisian, the medieval cave-dwellings of Khndzoresk, and nature preserves such as Sev Lich and Shikahogh. Every road offers beautiful streams or sacred spring sites, often with covered picnic tables, by which to pitch a tent.

Due to its rough terrain and isolation, Syunik stayed relatively autonomous under the control of local Armenian notables (the Orbelians in Vayots Dzor) long after the rest of the country had been incorporated in Mongol, Turkish or Persian fiefdoms. It was a hotbed of insurrection under Davit Bek, and the last redoubt of independent Armenia in 1921 under Garegin Nzhdeh.

To explore the area a highly recommended route leaves **Sisian** to the SE following the main road through the city on the E side of the river. The road turns left uphill, and ends at a T junction just past a stop sign. Turn right at the T, and follow the road SE. Just before the village of **Aghitu**, you see on the left the remains of a substantial Muslim cemetery. The village, has a large restored 7th century funerary monument ([Image 17](#)), W of the road. S of the village on a hill

are remains of Berdategh ruined fortress-settlement and Aghitu-3 Upper Paleolithic cave. There is also a Middle Bronze Age tomb field. From Aghitu, a fork left allegedly climbs to **Noravan**, and thence to the main Sisian-Goris highway. Staying on the main road through Aghitu, a few km beyond, the right fork (left goes to **Vaghatin**), which soon provides a splendid view of the Vorotan gorge and **Vorotnavank Monastery** (Image 41). This fortified monastery sits, right of the road via a paved driveway about 8.5 km from the stop sign, on a promontory overlooking the Vorotan. The main S. Stepanos church was built in AD 1000 by Queen Shahandukht, and the adjoining S. Karapet church was built in 1007 by her son Sevada. The dome of S. Karapet collapsed in the earthquake of 1931. There are interesting carved gravestones in the cemetery. One of the churches is allegedly good for snakebite. From the monastery, the road winds down to a bridge. From the monastery, the road winds down to a bridge. Staying on the N side of the river, a road goes to **Vorotan**, with 9th-14th century khachkars and a bridge of 1855 built by Melik Tangi (Image 46), with hot springs that local Peace Corps volunteers have successfully bathed in during the winter.

Crossing the automobile bridge, the road reaches a bend in the river, with a steep, rocky hill left of the road. Crowning the summit are the sparse remains of **Vorotnaberd** (Image 47), a key site in Armenian history since AD 450, when it was a stronghold of the rebels under Vardan Mamikonian. Border fortress of the kingdom of Kapan, it was captured by the Seljuk Turks in 1104, then recaptured by Ivane Zakarian in 1219 and given to Liparit Orbelian. It was captured by the troops of Timur Lenk in 1386, but the Orbelian brothers managed to persuade the Mongols to give it back. Karayusuf took it from Smbat in 1407, but in 1724 Davit Bek took it back from Melik Baghr. There are interesting pottery fragments of all periods on the slope, perhaps crockery dropped on the heads of successive invaders.

Beyond, a left fork goes to **Ltsen**, with a church and a shrine of 1347. There is a S. Khach pilgrimage site SE. Name of the village comes, according to legend, from a local holy man named Nerses, who urged the villagers to drop (*ltsnel*) boulders down on the invading Mongols. The right fork joins the Loraget River valley at **Darbas**. This village has a ruined S. Astvatsatsin church build in the 13th century by Tarsayich Orbelian and his wife Mamakhatur. There is a small, ruined S. Stepanos church and, below the village, the “Arzumani Bridge” (Images 67-68), of 1680, with inscription: “In the year of the Armenians 1129 (1680), in the reign of Shah Suleiman, and of local prince Maghsot Bek, who was controller of the royal house, was built the bridge of Haji Arzuman Agha for his remembrance, who was administrator of this place and many villages of this region, a man of good repute ... by the hand of master Hayrapet”. Next is **Getatagh**, with S. Astvatsatsin church of 1702. **Lor** (Image 71) has at the entrance to village the so-called “Spitak Khach” (White cross) or “Loriki Khach” (Lorik’s Cross) enclosed khachkar monument of 1271 (Image 73). The basilica church of S. Gevorg in the village (Image 74-75), which is non-functioning and locked, dates to 1666, built according to legend by Khoja Poghos in gratitude for the safe return of his

beautiful wife from the clutches of Shah Abbas. On the slope above town is a chapel called Sargis Khacher with an inscription of 1345 saying this S. Astvatsatsin church was built by Sargis and Amir Hasan for the salvation of their souls. Tsaru S. Hovhannes church of 1686 is half a km SW. The reverends Smith and Dwight spent two days snow-bound in Lor in 1830, staying with the son of the local priest. "He welcomed us hospitably to his own family room. It was under ground, like all the houses of these mountains, and lighted only by an open sky-light in the centre, through which the snow was continually falling. In different parts, piles of grain were heaped upon the ground, which formed the floor. Here a deep wicker basket plastered with mud and cow-dung, answered the purpose of a flour-barrel; there was a large chest of bread, the principal food of the family. In a dark corner was a pile of carpets, mattresses, cushions and coverlets for their accommodation at night; and in another direction stood a cradle with its crying contents". Warmed by the *tonir* oven sunk into the floor, the two Americans were warmed even more to find a man who owned and even read the Bible. From Lor, which they said had been depopulated under Nadir Shah and had only 12 houses, they rode on to Sisian, Shaghat (where they found the locals to be working or traveling on the Sabbath), and over the mountains to Nakhijevan.

The road here ends at **Shenatagh** (from 1940 till recently Lernashen) ([Images 82-83](#)), has a S. Sargis church with inscribed tombstones ([Images 92-93](#)) and S. Martiros church of 1704 ([Images 94-95](#)), and various cave dwelling complexes ([Images 88-89](#)) and ruined hamlets nearby. There are also ruined fortresses in the gorge ([Images 86, 90-91](#)).

For the second half of the future highway territory the main road starts W from Kapan (the Province center, [Image 126](#)) and runs along a pleasant gorge, with a view of pleasant view of the famous Khustup Mountain ([Image 127](#)). After about 6 km, near the village of **Shharjik**, a paved road on the left angles down across the Voghji River, then runs back SE to the monastery of **Vahanavank** ([Image 128](#)). This was founded in 911 by Vahan, son of Prince Gagik of Kapan, who (as historian Stepanos Orbelian reports) took on a monk's robe and lifestyle to cure himself of demonic possession. Gathering 100 like-minded clerics, he built the original S. Grigor Lusavorich church, and was buried near the door. His equally royal nephew, also Vahan, was educated at Vahanavank and rose to be Bishop of Syunik and then Katholikos. The monastery became the religious center of the kings of Syunik in the 11th century Queen Shahandukht built the Astvatsatsin church as a burial site for her and her relatives. The site is lovely, the ruins evocative, and a small team led by Academician Grigor Grigorian is attempting to restore as much as possible. SE of Vahanavank is a large tomb field of the end of the 2nd Millennium BC. The next turnoff leads to a summer camp and a rather snazzy guesthouse belonging to the Marzpet's office. There is allegedly excellent rock-climbing nearby. The former village of Musallam has a 13th century bridge on the Geghi River and an 11th-13th century church.



Beyond the turnoff, a road goes N to the hamlet of **Verin Giratagh**. On a hill above the confluence of the Voghji and Geghi Rivers (N of the road) stands the castle of **Baghaberd**, with double walls and strong towers. It became the capital of the Syunik kingdom in the 12th century, but was finally sacked in 1170 by the Seljuk Turks ([Image 129](#)). A road goes up the Geghi River to **Kavchut**, **Geghavank** (former Pirlu) and **Geghi**. The latter has scant remains of Geghi fortress and a 10th century church. **Kavchut** (former Kahurt) has castle remains S. There are several other small hamlets up the river valleys, such as **Bakavank**, **Ajibaj** and **Kard**, with 17th century churches. Under the altar of the Kard church is supposed to flow a spring of mineral water.

**Lernadzor** has an 18th century S. Astvatsatsin church. Across the river is a Katoghike church of the 5th-6th century church. The once-important village of Okhchi would have been nearby. The 20th century mining town of **Kajaran** (once Gejevan, [Image 125](#)) and (just beyond) village of **Kajarants** are famous for the massive copper-molybdenum mine, which is still in operation. It is impressive to drive up to the mine and see the trucks, tiny in comparison to the pit, dumping ore into an elaborate system of conveyers. The ore receives initial processing in Kajaran but must be exported for final conversion to metal. The waste rock is piped a discreet distance away, filling various stream valleys with dirt on which only the most impervious weeds grow. Pollution of the Voghji River is an unsolved problem.

Turning back to the presenting of the results of the fieldwork investigations, we have to mention again, that their aim was to record the sources, which have historical-cultural, archaeological, paleontological and spiritual significance for the design of the road. Those works were carried out within the time period from 01.10.2016 to 24.10.2016. The team which implemented the field investigations or the survey consisted of three archaeologists and one topography specialist. The members of the team implemented intensive survey along the alignment ([pk 0.00 – pk 65.2+75](#)), which was provided by the project designer ([Maps 00 and 00a](#)) and recorded whole information by using GPS coordinates, including visible constructions, surface finds, sections, natural structures, etc., which were related directly with the alignment or located in the close vicinity of the future road outline. The route or the outline was adopted on GIS based 20 m resolution raster (ArcGIS 10.2), after which the impacted archaeological sites and historical-cultural monuments recorded during the fieldwork activities were selected along the targeted areas as conventional separate units. This operation allowed us targeting the sites which will be under the direct impact or stay under the Right of Way (RoW) and the sites which will not directly affected, but will be under the danger of destruction or can be affected during the construction process. The collected information was compared with the State List of monuments of the Syunik Province to clarify the status of the recorded unit – known site or newly discovered. For dating of the sites pottery fragments, obsidian implements and other possible artifacts collected, were cleaned, studied and evaluated. Meanwhile, the units or sites were reflected on GIS based Maps (with separate sheets by 1:5 000 scale) and provided by color division of the

community, by its position to the community, and to the alignment divided by pk. The recorded units were also provided by their typological classification: cave, tomb field, cemetery, shrine, church, fortress etc. – units of archaeological, historical-cultural and spiritual significance; fossil, sections of diatomite origin lacustrine sediment, raw-material source – units with geological significance; and finally – natural monuments (*see the Legend*). As a result of the above mentioned activities **81 units** in total were recorded along the alignment (*Maps 001 and 001a*), which are reflected on 48 Maps (*see Maps 1-1a – 48-48a*), as well as by a separate list (*Table 1*). Herein, the recorded units are described one by one, by the numbers, by the possession to the community land and by position to the pk division of the road project design.

**Sisian community: pk 0+00 – pk 4.9+50, 17 units (Maps 1-1a – 4-4a).**

**1. Natural monument, pk 1.4+50 (Maps 1 and 1a; Table 1; Image 1)** – Is a formation appeared as a result of an abrasion and weathering of a natural rock. Reminds an opened mouth of a predator. Will be directly affected staying under the outline of the road. If possible, it's preferable to remove it and install next to the road as an aesthetic-decorative monument.

**2. Shrine-sanctuary «Stepan ukht», pk 2.3+20 (Maps 2 and 2u; Table 1; Image 2)** – Leaves the impression of a modern building, but, in all probability, it is built on old foundations. Medieval pottery sherds were collected from the area of the shrine, showing the existence of more early activity. More probably, the shrine is related to the large settlement and tomb field, located some 200-250 m S-SW. The area of the shrine-sanctuary is directly attached to the alignment of the road design from the right side and will appear in the close vicinity of the future construction activities. During the implementation of the road construction special protection measures will be required in order not to damage the shrine and its historical context. The excavations have to be done under a control of an archaeologist, while after exploitation of the highway the shrine has to be accessible for the locals.

**3-15. Settlement and tomb field, pk 2.5+50 – pk 3.7+50 (Map 2 and 2a, 3 and 3a; Table 1; Images 3-8)** – The site is included in the state list of monuments of the Syunik Province as a tomb field under the code 8.6.4.1. W from the recorded units, on the top of the hill overlooking Sisian the so called “Karaberd” Bronze-Iron Age fortress is located (code 8.6.4.). More probably, this tomb field belongs to the timing of the functioning of the fortress. It is occupying a large area, approximately 1-1.5 km in length and around 200-250 m in width. Even though the area of the monument was heavily meliorated and intensively cultivated (it was owned by Sisian forestry), some of its parts are very well preserved and presented by tombs constructed with gravel-stone fill and with cromlechs composed by big stone blocks, as well as by traces of circular dwelling constructions (*Images 3-8*). These objects often appear next to each other and belong to different time periods. Anyway, judging from the surface finds (pottery sherds) collected from destroyed parts of the site, the settlement and the tomb field can be dated by Iron Age and High Medieval

Period. Combination of the road construction design with the archaeological units shows that their main part will be directly affected during the excavation works and saving the measures for saving the historical-cultural value of those units can be implemented only by undertaking long-term excavations. Moreover, while determining the surface or amount of the excavated units, it should be considered the needs of the Contractor to built bypass roads, to make soil removals, fills and other construction operations, which can cause a need of additional safeguard excavations. In general the described site is a serious archaeological barrier for the project, as off the archaeological excavations will require long term activities.

**16. Section of diatomite origin lacustrine sediments 1, pk 4.6+00 (Maps 4 and 4a; Table 1; Image 9)** – The Middle stream of the Vorotan River basin has preserved deposits of lacustrine sediments of diatomite origins, which are presenting the geological history of the Quaternary lake existing in the limits of the Vorotan Depression (Map 50). These diatomite formations contain rich fossil floral and faunal remains (leaves, insects, fish imprints and mammalian remains) and are very important sources for understanding of the geological history of Armenia and the whole region, as well as for the reconstruction of the Pleistocene climate. The sections of such deposits, containing described finds, are determined as paleontological localities. Their main description, details of study and preservation are given below – in section for Darbas. Similar section is present in the limits of the Sisian community (at pk 4.6+00, Image 9), which, judging from the combination of the road construction design and this geological unit, will be directly affected during the future construction activities and will require special protection measures.

**17. Section of diatomite origin lacustrine sediments 2, pk 4.9+50 (Maps 4 and 4a; Table 1; Image 10)** – Similar section was recorded at the border of the Sisian and Uyts communities at pk 4.9+50 (Image 10). Judging from the combination of the road construction design and this geological unit, the section will not be directly affected, as of it will stay atop the tunnel planned starting at pk 4.8+50 and ending at pk 5.3+00. However, it is possible, that during the construction works of the tunnel the basal part of those sediments will be opened, which then, will require applying special study and protection measures.

**Uyts community: pk 4.9+50 – pk 5.5+50, 3 units (Maps 4-4a).**

**18-20. Tomb field, pk 5.1+00 – pk 5.5+50 (Maps 4 and 4a; Table 1; Images 11-12)** – In all probability this is the necropolis of the Bronze age fortress existing in the neighborhood of the so called “Syuni berd” fortress, which, however, is not included in the state list of monuments of the Syunik Province as a separate subunit. Some of the units of the above mentioned tomb field are located along the design of the road, in very close vicinity or some will be directly affected during the road construction activities – for example unit 20 recorded at pk 5.5+50 (Image 13). Similar to the previous tomb field, the only way to save the historical-cultural values of the

archaeological units here can be implemented by undertaking safeguard excavations. However, taking into consideration the existence of tunnel starting at pk 4.8+50 and ending at pk 5.3+00, part of them will stay above it and will not carry direct impact, and some part (especially tombs located in close proximity of the functioning Sisian-Aghitu road) will carry direct impact. Anyway, only after nailing the points of the destruction zone in the field conditions it will be possible to decide the real amount of the affected units requiring safeguard excavations.

**Aghitu community: pk 4.9+50 – pk 9.1+00 and pk 9.6+00 – pk 10.3+60, 12 units (Maps 5-5a to Maps 9-9a).**

**21. Unclassified structure remains 1, pk 6.0+00 (Maps 5 and 5a; Table 1)** – The area where this unit is recorded is meliorated; this is why it is a problem to suggest any idea about its function or timing period. Archaeological finds are not recorded as well. As of this unit will be directly affected, it will be more than enough to measure it and/or to implement test excavations.

**22. Natural monument 1, pk 6.0+40 (Maps 5 and 5a; Table 1; Image 14)** – Is recorded North-East from the previous unit. It is a formation which appeared as a result of an abrasion and weathering of a natural rock, at the basal part of which a natural empty area or cavern is present and a prominence on the top (Image 14). No traces of artificial processing are noticeable on the surface, but the lower part was blocked by a wall structure from the front. No archaeological materials were discovered. More probably, it served as a hiding place or a shelter. However, judging from the combination of the road construction design and this unit, it will not be directly affected, but will stay in close proximity of the construction area, and will require special protection measures and protocols.

**23. Unclassified structure remains 2, pk 6.5+50 (Maps 5 and 5a; Table 1)** – The area around this recorded unit is meliorated; it is difficult to conclude anything about its function (tomb or structure remnants) and timing period. No archaeological materials were discovered. As of this unit will be directly affected, it will be more than enough to implement test excavations and to measure it, if there will be some situations recorded.

**24. Structure remnants or settlement 1, pk 6.8+50 (Maps 6 and 6a; Table 1; Image 15)** – In the are of this recorded unit remnants of wall structures, traces of separate constructions are visible, which are allowing to conclude, that more probably, we have here with a settlement (Image 15). Absence of surface archaeological finds is not allowing to understand the chronological frames of functioning of the settlement. Based on the existence of Early Medieval period cemetery or tomb field presented by slab graves located some 100 m South-East from the site (see below), the settlement has the same timing. In general the whole complex can be one of the portion of Late Hellenistic and Early Medieval Periods Aghitu village or town, and synchronous to the large funerary monument of the 6th-7th centuries AD standing in the center

of the nowadays village (**Image 17**). Meanwhile, after comparison with the road construction design its coming clear that this newly discovered archaeological unit, which is not present in the state list of monuments of the Syunik Province, will be directly affected and from the perspective of saving its historical-cultural value requires safeguard excavations. Only after nailing the points of the destruction zone in the field conditions it will be possible to decide the real surface and volume of the safeguard excavations.

**25. Early Medieval tomb field or cemetery, pk 7.0+20 (Maps 6 and 6a; Table 1; Image 16)** – This newly discovered archaeological unit is located some 100 m South-East from the previous one. It is presented by slab graves visible in the section of sediments, which more probably have Early Medieval Age (**Image 16**). After comparison with the road construction design, it is becoming clear that this archaeological unit, which is not present in the state list of monuments of the Syunik Province, will be directly affected and from the perspective of saving its historical-cultural value requires safeguard excavations. Even though these burials have no archaeological value, they have great historical and archaeobiological significance. Probably excavation works will include the burials located at the Southern part of the tomb field, which will be attached to the newly constructed highway outline from the left side. For the rest of the burial units special protection measures will be required.

**26. Structure remnants or settlement 2, pk 7.6+30 (Maps 7 and 7a; Table 1; Images 18-20)** – This newly discovered archaeological unit is located below the Southern side of the basaltic cliff formation located standing South from the village and is one of the old terraces of the Vorotan River. At the Northern side of this formation Aghitu-3 Upper Paleolithic cave site is located, as well as atop there is a large Bronze-Iron Age and Classical-Medieval Periods large fortified settlement. Below the terrace there are numerous caves, which bear traces of intensive occupation. In general, this area contains traces of long term occupation, which, in the case of the presented site are presented by outlines of wall structures overlooking the Vorotan valley with some noticeable incline (**Image 18**), and with thousands of pottery fragments spread in the area (**Image 19**). Among of them Iron Age and High Medieval Period (**Image 20**) samples can be easily separated. It is clear that the presented section is a result of vital activities of people occupying the above mention settlement atop of the cliff. According to the road construction design it is planned to built a bridge here, which starts at pk 7.6+47.15 and ends at pk 8.0+67.15 (**Maps 7 and 7a**). It means that besides of the safeguard excavations required for the portion of site staying under RoW, there will be a need of protection measures for the whole monument during the construction activity process. After nailing the points of the destruction zone in the field conditions it will be possible to decide the real surface and volume of the safeguard excavations.

Starting from the end of the bridge the road will pass through a tunnel installed along picturesque Vorotan gorge presented by complexes of unique natural monuments ([Images 21 and 22](#)) till pk 8.8+00, where also a density of archaeological sites is recorded.

**27-29. Structure remnants in shape of walls and tombs 1, pk 8.7+90 – pk 8.8+30 ([Maps 8 and 8a; Table 1; Images 23-24](#))** – In the area of this newly discovered unit traces of wall structures on the ground are visible ([Image 24](#)), as well as circular structures leaving impression of tombs ([Image 23](#)), which allow us to conclude, that, more probably, here remnants of a settlement and/or tomb field. Absence of surface archaeological finds is not allowing to have any observations about the chronological frames of the site's functioning. Meanwhile, we can not exclude the Bronze-Iron Age date of the monument After comparison with the road construction design, it is becoming clear that this archaeological unit, which is not present in the state list of monuments of the Syunik Province, will be directly affected and from the perspective of saving its historical-cultural value requires safeguard excavations for some portion of the site. Only after nailing the points of the destruction zone in the field conditions it will be possible to decide the real surface and volume of the safeguard excavations.

**30. Natural monument 2, pk 9.0+30 ([Maps 8 and 8a; Table 1; Images 25-26](#))** – Is a formation appeared as a result of an abrasion and weathering of a natural rock. Reminds a prehistoric animal ([Images 25-26](#)). Will be directly affected staying under the left side of the outline of the road. If possible, it's preferable to remove it and install next to the road as an aesthetic-decorative monument.

**31. Structure remnants in shape of walls and tombs 2, pk 9.0+90 ([Maps 8 and 8a; Table 1; Images 27-28](#))** – In the area of this newly discovered unit traces of wall structures on the ground are visible, as well as circular structures leaving impression of tombs ([Image 28](#)), which allow us to conclude, that, more probably, here remnants of a settlement and/or tomb field. In the area of the site a complex consisting from several rock-shelters front part of which is separated by a wall structure was recorded ([Image 27](#)). Absence of surface archaeological finds is not allowing to have any observations about the chronological frames of the site's functioning. After comparison with the road construction design, it is becoming clear that this archaeological unit, which is not present in the state list of monuments of the Syunik Province, will not be directly affected and for that reason during the construction activities only special protection measures will be required.

**37. Natural monument 3, pk 9.7+00 ([Maps 9 and 9a; Table 1; Images 29-31](#))** – Is a formation appeared as a result of an abrasion and weathering of a sandstone origin natural rock ([Images 30-31](#)). The work of rainwater and wind “carved” lots of cup-marks and lines on the surface of the rock, creating “amazing” scenes. Will be directly affected staying under the right ending of the outline of the road design. If possible, it's preferable to remove it and install next to



the road as an aesthetic-decorative monument. We can also add that at the basal part of the formation, where the erosion is more intensive, a section like a rock-shelter is existing in front of which traces of badly preserved wall structure is visible ([Image 29](#)). We suggest to do test excavations in this part.

**Noravan community: pk 9.1+00 – pk 9.6+00, 5 units ([Maps 8-8a](#)).**

**32. Natural monument 1, pk 9.2+20 ([Maps 8 and 8a; Table 1; Image 32](#))** – Is a formation appeared as a result of an abrasion and weathering of a natural rock. Reminds a phallic stella ([Image 32](#)). After comparison with the road construction design, it is becoming clear that, this unit will not be directly affected, but is located very close to the left outline of the road design, that's why will require special protection measures and protocols during the construction activities.

**33. Natural monument 2, pk 9.2+50 ([Maps 8 and 8a; Table 1; Image 33](#))** – Is located in the neighborhood of the previous one. It is a formation appeared as a result of an abrasion and weathering of a natural rock. Reminds a phallic stella ([Image 33](#)). Will be directly affected staying under the left ending of the outline of the road design. If possible, it's preferable to remove it and install next to the road as an aesthetic-decorative monument.

**34. Wall structure remnants near Natural monument 2, pk 9.2+50 ([Maps 8 and 8a; Table 1; Image 34](#))** – This newly discovered and recorded unit is located at the start of the hill, where the above mentioned natural monument is standing. Function and timing are not clear. Will be directly affected staying under the left ending of the outline of the road design. It will be necessary to implement test excavations here and depending on the results to record and suggest mitigation measures.

**35. Natural monument 3, pk 9.4+00 ([Maps 8 and 8a; Table 1; Image 35](#))** – Is a formation appeared as a result of an abrasion and weathering of a natural rock. Reminds a mask of a soldier in helmet ([Image 35](#)). After comparison with the road construction design, it is becoming clear that, this unit will not be directly affected, but is located very close to the left outline of the road design, that's why will require special protection measures and protocols during the construction activities.

**36. Remnants of a truncated settlement, pk 9.5+00 ([Maps 8 and 8a; Table 1; Images 36-37](#))** – This newly discovered and recorded unit, judging from the preserved wall structures at the place ([Image 37](#)), was a settlement, which was fully destroyed, because of melioration of the area with usage of heavy machinery ([Image 36](#)). Absence of surface archaeological finds is not allowing to have any observations about the chronological frames of the site. After comparison with the road construction design, it is becoming clear that this archaeological unit, which is not present in the state list of monuments of the Syunik Province, will not be directly affected. We



suggest to do test excavations in one of the portions of the site which is well worth preserved and only after that to decide the final protection measures to be required.

**Vaghatin community: pk 10.3+60 – pk 12.5+90, 8 units (Maps 9-9a to 11-11a).**

**38. Section of diatomite origin lacustrine sediments, pk 10.6+00 (Maps 9 and 9a; Table 1; Image 38)** – Was recorded close to the administrative border of the Vaghatin community, at pk 10.6+00 (Image 38). Judging from the combination of the road construction design and this geological unit, the section will not be directly affected. However, it is possible, that during the construction works the basal part of those sediments will be opened, as of it is located very close to the left outline of the road design, which then, will require applying special study and protection measures.

**39. Surface finds around wall structure remnants, pk 10.8+90 (Maps 10 and 10a; Table 1; Image 39)** – The area of mentioned finds is a small hill, on slopes of which structures leaving an impression of walls remnants are visible. Judging from the limited amount of badly preserved Late Chalcolithic Period pottery fragments and existence of an obsidian flake, it is possible to conclude, that here we can have traces of naturally eroded and partially removed early (more probably dating to the first half of the IV Millennium BC) settlement remnants (Image 39). After comparison with the road construction design, it is becoming clear that this archaeological unit, which is not present in the state list of monuments of the Syunik Province, will be directly affected. It will be correct to do test excavations at the site and to clarify the historical-cultural value of the above mentioned structures and depending on the results suggest final mitigation measures.

**40. Wall structure remnants, pk 11.2+30 (Maps 10 and 10a; Table 1; Image 40)** – The area of this newly discovered unit is a steep hill, where at the parts with eroded and washed sediments of the slopes diatomite origin lacustrine deposits are visible. At the top of the hill wall structures are present, which function and timing is not certain, because of absence of surface archaeological finds. Taking into consideration the position of these walls in comparison with local relief, it is possible that here we have remains of a tower or a guard point (Image 40). After comparison with the road construction design, it is becoming clear that this archaeological unit, which is not present in the state list of monuments of the Syunik Province, will be directly affected. It will be correct to do test excavations at the site and to clarify the historical-cultural value of the above mentioned structures and depending on the results suggest final mitigation measures.

In the vicinity of pk **11.5+00** of the road project Vorohtnavank Monastic complex is located, with a very impressive view (Image 41).

**41. Medieval village remains and Spring-monument, pk 11.9+00 (Maps 11 and 11a; Table 1; Image 42)** – This complex located at pk 11.9+00 is presented by Medieval village

remains, which is clear from the traces of house foundations. The spring, nowadays converted to the monument, which was supplying water to the former village is also located here. In place, at the immediate vicinity of the spring a natural rock formation with a shape of a stella with a hole in the middle part is erected. (Image 42). It was brought here at some time from another place, or has a local origin is difficult to tell. After comparison with the road construction design, it is becoming clear that this archaeological unit, which is not present in the state list of monuments of the Syunik Province, will be directly affected and from the perspective of saving its historical-cultural value requires safeguard excavations for some portion of the site. Only after nailing the points of the destruction zone in the field conditions it will be possible to decide the real surface and volume of the safeguard excavations.

**42-45. Wall structures preserved in the area of old gardens, pk 12.1+00 – pk 12.5+90 (Maps 11 and 11a; Table 1; Images 43-45)** – Presented units are spread over a large area, around 500 m in length, which is used as gardens today, and which, judging from wall structure remnants were functioning at least from High or Late Medieval Period, and probably were the monastic gardens of Voroṭnavank. Part of the preserved wall structures (Images 43-45), which function and timing are not clear (probably those are gardeners' houses or wine production installations). After comparison with the road construction design the unit will be directly affected. It will be correct to do test excavations at the site and to clarify the historical-cultural value of the above mentioned structures and depending on the results suggest final mitigation measures.

**Vorotan community: pk 12.5+90 – pk 14.8+00, 4 units (Maps 11-11a to 13-13a).**

**46. Section of diatomite origin lacustrine sediments, pk 12.5+90 (Maps 11 and 11a; Table 1; Image 48)** – Was recorded close to the administrative border of the Vorotan community, at pk 12.5+90, very close to the right outline of the road design (Image 48). Judging from the combination of the road construction design and this geological unit, the section will be directly affected, and for this reason will require applying special study and protection measures.

**47-49. Vorotan (Voroṭn) Medieval village remains and cemetery, Bronze-Iron Age tomb field, pk 13.2+40 – pk 13.5+50 (Maps 12 and 12a; Table 1; Images 49-55)** – In the state list of monuments of the Syunik Province this site is recorded under 8.78.2. (Vorotan (Voroṭn) Medieval village remains) and 8.78.2.1. (Cemetery) codes, which are dated to Early and Late Medieval Periods. Study of the area by the team showed that there is also a Bronze-Iron Age and Classical Period tomb field existing, because of in between of the preserved house foundations, gravestones, stellae and khachkars traces of cromlechs, slab graves are visible, which have been damaged because of Medieval burials (Images 52-53). This is also confirmed by Iron Age and Classical Period pottery fragments, collected from the surface of the site's area, allowing to conclude that in the case of this site we have to deal with multilayer and a complex archaeological site – a Bronze-Iron Age and Classical Period tomb field and Medieval village

remains. Moreover, the monument consists of two parts, the first is located around the limits of pk 13.2+40 (here house foundations, cemetery and tomb field are present), and the second is around 300 m South, around the limits of pk 13.5+50 (in this part only cemetery and tomb field are present). In general, the monument is overlooking the Vorothenberd fortress, located West from it, atop of the hill on the right side of the functioning Sisian-Shenatagh road ([Image 53](#)). Finally, it is clear that the area of the existing Bronze-Iron Age tomb field (its existence also confirmed by numerous chance finds from the area around the Vorothenberd fortress, as well as from the described area) later was converted into the Early and Late Medieval Period cemetery, which has to be related to the Vorothenberd and the settlement functioning around it, and the village remains belong only to Late Medieval Period. However, after comparison with the road construction design it is clear that both portions of this archaeological monument will directly be affected staying under RoW. Meanwhile the road construction will destroy the most important parts of the monument. So, for saving the historical-cultural value of the site implementation of complex mitigation measures are required. First, it will be important to number and remove all the gravestones and the stellae. Afterwards, there will be a need to excavate all the graves and tombs, which will need implementation of long-term excavation works. That is why Vorothen (Vorothen) Medieval village remains, cemetery and tomb field can be considered as the second big archaeological barrier for the Sisian-Kajaran road construction project after the Karaberd settlement and tomb field in the limits of the Sisian community. Only after nailing the points of the destruction zone in the field conditions it will be possible to decide the real surface and volume of the safeguard excavations.

Near **pk 15.0+00**, in the neighborhood of the Vorothen hydroelectric power station picturesque view of the Shamb Reservoir is being opened, occupied by yellowish and white color lacustrine deposits ([Images 56-57](#)). In general, as it was mentioned before, the middle stream of the Vorothen River gorge preserved deposits of diatomite origin lacustrine sediments, which are reflecting the geological history of the paleolake, existing in the limits of the Vorothen Depression in Quaternary Period ([Image 50](#)). Those diatomite formations contain rich fossil flora and fauna (leave, insect, fish imprints and mammal remains) and are a valuable source for the geological history of Armenia and the whole region, as well as for the reconstruction of the Pleistocene climate. Those fossil remains are being studied over 100 years and are known from various localities, among of which the most important ones are Uyts, Vorothen, Shamb and Darbas groups of localities ([Map 50](#), [Images 58-60](#)). Especially Shamb and Darbas, which are dated to 1.5-1 Million years and are the best preserved sequence for MIS (**Marine Isotope Stage**) 31 in the entire world. Their study is going on, meanwhile the road project design is passing through numerous diatomite section in the administrative limits of Uyts, Darbas and Shenatagh ([Images 69-70](#), [Maps 14-14a to 22-22a](#)). However, large amount of the paleontological sites is not a barrier for the organization of the road construction activities. Only those localities have to be studied by

the corresponding specialists and the future investigations have to be oriented for shaping secure measures for their future protection.

**Darbas community: pk 14.8+00 – pk 19.9+50, 5 units (Maps 13-13a to 17-17a).**

**50. Flint raw-material source for making stone tools, pk 15.2+00 (Maps 13 and 13a; Table 1; Image 61)** – Was recorded South-West from the confluence of the Vorotan River with Shamb Reservoir at pk 15.2+00, at the left outline of the alignment (Image 61): Flint, like obsidian as a raw material for making tools and implements was used from the dawn of humans history till the ethnographic period. According to a new data, in the limits of Syunik such raw material was used around 40 thousand years ago by anatomically modern humans occupying the Aghitu-3 cave. But if the obsidian sources used by the inhabitants of the cave for tool production are well worth studied and known to us, the flint sources are still unknown. In this context discovery of such a newly discovered source is becoming valuable. After comparison with the road construction design and this geological unit it will be directly affected, and for that reason will require applying special study and protection measures.

**51. Structure remnants in shape of tombs, pk 15.6+60 (Maps 13 and 13a; Table 1; Image 62)** – The area of this newly discovered unit is part closer to the top of a small hill, where structures in shape of small tombs with rock shields are preserved (Image 62). In case of absence of surface archaeological finds it is difficult to decide their function and timing. We can not exclude the recorded structures are Bronze-Iron Age tombs. Judging from the comparison with the road construction design these units will be directly affected. It will be correct to do test excavations at the site and to clarify the historical-cultural value of the above mentioned structures and depending on the results suggest final mitigation measures.

**52-53. Shrine (church) ruins, cemetery and khachkas (Parvants), pk 17.6+90 (Maps 15 and 15a; Table 1; Images 63-66)** – In the state list of monuments of the Syunik Province this site is recorded under 8.31.3. code, and is presented as a 13th-15th centuries cemetery. After study of the area by the survey team members, small church traces were recorded, which then were converted into a shrine in later period (Images 63-64). Inside of the shrine fragment of a khachkar is preserved (Image 65), and on the overlooking hill (to the East) there is a complete khachkar lying on the ground (Image 66). Judging from the comparison with the road construction design a large portion of the site, especially the shrine and the adjacent small gorge will be directly affected, staying under RoW, meanwhile the shrine attached to the alignment from the left side will stay under the fill. For saving the historical-cultural value of the site changing the configuration of the fill in the construction design is required. If not possible, then the whole site has to be excavated and removed to the vicinity, which is not the best solution.

**54. “Arzuman’s bridge” and Medieval road, pk 18.6+00 (Maps 15 and 15a, 16 and 16a; Table 1; Images 67-68)** – This bridge, which was built on one of the tributaries of Vorotan – the Loraget River in 1675 (in the state list of monuments of the Syunik Province is recorded under 8.31.10. code), and which was described above, has no direct connection to the road construction project. It is located West from pk 18.6+00. Taking into account, that the monument was restavrated and was brought to a proper shape recently (Image 67), as well as there are preserved traces of a Medieval road at it Western ending, we are suggesting to include it into the future tourism development list and to plan building an access in the frame of the road construction project for visiting the monument.

**Getatagh community: pk 19.9+50 – pk 21.2+90, 0 units (Map 17-17a and 18-18a).**

Along the alignment of the project passing in the limits of this community no units having historical-cultural, archaeological, paleontological and spiritual significance was recorded.

**Lor community: pk 21.2+90 – pk 24.9+00, 5 units (Maps 18-18a to 20-20a).**

**55. Enclosed khachkar or “Loriki khach (Lorik’s Cross)” monument, pk 22.2+00 (Maps 18 and 18a, Table 1; Image 73)** – This enclosed khachkar erected at 1271 (in the state list of monuments of the Syunik Province is recorded under 8.41.2.1. code), is standing in the 13th -20th century cemetery which is not far away from the Northern gateway of the village and is the symbol of this settlement. The monument has no direct connection to the road construction project. It is located West from pk 21.7+00. Taking into account, that the monument was restavrated and was brought to a proper shape recently (Image 73), we are suggesting to include it into the future tourism development list and to plan building an access in the frame of the road construction project for visiting the monument.

**56. Cave complex carved in a section of diatomite origin lacustrine sediments, pk 22.7+50 (Maps 19 and 19a, Table 1; Image 76)** – Such kind of structures are widely spread in the area of the Syunik Province and are being used even today. The city of Goris and the adjacent villages are the best example, where people were living in the caves until 1950-ies. In this part of Syunik the existence of such caves is connected with the diatomite origin lacustrine sediments, which are very soft and being easily processed. Those kinds of monuments are directly existing in the area of spread of the above mentioned geological formations – Shamb, Ltsen, Darbas, Getatagh, Shenatagh, as well as Lor, where powerful deposits of diatomites also exist (Images 76, 82-83). The cave complex recorded at pk 22.7+50, most probably was created in near past, during the 30-ies of the 20th century and has no historical-cultural value (Image 76). Judging from the comparison with the road construction design main part of this complex will be directly affected staying under RoW. According to our opinion, it will be more than enough to implement test excavations and to record and to measure it, after which the construction activities can start.

**57. Mardakayr Medieval village remains and Tsaru S. Hovhannes church (1686), tomb field (II-I Millennium BC), pk 23.1+60 (Maps 19 and 19a, Table 1; Images 77-78)** – In the state list of monuments of the Syunik Province of the RA this archaeological unit is presented as a Medieval village remains and Tsaru S. Hovhannes church (1686) located on the slope of the hill which is at some 500 m South from the village (code 8.41.6.), as well as by a tomb field dating to II-I Millennium BC 50 m South from the previous site (code 8.41.4.). Meanwhile, detailed study of the described area by the survey team members no traces of Medieval village remains, church or tomb field were recorded. It was possible to record only one gravestone and one khachkar at the place (Image 78). We suggest, that the external signs of the monument were fully truncated, because of the heavy melioration of the area, taking into the consideration that in the state list those units are always recorded as destroyed. Anyway, from the comparison with the road construction design it is planned to built a bridge here, between pk 23.0+59.56 and pk 23.2+15.58, West from which the former site area is located. According to our opinion, it will be correct if the future construction activities here will be implemented under the control of an archaeologist, as of during the construction process it is possible that on the nearby hills archaeological sites or historical-cultural values can be opened.

**58. Medieval village remains, pk 23.3+90 (Maps 19 and 19a, Table 1; Images 79-80)** – The area of this newly discovered site is presented by a hill with wall structure remains visible on the North-Eastern slopes. They look like foundations of former houses (Images 79-80). Judging from the limited amount of High Medieval period ceramic fragments collected at the place, we can propose that this newly recorded unit, which is missing in the state list of monuments of the Syunik Province, is a Medieval village. Based on the comparison with the road construction design it will not be directly affected, but the left outline of the alignment will pass very close to the site, and for that reason will require applying special protection measures during the construction process.

**59. Section of diatomite origin lacustrine sediments, pk 23.9+50 (Maps 20 and 20a; Table 1; Image 81)** – Was recorded close to the administrative border of the Lor and Shenatagh communities at pk 23.9+50, closer to the left outline of the alignment (Image 81). Judging from the combination of the road construction design and this geological unit, the section will not be directly affected. However, it is possible, that during the construction works the basal part of those sediments will be opened, which then, will require applying special study and protection measures.

**Shenatagh community: pk 24.9+00 – pk 31.8+00, 6 units (Maps 20-20a to 22-22a).**

**60. Spring-monument, pk 25.7+00 (Maps 21 and 21a; Table 1; Images 84-85)** – This spring monument built on the source of the mineral water in 1981 and dedicated to the memory of the geologist Yegor Mirzai Harutyunyan is located on the Western side of the village. The monument has no direct connection to the road construction project. It is located West from pk



25.7+00. Taking into account, that the monument today is in a proper shape ([Image 84](#)) and the mineral water here has specific quality, we are suggesting to include it into the future tourism development list and to plan building an access in the frame of the road construction project for visiting the monument.

**61. Surface finds at the base of a hill with an Iron Age fortress, pk 25.6+60 ([Maps 21 and 21a](#), [Table 1](#); [Images 86-87](#))** – During the survey implemented along the alignment of the road construction project at pk 25.6+00 Iron Age pottery fragments were collected, without clear archaeological context. Additional study of the area showed that atop the hill located East from pk 25.6+00 there is an Iron Age fortress, which is missing in the state list of monuments of the Syunik Province ([Image 86](#)). Most probably, the above mentioned finds are related to the fortress, as of they had been collected from the slope of the hill where the fortress exists ([Image 87](#)). However, even though the fortress will not be directly affected during the construction activities, we are suggesting to carry additional study in the area of the finds, and to undertake test excavations here, or to apply for archaeologist's control during the construction activities.

**62. Cave complex carved in a section of diatomite origin lacustrine sediments, pk 25.7+00 ([Maps 21 and 21a](#), [Table 1](#); [Images 88-89](#))** – As it was mentioned above, such artificial caves are widely spread in Syunik, and especially in this part of the Province. The area of the Shenatagh community is also rich with such caves. The timing of creation of those structures is unknown yet, even though they are being exploited in Shenatagh and neighboring Lor till nowadays for keeping cattle and producing zoogenic fuel or *atar* as the locals call it ([Image 89](#)). Such king of a large complex is present on the hill situated at the Eastern side of the community in the limits of pk 25.7+00 ([Image 88](#)), which, based on the comparison of the road construction design and this unit, will be directly affected during the implementation of the road construction project. Especially, according to the design, it is planned to build a bridge between pk 25.7+24.23 and pk 25.8+80.23. The first pillar of the bridge spring will foot on one of the portions of the site. We can conclude that at this portion of the site safeguard excavations will be required and after the evaluation of the archaeological situation it will be possible to decide where to erect the pillar of the bridge.

**63. “Sagu ghala” fortress, pk 26.9+20 ([Maps 22 and 22a](#); [Table 1](#); [Images 90-91](#))** – In the state list of monuments of the Syunik Province of the RA this archaeological unit is presented as a Medieval fortress located 1 km South from the village (code 8.71.1.). As a result of detailed study of the fortress area by the members of the survey team, it came clear that nowadays the fortress is standing at the Southern suburbs of the village, as well as part of the hill of the site was destroyed because of recent construction activities and building of bypass roads. Anyway, some portions of the stratification walls of the fortress are well preserved and clearly ([Images 90-91](#)). All the attempts for collecting some surface archaeological finds in order to clarify the chronology



of the site were not positive. Based on the comparison with the road construction design, it is clear that the site will be directly affected because of the bridge, that is planned to be built between pk 26.3+81.66 and pk 26.5+21.16, and the last pillar of the bridge spring will be erected on the hill o the fortress. We can conclude that at this portion of the site safeguard excavations will be required and only after the evaluation of the archaeological situation it will be possible to decide where to erect the pillar of the bridge.

**64. Natural monument complex 1, pk 26.9+20 (Maps 22 and 22a; Table 1; Image 96)**

– Are formations appeared as a result of an abrasion and weathering of a natural rock. They remind erected stellae (Image 96). After comparison with the road construction design, it is becoming clear that this unit will be directly affected, and will stay under RoW before the start of the entrance of the tunnel at pk 27.1+00. According to our opinion there is now way to allocate or preserve the site.

**65. Natural monument complex 2, pk 26.9+90 (Maps 22 and 22a; Table 1; Image 97)**

– Are formations appeared as a result of an abrasion and weathering of a natural rock. They remind erected stellae (Image 97). After comparison with the road construction design, it is becoming clear that this unit will be directly affected, and will stay under RoW before the start of the entrance of the tunnel at pk 27.1+00. According to our opinion there is now way to allocate or preserve the site.

According to the design at pk 27.1+00 a tunnel with approximately 8.6 km in length is starting, ending at pk 35.7+40, which is already the area of the Geghi community. For that reason this part of the road construction project we named conventionally Geghi-Kajaran section (pk 31.8+00 – pk 65.2+75, Maps 23-23a to 49-49a).

**Geghi community: pk 31.8+00 – pk 42.1+00, and pk 44.2+70 – pk 52.1+00, 7 units (Maps 23-23a to 27-27a, and 29-29a to 37-37a).**

**66. Medieval village remains 1 at Kitsk (Kirs) area, pk 36.1+40 (Maps 23 and 23a, Table 1; Images 98-100)** – The area of this newly discovered site is presented by a flat slope where traces of walls are visible, located at the Northern side of the former Kitsk (Kirs) village, which is abandoned nowadays. These are Medieval village remains (Images 98-99), which were partly destroyed while building the modern houses of the village. High Medieval Period - 13th-15th centuries pottery fragments were collected at the place (Image 100 – 7). After comparison with the road construction design, it is becoming clear that this archaeological unit, which is not present in the state list of monuments of the Syunik Province, will be directly affected and from the perspective of saving its historical-cultural value requires safeguard excavations for some portion of the site. Only after nailing the points of the destruction zone in the field conditions it will be possible to decide the real surface and volume of the safeguard excavations.

**67. Church (18th century) at Kitsk (Kirs) area, pk 36.3+00 (Maps 23 and 23a, Table 1; Images 101-102)** – Standing at the Northern side of the village, which was inhabited until the start of the Artsakh war, this church which was built in 18th century, is a single-neff hall, which is badly preserved. There are some fragmented gravestones existing in the vicinity (Images 101-102). It is recorded in the state list of the monuments of the Syunik Province 8.112.1.2. code. After comparison with the road construction design, it is becoming clear that the church will be directly affected, because it is directly attached to the alignment outline from the right side at pk 36.3+00, staying under the fill. For saving the historical-cultural value of the monument it will be required to change the configuration of the fill, and, if not, there will be a need to excavate and to remove the whole site which is not the best solution. We have to take also into consideration, that there is a possibility that there will be discovered a graveyard or a cemetery occupying the church, because we have already mentioned about existence of some gravestones at the place (Image 101).

**68. Medieval village remains 2 at Kitsk (Kirs) area, pk 36.6+50 (Maps 23 and 23a, Table 1; Image 103)** – According to the state list of the monuments of the Syunik Province at the South-Eastern side of the village which was populated until the Artsakh war, Medieval village remains (15th-17th centuries) exist (code 8.112.1.1.), and traces of which are still visible in the shape of house foundations (Image 101). The monument was heavily suffered because local Azeri Turk inhabitants used the area of the site as their cemetery. Based on the comparison with the road construction design it will not be directly affected during the project implementation, but the left outline of the alignment at pk 36.6+50 will pass very close to the site, and for that reason will require applying special protection measures during the construction process.

**69. Medieval and modern cemetery at Kitsk (Kirs) area, pk 36.7+20 (Maps 23 and 23a, Table 1; Images 104-105)** – The cemetery is located South from the village. According to the state list of the monuments of the Syunik Province (code 8.112.1.1.1.) it is synchronous to the 15th-17th centuries Medieval village remains. The monument was heavily suffered because local Azeri Turk inhabitants used the area of the site as their cemetery (Image 105), Based on the comparison with the road construction design and the site it will not be directly affected during the project implementation, but the left outline of the alignment at pk 36.7+20 will pass very close to the site, and for that reason will require applying special protection measures during the construction process.

**70. Siliceous limestone raw-material source 1 for making stone tools at Karot (Kyurut) area, West from pk 42.3+00 (Map 27 and 27a, Table 1; Image 106)** – Was recorded West from pk 42.3+00, at the right bank of Geghi - the tributary of the Voghji River (Image 106). The source has high quality and is good for knapping. Implements made from such raw material are known from Vayots Dzor Paleolithic sites. Based on the comparison with the road construction

design and this geological unit, it will not be directly affected, and for that reason will require applying special protection measures during the construction process.

The state list of the monuments of Syunik Province of the RA provides with numerous sites in the vicinity of the former Karut or Kyurut village, which can be related to the road construction project and among of which are: 19th century church standing at the Northern outskirts of the village (code 8.112.4.), II-I Millennium BC Santchagharim or Sanjaravaz fortress with tomb field located at the Northern side of the village (codes 8.122.1 and 8.122.1.2.), and Medieval village with a cemetery adjacent to them (codes 8.122.1.1 and 8.122.1.1.1.), as well as another Medieval (17th -19 th centuries) village remains some 500 m North (code 8.122.2.). Unfortunately during the survey it was not possible to find those units, because of time limitation.

**73. Siliceous limestone raw-material source 2 for making stone tools at Geghi area, pk 47.0+00 (Maps 32 and 32a, Table 1; Image 107)** – Was recorded at pk 47.0+00, at the left bank of Geghi - the tributary of the Voghji River, close to the Eastern ending of the Geghi community (Image 107). The source has high quality and is good for knapping. Implements made from similar raw material are known from the Upper Paleolithic Aghitu-3 cave. Based on the comparison with the road construction design and this geological unit, it will not be directly affected, but the right outline of the alignment at pk 47.0+00 will pass very close to it, and for that reason will require applying special protection measures during the construction process.

**74. Structure remains (Medieval village remains) at Verin Geghavank (Baharlu) area, pk 48.6+00 (Maps 34 and 34a, Table 1; Image 108)** – The area of this newly recorded unit is presented by a slope in the gorge of the Geghi River overlooking North, where wall structure remnants are visible. They look like traces of dwellings and other structures functioning here in the past, so probably are traces of Medieval village remains (Image 108). Absence of surface archaeological finds is not allowing to date more precisely the site, which is absent in the state list of monuments of the Syunik Province. Judging from the comparison with the road construction design it is possible that the Northern ending of the site can be directly affected, as of it is located very close to the right side of the alignment at 48.6+00. We think that special protection measures will be required during the construction activities, while after nailing the points of the destruction zone in the field conditions in order to study the level of impact on the site there will appear a necessity to do here some safeguard excavations.

**Nor Astghaberd community: pk 42.1+00 – pk 44.2+70, 2 units (Maps 27-27a to 29-29a).**

**71. Natural monument 1, pk 42.5+10 (Maps 28 and 28a; Table 1; Image 109)** – Is a formation appeared as a result of an abrasion and weathering of a natural rock. Reminds an erected guarding tower (Image 109). After comparison with the road construction design, it is

becoming clear that, this unit will not be directly affected, but is located very close to the right outline of the alignment at pk 42.5+10. According to our opinion for saving the monument special mitigation measures can be required helping to preserve the structure and to use it as an aesthetic-decorative monument for the highways' surrounding landscape.

**72. Natural monument 2, pk 42.5+80 (Maps 28 and 28a; Table 1; Image 110)** – Is located close to the previous one and is a formation appeared as a result of an abrasion and weathering of a natural rock. Reminds a mask of a soldier in helmet (Image 110). After comparison with the road construction design, it is becoming clear that this unit will be directly affected, and will stay under RoW at pk 42.5+80. According to our opinion there is now way to allocate or preserve the site.

**Lernadzor community: pk 52.1+00 – pk 62.7+50, 6 units (Maps 38-38a to 47-47a).**

**75. Cave-complex Lernadzor-1 at Kavchut area, pk 53.1+80 (Maps 38 and 38a; Table 1; Images 111-114)** – This newly discovered archaeological unit is located at pk 53.1+80, at the Western suburbs of the village of Kavchut. It is a cave-complex with multiple niches originated in the colluvial sediment formations as a result of mechanical weathering (Image 111). It is dry and light inside. The wall structure in front of the central niche of the cave (Image 112) and traces of artificial modifications (carvings) of the inner walls (Images 113-114), show that the complex was heavily used by people. Absence of surface archaeological finds is making difficult to decide the timing of exploitation of the cave-complex. The reason of this absence are the intensive weathering of the walls of the structure, as well as long- term cattle keeping activity inside, which burry the cultural remains under a thick sediment accumulation. However, this newly recorded unit which is absent in the state list of monuments of the Syunik Province, while being compared with the road construction design, obviously will be directly affected staying completely under RoW. The only way to save the historical-cultural value of the complex is to implement total excavations of the monument, as of there is no chance to allocate the design or to remove the site.

**76. Tomb field at Kavchut area, pk 53.3+00 (Maps 39 and 39a; Table 1; Images 115-116)** – This newly discovered archaeological unit is located at pk 53.3+00, at the Western suburbs of the village of Kavchut. During the study of the area it was possible to record structures which have cromlechs consisting of large stone blocks (Images 115-116) and, most probably, are Bronze-Iron Age tombs (surface archaeological finds are missing). After comparison with the road construction design, it is becoming clear that this archaeological unit, which is not present in the state list of monuments of the Syunik Province, will be not directly affected, but the fact, that it is located close to the left outline of the alignment at pk 53.3+00, is pushing to require special protection measures during the construction activities.

**77. Chalcolithic settlement, pk 60.2+70 (Maps 44 and 44a; Table 1; Image 117)** – This newly discovered archaeological unit was recorded approximately 500 m North-East from the village of Lernadzor, directly on the right side of the road leading to the Geghi community at pk 60.2+70 of the new highway alignment. Traces of rounded structures, wall outlines are visible at the site (Image 117), the Northern ending of which was damaged during the road construction activities. The chaff-tempered pottery fragments collected at the place are mentioning the Late Chalcolithic age of the site (first half of the IV Millennium BC). After comparison with the road construction design, it is becoming clear that this archaeological unit, which is not present in the state list of monuments of the Syunik Province, will be partly affected, as of its Northern ending will stay under RoW. Before the start of the construction activities there will be a need to implement safeguard excavations. Only after nailing the points of the destruction zone in the field conditions it will be possible to decide the real surface and volume of the safeguard excavations.

**78. Archaeological complex – Upper Paleolithic open-air site, Chalcolithic settlement and Early Medieval tomb field, pk 60.9+00 (Maps 45 and 45a; Table 1; Images 100, 118-120)** – This newly discovered archaeological unit is located East from pk 60.9+00, at the North-Eastern suburbs of the village of Lernadzor, not far from the point of confluence of the Voghji and Pukhrut Rivers. The area occupied by the site heavily suffered as a result of a building and high voltage line pillar erected at the place. The stratigraphy of the site can be observed in the section of the road passing below, where palesol layer (Image 118), traces of Chalcolithic Period structures and pits (Images 118-119), as well as slab and soil construction grave chambers (Images 119-120) are clearly visible. Oblique, double platform flint cores discovered from the section of palesol are very characteristic to the Upper Paleolithic Period sites of the region (Image 100 – 1-3) and are aimed for production of bladelets. Such are known from the Upper Paleolithic layers of the Aghitu-3 cave, the inhabitants of which had obvious connections with the population of the neighboring Iranian Plateau. The record of such a site is proving again the cultural connection between those two areas around 27-23 000 years BP, which has a great scientific significance. From the regional perspective with not less scientific importance is the record and study of new Eneolithic or Chalcolithic sites of Armenia and especially the Syunik Province, as of they were totally unknown and are very badly studied. It seems that in case of the Chalcolithic stratum of the Lernadzor complex we have Late Chalcolithic settlement functioning during the chronological frames of the first half of the IV Millennium BC, proved by the obsidian blade and chaff-tempered pottery fragments collected from the section, which are very characteristic to this period (Image 100 – 4-6). It is very valuable also the existence of the graveyard or the tomb field, where the burials, more probably, belong to Early Medieval Period, to a phase, which needs a detailed study in whole Armenia and in Syunik as well. However, after comparison with the road construction design, it is becoming clear that this archaeological unit, which is not present in the state list of monuments of the Syunik Province, will not be directly affected, as of it is located East

from pk 60.9+00, at a distance of approximately 150-200 m left from the outline. Considering the importance of the site, special protection measures during the construction activities will be required, because of a necessity for building bypass roads, soil borrowing and damping or the removal high voltage line pillar can be possible.

**79. Kolagegh Medieval village remains and S. Gevorg church, pk 61.1+00 (Maps 45 and 45a; Table 1; Image 121)** – This archaeological unit (Medieval village remains and church, probably also a cemetery), is occupying a large area as well and is not directly related to the road construction project. It is located 200 m East from the pk 61.1+00, some 120 m South from the previous site, at the Eastern outskirts of Lernadzor, not far from the point of confluence of the Voghji and Pukhrut Rivers. It is given in the state list of the monuments of the Syunik province under 8.38.6. (Kolagegh Medieval village remains) and 8.38.6.1. (S. Gevorg church, 12th century, Image 121) codes. It is very possible, that there is a cemetery spread around the church. For the same reason, as in the case of the previous site, special protection measures during the construction activities will be required

**80. Paleontological site, km 61.1+00 (Maps 45 and 45a; Table 1; Images 122-123)** – this newly discovered paleontological site was recorded North from the church, in the section, opened during the construction of a road, where different origin sediments are visible (Image 122). In the alluvial origin sediments of the section fossilized remains of anatomical parts of mammals, i.e. teeth, pipe bones are visible (Image 123). We can propose that this geological layer has the same age as the Upper Paleolithic open-air site mentioned above – it belongs to the Upper Pleistocene. Study of this site is very important for the reconstruction of the Paleogeographic environment and climate reconstruction of the Voghji River valley. For the same reason, as in the case of the previous sites, special protection measures during the construction activities will be required.

**Kajaran community: pk 62.7+50 – pk 65.2+75, 1 unit (Maps 47-47a to 48-48a).**

**81. Late Medieval cemetery, pk 64.0+00 (Maps 48 and 48a; Table 1; Image 124)** – This last archaeological unit along the road construction project is located at pk 64.0+00, in the Voghji River valley, near the Kajaran bridge, on the slope and gorge of the Southern ending of the bridge. It is not present in the state list of monuments of the Syunik Province, but exists in the state cadastral map of the city. During the field investigations it was not possible to implement detailed study of the area, as of it is divided by private gardens and surrounded by fences (Image 124). Also most of the gravestones were used by locals to build modern constructions and houses. After comparison of the road construction design with the area of the site location, it is clear that it will be directly affected staying under RoW of the highway at pk 64.0+00. We are suggesting undertaking additional study of the area after the process of land acquisition, and, if needed, to



implement test excavations at the site or organize archaeological control during the construction activities.

Summarizing the description of the sources, which have historical-cultural, archaeological, geological-paleontological and spiritual significance for the Sisian-Kajaran road project (**Table 1, Maps 001 and 001a**), we have to mention that this road with 65 km and 275 m length will pass through administrative area of **14 communities** (those are Sisian, Uyts, Aghitu, Noravan, Vaghatin, Vorotan, Darbas, Getatagh, Lor, Shenatagh, Geghi, Nor Astghaberd, Lernadzor, Kajaran). Along the whole alignment **81 units** were recorded and studied, which are distributed by communities in the following way: **Sisian-17 (1-17), Uyts-3 (18-20), Aghitu-12 (31-30, 37), Noravan-5 (32-36), Vaghatin-8 (38-45), Vorotan-4 (46-49), Darbas-5 (50-54), Getatagh-0, Lor-5 (55-59), Shenatagh-6 (60-65), Geghi-7 (66-70, 73-74), Nor Astghaberd-2 (71-72), Lernadzor-6 (75-80), Kajaran-1 (81), (Table 1)**. But this picture is relative, as of some sites are recorded by separate units, but in reality those must be considered as one complex. With such an approach there will be in total **62** monuments recorded along the alignment - **11 Natural monuments** (units 1, 21, 30, 32, 33, 35, 37, 64, 65, 71, 72); **9 Geological monuments** (units 16, 17, 38, 46, 50, 59, 70, 73, 80), including the paleontological localities (units 16, 17, 38, 46, 59) and raw-material source suitable for making stone tools (units 50, 70, 73, 80); **9 Historical-architectural and spiritual monuments** (units 2, 41, 52, 54, 55, 57, 60, 67, 79) – shrines, churches, spring-monuments, khachkars, stellae, bridges, part of which we have suggested to consider as interesting objects for the future tourism development, and finally - **33 Archaeological monuments** (units 3-15, 18-20, 21, 23, 24, 25, 26, 27-29, 31, 34, 36, 39, 40, 41, 42-45, 47-49, 51, 53, 56, 57, 58, 61, 62, 63, 66, 68, 69, 74, 75, 76, 77, 78, 81), including Paleolithic open-air sites 1 (unit 78), cave-dwellings 1 (unit 75) and artificially carved cave complexes 2 (units 56, 62), fortresses 1 (unit 63), settlements, medieval village remains, temporary shelters, uncertain structures and wall remnants, industrial-economic structures 21 (units 3-15, 21, 23, 24, 26, 27-29, 31, 34, 36, 40, 41, 42-45, 47, 57, 58, 66, 68, 74, 77, 78, 79), burial complexes – tomb fields, cemeteries, separate tombs 13 (units 3-15, 18-20, 25, 27-29, 31, 47-49, 51, 53, 57, 69, 76, 78, 81), points or places of surface finds, which have definite archaeological contexts 2 (units 39, 61) and are showing the existence of former sites in the vicinity and now destroyed or denudated. Indeed, such division or classification of the units is also very relative, as of in the case of the archaeological monuments, as a rule and as it seen from the report, we are mostly facing with their combinations or with so-called archaeological complexes, like settlement or medieval village remains and tomb field or cemetery, fortress-settlement and tomb field, medieval village remains-church and cemetery etc. Often the sites forming such a complex are being discussed separately, because of the areas in-between are always meliorated or destructed. In many cases the grass cover, absence of surface archaeological materials making very difficult to understand and to evaluate the function and the chronological frame of the site. To some degree it is always relative



to divide or to classify the sites into natural, geological, archaeological, historical and spiritual significance. As are reflected in the current report, for example, near most of the natural monuments traces of artificial wall structures have been recorded, the churches, as a rule are built in the limits of the medieval village remains and/or their areas are often occupied with cemeteries. For the geological monuments, in the vicinity of raw material sources used for preparation of stone implements, it is easy to record the traces of activity of people or groups visiting the area, as well as in case of the paleontological or archaeozoological sites, the last are helping to reconstruct the environment which supported the human life and the old climate, etc.

However, as it was mentioned above, for the Sisian-Kajaran road project, that from the point of view of the assessment of the impact of the future construction activities on the resources of historical-cultural, archaeological geological-paleontological and spiritual significance, as well as for saving the historical-cultural and scientific value of those resources and, finally, for realization of the management of the tasks raised during the construction process, the recorded monuments were divided into two categories or groups. Those are sites with direct impact and sites with indirect impact. From that perspective the most important are the sites with direct impact or the units which will stay under Right of Way (RoW), as of those, which will not be directly affected, but can be under the danger of destruction or carry partial damage during the construction activities, are not requiring long-term safeguard-protection procedures. For those only specific protection measures are needed. And for the sites staying under RoW comprehensive and sometimes very complex and long-term protection measures are required, such as excavations, removal, changes in the alignment design or the construction concept, which leaves its own impact on the project implementation. In Table 1 units which can have indirect impact or are located in close vicinity of the future road outline are provided with black color, units with direct impact are provided in red, moreover, the units which are serious barriers are in bold, and finally, blue color is used for distribution of the sites which are recommended to use under the future tourism development of the area. Thus, based on the data provided in Table 1, **41 monuments** will carry direct impact during the project implementation, including **7 Natural monuments** (units 1, 30, 33, 37, 64, 65, 72); **3 Geological monuments** (units 16, 46, 50); **4 Historical-architectural and spiritual significance monuments** (units 41, 52, 57, 67) and **27 Archaeological monuments** (units 3-15, 18-20, 21, 23, 24, 25, 26, 27-29, 34, 36, 39, 40, 41, 42-45, 47-49, 51, 53, 56, 57, 61, 62, 63, 66, 74, 75, 77, 81). The given data shows, that 66% of the whole recorded units will be directly affected, from which, correspondingly - 64% of the natural monuments, 33% of the geological monuments, 44% of the historical-architectural and spiritual significance monuments, and 82% of the archaeological monuments. Meanwhile, the largest portion goes to the archaeological sites, which in comparison to the total amount of the recorded sites make up 44%, and to the amount of the sites with direct impact - 61%.

Lets now discuss the question regarding to what extent may be affected the resources which will stay under RoW as a result of the road construction project implementation, and which are the largest barriers, which can arise during the construction activities, as well as which are the most optimal measures for saving the cultural-historical and scientific value of those resources, starting from the archaeological sites:

1. As a rule, during the road construction projects archaeological sites are becoming serious barriers, because the only way to save their historical-cultural and scientific value are the implementation of archaeological excavation works. The most time consuming are archaeological complexes occupying wide areas, which, as it was mentioned above, contain different types of sites from different time periods or are multilayered. Such kind of units along the Sisian-Kajaran road project alignment are 2 - the settlement and tomb field near the Karaberd fortress between pk 2.5+50 – pk 3.7+50 (Sisian community, unit 3-15) and Vorotan (Vorohtn) Medieval village remains and cemetery and Bronze-Iron Age tomb field between pk 13.2+40 – pk 13.5+50 (Vorotan community, unit 47-49), (Table 1). In the case of the first site large volume and long term excavation works will be required along the whole square of the alignment, even maybe more, because of the Contractor will need to built bypass roads, to make soil removals, fills, communication structure installations and other operations, which can cause a need of additional safeguard excavations. And in the case of the second side there will also raise tasks for numbering and removal of the gravestones, khachkars and stellae. Not less volume of safeguard excavations will be required for the “Sagu ghala” fortress (Shenatagh community, unit 63) located at pk 26.9+20, Medieval village remains 1 (Geghi community Kitsk (Kirs) area, unit 66) located at pk 36.1+40, as well as the newly recorded Chalcolithic settlement (Lernadzor community, unit 77) located at pk 60.2+70. We can also add to this list the Lernadzor-1 cave complex (Lernadzor community, Kavchut area) located at pk 53.1+80 (unit 75), which will stay completely under RoW and for that reason will be excavated in full volume. The volume of excavations here is difficult to estimate, because based on the external analyses it is not possible to decide the stratigraphic content of the cave. Thus, from 27 archaeological sites which will be directly affected 6 are serious barriers for the implementation of the project. For the rest 21 archaeological units relatively small volume of safeguard and test excavations will be required, as a result of which their scientific potential will be clarified, which can bring to a need of additional excavations. However, organization of excavation works at 27 sites is not an easy task and will require long duration and big financial and human resources. If we will take into consideration the fact, that in many sections of the alignment the full absence of the sites can be explained by very active slope processes at the area (for example in Darbas-Senatagh section) and in this case the archaeological units shall be buried under a thick cover of sediments, the excavation and soil removal works during the construction activities can open new sites requiring additional excavations. We can conclude that

in many sections of the alignment the construction works have to be implemented under the control of archaeologist.

2. The sites with historical-cultural and spiritual significance while carrying a direct impact also can be a serious barrier for the road construction projects. They require special attitude, as of they have important meaning for the local inhabitants. 3 of the 4 such units presented in our report will be directly affected during the project implementation. Those are the following units: spring monument (Vaghatin community, unit 41) recorded at pk 11.9+00, shrine (church) ruins with adjacent cemetery and khachkars (Darbas community, units 52-53) existing at pk 17.6+90, and church (Geghi community, Kitsk (Kirs area), unit 67) standing at pk 36.3+00 (Table 1). All three mentioned units, judging from the comparison with the design, will stay under the fill of the road, which means that after excavation works they have to be removed and reinstalled. Removal and reinstallation of such structures is very expensive and long lasting procedure, if we will take also into consideration, that as a rule, churches and shrines have adjacent cemeteries. In this case the process is becoming more complicated. We think that it will be better to excavate only the portions of those sites which are directly related to the RoW, and if possible, to change the configurations of the fills, and then after separate the sites from the road through building of a protection walls, which can be the best solution.

3. In case of the geological-paleontological sites, considering the amount of the recorded units and sections and their distribution along the alignment as a base for measuring the level of impact is meaningless, because this is relative too. As a result of the field investigation works only the open or visible sections were recorded, where the available parts are not reflecting the real scale of those formations. While the maps are showing that they spread on dozens of kilometers. From what is said it is impossible to conclude that all the parts of those deposits contain paleontological localities and all of them have scientific value. These units can not be a barrier for the road construction project. However, the implementation of the construction activities, as it is will support their study, bringing an opportunity to study the newly opened and cleaned sections. We can conclude that in parallel with construction activities and excavations a team consisting of corresponding specialists has to work in the field, which will check the sections and only with a fact of discovery of a paleontological locality and will start the study and after will suggest the future mitigation measures for each unit.

4. As it was mentioned before, regarding the natural monuments, such 11 units were recorded along the alignment, 7 of which will be directly affected (Table 1). Richness of such structures in the area of Syunik can be explained by complex and unique geological formation of the area, especially the existence of Quaternary volcanism (for comparison lets assume, that along Ashtarak-Gyumri road alignment only one natural monument exists). Syunik has the best examples of the natural monuments in Armenia, where the creative hand of the nature worked

Millennia and it is impossible just to bypass them without a stop. Unfortunately most of them are not included in the state lists, having geological, aesthetic as well as cultural values, and some are objects of ancient cult or are used by people starting from at least the Chalcolithic period. For such kind of monuments experience of implementation of protection measures during construction projects do not exist. Due to our opinion, some of those units will be possible to remove and reinstall near the alignment as decorative-aesthetic units or elements of the highways landscape. Such solution can be suggested for the following recorded units. pk 1.4+50 (Sisian community, unit 1), pk 9.0+30 (Aghitu community, unit 30), pk 9.0+30 (Aghitu community, unit 33), pk 9.7+00 (Aghitu community, unit 37). Talking about the units recorded at pk 26.9+20 (Shenatagh community, unit 64), pk 26.9+90 (Shenatagh community, unit 65) and pk 42.5+80 (Nor Astghaberd community, unit 72), their preservation and reinstallation is not possible (Table 1).

Summarizing the results of study of the resources with historical-architectural, spiritual, archaeological, geological-paleontological significance located along the Sisian-Kajaran road project, we can come to the following conclusions. If we exclude any possible realignment, as a measure for saving the historical-cultural, scientific and ecological value of the recorded units, long term activities for their excavations, study, removal and reinstallation will be required. It means that the implementation of the project will need extensive environmental event component, including archaeology and corresponding financial and human resources. For the historical-architectural and spiritual sites (shrines, chapels, churches, spring-monuments, cemeteries) only the excavation works are not enough as a mitigation measure. There will be a need to carry out additional protection measures, such as removal and reinstallation, building of protection walls, vibration limitation during the construction activities, etc. Another kind of tasks are the paleontological sites, which are widely spread in Vorotan River valley in a shape of diatomite origin lacustrine sediments. Those localities can not delay the timetable of the road construction activities, but they need to be studied and recorded by corresponding specialists in parallel with the construction works. Natural monuments are the most problematic task for the Sisian-Kajaran road construction project. The units which will be under the direct impact, have to be removed or allocated and reinstalled, but in Armenia an experience of implementation of such procedures doesn't exist and each unit requires separate and unique solutions, as well as part of them will not be possible to save. As a whole, we can separate two categories of barriers for this road construction project: 1) Time consuming, which are historical-cultural, spiritual or ritual and archaeological sites (long term excavation activities and removal procedures of the units), 2) Activities requiring complicated or hard solutions, which are mainly related to fortresses, cave dwellings and natural monuments (suggestion of specific mitigation measures for saving their value).



In general, final mitigation measures for each directly affected unit or site will be suggested during the next stage based on the study of the level of impact according included in the Physical and Cultural Resources (PCR) Preservation Plan that should be prepared by the Contractor prior to the construction works.

It's only left to add, that the most noticeable concentration of the above mentioned barriers are present in the administrative areas of the Sisian-Uyts-Aghitu communities (pk 1.4+50 - pk 9.7+00) for the Sisian-Shenatagh section, and for the Geghi-Kajaran section in the area of the Geghi community (pk 36.1+40 - pk 48.6+00), (Maps 001-001a).

**Boris Gasparyan**

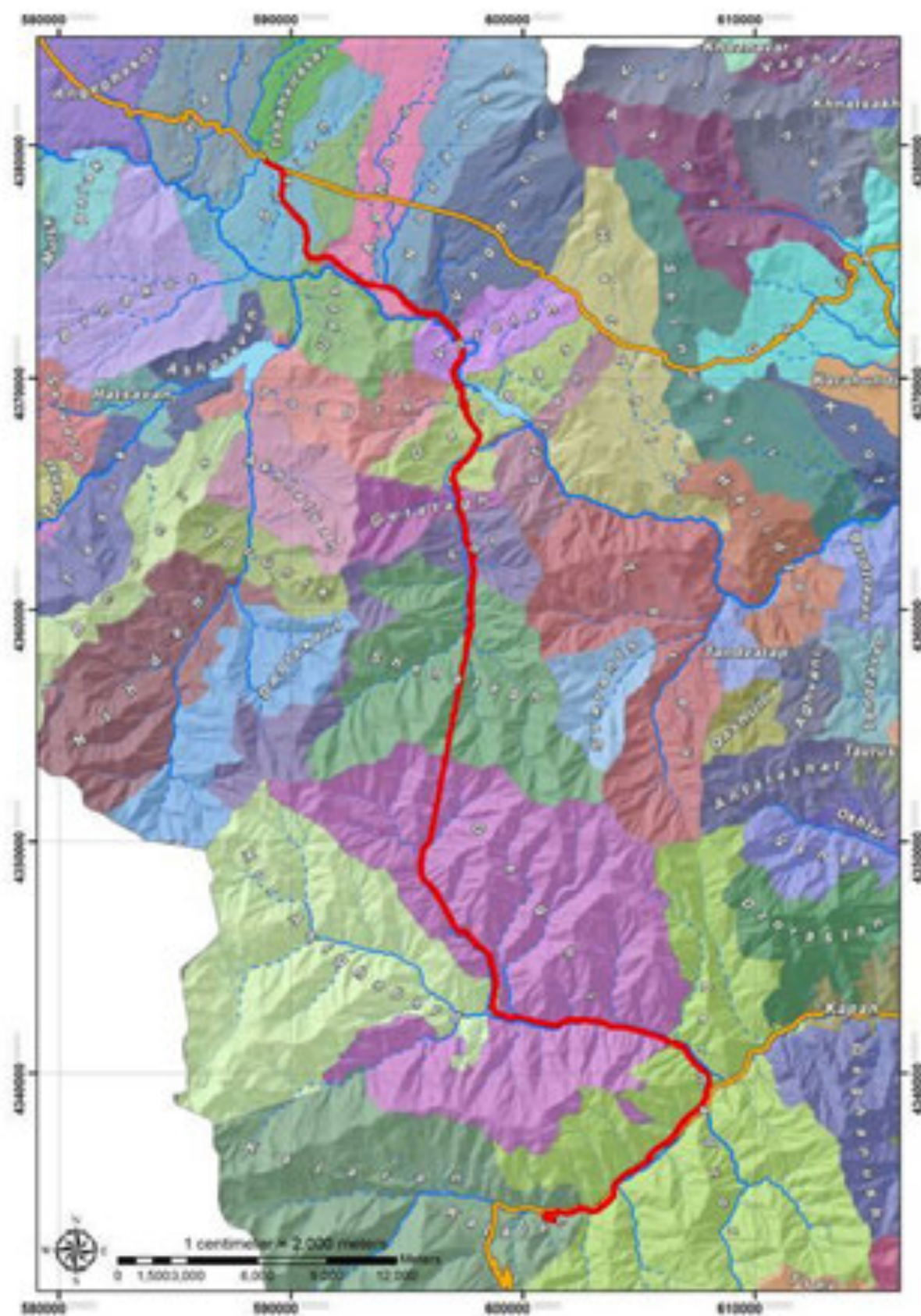
**National Archaeological Expert**

**13.02.2017**





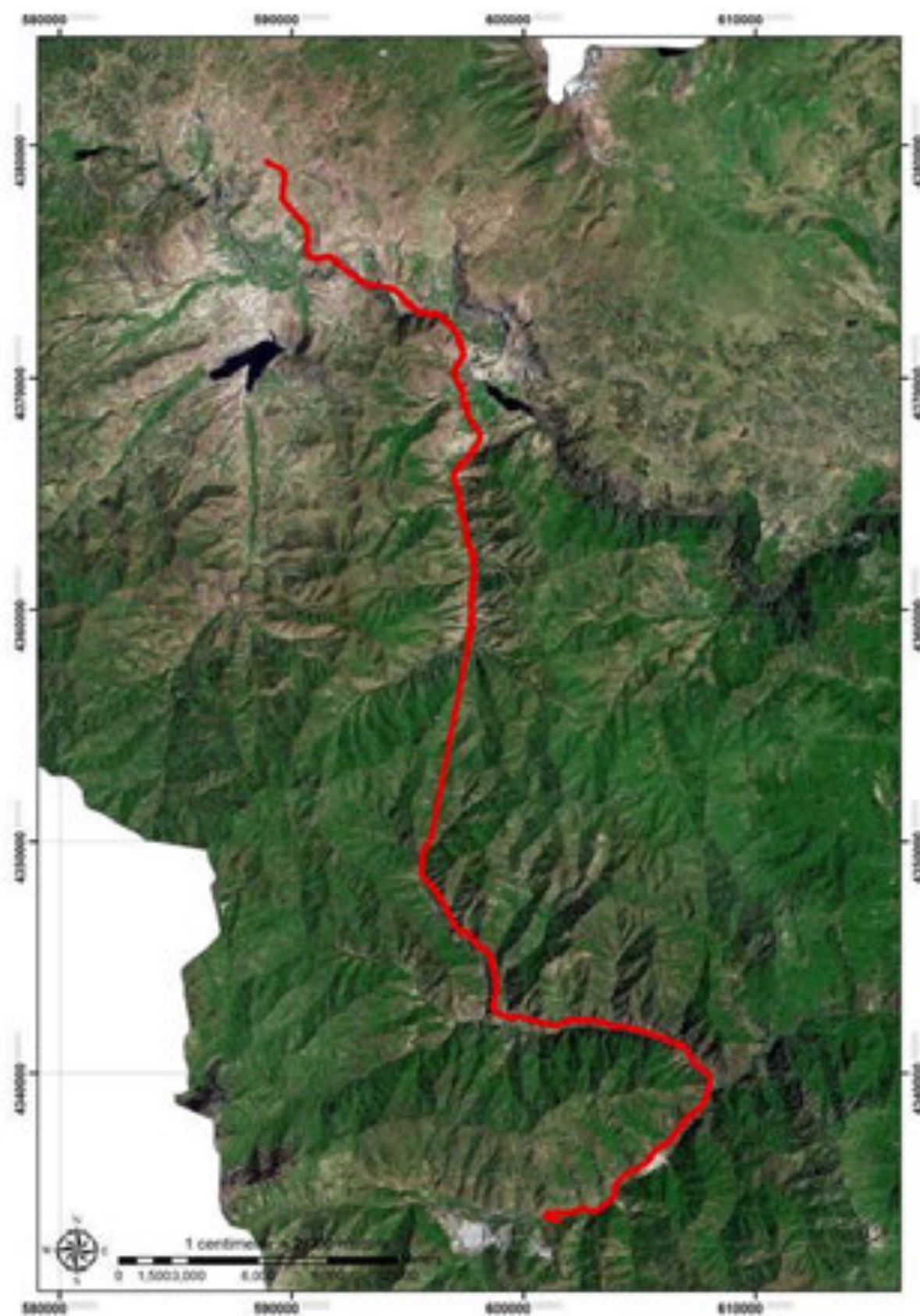
Map 00





Alignment of Sisian-Kajaran future highway according to the suggested design

Map 00a

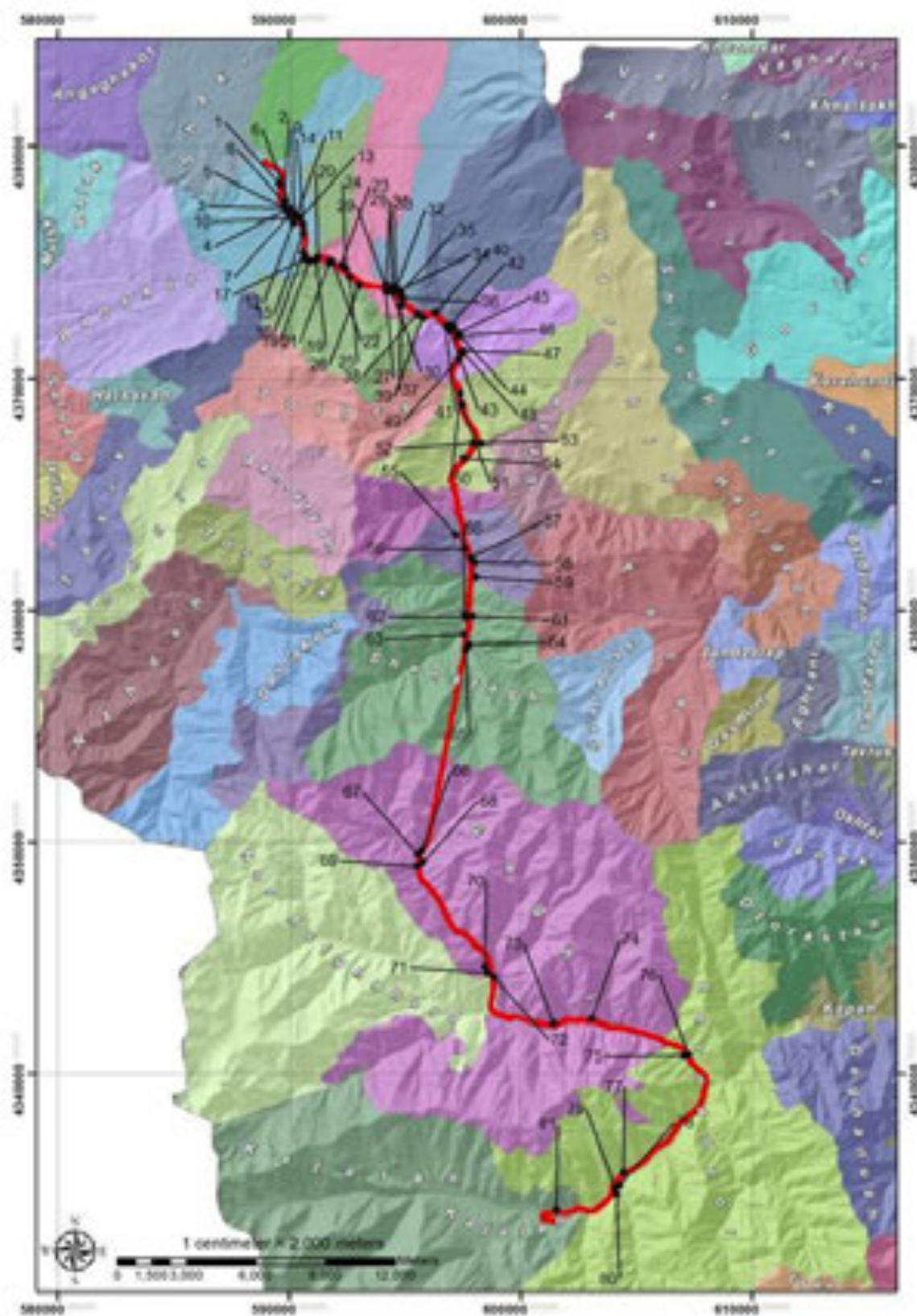






Alignment of Sisian-Kajaran future highway according to the suggested design

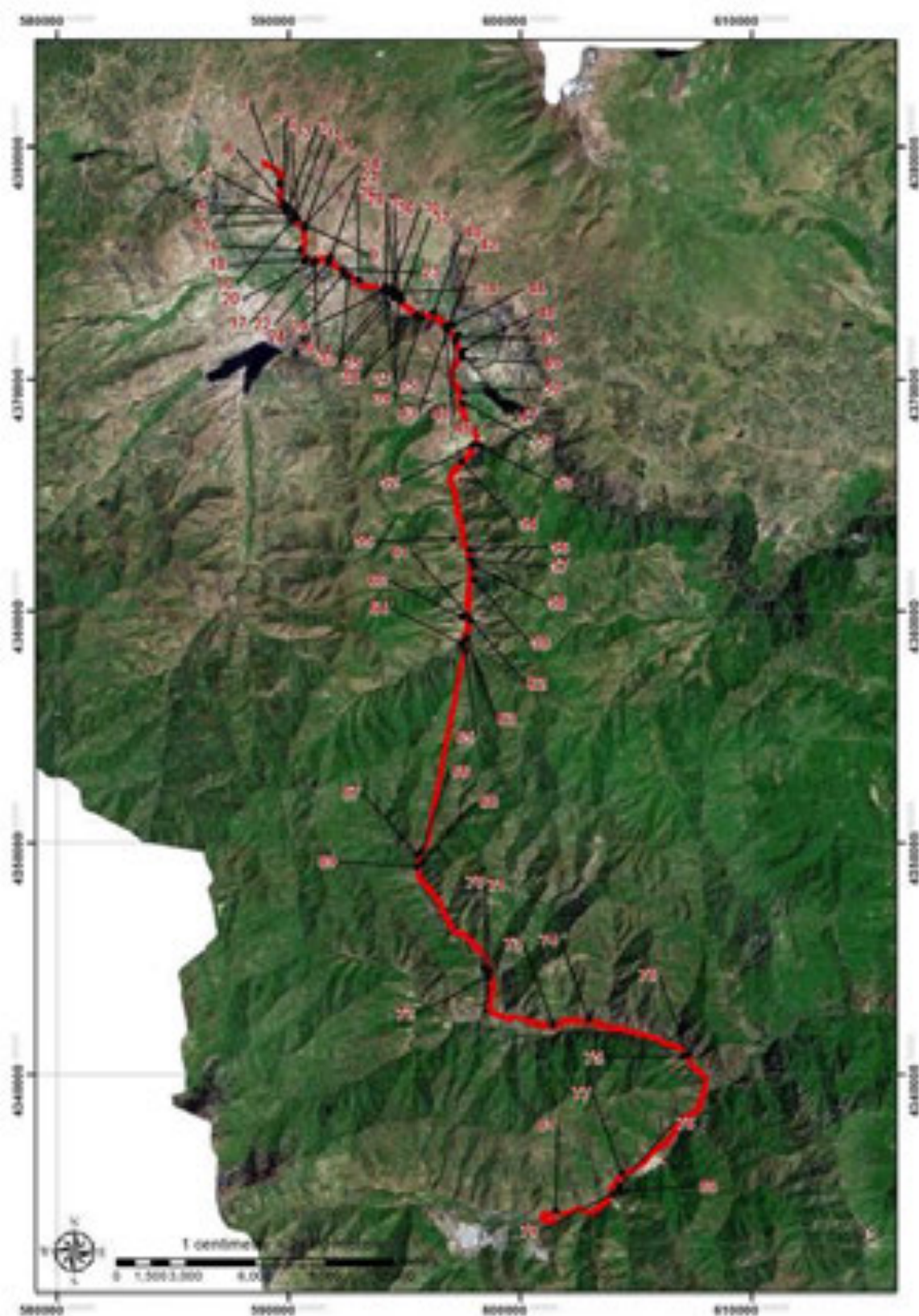
Map 001





81 units of cultural-historical, archaeological, paleontological and spiritual significance recorded along the suggested design of the Sisian-Kajaran Highway project

Map 001a





81 units of cultural-historical, archaeological, paleontological and spiritual significance recorded along the suggested design of the Sisian-Kajaran Highway project

## Legend

|                                                                                       |                  |                                                                                       |                 |                                                                                     |                     |
|---------------------------------------------------------------------------------------|------------------|---------------------------------------------------------------------------------------|-----------------|-------------------------------------------------------------------------------------|---------------------|
|    | Cave complex     |    | Fortress        |    | Natural monument    |
|    | Cemetery         |    | Settlement      |    | Fossil              |
|    | Chapel           |    | Tomb field      |    | Diatomites          |
|    | Church           |    | Structures      |    | Raw material source |
|  | Khachkar         |  | Surface finds   |  | Tunnel              |
|  | Monastic complex |  | Spring monument |  | Bridge              |



Table 1

(units with direct impact are given in red, units which can have indirect impact or are located in close vicinity of the future road outline are given with black, blue color is used for distribution of the sites which are recommended to use under the future tourism development of the area)

| Number | Type of the site                                         | Community | Time Period or Age                           | Coordinates   |                |         | Code from the State list of the monuments of Syunik Province | Location compared to the design | Corresponding map |
|--------|----------------------------------------------------------|-----------|----------------------------------------------|---------------|----------------|---------|--------------------------------------------------------------|---------------------------------|-------------------|
|        |                                                          |           |                                              | X             | Y              | ASL (m) |                                                              |                                 |                   |
| 1      | 2                                                        | 3         | 4                                            | 5             |                |         | 6                                                            | 7                               | 8                 |
| 1      | Natural monument                                         | Sisian    | -                                            | 589637.1<br>1 | 4378309.1<br>5 | 1784    | newly discovered                                             | pk<br>1.4+50                    | 1 - 1a            |
| 2      | Shrine-sanctuary<br>"Stepan ukht"                        | Sisian    | Medieval-Modern<br>Period                    | 589742.8<br>5 | 4377476.5<br>5 | 1757    | newly discovered                                             | pk<br>2.3+20                    | 2 - 2a            |
| 3 - 15 | Settlement and tomb<br>field                             | Sisian    | Bronze-Iron<br>Ages, High<br>Medieval Period | 589941.3<br>7 | 4377328.3<br>4 | 1745    | 8.6.4.1.                                                     | pk<br>2.5+50 –<br>pk<br>3.7+50  | 2 - 2a,<br>3 - 3a |
| 16     | Section of diatomite<br>origin lacustrine<br>sediments 1 | Sisian    | Pleistocene                                  | 590622.3<br>6 | 4375555.1<br>8 | 1699    | newly discovered                                             | pk<br>4.6+00                    | 4 - 4a            |



|         |                                                    |        |                                              |               |                |      |                  |                                |        |
|---------|----------------------------------------------------|--------|----------------------------------------------|---------------|----------------|------|------------------|--------------------------------|--------|
| 17      | Section of diatomite origin lacustrine sediments 2 | Sisian | Pleistocene                                  | 590755.4<br>8 | 4375228.5<br>2 | 1702 | newly discovered | pk<br>4.9+50                   | 4 - 4a |
| 18 - 20 | Tomb field                                         | Uyts   | Bronze Age                                   | 590882.8<br>4 | 4375188.7<br>2 | 1727 | newly discovered | pk<br>5.1+00 –<br>pk<br>5.5+50 | 4 - 4a |
| 21      | Unclassified structure remains 1                   | Aghitu | -                                            | 591739.5<br>3 | 4375149.8<br>8 | 1630 | newly discovered | pk<br>6.0+00                   | 5 - 5a |
| 22      | Natural monument 1                                 | Aghitu | -                                            | 591791.6<br>8 | 4375166.8<br>1 | 1636 | newly discovered | pk<br>6.0+40                   | 5 - 5a |
| 23      | Unclassified structure remains 2                   | Aghitu | -                                            | 592164.0<br>3 | 4374775.3      | 1630 | newly discovered | pk<br>6.5+50                   | 5 - 5a |
| 24      | Structure remnants or settlement 1                 | Aghitu | Classical Period-Medieval?                   | 592429.3<br>2 | 4374625.9<br>5 | 1607 | newly discovered | pk<br>6.8+50                   | 6 - 6a |
| 25      | Tomb field or cemetery                             | Aghitu | Early Medieval                               | 592573.2<br>3 | 4374540.6<br>4 | 1581 | newly discovered | pk 7.0+2<br>0                  | 6 - 6a |
| 26      | Structure remnants or settlement 2                 | Aghitu | Bronze-Iron Ages, Classical Period, Medieval | 593025.7<br>4 | 4374152.7<br>9 | 1567 | newly discovered | pk<br>7.6+30                   | 7 - 7a |
| 27 - 29 | Structure remnants in shape of walls and tombs 1   | Aghitu | -                                            | 594129.2<br>5 | 4373887.3      | 1593 | newly discovered | pk<br>8.7+90 –<br>pk<br>8.8+30 | 8 - 8a |



|    |                                                     |          |                  |               |                |      |                  |               |        |
|----|-----------------------------------------------------|----------|------------------|---------------|----------------|------|------------------|---------------|--------|
| 30 | Natural monument 2                                  | Aghitu   | Lower Quaternary | 594383.9<br>2 | 4373824.6<br>9 | 1579 | newly discovered | pk<br>9.0+30  | 8 - 8a |
| 31 | Structure remnants in shape of walls and tombs<br>2 | Aghitu   | -                | 594435.6<br>5 | 4373827.6<br>5 | 1564 | newly discovered | pk<br>9.0+90  | 8 - 8a |
| 32 | Natural monument 1                                  | Noravan  | Upper Quaternary | 594560.2<br>6 | 4373734.3<br>8 | 1559 | newly discovered | pk<br>9.2+20  | 8 - 8a |
| 33 | Natural monument 2                                  | Noravan  | Upper Quaternary | 594583.1<br>3 | 4373677.8<br>2 | 1560 | newly discovered | pk<br>9.2+50  | 8 - 8a |
| 34 | Wall structure remnants near Natural monument<br>2  | Noravan  | -                | 594582.8<br>8 | 4373719.8<br>9 | 1555 | newly discovered | pk<br>9.2+50  | 8 - 8a |
| 35 | Natural monument 3                                  | Noravan  | -                | 594722.1<br>4 | 4373624.4<br>7 | 1548 | newly discovered | pk<br>9.4+00  | 8 - 8a |
| 36 | Remnants of a truncated settlement                  | Noravan  | -                | 594711.8<br>2 | 4373483.4<br>8 | 1558 | newly discovered | pk<br>9.5+00  | 8 - 8a |
| 37 | Natural monument 3                                  | Aghitu   | Lower Quaternary | 594813.2<br>8 | 4373323.1      | 1581 | newly discovered | pk<br>9.7+00  | 9 - 9a |
| 38 | Section of diatomite origin lacustrine sediments    | Vaghatin | Pleistocene      | 595603.6<br>2 | 4372883.2<br>6 | 1532 | newly discovered | pk<br>10.6+00 | 9 - 9a |



|         |                                                                                           |          |                                                                            |                       |                        |             |                                |                                            |                     |
|---------|-------------------------------------------------------------------------------------------|----------|----------------------------------------------------------------------------|-----------------------|------------------------|-------------|--------------------------------|--------------------------------------------|---------------------|
| 39      | Surface finds around wall structure remnants                                              | Vaghatin | Late Chalcolithic (First half of the IV Millennium BC)                     | 595807.7<br>0         | 4372771.0<br>1         | 1516        | newly discovered               | pk<br>10.8+90                              | 10 -<br>10a         |
| 40      | Wall structure remnants                                                                   | Vaghatin | -                                                                          | 596196.0<br>0         | 4372761.7<br>3         | 1492        | newly discovered               | pk<br>11.2+30                              | 10 -<br>10a         |
| 41      | <b>Medieval village remains and Spring-monument</b>                                       | Vaghatin | <b>High or Late Medieval Period</b>                                        | <b>596715.6<br/>4</b> | <b>4372393.0<br/>1</b> | <b>1445</b> | <b>newly discovered</b>        | <b>pk<br/>11.9+00</b>                      | <b>11 -<br/>11a</b> |
| 42 - 45 | Wall structures preserved in the area of old gardens                                      | Vaghatin | High or Late Medieval Period                                               | 596856.0<br>3         | 4372211.1<br>7         | 1456        | newly discovered               | pk<br>12.1+00<br>– pk<br>12.5+90           | 11 -<br>11a         |
| 46      | Section of diatomite origin lacustrine sediments                                          | Vorotan  | Pleistocene                                                                | 597138.8<br>4         | 4371825.0<br>9         | 1422        | newly discovered               | pk<br>12.5+90                              | 11 -<br>11a         |
| 47 - 49 | <b>Vorotan (Voroṭn) Medieval village remains and cemetery, Bronze-Iron Age tomb field</b> | Vorotan  | <b>Bronze-Iron Ages, Classical Period, Early and Late Medieval Periods</b> | <b>597371.1<br/>2</b> | <b>4371210.7<br/>3</b> | <b>1421</b> | <b>8.78.2. Լ<br/>8.78.2.1.</b> | <b>pk<br/>13.2+40<br/>– km<br/>13.5+50</b> | <b>12 -<br/>12a</b> |
| 50      | Flint raw-material source for making stone tools                                          | Darbas   | -                                                                          | 597376.5<br>3         | 4369479.9<br>4         | 1385        | newly discovered               | pk<br>15.2+00                              | 13 -<br>13a         |





|         |                                                                              |        |                            |                       |                        |             |                      |                       |                          |
|---------|------------------------------------------------------------------------------|--------|----------------------------|-----------------------|------------------------|-------------|----------------------|-----------------------|--------------------------|
| 51      | Structure remnants in shape of tombs                                         | Darbas | Bronze-Iron Ages?          | 597366.6<br>0         | 4369017.0<br>5         | 1419        | newly discovered     | pk<br>15.6+60         | 13 -<br>13a              |
| 52 - 53 | <b>Shrine (church) ruins, cemetery and khachkas (Parvants)</b>               | Darbas | <b>13th-15th centuries</b> | <b>598052.1<br/>2</b> | <b>4367209.3<br/>7</b> | <b>1477</b> | <b>8.31.3.</b>       | <b>pk<br/>17.6+90</b> | <b>15 -<br/>15a</b>      |
| 54      | “Arzuman’s bridge” and Medieval road                                         | Darbas | 1675                       | 597362.2<br>4         | 4366594.7<br>2         | 1460        | 8.31.10.             | pk<br>18.6+00         | 15 -<br>15a, 16<br>- 16a |
| 55      | Enclosed khachkar or “Loriki khach (Lorik’s Cross)”                          | Lor    | 1271                       | 597025.9<br>4         | 4363619.9<br>1         | 1636        | 8.41.2.1.            | pk<br>22.2+00         | 18 -<br>18a              |
| 56      | Cave complex carved in a section of diatomite origin lacustrine sediments    | Lor    | 20th century               | 597679.7<br>8         | 4362642.3              | 1681        | newly discovered     | pk<br>22.7+50         | 19 -<br>19a              |
| 57      | Mardakayr Medieval village remains and Tsaru S. Hovhannes church, tomb field | Lor    | II-I Millennium BC, 1686   | 597692.6<br>6         | 4362200.2<br>4         | 1682        | 8.41.6. և<br>8.41.4. | pk<br>23.1+60         | 19 -<br>19a              |
| 58      | Medieval village remains                                                     | Lor    | High Medieval Period       | 597842.1<br>5         | 4362030.1<br>8         | 1748        | newly discovered     | pk<br>23.3+90         | 19 -<br>19a              |
| 59      | Section of diatomite origin lacustrine sediments                             | Lor    | Pleistocene                | 597902.6<br>1         | 4361461.7<br>3         | 1767        | newly discovered     | pk<br>23.9+50         | 20 -<br>20a              |



|    |                                                                           |                          |                             |               |                |      |                  |               |              |
|----|---------------------------------------------------------------------------|--------------------------|-----------------------------|---------------|----------------|------|------------------|---------------|--------------|
| 60 | Spring-monument                                                           | Shenatagh                | 1981                        | 597545.4<br>4 | 4359705.9<br>9 | 1747 | -                | pk<br>25.7+00 | 21 - 21<br>a |
| 61 | Surface finds at the base of a hill with an Iron Age fortress             | Shenatagh                | Iron Age                    | 597753.3<br>5 | 4359756.6<br>6 | 1839 | newly discovered | pk<br>25.6+60 | 21 - 21a     |
| 62 | Cave complex carved in a section of diatomite origin lacustrine sediments | Shenatagh                | Late Medieval Period-Modern | 597749.9<br>3 | 4359700.2<br>3 | 1813 | newly discovered | pk<br>25.7+00 | 21 - 21a     |
| 63 | “Sagu ghala” fortress                                                     | Shenatagh                | Medieval                    | 597645.0<br>2 | 4358944.1<br>1 | 1820 | 8.71.1.          | pk<br>26.9+20 | 22 - 22a     |
| 64 | Natural monument complex 1                                                | Shenatagh                | Neogene                     | 597596.5<br>6 | 4358515.1<br>6 | 1855 | newly discovered | pk<br>26.9+20 | 22 - 22a     |
| 65 | Natural monument complex 2                                                | Shenatagh                | Neogene                     | 597591.8<br>4 | 4358452.2<br>7 | 1874 | newly discovered | pk<br>26.9+90 | 22 - 22a     |
| 66 | Medieval village remains 1                                                | Geghi, Kitsk (Kirs) area | 13th-15th centuries         | 595660.3<br>6 | 4349504.5<br>8 | 2060 | newly discovered | pk<br>36.1+40 | 23 - 23a     |
| 67 | Church                                                                    | Geghi, Kitsk (Kirs) area | 18th century                | 595627.9<br>5 | 4349362.2<br>1 | 2042 | 8.112.1.2.       | pk<br>36.3+00 | 23 - 23a     |
| 68 | Medieval village remains 2                                                | Geghi, Kitsk (Kirs) area | 15th-17th centuries         | 595661.1<br>8 | 4349001.6<br>6 | 2016 | 8.112.1.1.       | pk<br>36.6+50 | 23 - 23a     |



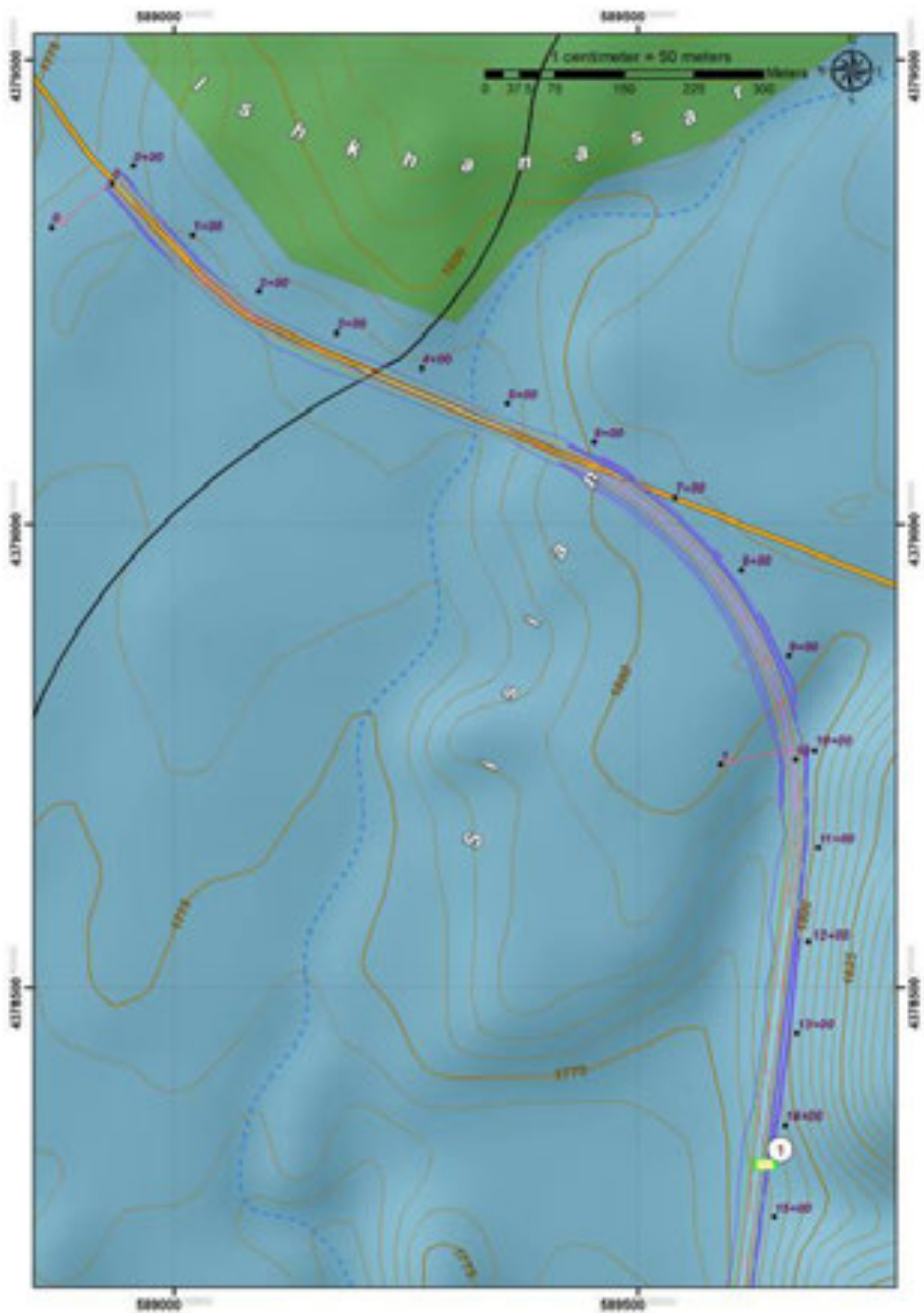
|    |                                              |                                       |                     |               |                |      |                  |               |             |
|----|----------------------------------------------|---------------------------------------|---------------------|---------------|----------------|------|------------------|---------------|-------------|
| 69 | Medieval and modern cemetery                 | Geghi, Kitsk (Kirs) area              | 15th-20th centuries | 595647.0<br>2 | 4348925.6<br>7 | 2016 | 8.112.1.1.1.     | pk<br>36.7+20 | 23 -<br>23a |
| 70 | Siliceous limestone raw-material source 1    | Geghi, Karut (Kyurut) area            | -                   | 598417.9<br>8 | 4344488.7<br>9 | 1694 | newly discovered | pk<br>42.3+00 | 27 -<br>27a |
| 71 | Natural monument 1                           | Nor Astghaber                         | -                   | 598682.1<br>2 | 4344327.3<br>4 | 1751 | newly discovered | pk<br>42.5+10 | 28 -<br>28a |
| 72 | Natural monument 2                           | Nor Astghaber                         | -                   | 598733.2<br>5 | 4344258.5<br>6 | 1787 | newly discovered | pk<br>42.5+80 | 28 -<br>28a |
| 73 | Siliceous limestone raw-material source 2    | Geghi                                 | -                   | 601429.8<br>8 | 4342042.1<br>5 | 1519 | newly discovered | pk<br>47.0+00 | 32 -<br>32a |
| 74 | Structure remains (Medieval village remains) | Geghi, Verin Geghavank (Baharlu) area | Medieval?           | 602987.6<br>1 | 4342238.8<br>8 | 1439 | newly discovered | pk<br>48.6+00 | 34 -<br>34a |
| 75 | Cave-complex Lernadzor-1                     | Lernadzor, Kavchut area               | -                   | 607138.9<br>7 | 4340774.4<br>9 | 1339 | newly discovered | pk<br>53.1+80 | 38 -<br>38a |
| 76 | Tomb field                                   | Lernadzor, Kavchut area               | Bronze-Iron Ages    | 607268.9<br>8 | 4340683.4<br>8 | 1320 | newly discovered | pk<br>53.3+00 | 39 -<br>39a |



|    |                                                                                                                 |           |                                                                               |               |                |      |                                             |               |             |
|----|-----------------------------------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------|---------------|----------------|------|---------------------------------------------|---------------|-------------|
| 77 | Chalcolithic settlement                                                                                         | Lernadzor | Late Chalcolithic (First half of the IV Millennium BC)                        | 604397.6<br>6 | 4335594.9<br>5 | 1529 | newly discovered                            | pk<br>60.2+70 | 44 -<br>44a |
| 78 | Archaeological complex – Upper Paleolithic open-air site, Chalcolithic settlement and Early Medieval tomb field | Lernadzor | 27-23 000 years BP, First half of the IV Millennium BC, Early Medieval Period | 604171.2<br>2 | 4335110.3<br>1 | 1514 | newly discovered                            | pk<br>60.9+00 | 45 -<br>45a |
| 79 | Kolagegh Medieval village remains and S. Gevorg church                                                          | Lernadzor | High and Late Medieval Periods                                                | 604113.1<br>1 | 4334917.9<br>5 | 1549 | 8.38.6. Լ<br>8.38.6.1.                      | pk<br>61.1+00 | 45 -<br>45a |
| 80 | Archaeozoological site                                                                                          | Lernadzor | Upper Pleistocene                                                             | 604112.0<br>6 | 4334945.0<br>2 | 1535 | newly discovered                            | pk<br>61.1+00 | 45 -<br>45a |
| 81 | Cemetery                                                                                                        | Kajaran   | Late Medieval Period                                                          | 601520.0<br>1 | 4333973.4<br>3 | 1666 | recorded in state cadastral map of the city | pk<br>64.0+00 | 48 -<br>48a |



Map 1





**(1: 5000)**



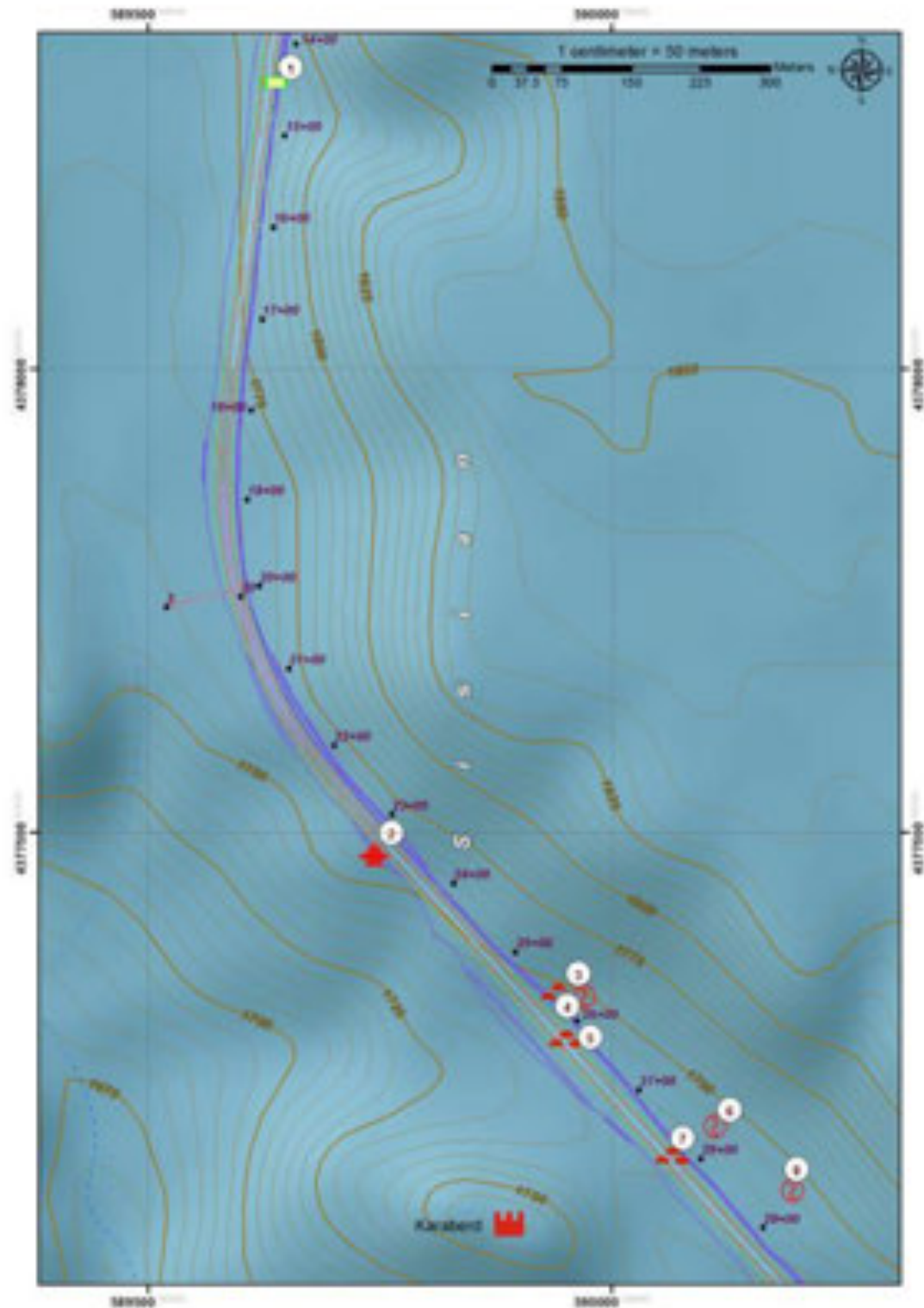
### Map 1a



Units recorded in the area of the Sisian community. Sisian-Shenatagh section of the road project design - pk 0+00 – pk 1.5+00

(1: 5000)

Map 2







Units recorded in the area of the Sisian community. Sisian-Shenatagh section of the road project design - pk 1.5+00 – pk 2.9+00

(1: 5000)

Map 2a

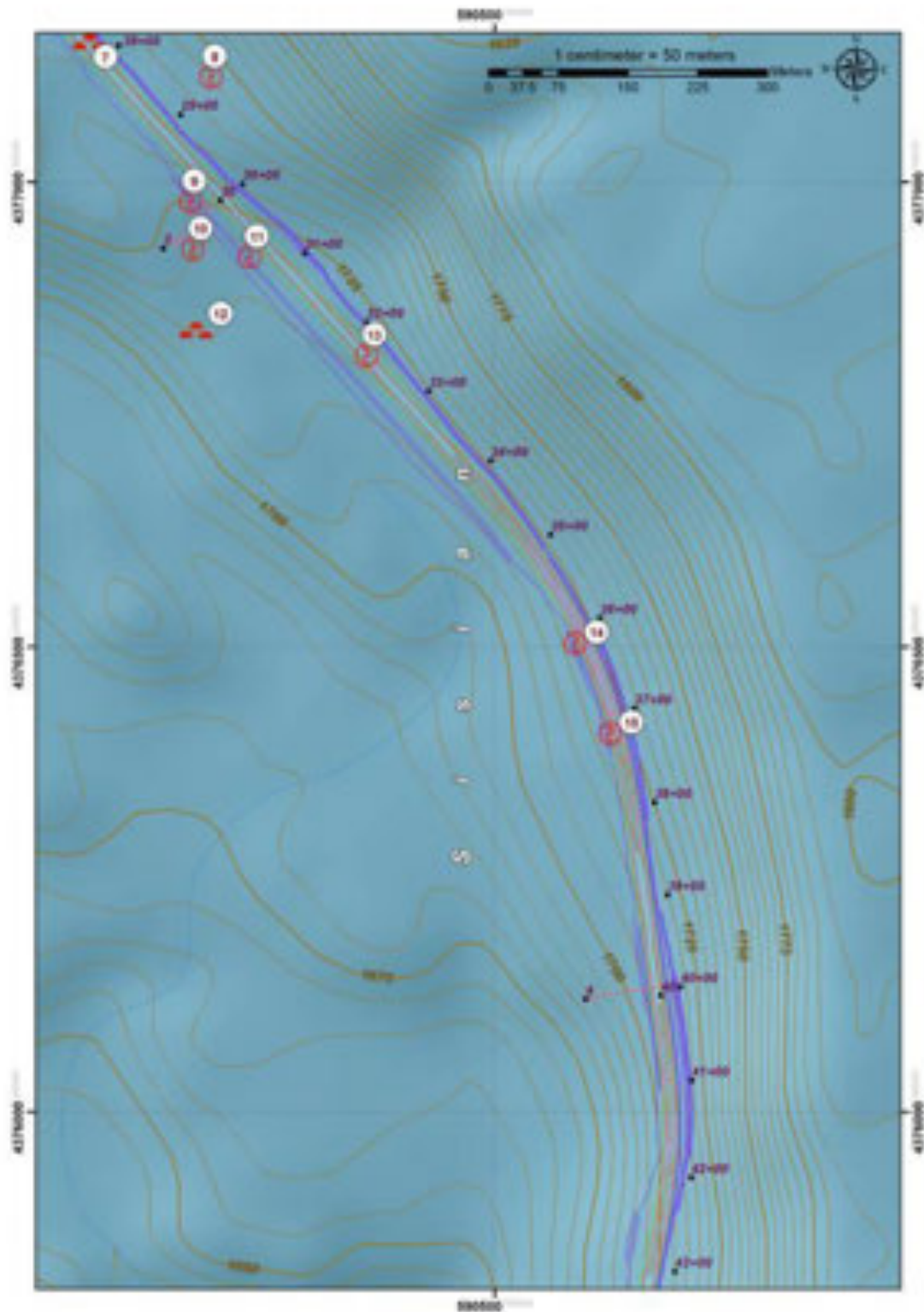




Units recorded in the area of the Sisian community. Sisian-Shenatagh section of the road  
project design - pk 1.5+00 – pk 2.9+00

(1: 5000)

Map 3







Units recorded in the area of the Sisian community. Sisian-Shenatagh section of the road  
project design - pk 2.9+00 – pk 4.3+00

(1: 5000)

Map 3a

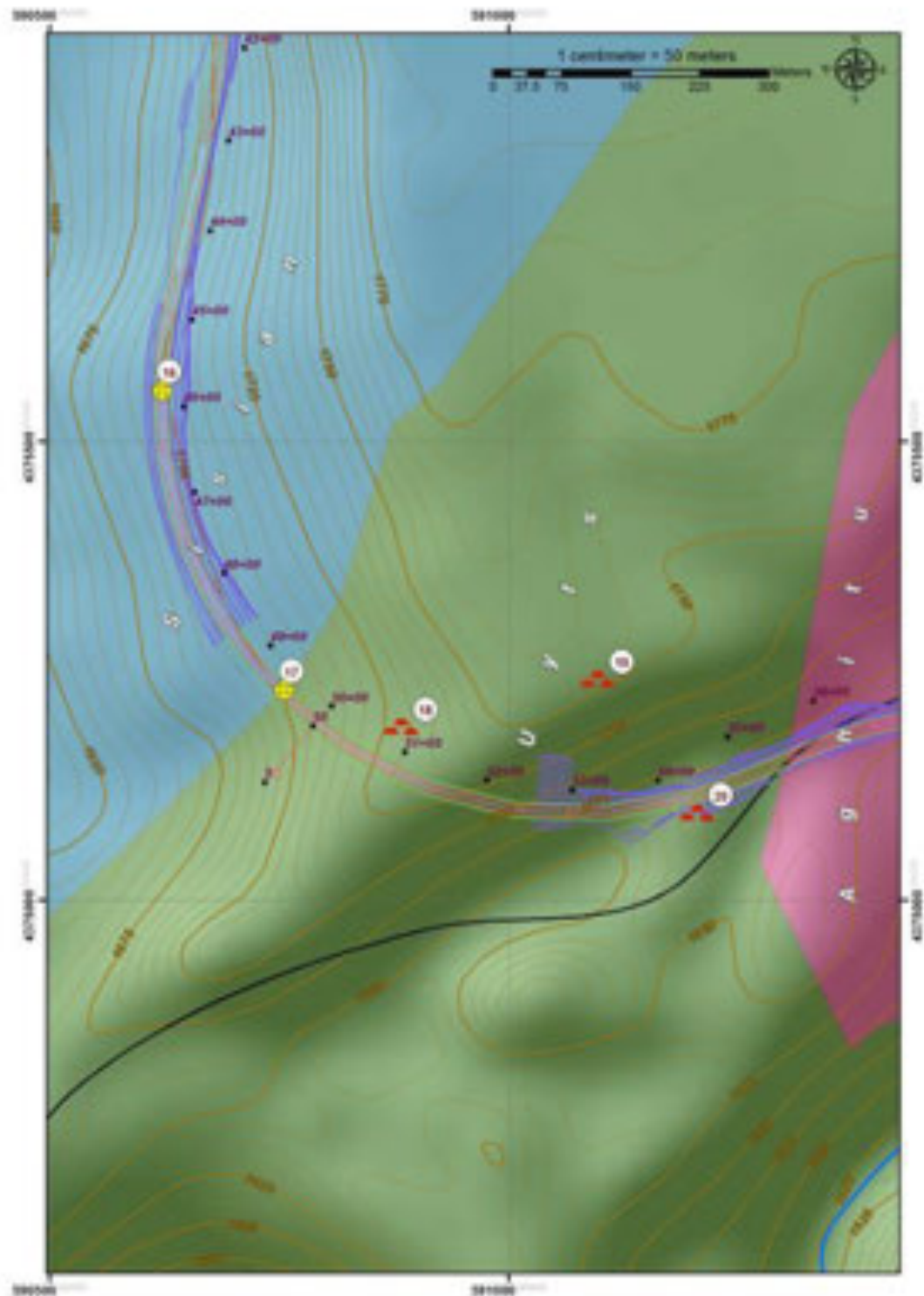




Units recorded in the area of the Sisian community. Sisian-Shenatagh section of the road  
project design - pk 2.9+00 – pk 4.3+00

(1: 5000)

Map 4

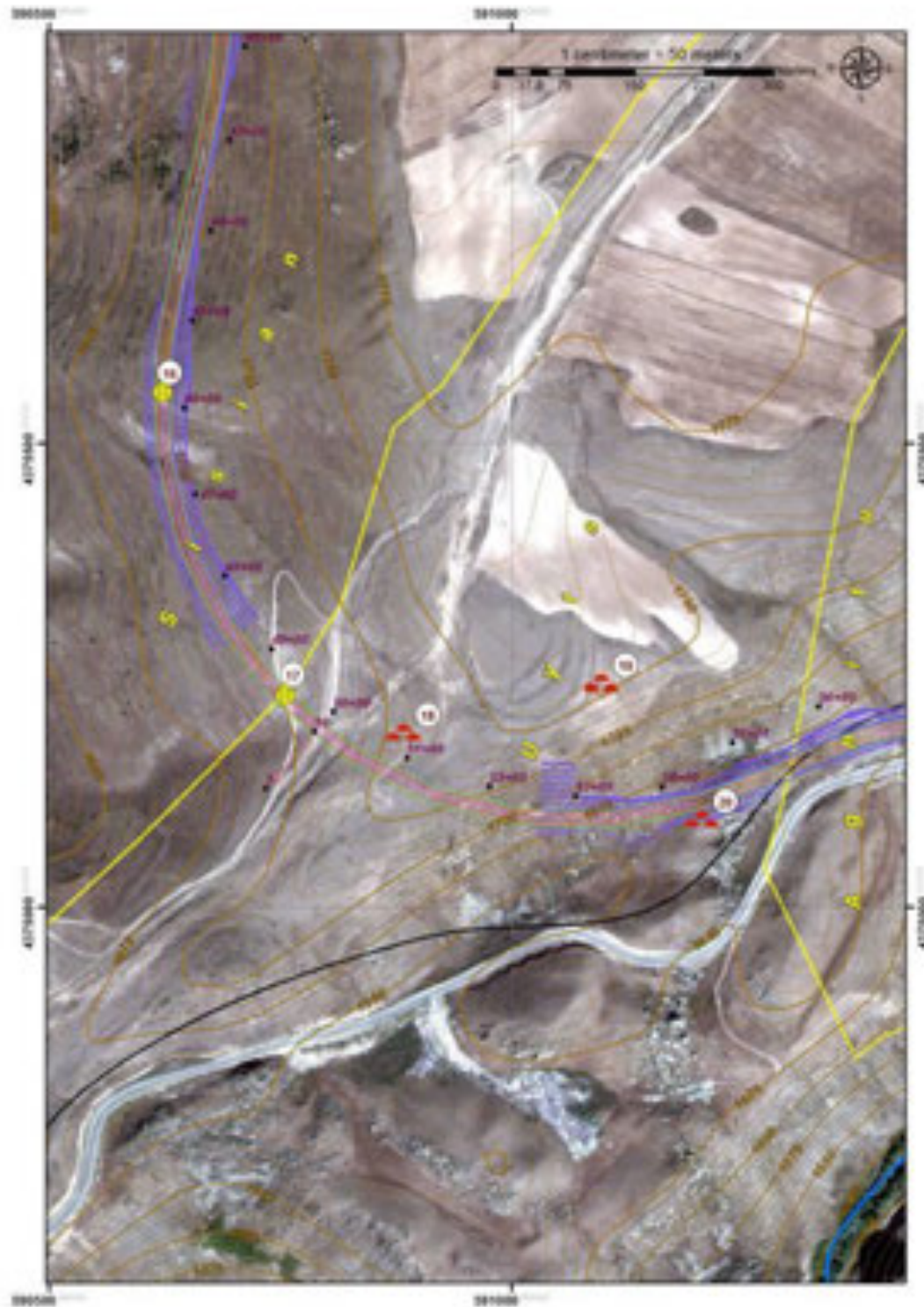




Units recorded in the areas of the Sisian and Uyts communities. Sisian-Shenatagh section  
of the road project design - pk 4.3+00 – pk 5.6+00

(1: 5000)

Map 4a



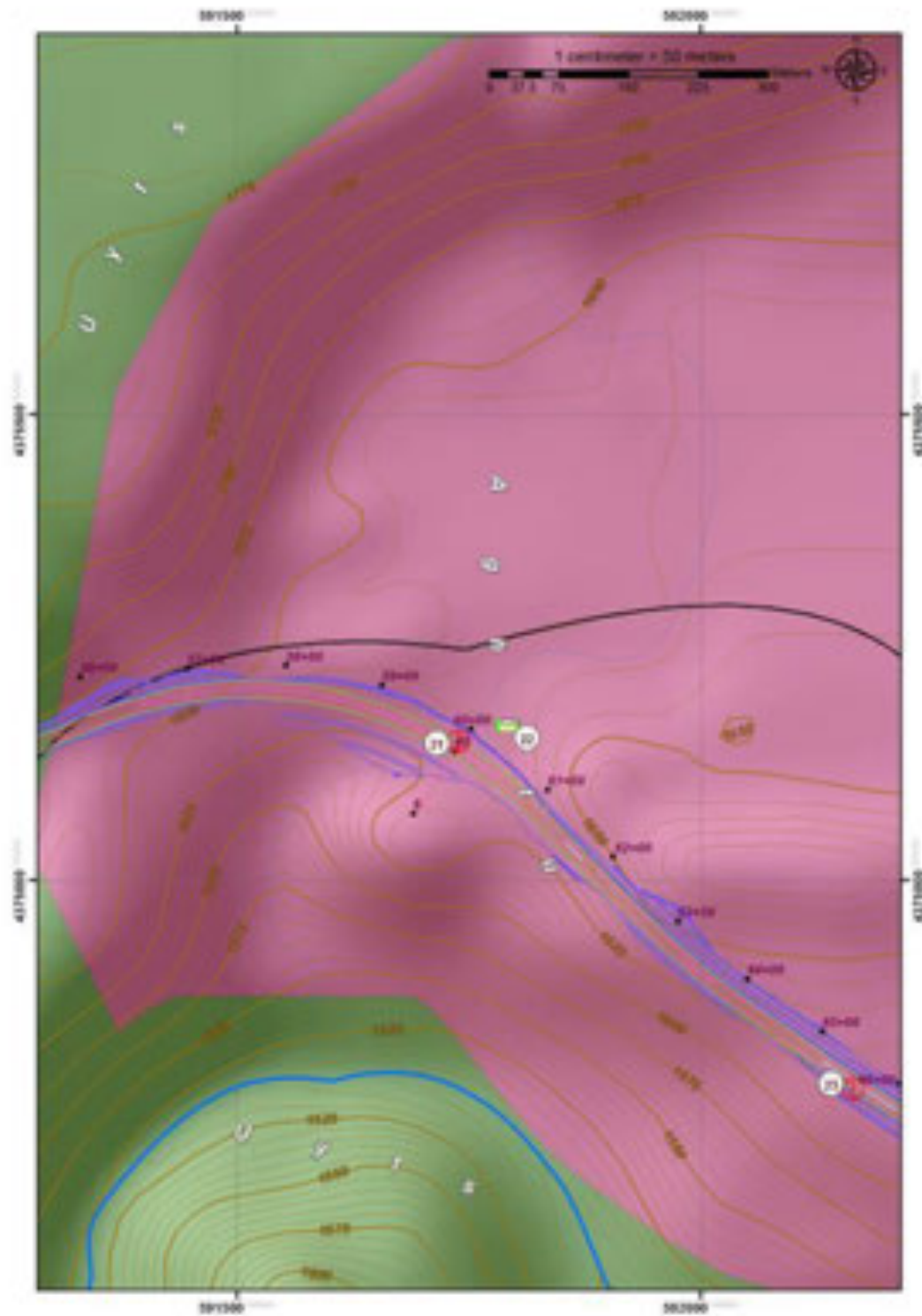




**Units recorded in the areas of the Sisian and Uyts communities. Sisian-Shenatagh section  
of the road project design - pk 4.3+00 – pk 5.6+00**

(1: 5000)

**Map 5**





Units recorded in the area of the Aghitu community. Sisian-Shenatagh section of the road  
project design - pk 5.6+00 – pk 6.6+00

(1: 5000)

Map 5a



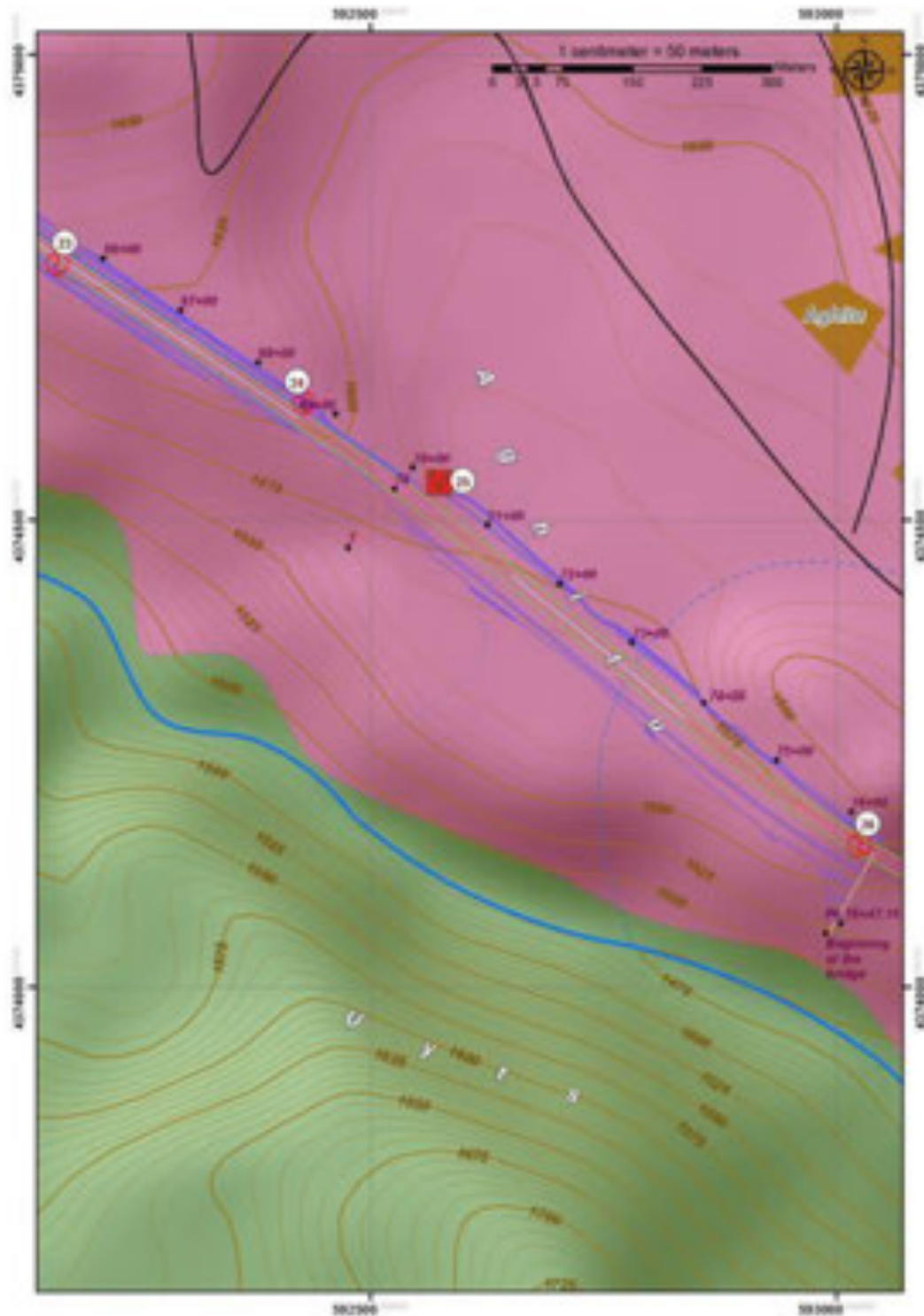




**Units recorded in the area of the Aghitu community. Sisian-Shenatagh section of the road project design - pk 5.6+00 – pk 6.6+00**

(1: 5000)

**Map 6**





Units recorded in the area of the Aghitu community. Sisian-Shenatagh section of the road project design - pk 6.6+00 – pk 7.6+00

(1: 5000)

Map 6a





**Units recorded in the area of the Aghitu community. Sisian-Shenatagh section of the road project design - pk 6.6+00 – pk 7.6+00**

(1: 5000)

**Map 7**







Units recorded in the area of the Aghitu community. Sisian-Shenatagh section of the road  
project design - pk 7.6+00 – pk 8.5+00

(1: 5000)

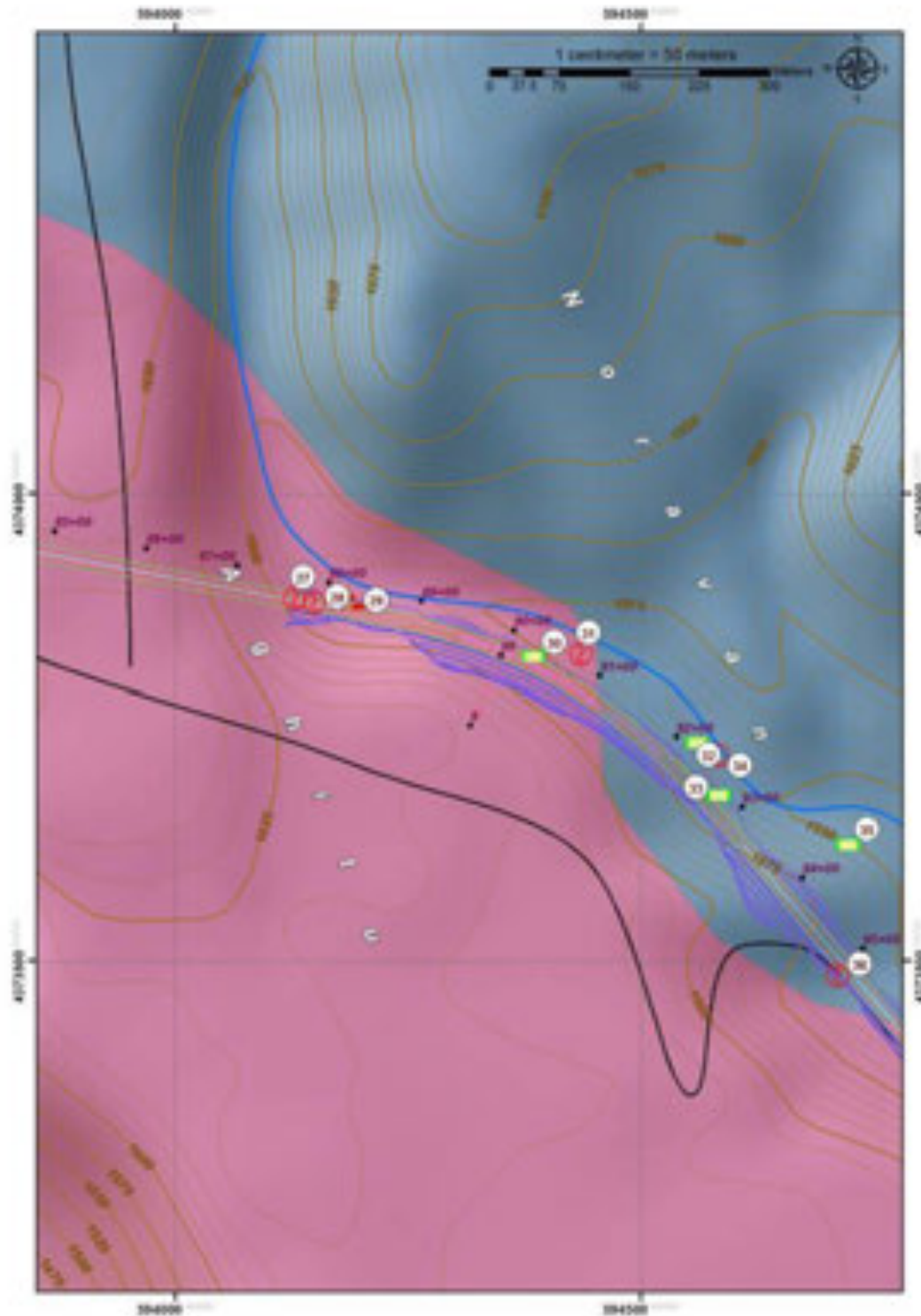
Map 7a



**Units recorded in the area of the Aghitu community. Sisian-Shenatagh section of the road project design - pk 7.6+00 – pk 8.5+00**

**(1: 5000)**

## Map 8







**Units recorded in the areas of the Aghitu and Noravan communities. Sisian-Shenatagh section of the road project design - pk 8.5+00 – pk 9.5+00**

(1: 5000)

**Map 8a**

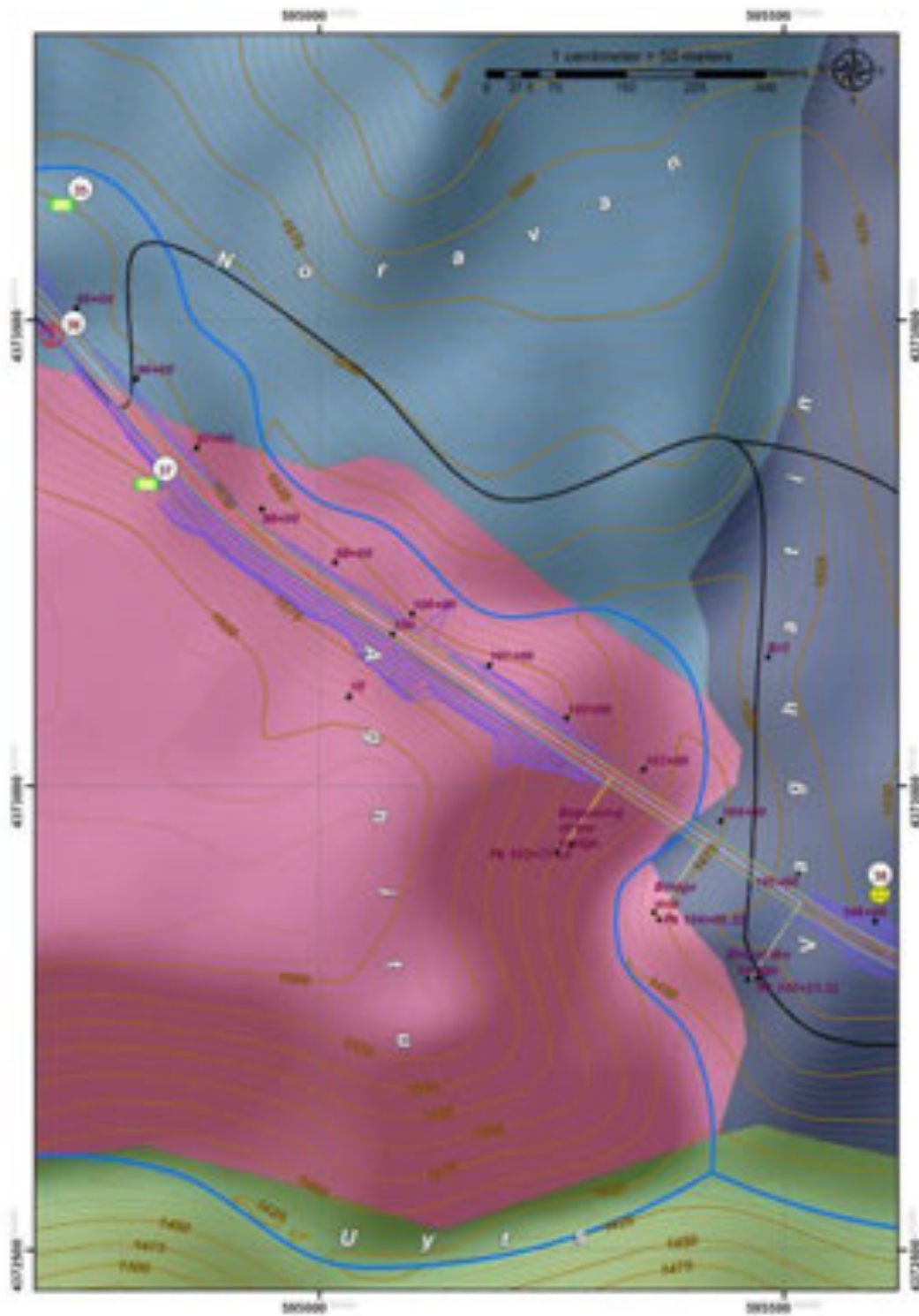




**Units recorded in the areas of the Aghitu and Noravan communities. Sisian-Shenatagh section of the road project design - pk 8.5+00 – pk 9.5+00**

**(1: 5000)**

## Map 9

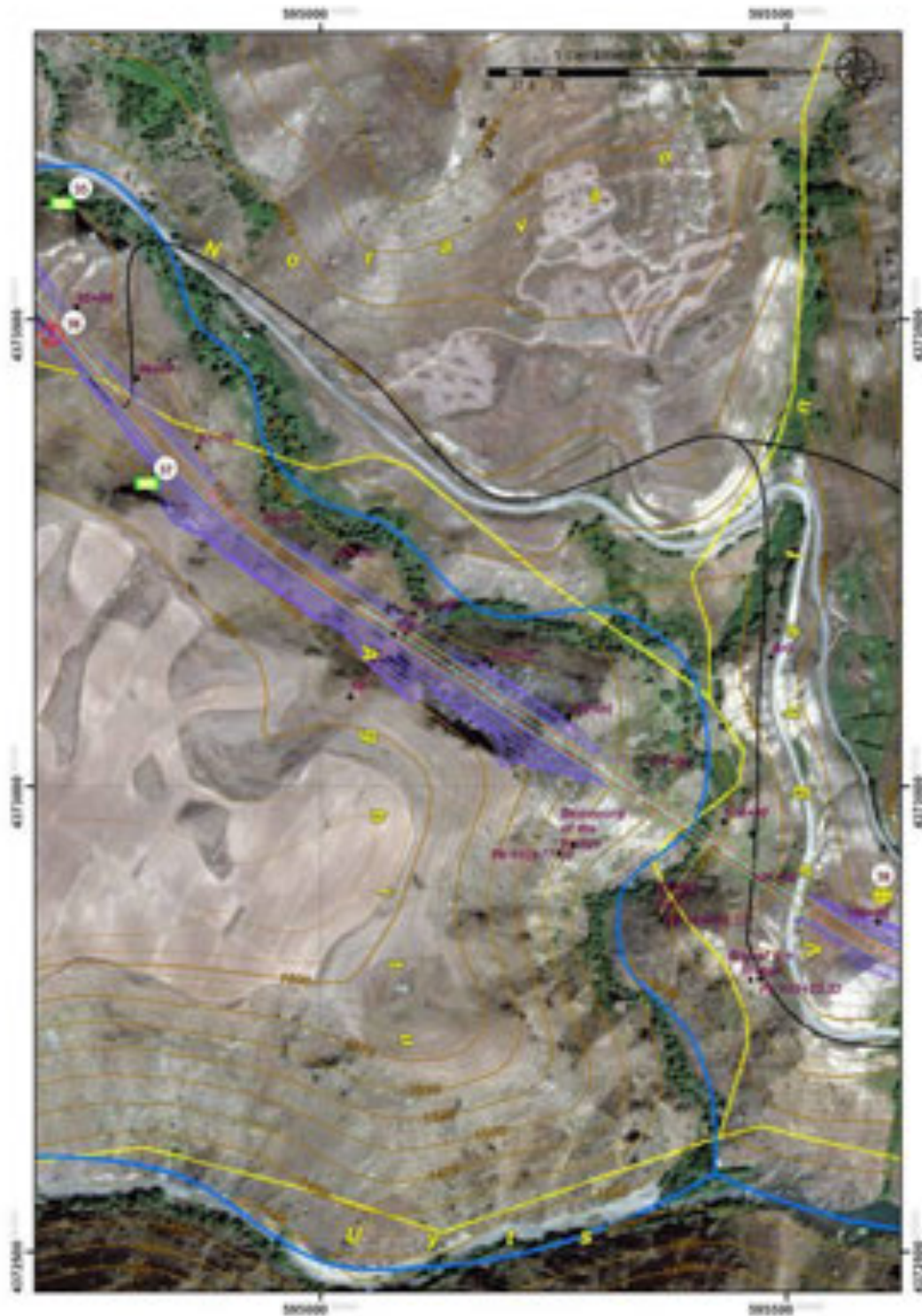




Units recorded in the areas of the Noravan, Aghitu and Vaghatin communities. Sisian-Shenatagh section of the road project design - pk 9.5+00 – pk 10.6+00

(1: 5000)

Map 9a

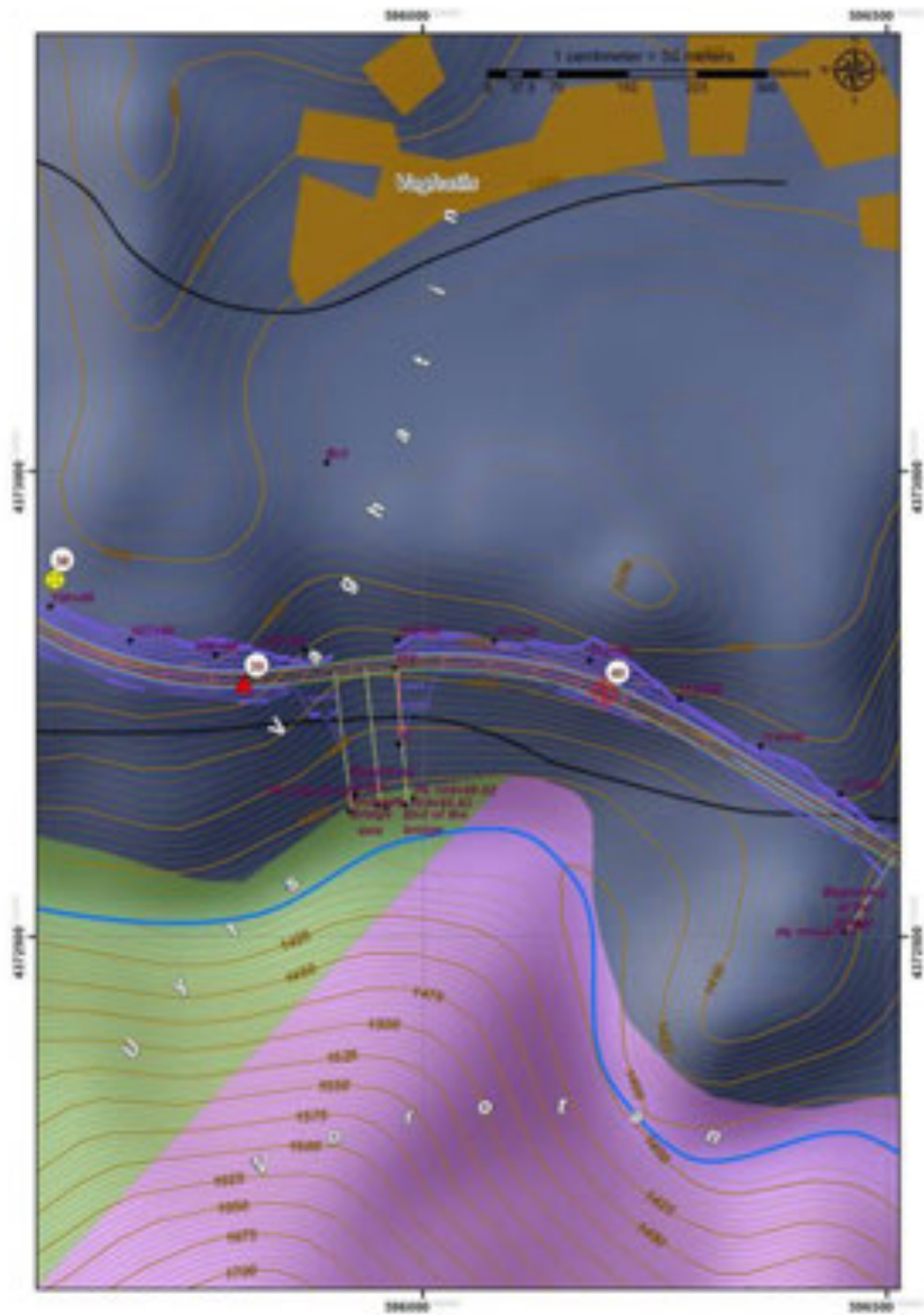




Units recorded in the areas of the Noravan, Aghitu and Vaghatin communities. Sisian-Shenatagh section of the road project design - pk 9.5+00 – pk 10.6+00

(1: 5000)

Map 10







Units recorded in the area of the Vaghatin community. Sisian-Shenatagh section of the road  
project design - pk 10.6+00 – pk 11.5+00

(1: 5000)

Map 10a

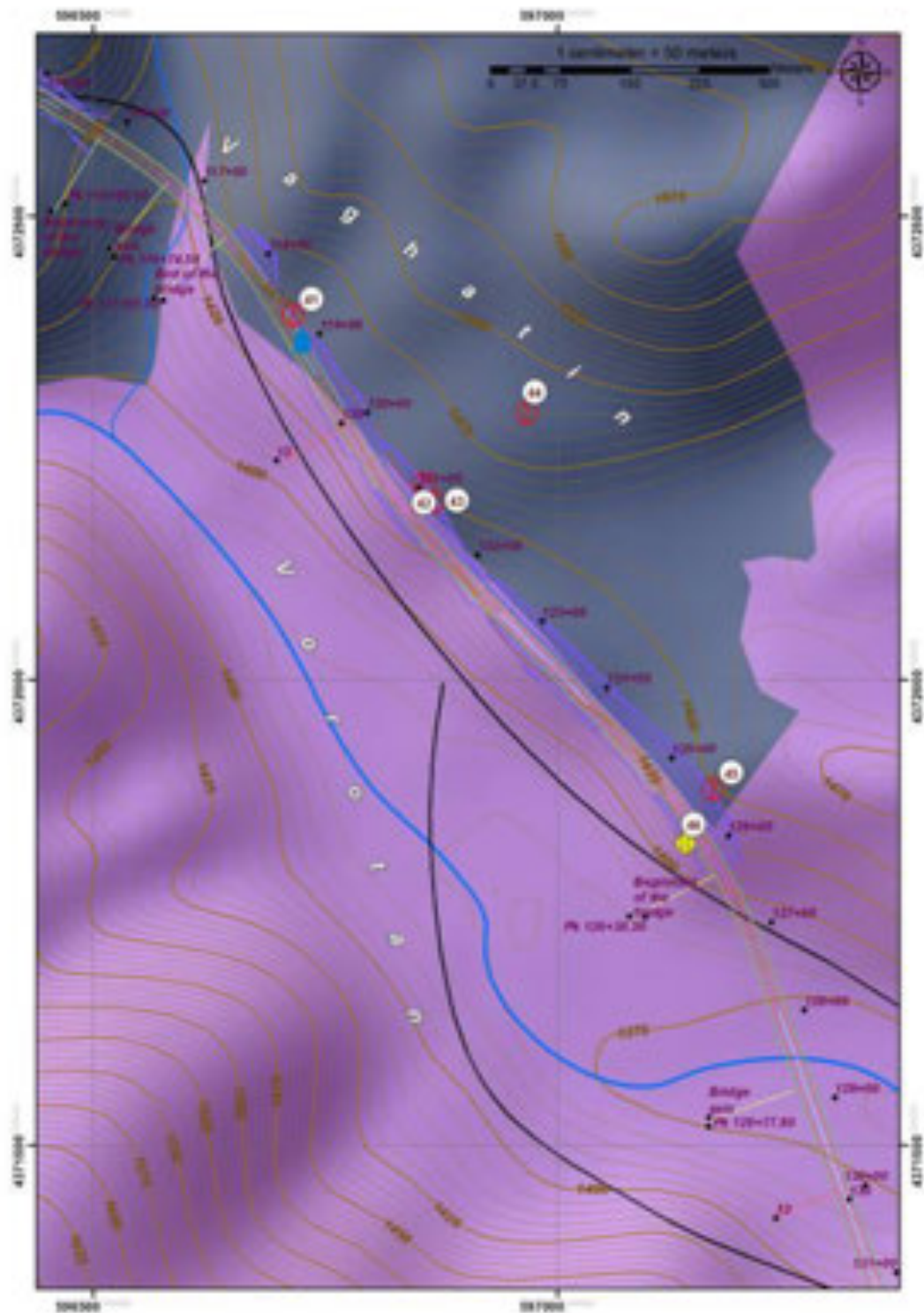




Units recorded in the area of the Vaghatin community. Sisian-Shenatagh section of the road project design - pk 10.6+00 – pk 11.5+00

(1: 5000)

Map 11







Units recorded in the areas of the Vaghatin and Vorotan communities. Sisian-Shenatagh section of the road project design - pk 11.5+00 – pk 13.1+00

(1: 5000)

Զարմուշ 11a

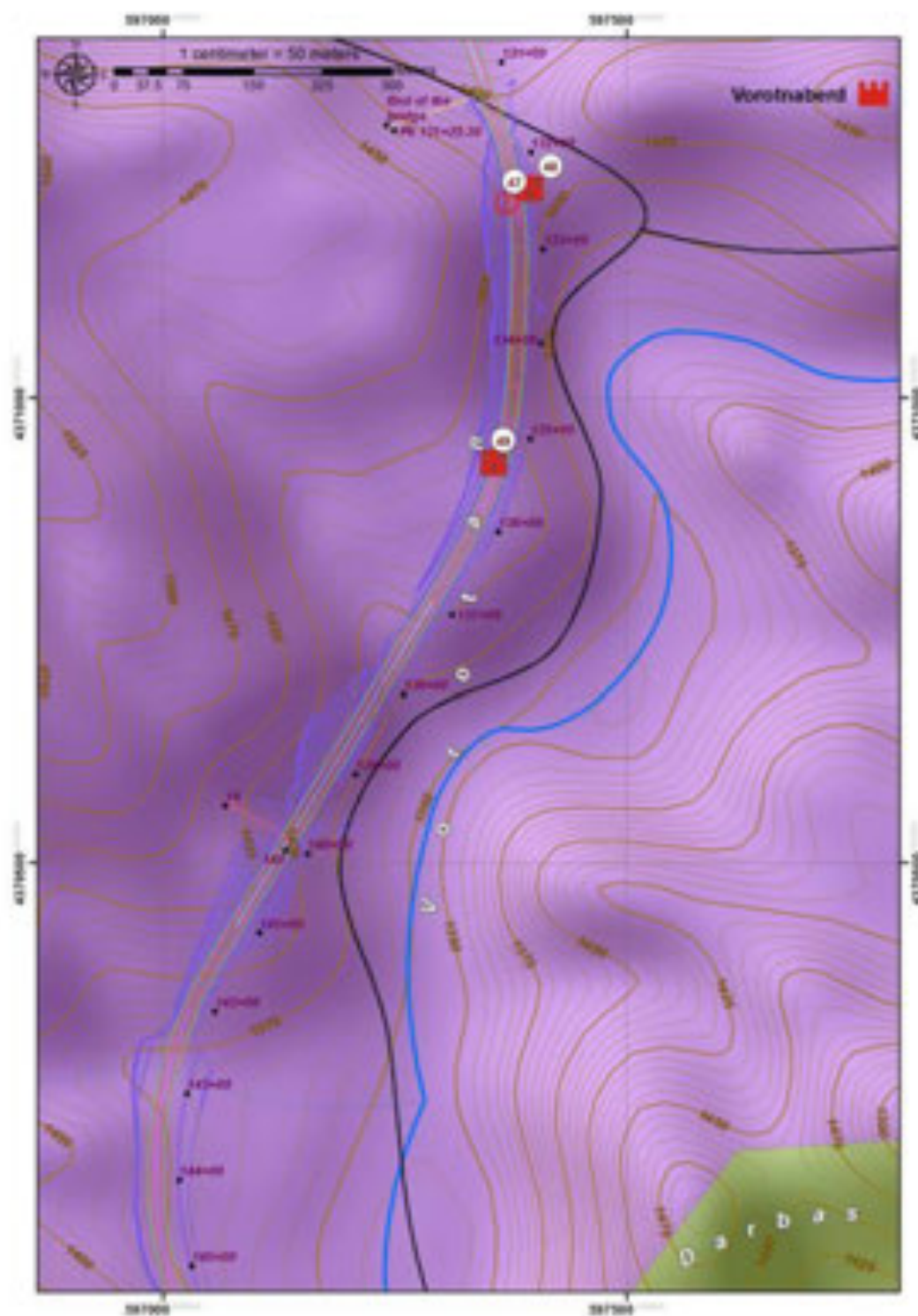




**Units recorded in the areas of the Vaghatin and Vorotan communities. Sisian-Shenatagh section of the road project design - pk 11.5+00 – pk 13.1+00**

**(1: 5000)**

## Map 12





Units recorded in the area of the Vorotan community. Sisian-Shenatagh section of the road project design - pk 13.1+00 – pk 14.5+00

(1: 5000)

Map 12a

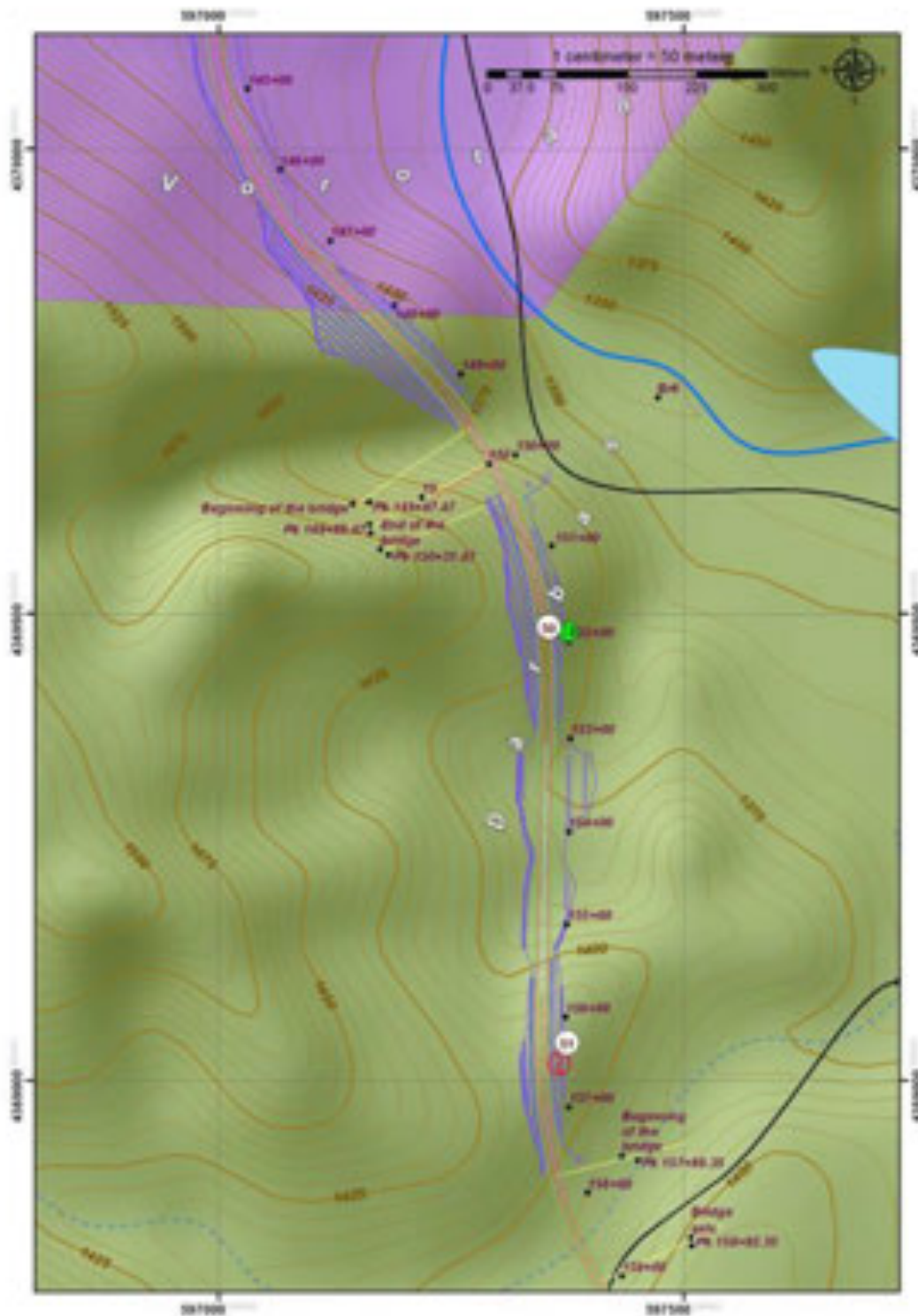




Units recorded in the area of the Vorotan community. Sisian-Shenatagh section of the road project design - pk 13.1+00 – pk 14.5+00

(1: 5000)

Map 13







**Units recorded in the areas of the Vorotan and Darbas communities. Sisian-Shenatagh section of the road project design - pk 14.5+00 – pk 15.9+00**

(1: 5000)

**Map 13a**

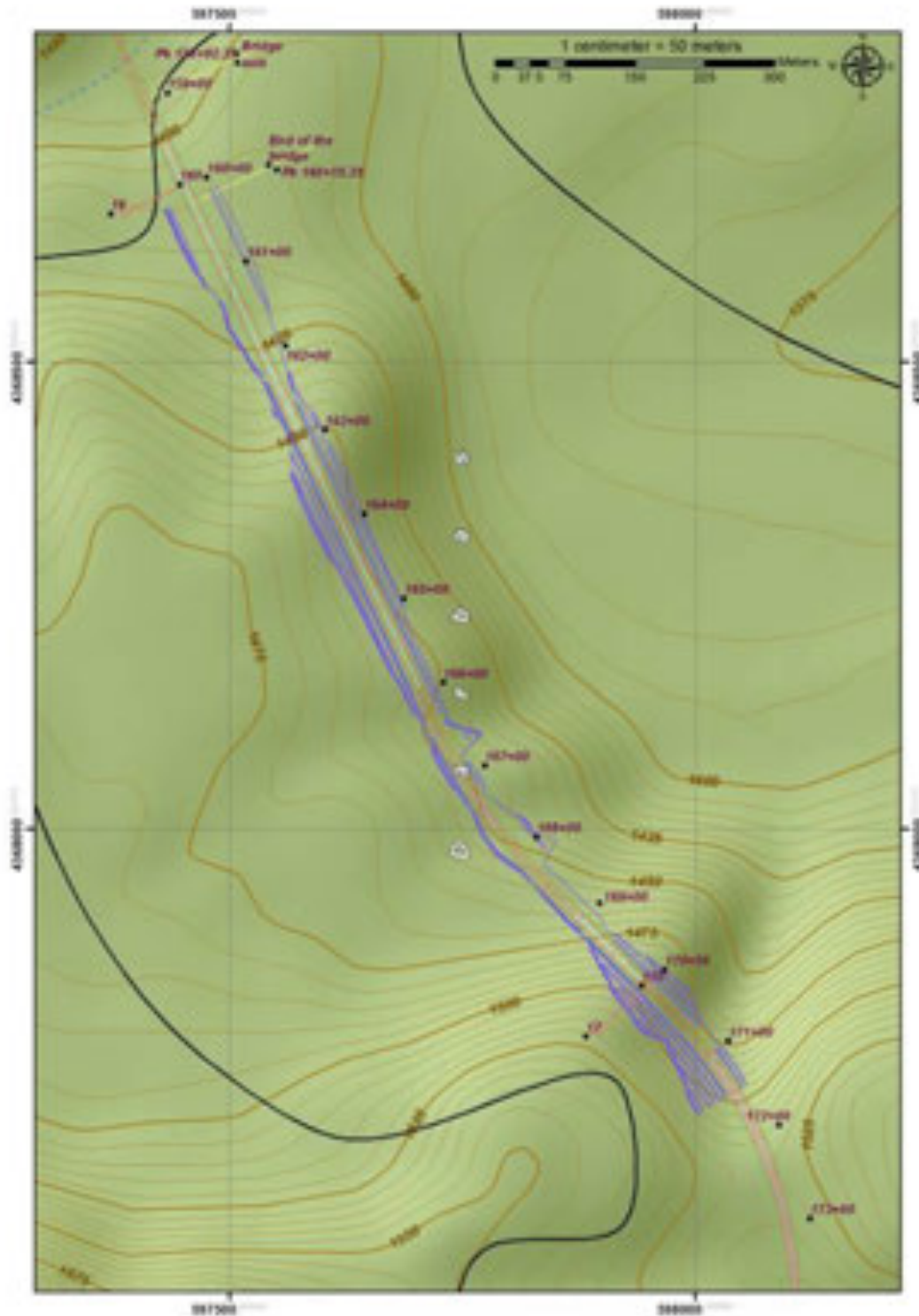




**Units recorded in the areas of the Vorotan and Darbas communities. Sisian-Shenatagh section of the road project design - pk 14.5+00 – pk 15.9+00**

(1: 5000)

**Map 14**







Units recorded in the area of the Darbas community. Sisian-Shenatagh section of the road project design - pk 15.9+00 – pk 17.3+00

(1: 5000)

Map 14a



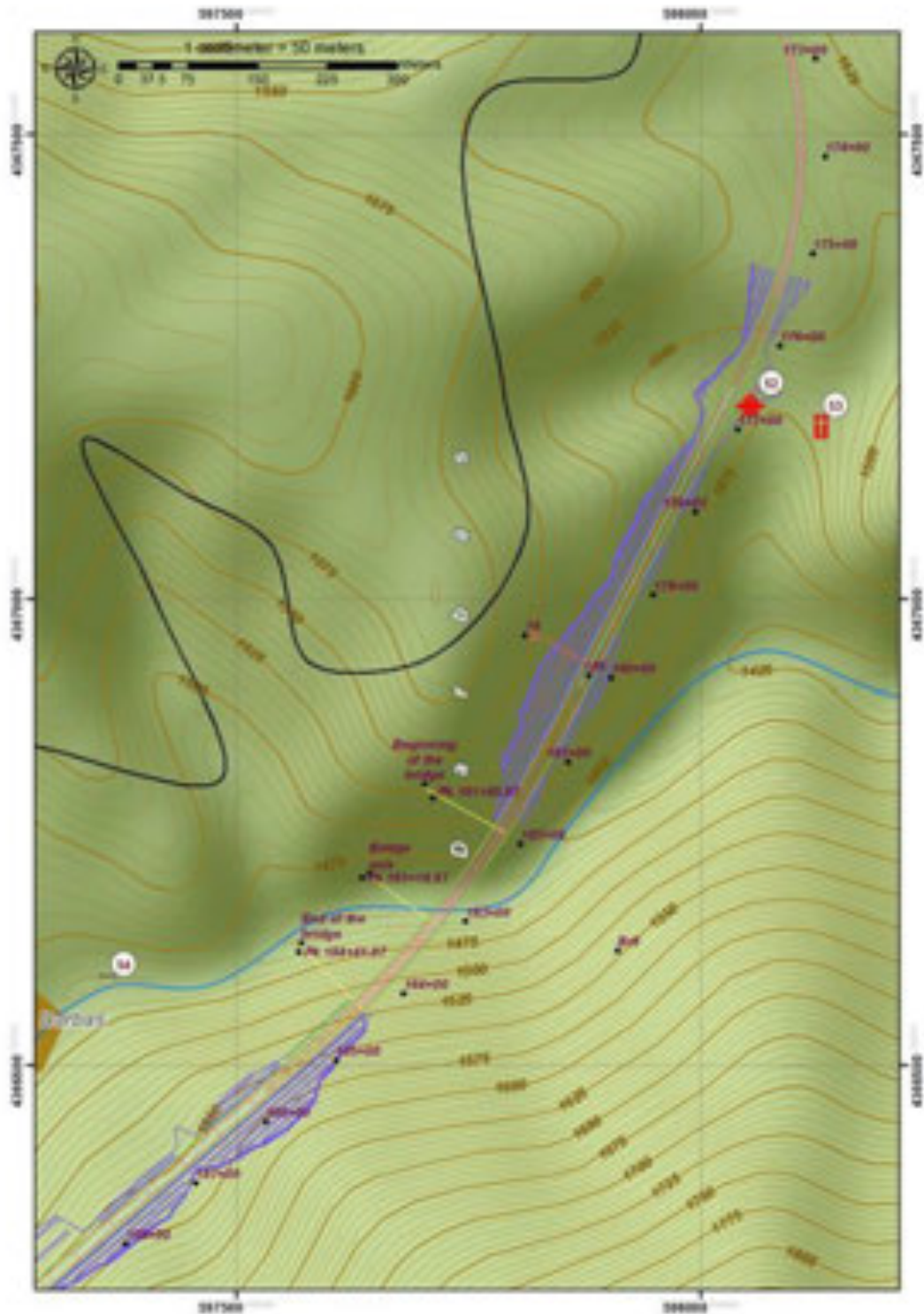




Units recorded in the area of the Darbas community. Sisian-Shenatagh section of the road project design - pk 15.9+00 – pk 17.3+00

(1: 5000)

Map 15

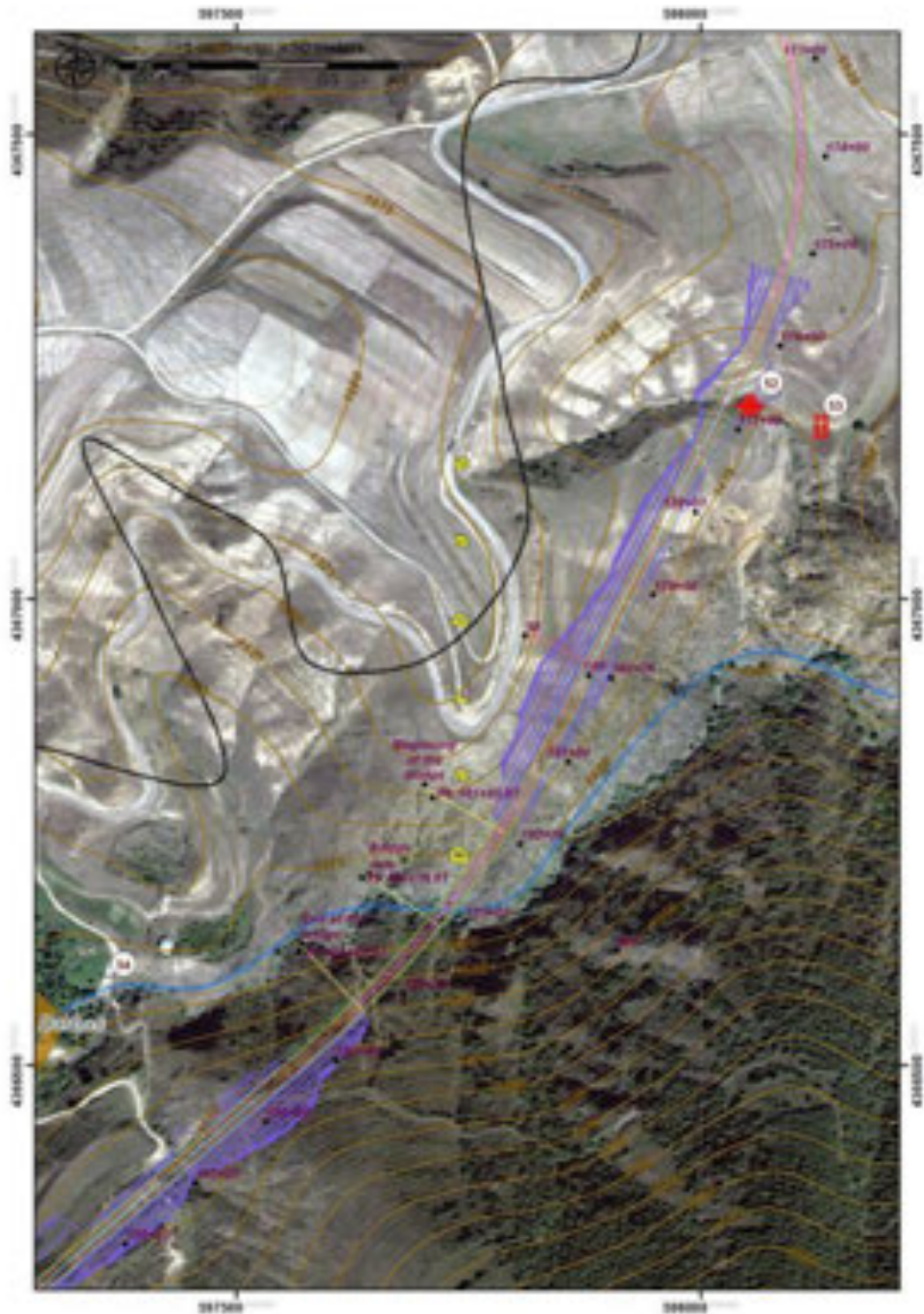




Units recorded in the area of the Darbas community. Sisian-Shenatagh section of the road project design - pk 17.3+00 – pk 18.7+00

(1: 5000)

Map 15a





**Units recorded in the area of the Darbas community. Sisian-Shenatagh section of the road  
project design - pk 17.3+00 – pk 18.7+00**

**(1: 5000)**

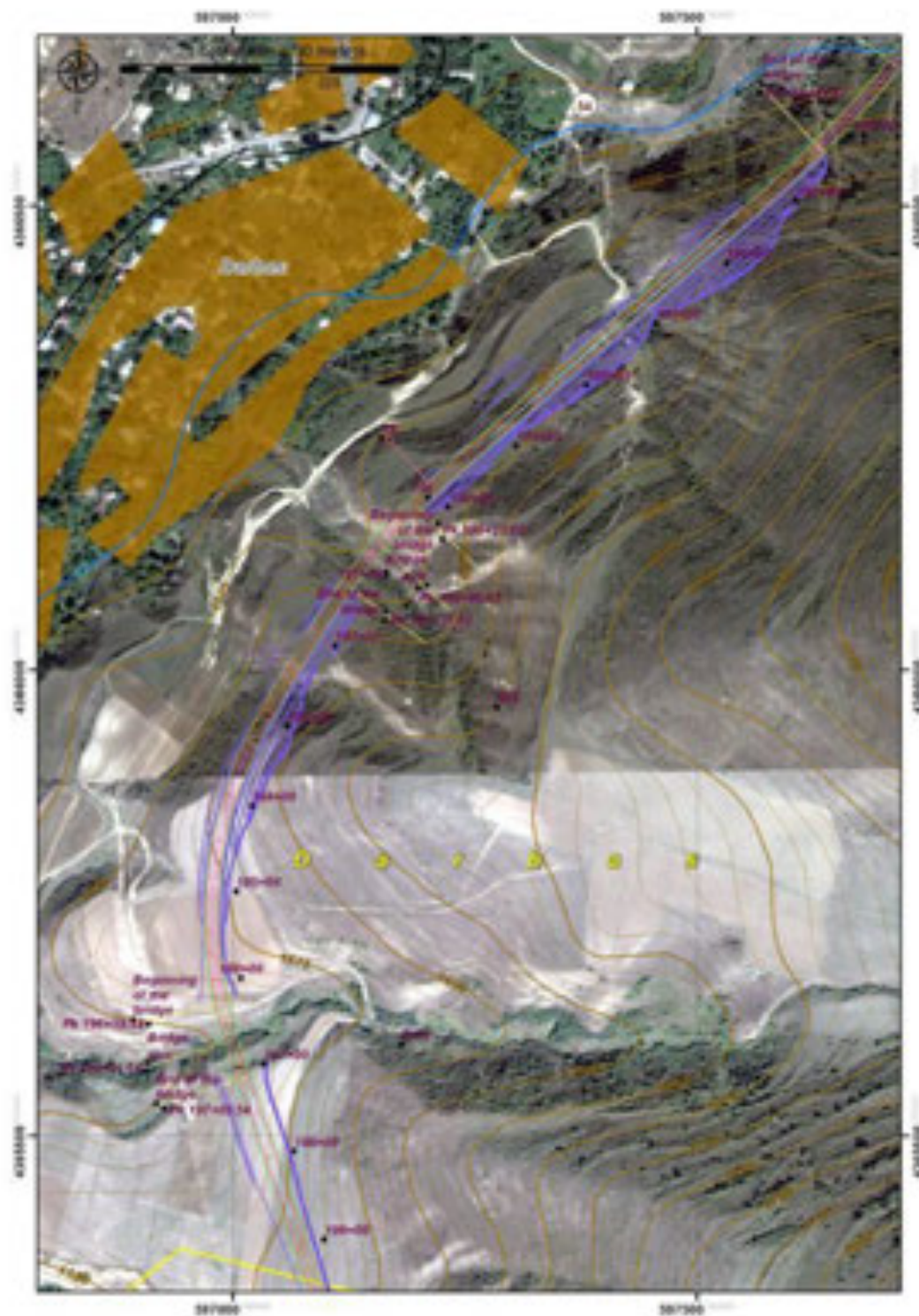
### Map 16



**Units recorded in the area of the Darbas community. Sisian-Shenatagh section of the road  
project design - pk 18.7+00 – pk 19.9+00**

**(1: 5000)**

### Map 16a



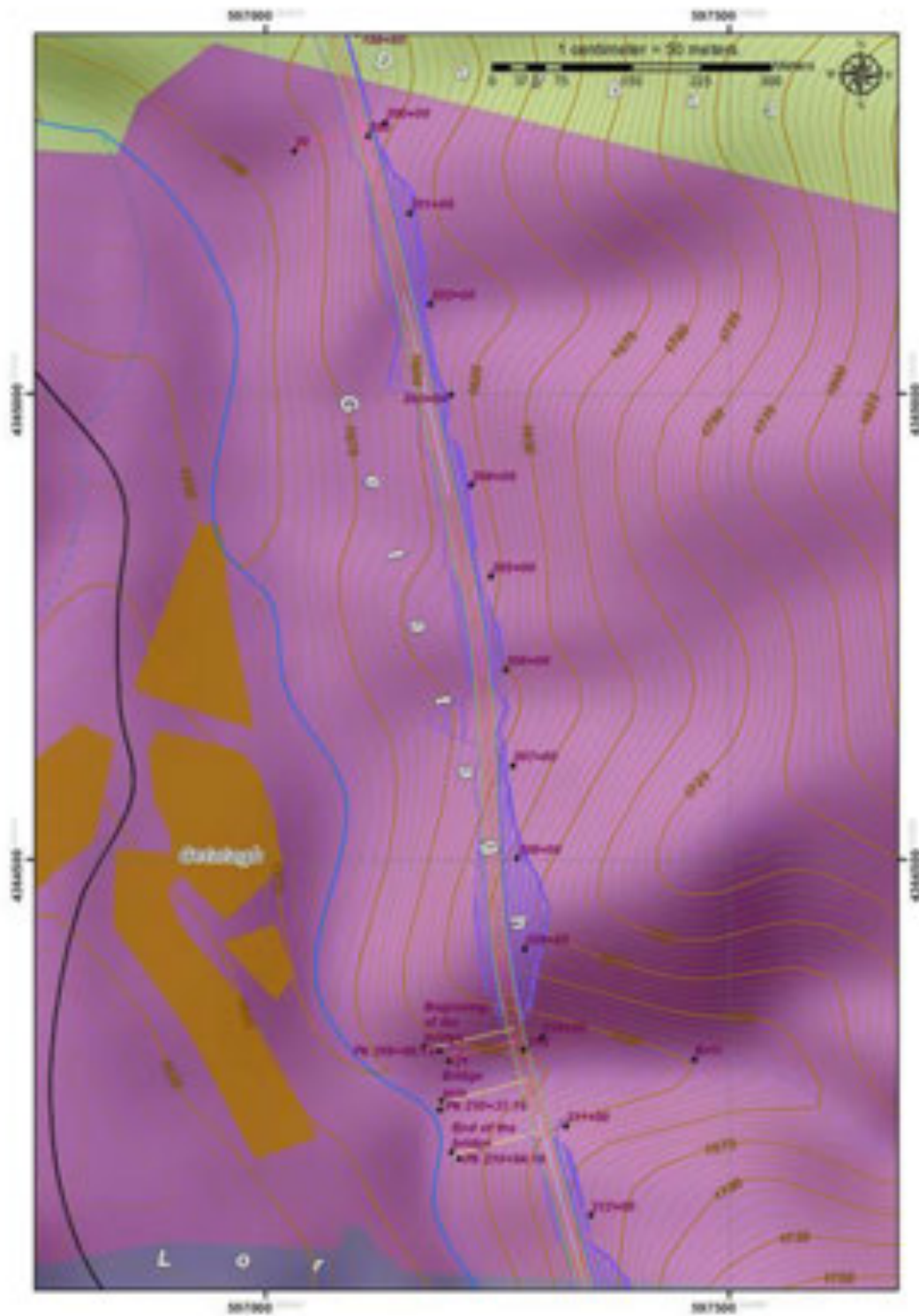




**Units recorded in the area of the Darbas community. Sisian-Shenatagh section of the road project design - pk 18.7+00 – pk 19.9+00**

(1: 5000)

**Map 17**

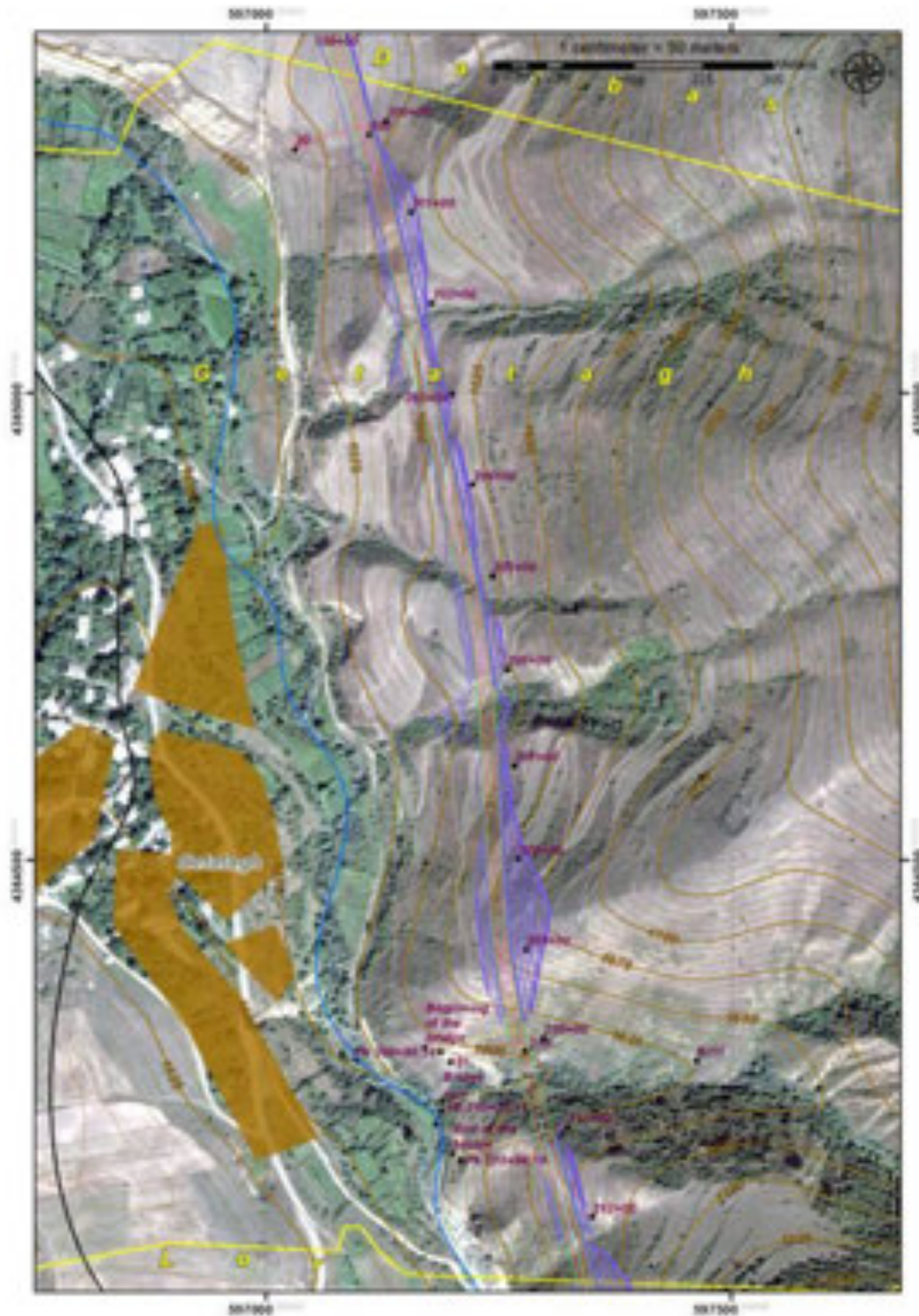




Units recorded in the area of the Getatagh community. Sisian-Shenatagh section of the road project design - pk 19.9+00 – pk 21.2+00

(1: 5000)

Map 17a



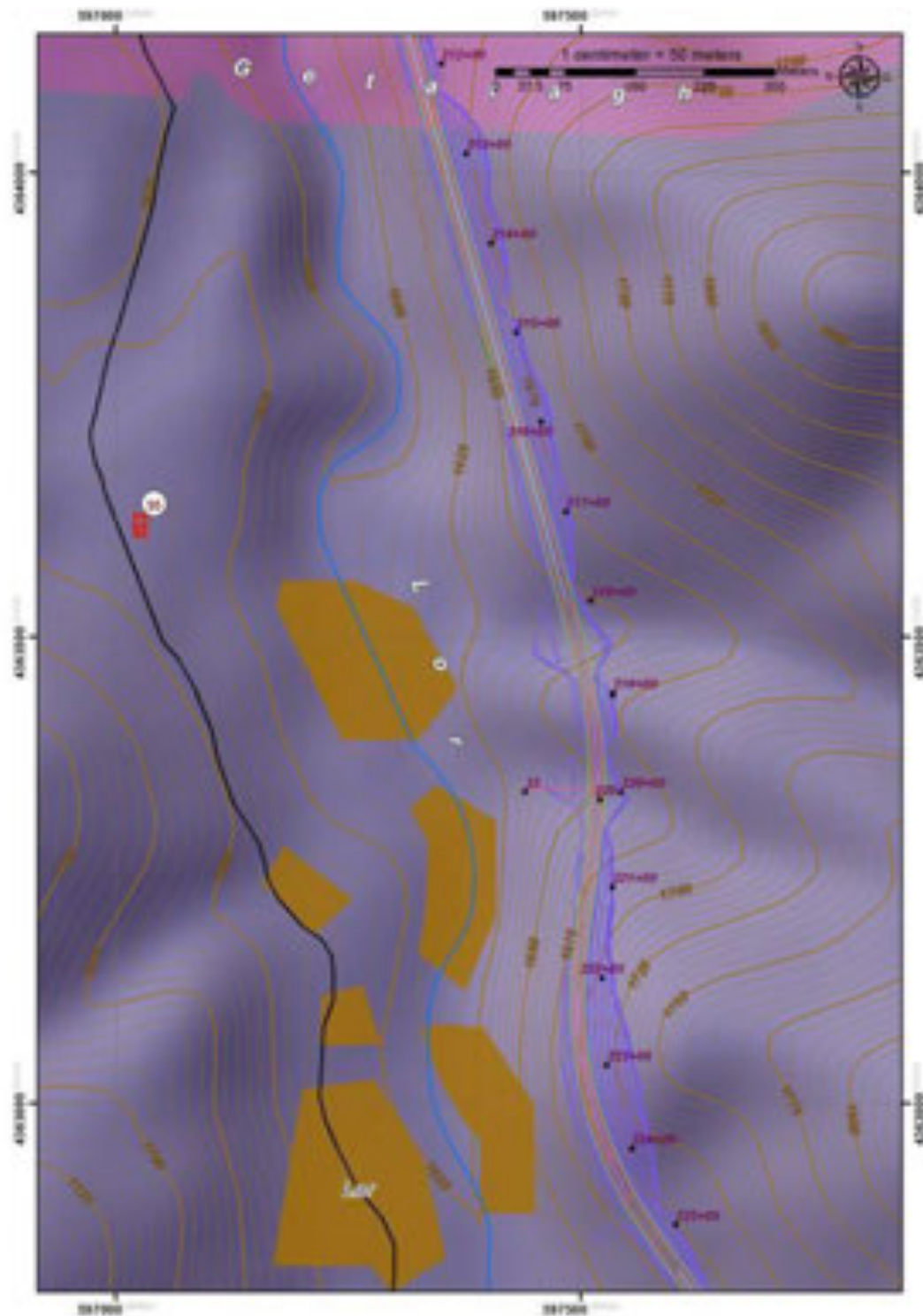




Units recorded in the area of the Getatagh community. Sisian-Shenatagh section of the road project design - pk 19.9+00 – pk 21.2+00

(1: 5000)

Map 18

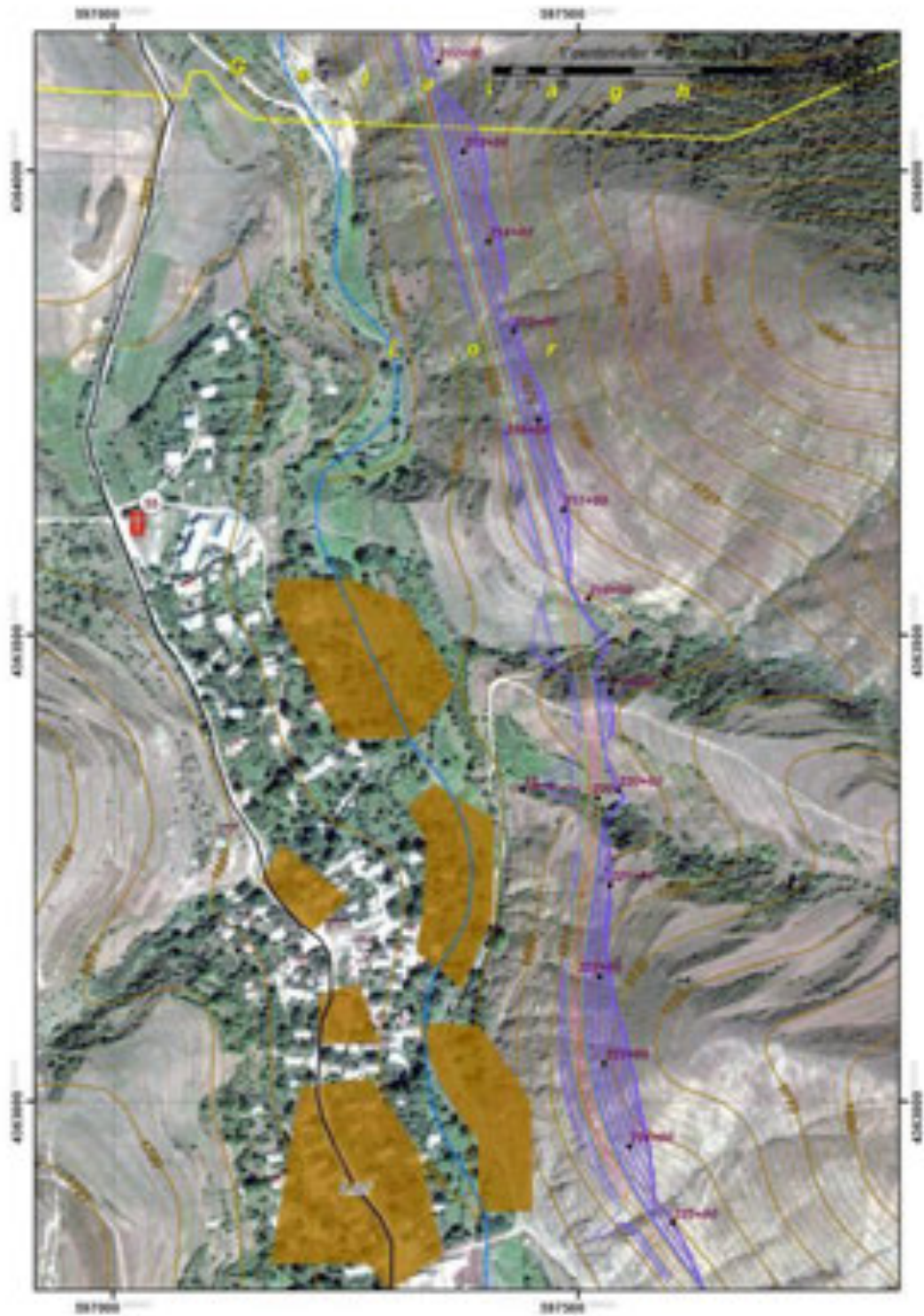




**Units recorded in the area of the Lor community. Sisian-Shenatagh section of the road  
project design - pk 21.2+00 – pk 22.5+00**

(1: 5000)

**Map 18a**

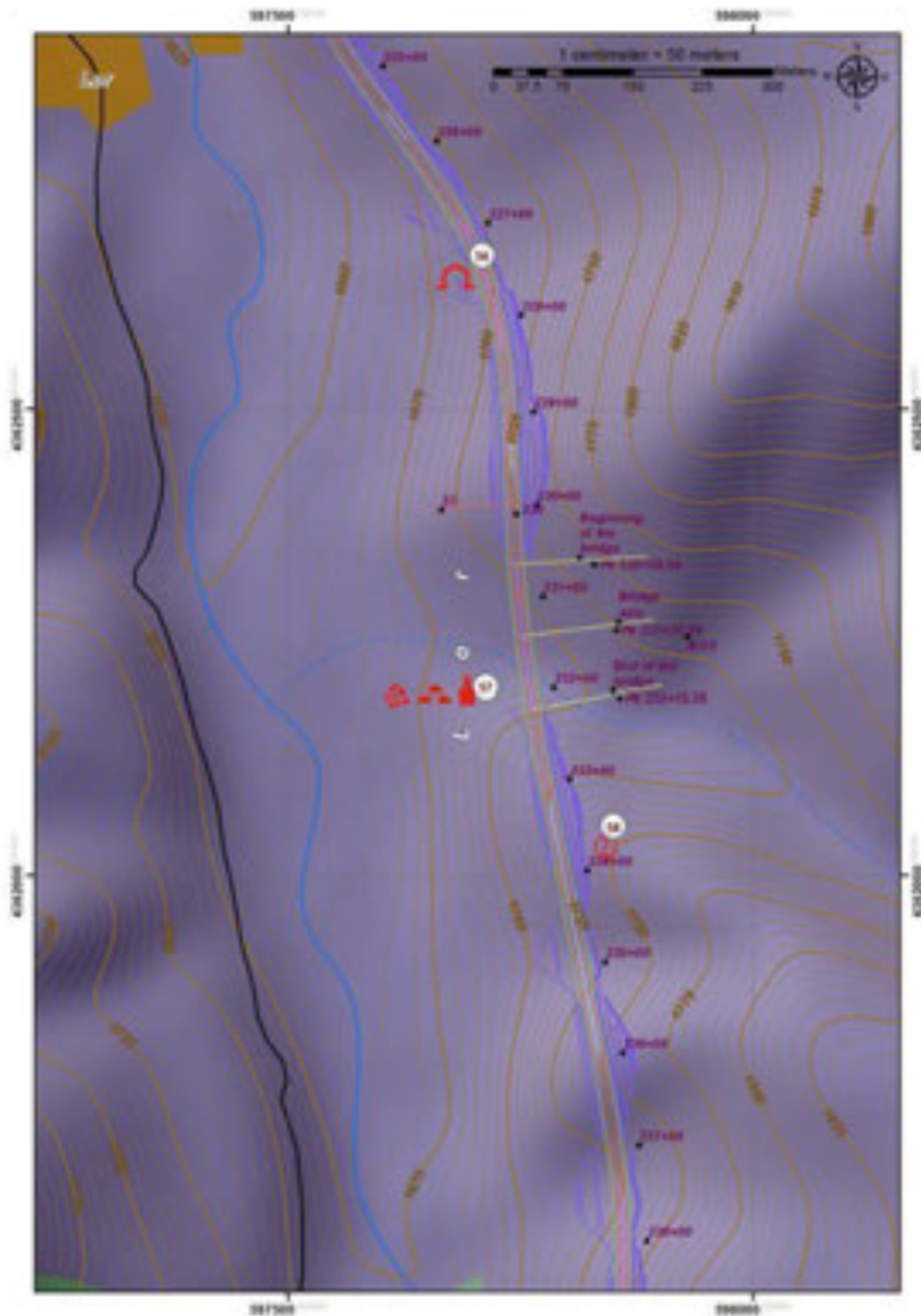




**Units recorded in the area of the Lor community. Sisian-Shenatagh section of the road  
project design - pk 21.2+00 – pk 22.5+00**

(1: 5000)

**Map 19**



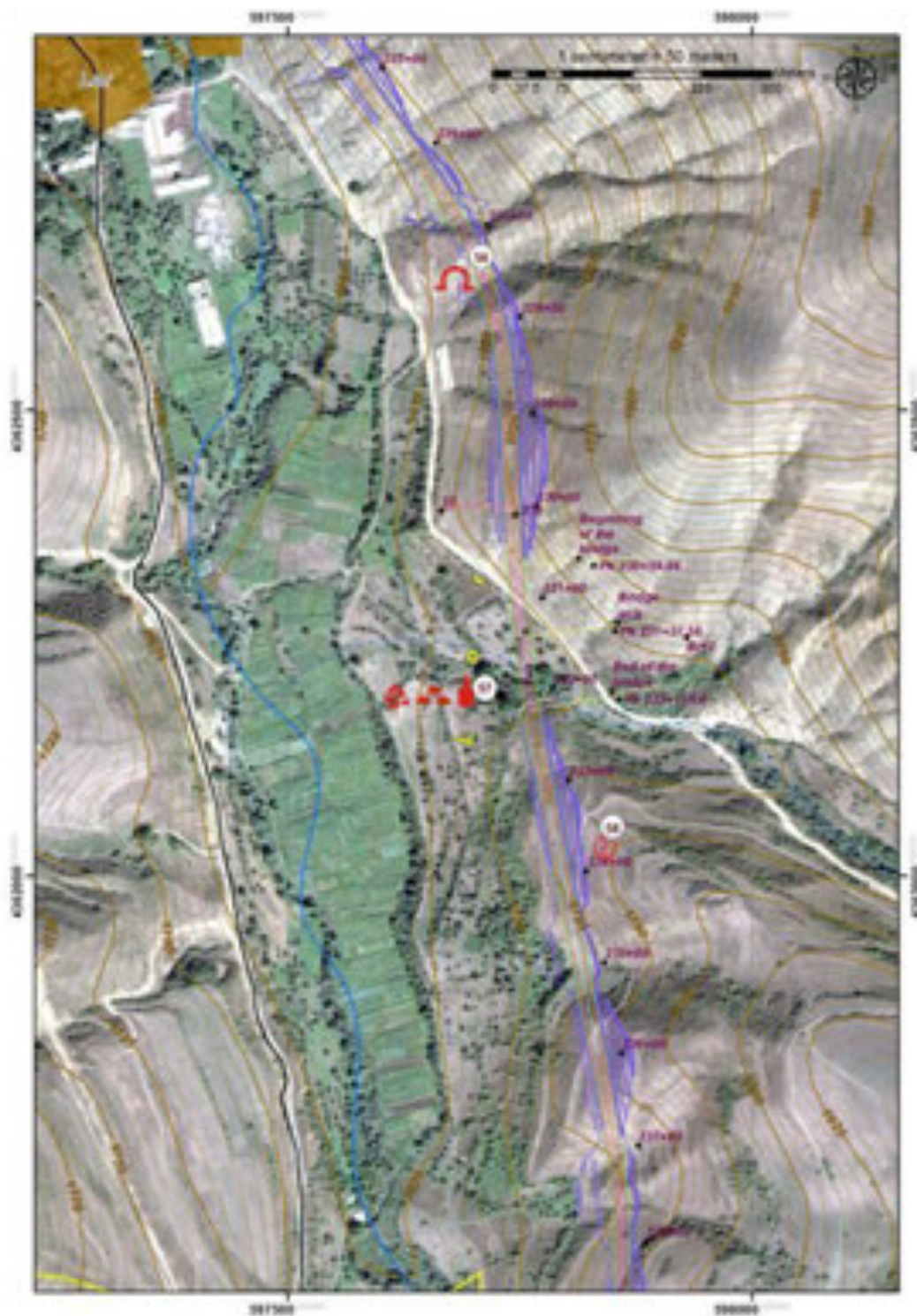




**Units recorded in the area of the Lor community. Sisian-Shenatagh section of the road  
project design - pk 22.5+00 – pk 23.8+00**

(1: 5000)

**Map 19a**

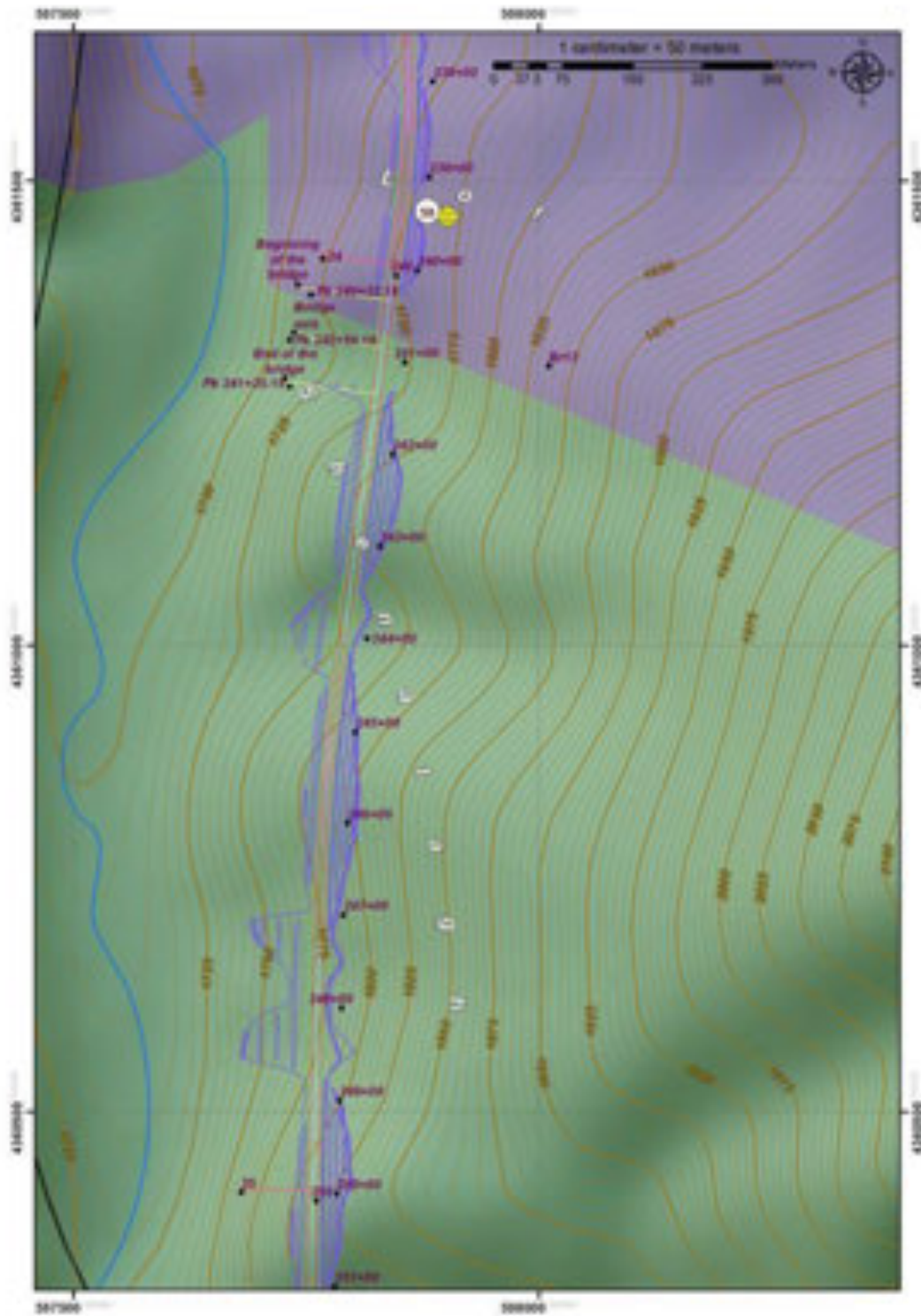




**Units recorded in the area of the Lor community. Sisian-Shenatagh section of the road project design - pk 22.5+00 – pk 23.8+00**

(1: 5000)

Map 20



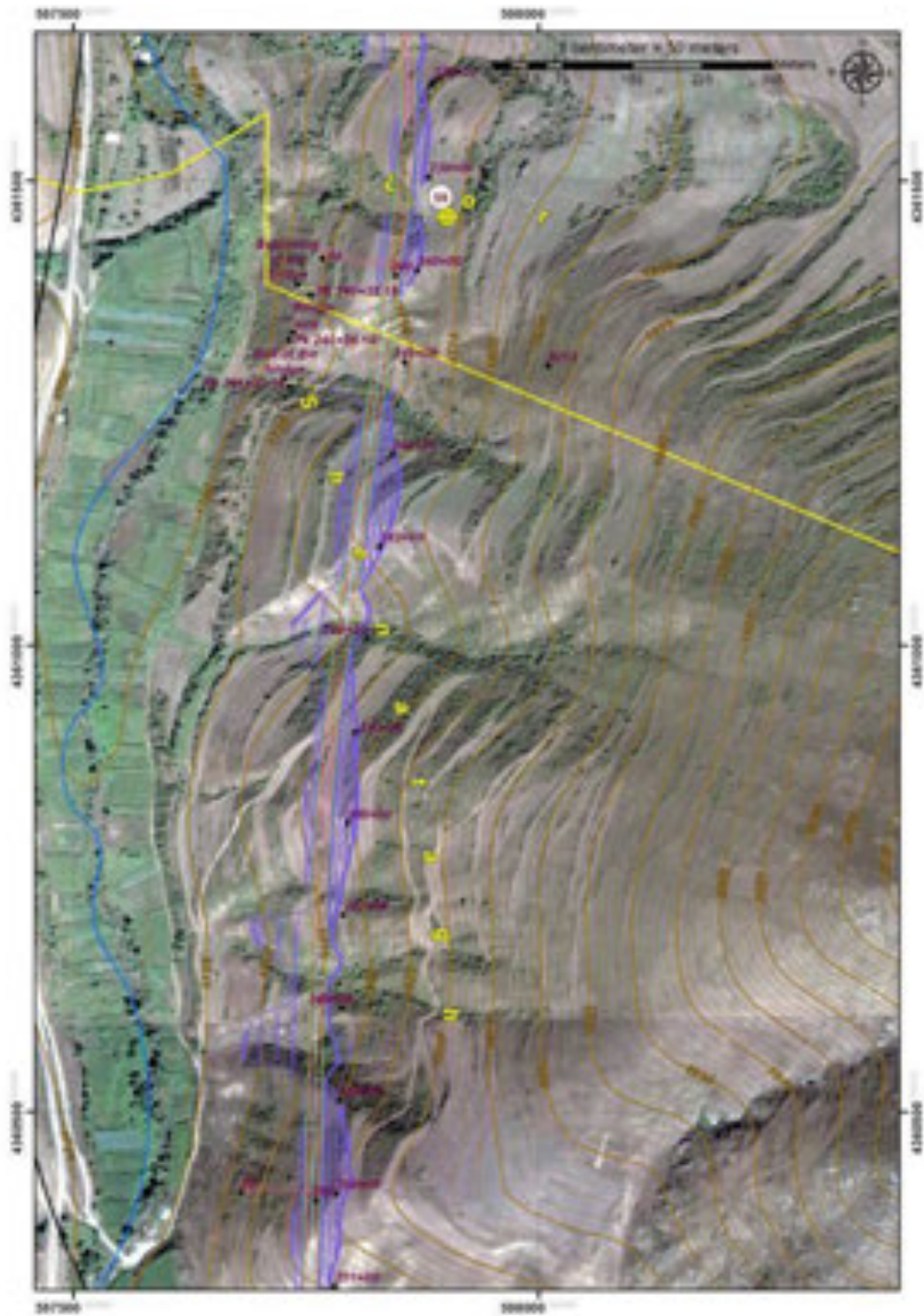




**Units recorded in the areas of the Lor and Shenatagh communities. Sisian-Shenatagh section of the road project design - pk 23.8+00 – pk 25.1+00**

(1: 5000)

**Map 20a**



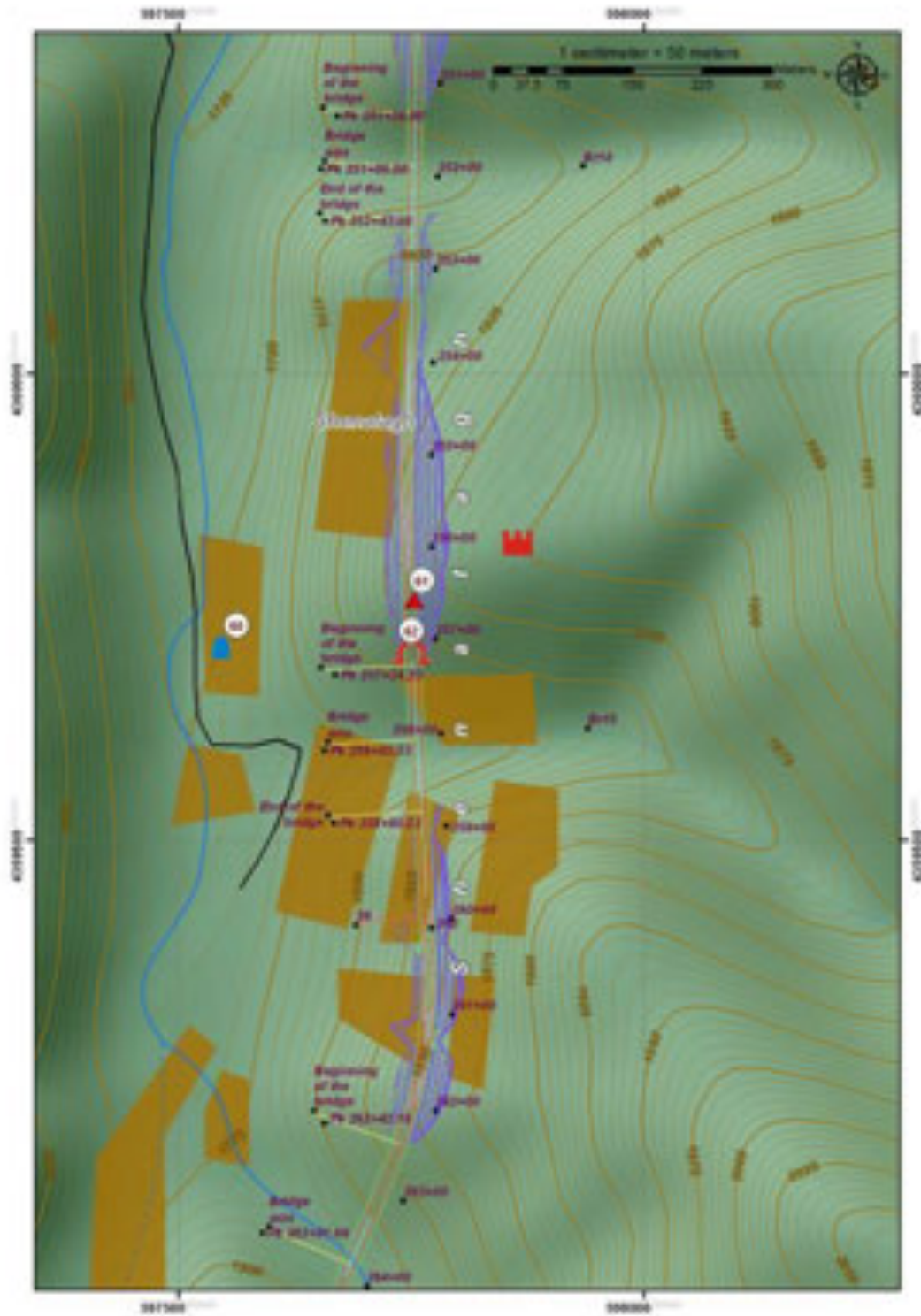




**Units recorded in the areas of the Lor and Shenatagh communities. Sisian-Shenatagh section of the road project design - pk 23.8+00 – pk 25.1+00**

(1: 5000)

**Map 21**

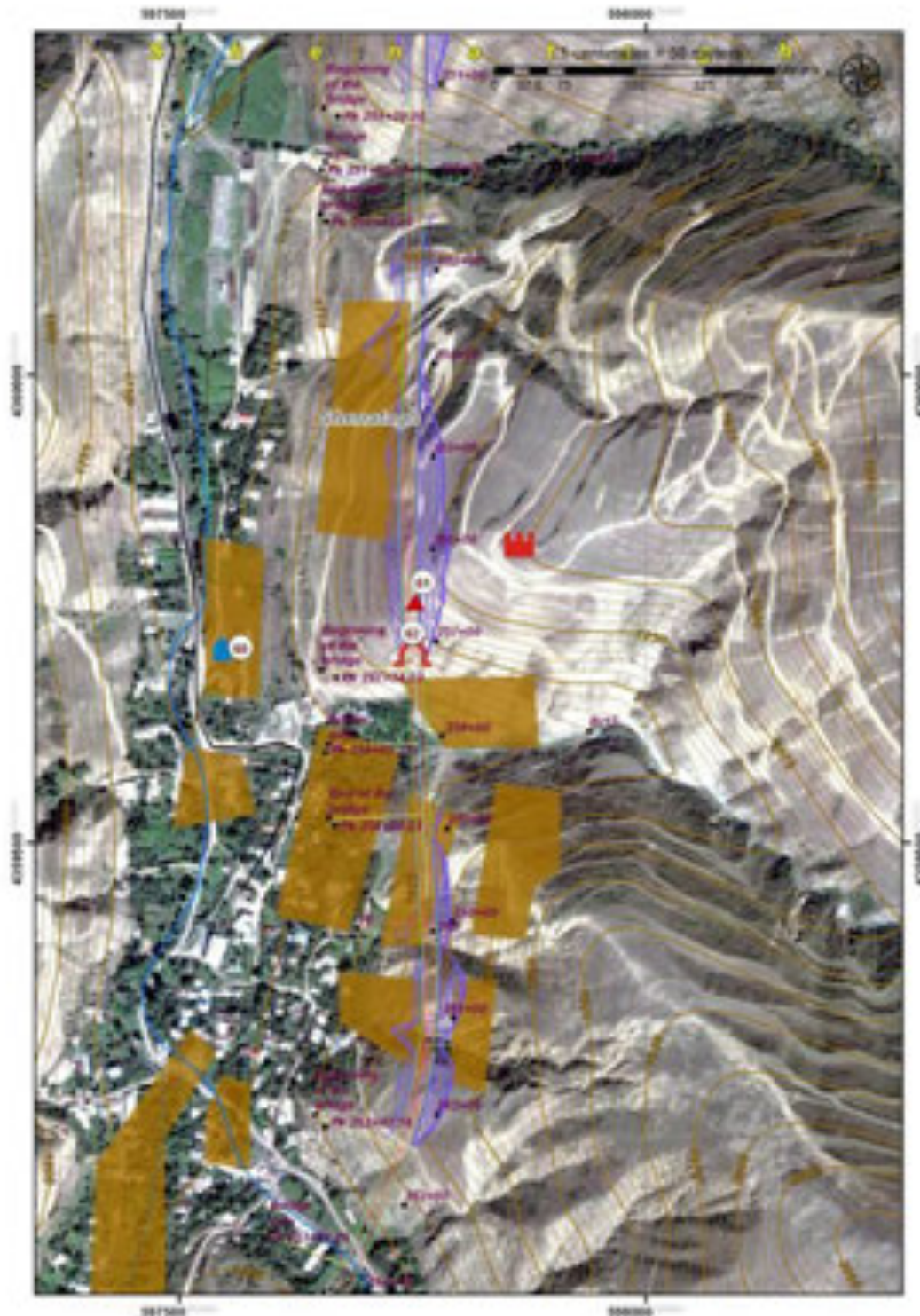




Units recorded in the area of the Shenatagh community. Sisian-Shenatagh section of the road project design - pk 25.1+00 – pk 26.3+00

(1: 5000)

Map 21a

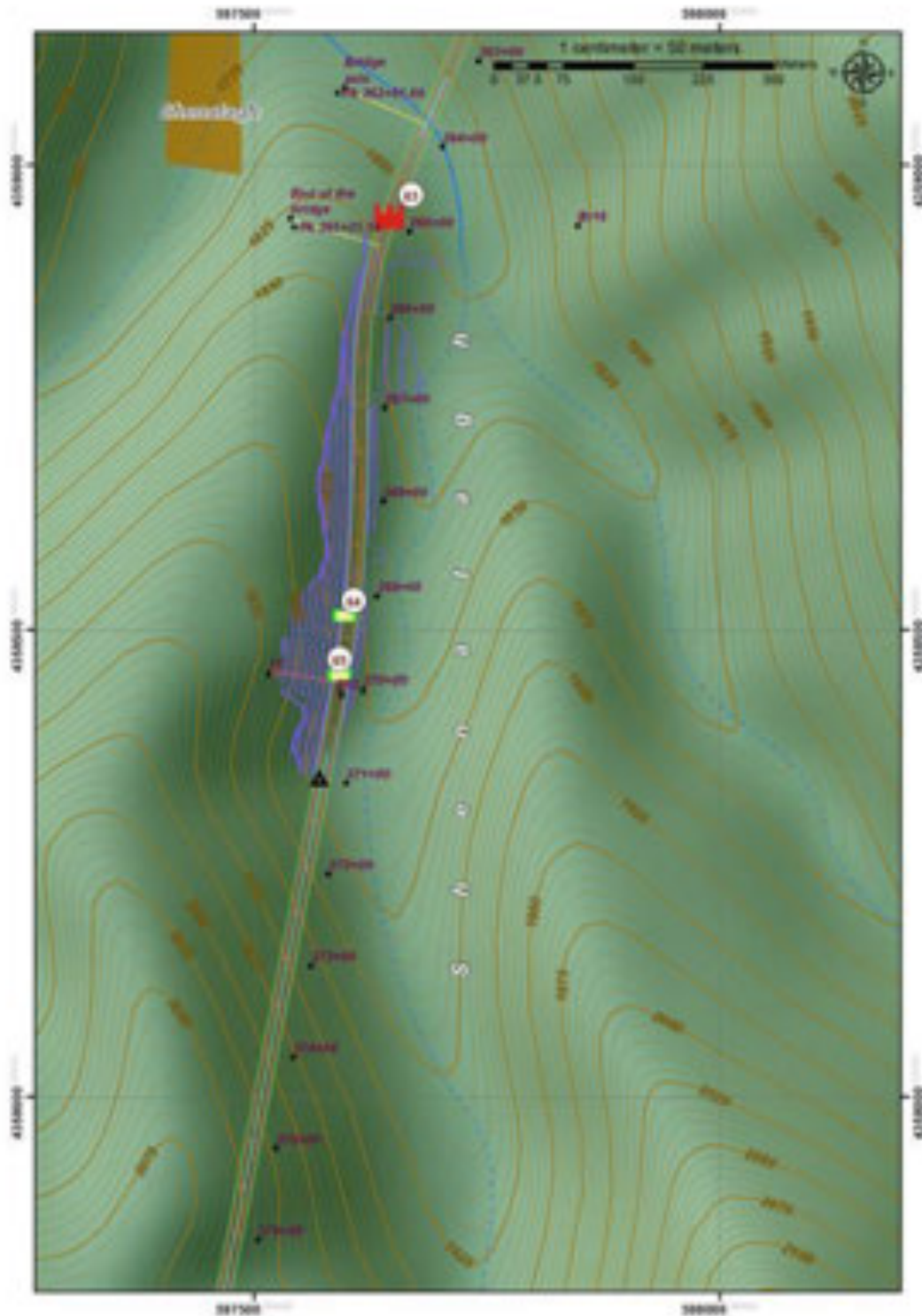




Units recorded in the area of the Shenatagh community. Sisian-Shenatagh section of the road project design - pk 25.1+00 – pk 26.3+00

(1: 5000)

Map 22

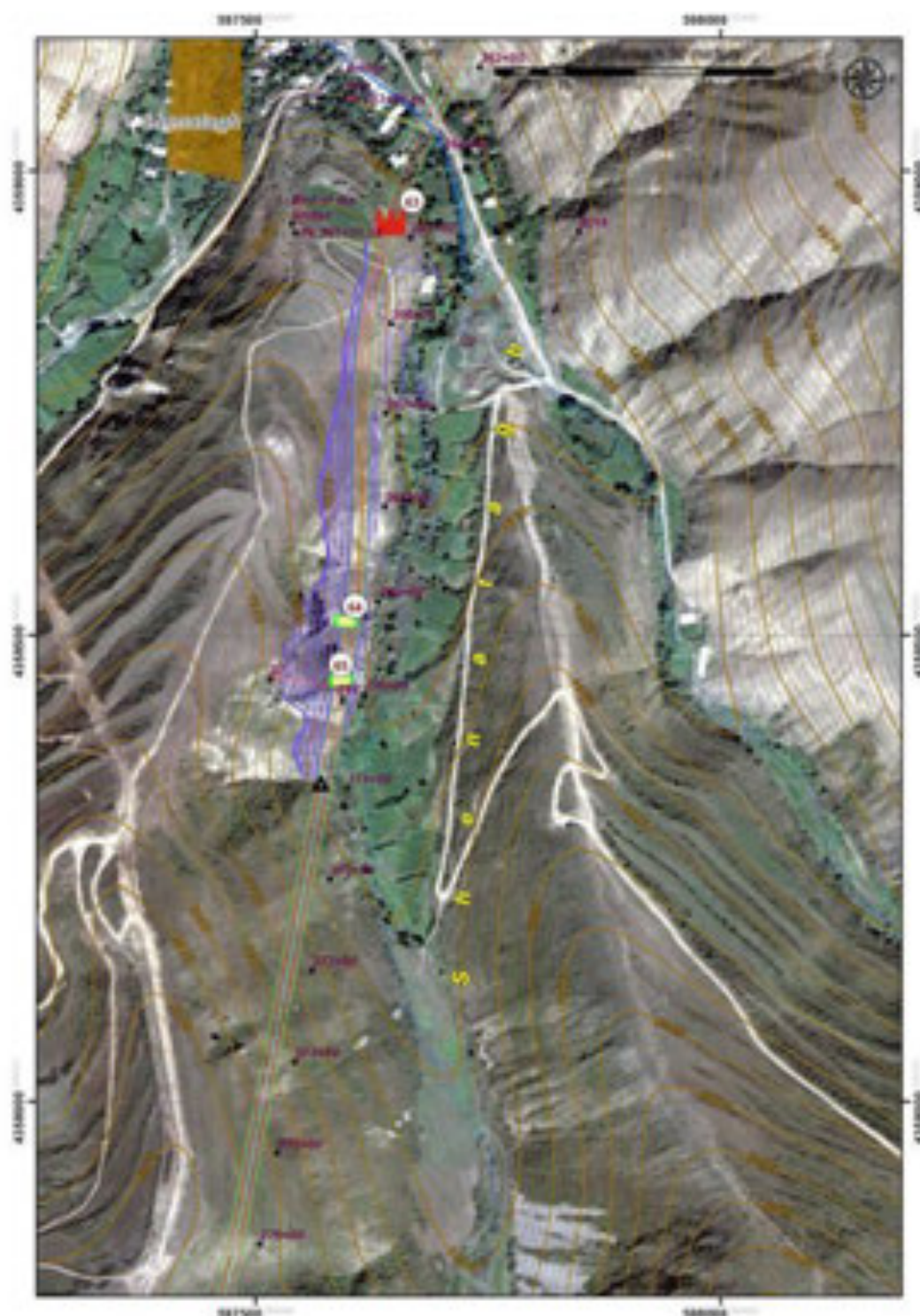




**Units recorded in the area of the Shenatagh community. Sisian-Shenatagh section of the road project design - pk 26.3+00 – pk 27.6+00**

**(1: 5000)**

### Map 22a

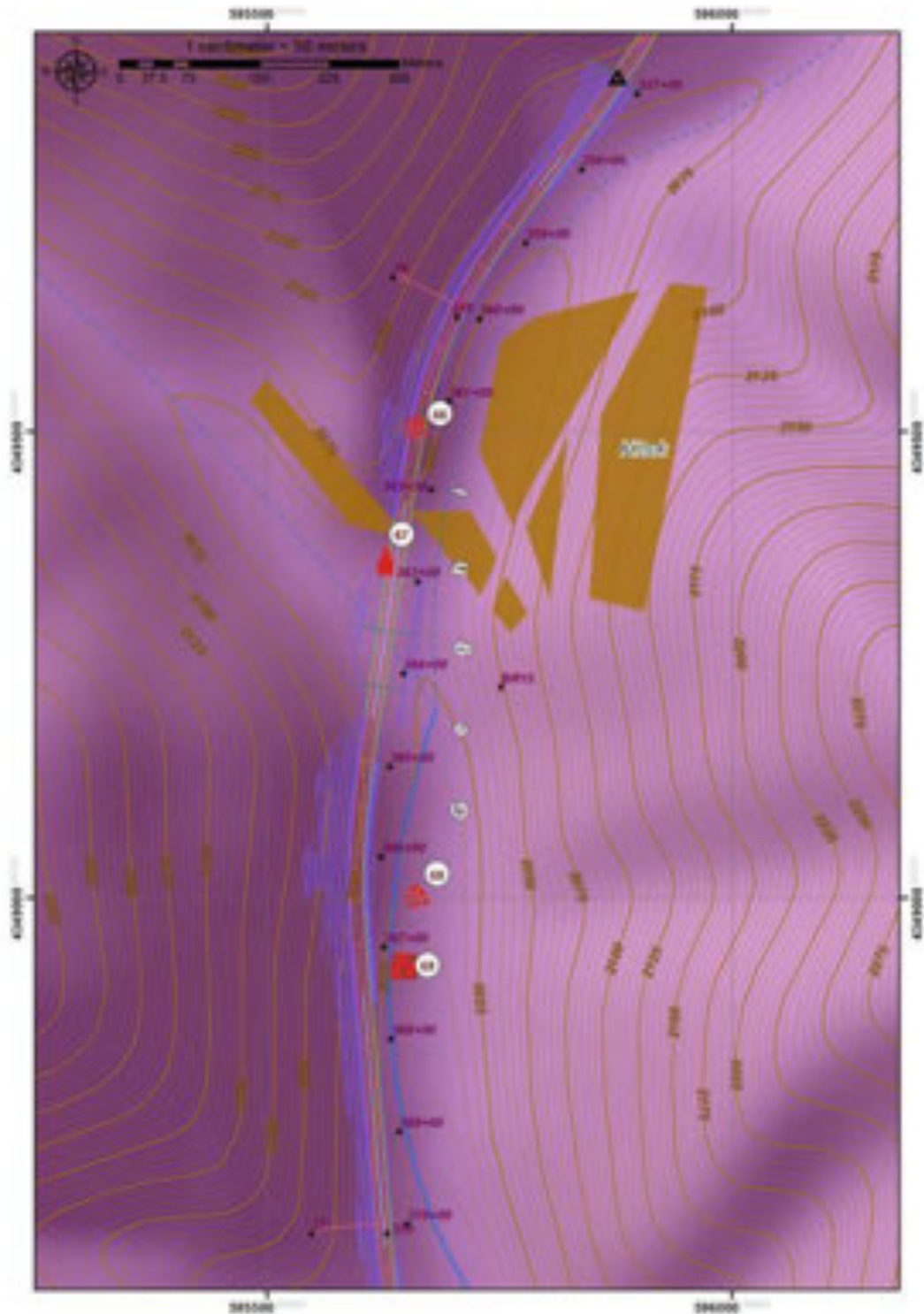




Units recorded in the area of the Shenatagh community. Sisian-Shenatagh section of the road project design - pk 26.3+00 – pk 27.6+00

(1: 5000)

Map 23







Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road project design - pk 35.7+00 – pk 37.0+00

(1: 5000)

Map 23a



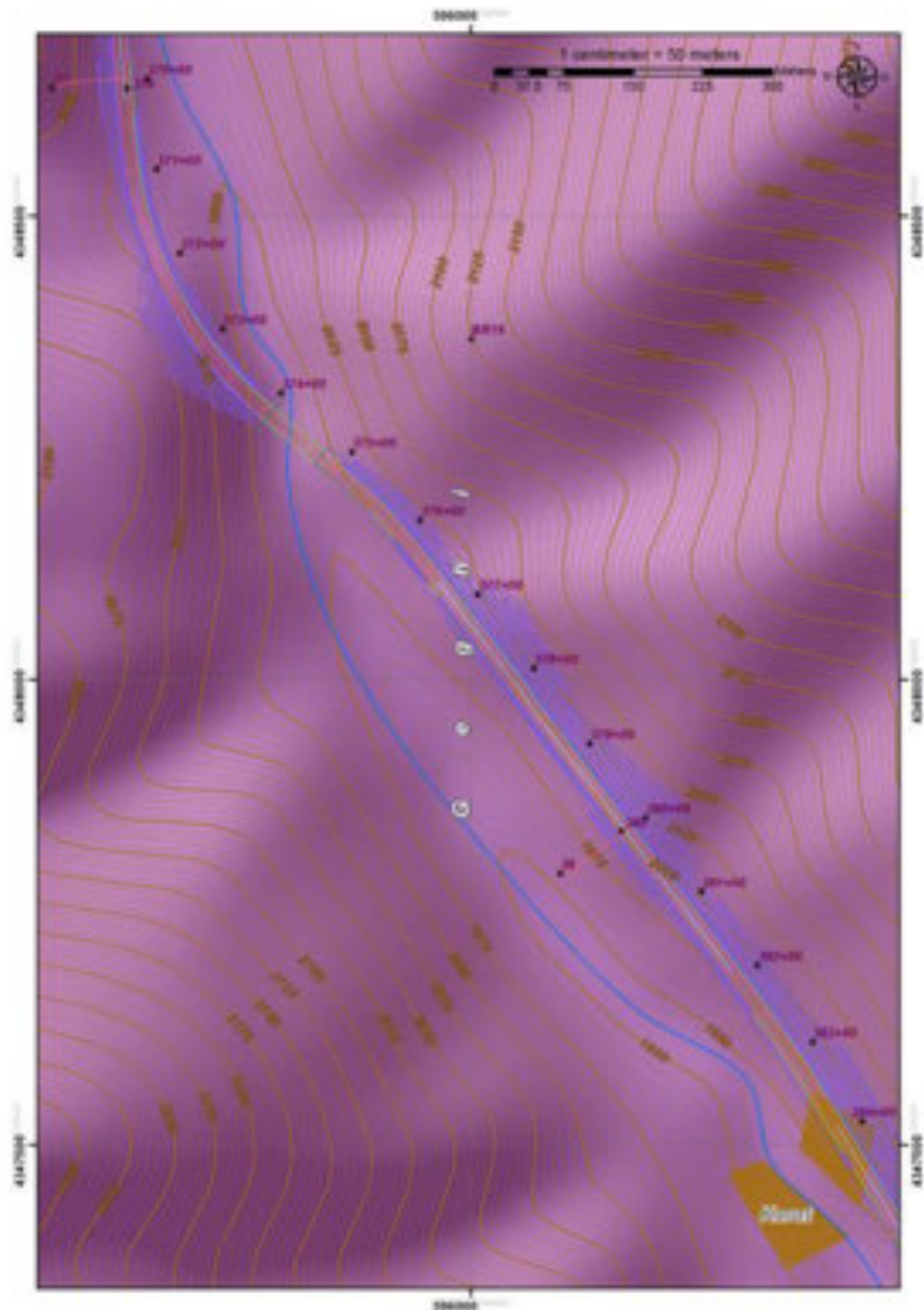




Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 35.7+00 – pk 37.0+00

(1: 5000)

Map 24



**Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 37.0+00 – pk 38.4+00**

**(1: 5000)**

### Map 24a

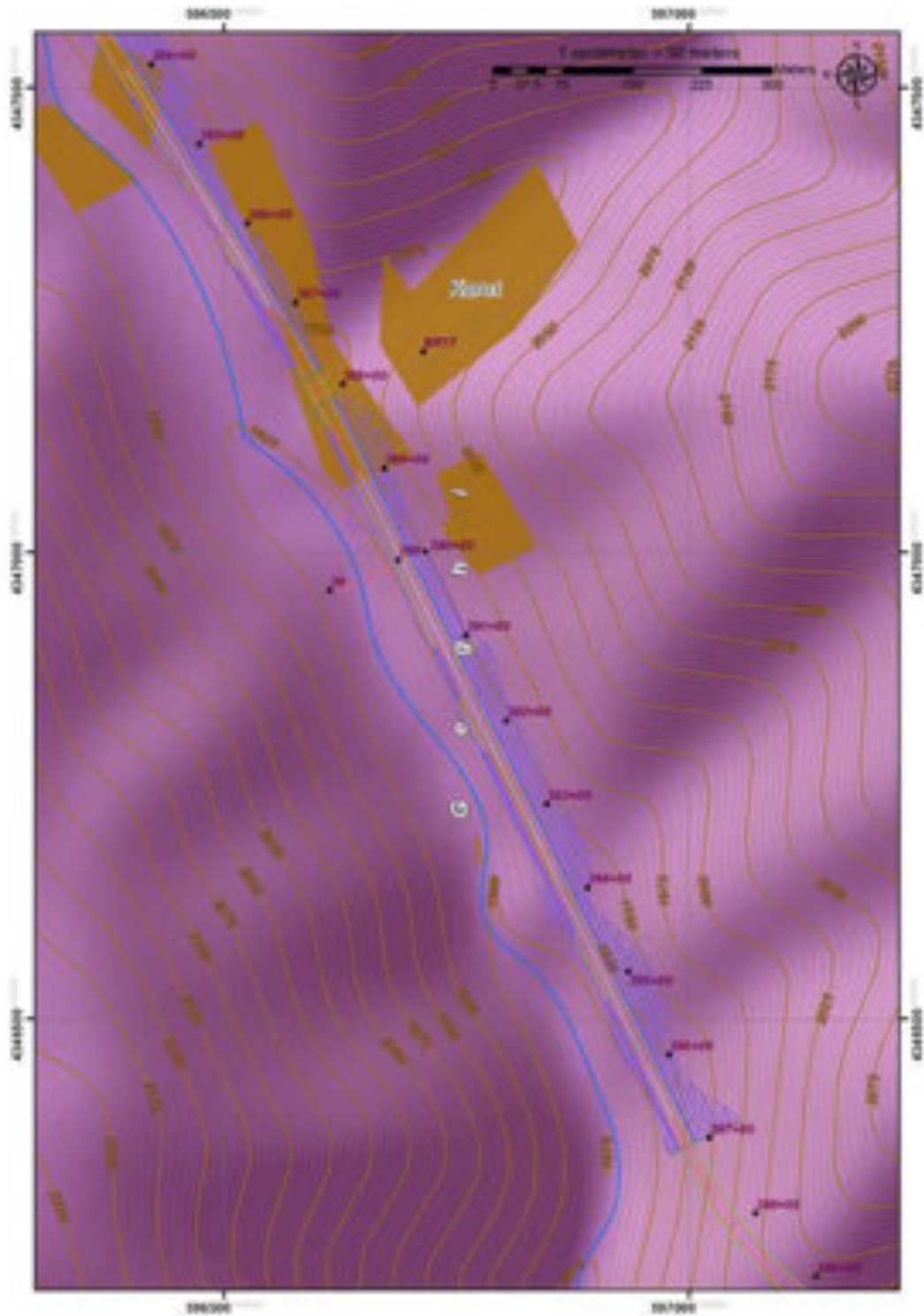




Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 37.0+00 – pk 38.4+00

(1: 5000)

Map 25







Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 38.4+00 – pk 39.9+00

(1: 5000)

Map 25a

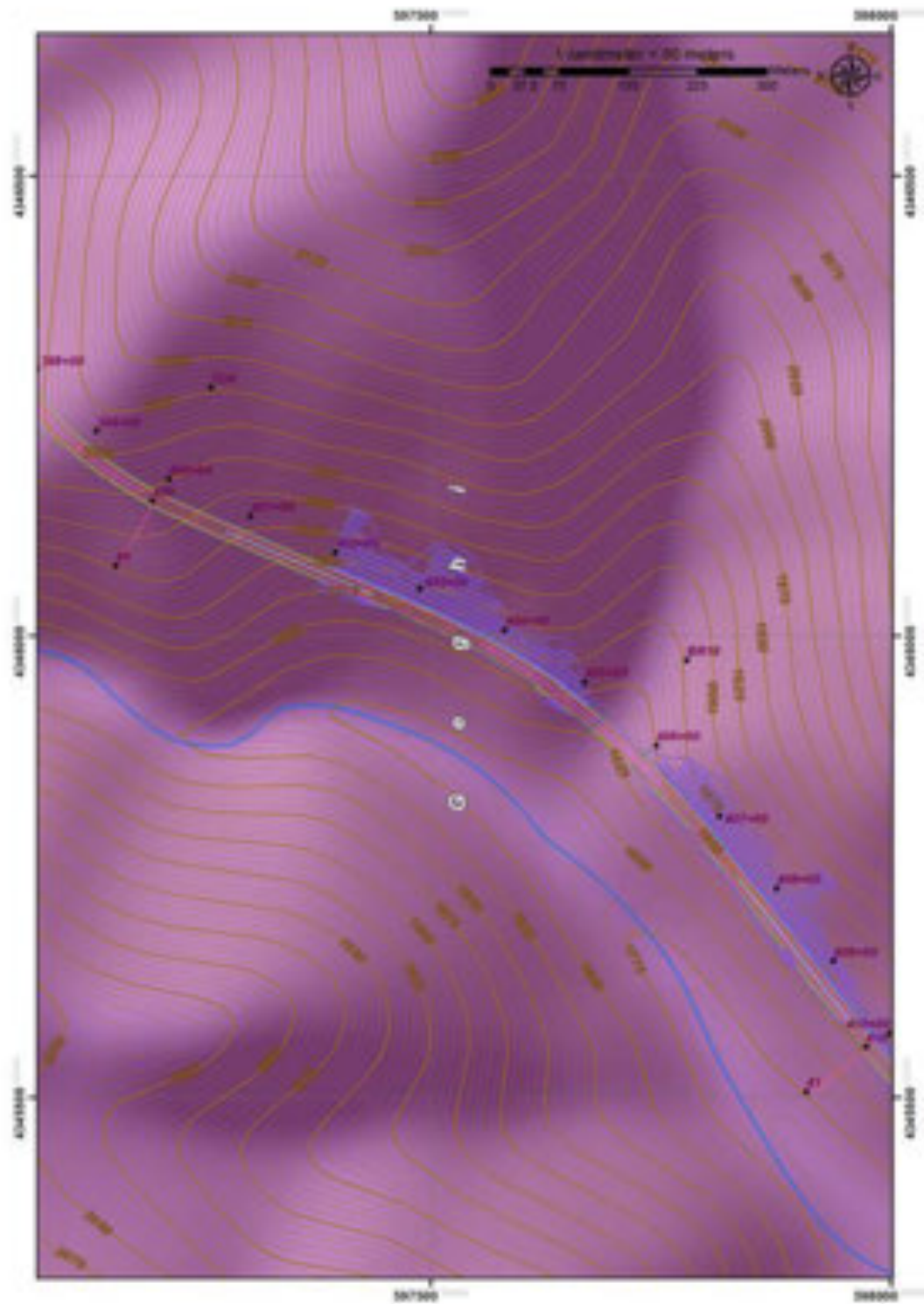




**Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 38.4+00 – pk 39.9+00**

(1: 5000)

**Map 26**

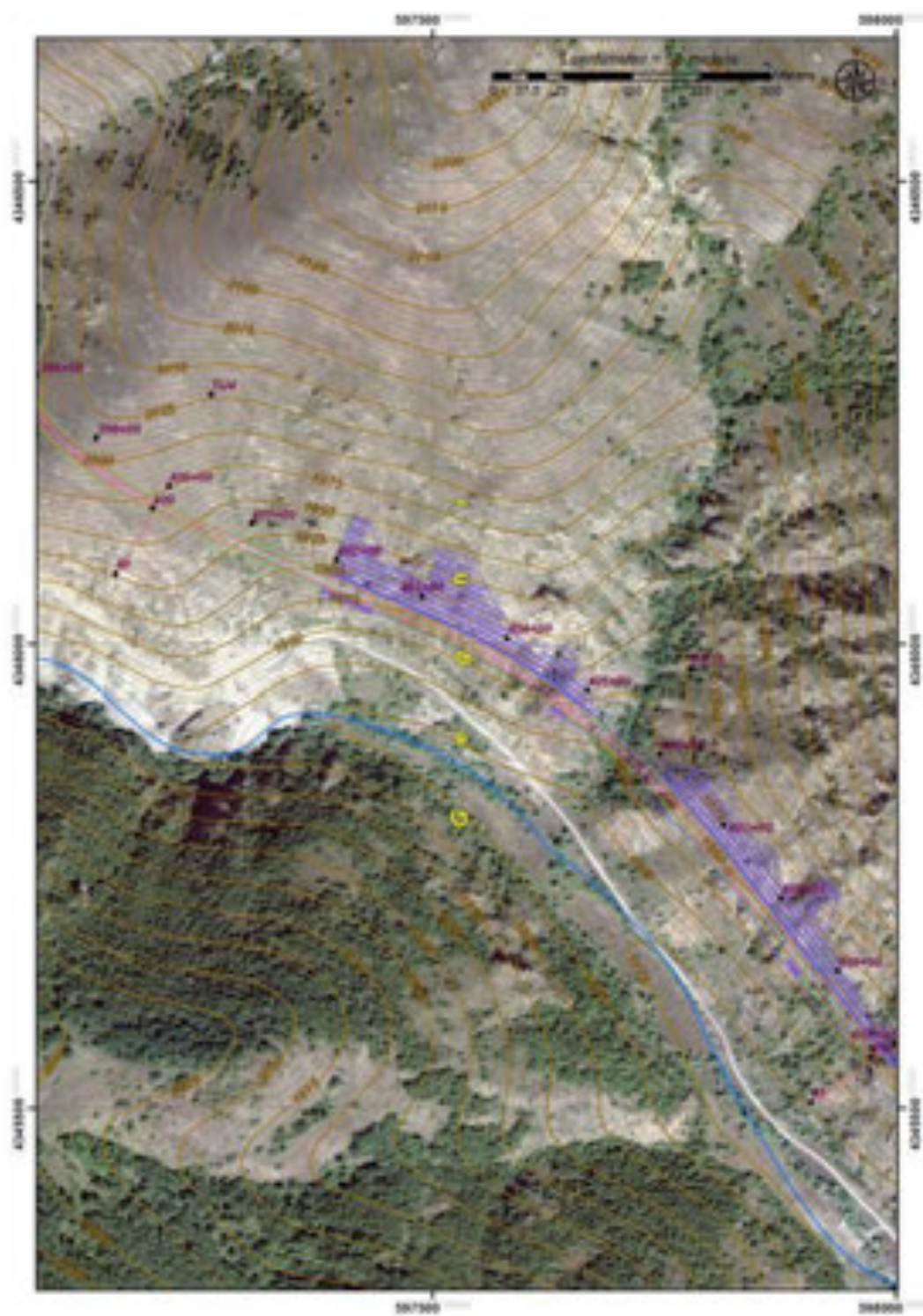




**Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road project design - pk 39.9+00 – pk 41.0+00**

**(1: 5000)**

### Map 26a

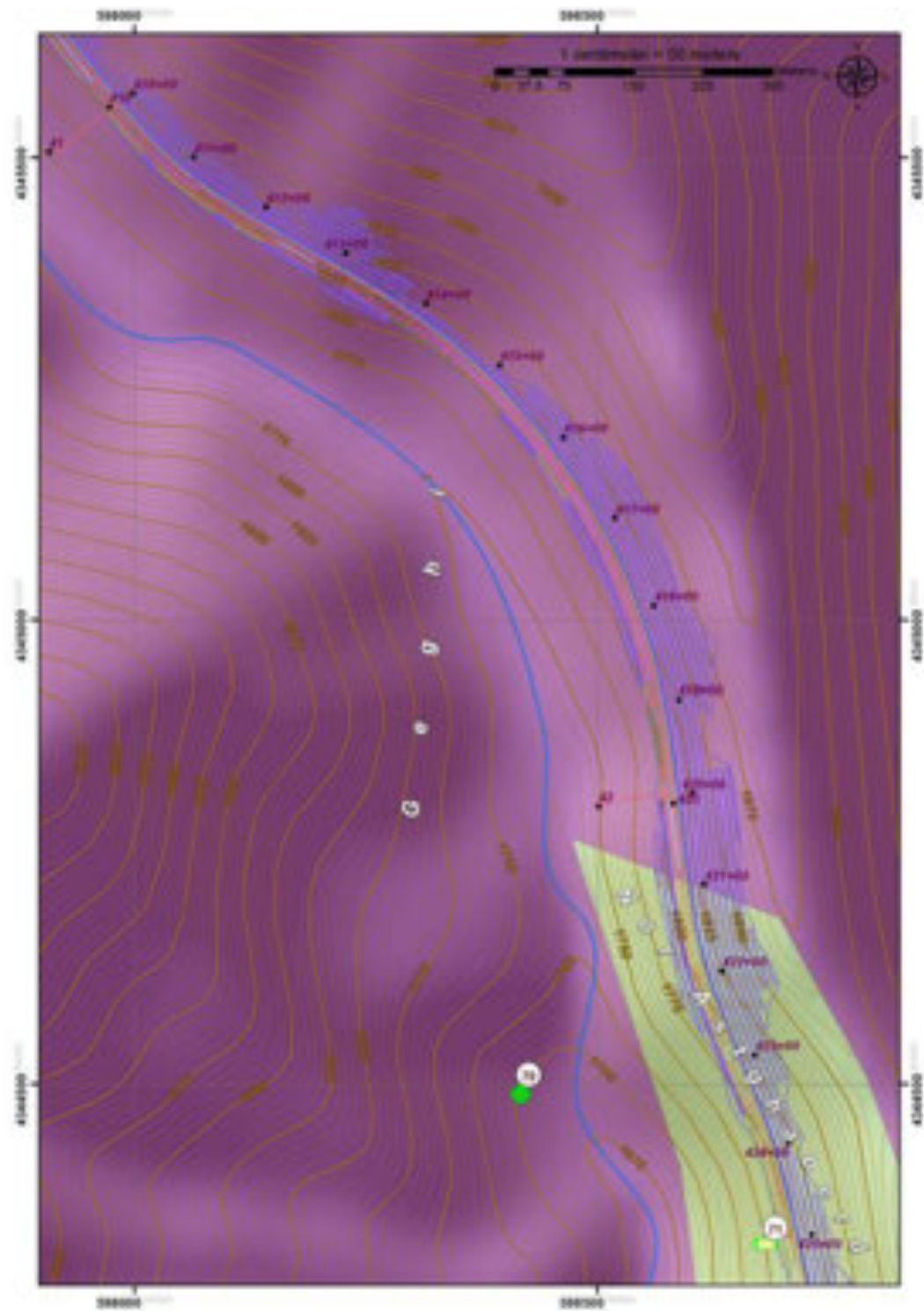




Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 39.9+00 – pk 41.0+00

(1: 5000)

Map 27

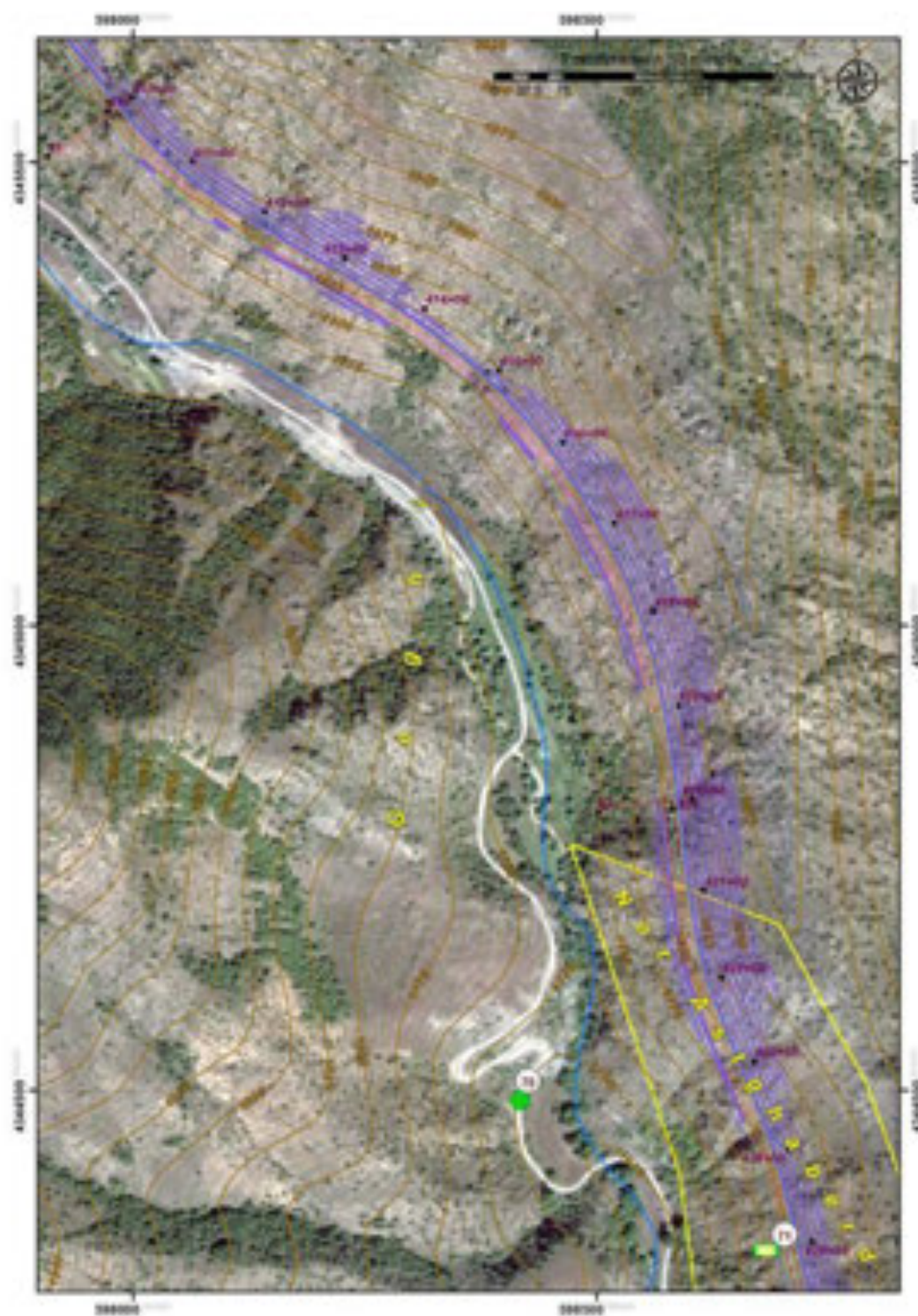




**Units recorded in the areas of the Geghi and Nor Astghaberd communities. Geghi-Kajaran section of the road project design - pk 41.0+00 – pk 42.5+00**

**(1: 5000)**

### Map 27a

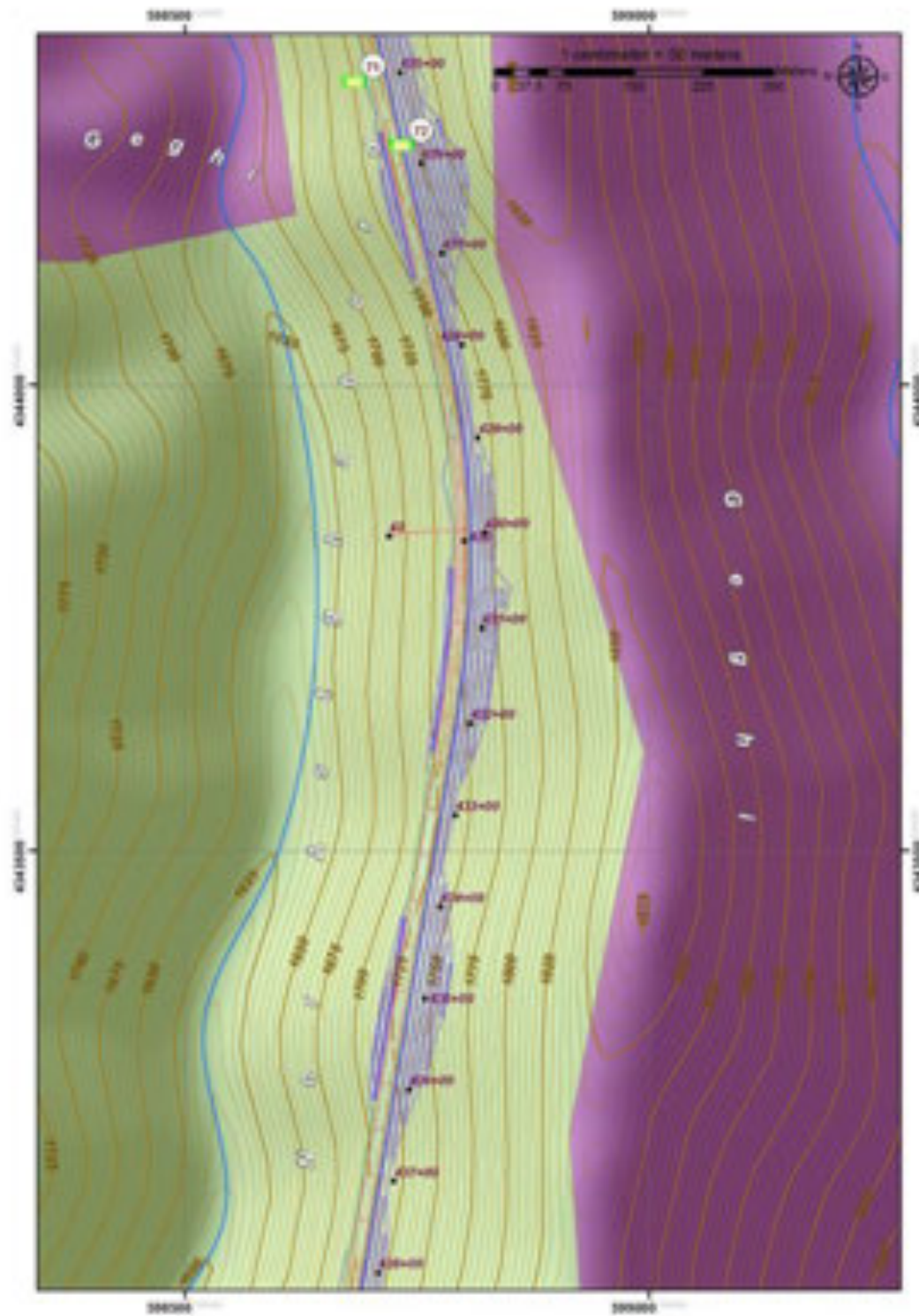




Units recorded in the areas of the Geghi and Nor Astghaberd communities. Geghi-Kajaran section of the road project design - pk 41.0+00 – pk 42.5+00

(1: 5000)

Map 28



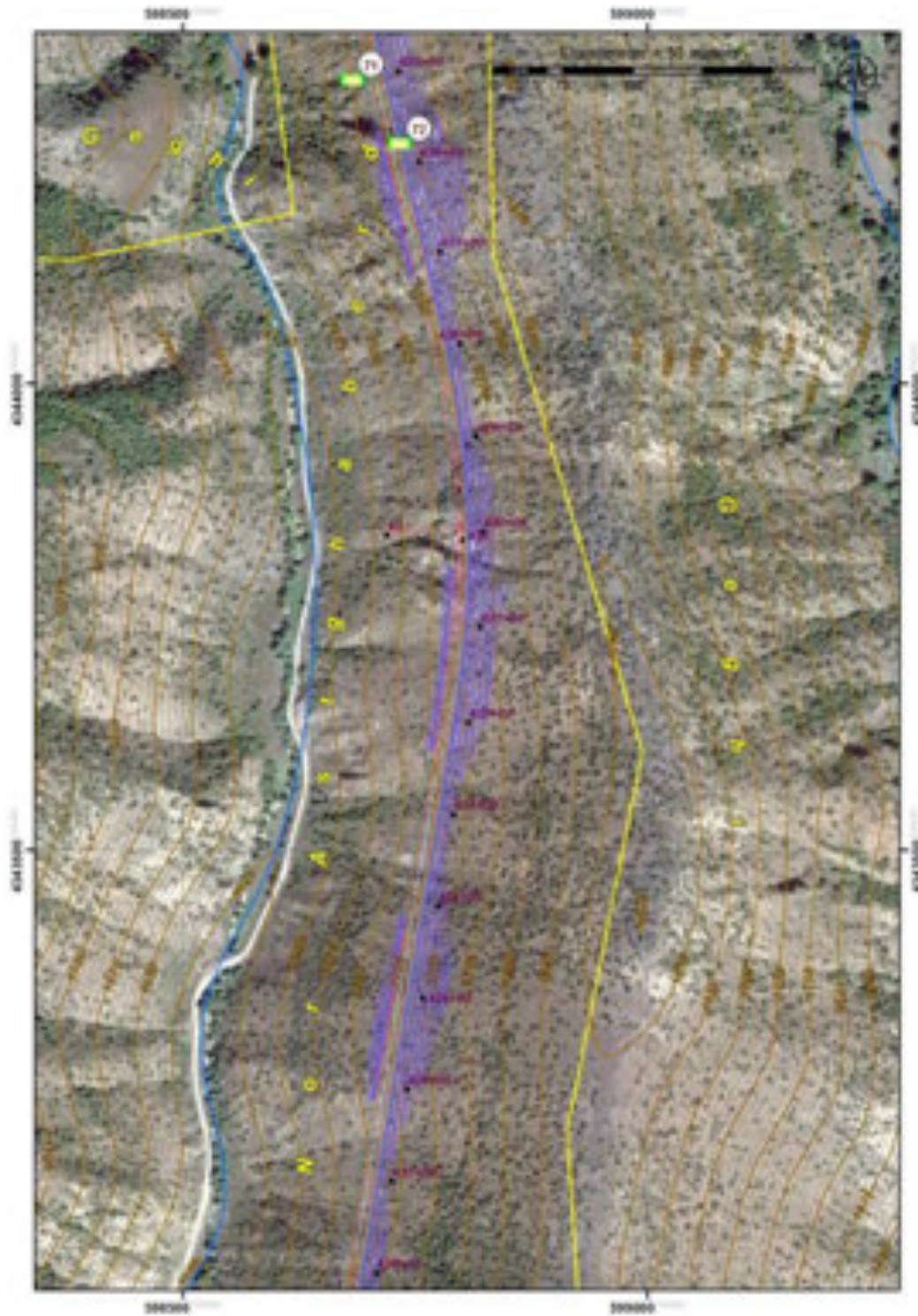




Units recorded in the area of the Nor Astghaberd community. Geghi-Kajaran section of the road project design - pk 42.5+00 – pk 43.8+00

(1: 5000)

Map 28a



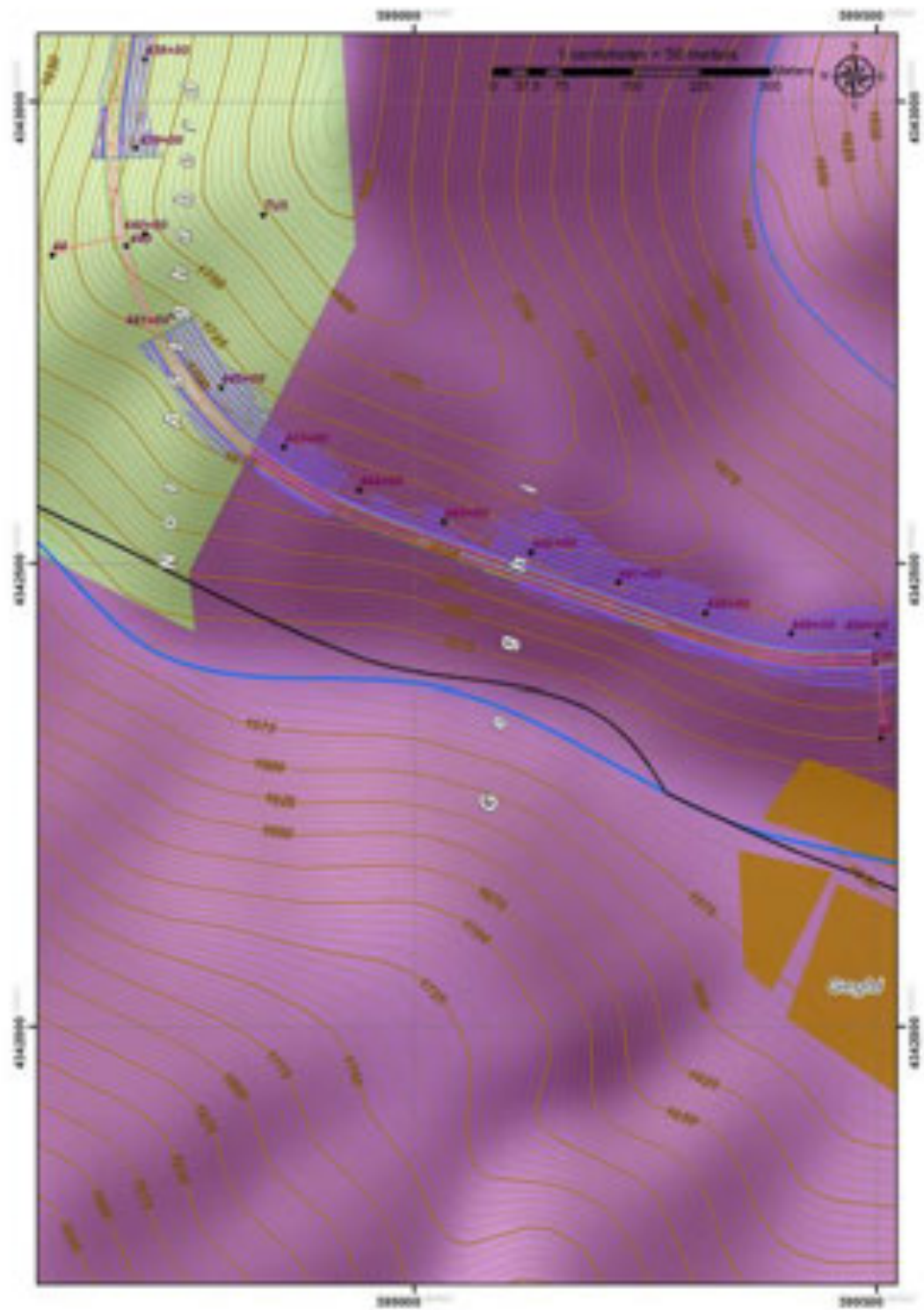




Units recorded in the area of the Nor Astghaberd community. Geghi-Kajaran section of the road project design - pk 42.5+00 – pk 43.8+00

(1: 5000)

Map 29





Units recorded in the areas of the Nor Astghaberd and Geghi communities. Geghi-Kajaran section of the road project design - pk 43.8+00 – pk 45.0+00

(1: 5000)

Map 29a



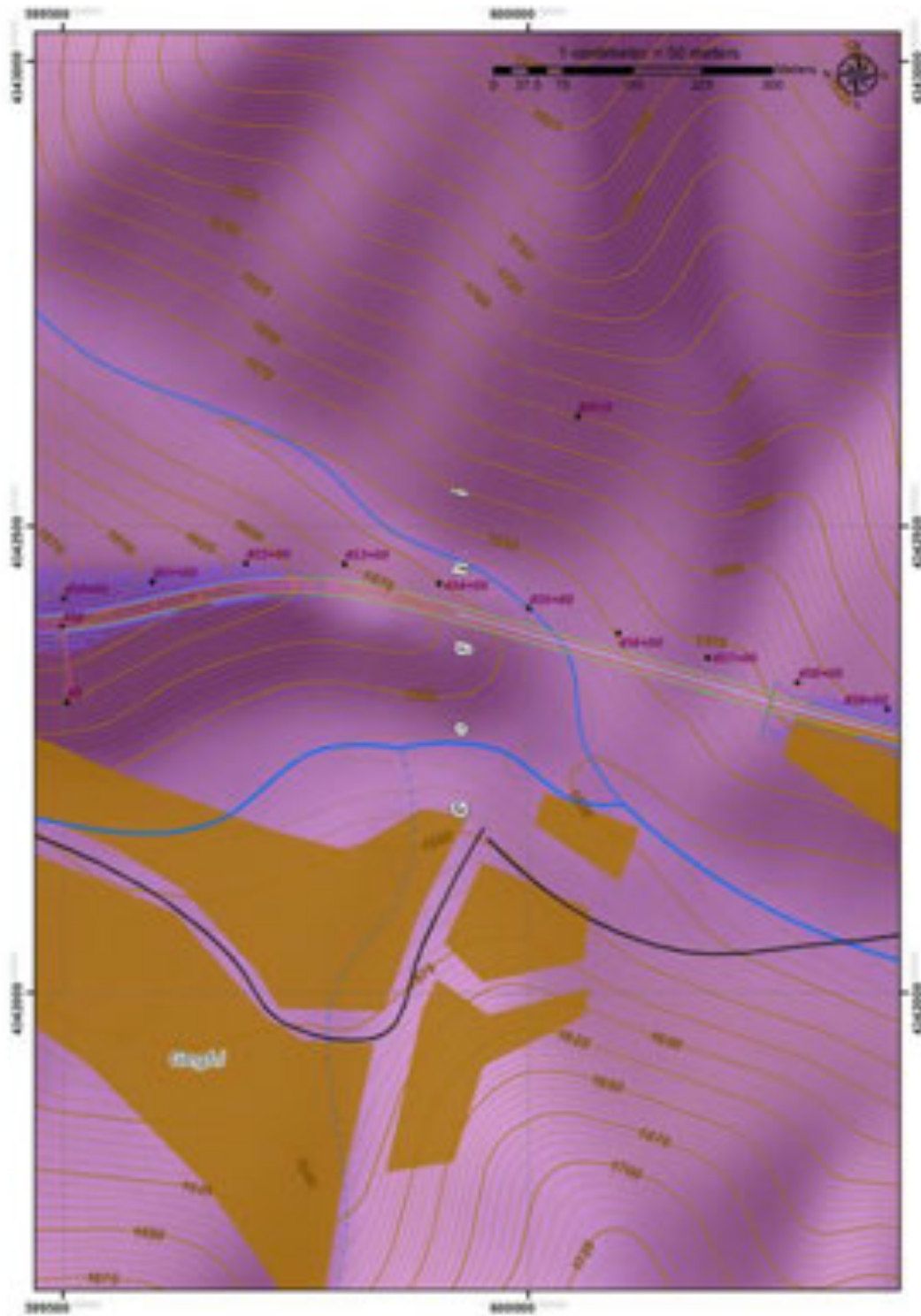




Units recorded in the areas of the Nor Astghaberd and Geghi communities. Geghi-Kajaran section of the road project design - pk 43.8+00 – pk 45.0+00

(1: 5000)

Map 30

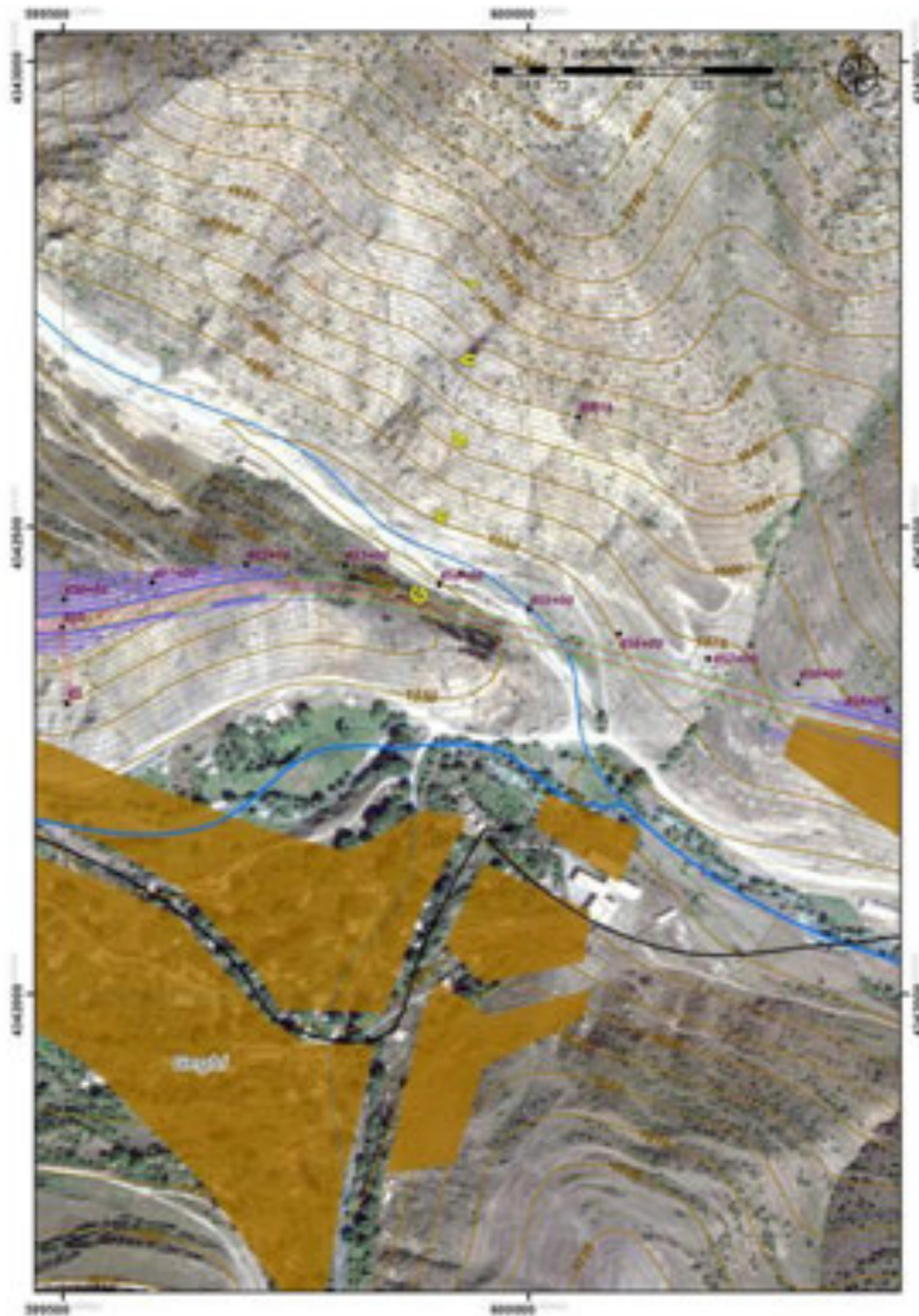




Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 45.0+00 – pk 45.9+00

(1: 5000)

Map 30a

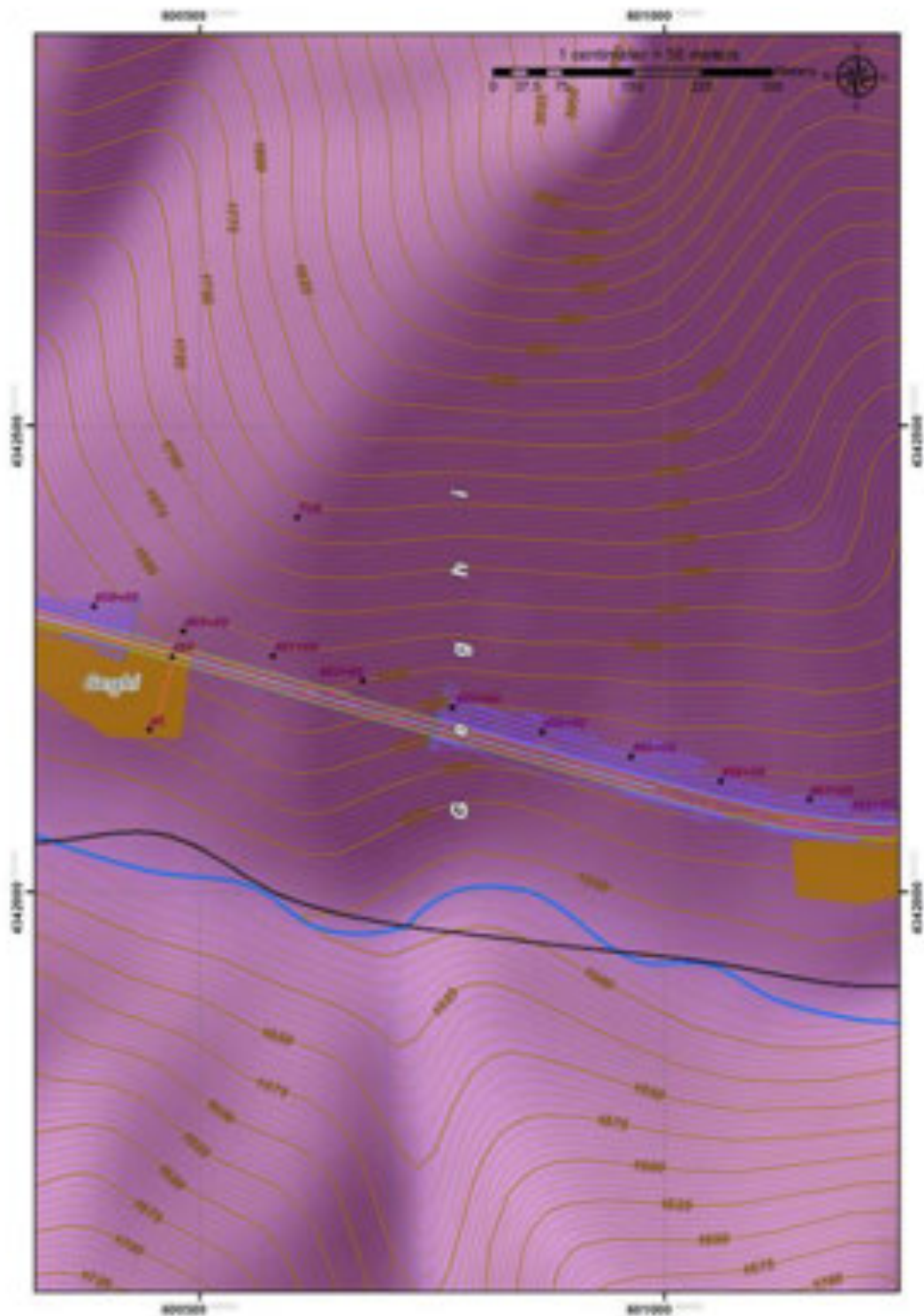




**Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 45.0+00 – pk 45.9+00**

(1: 5000)

**Map 31**



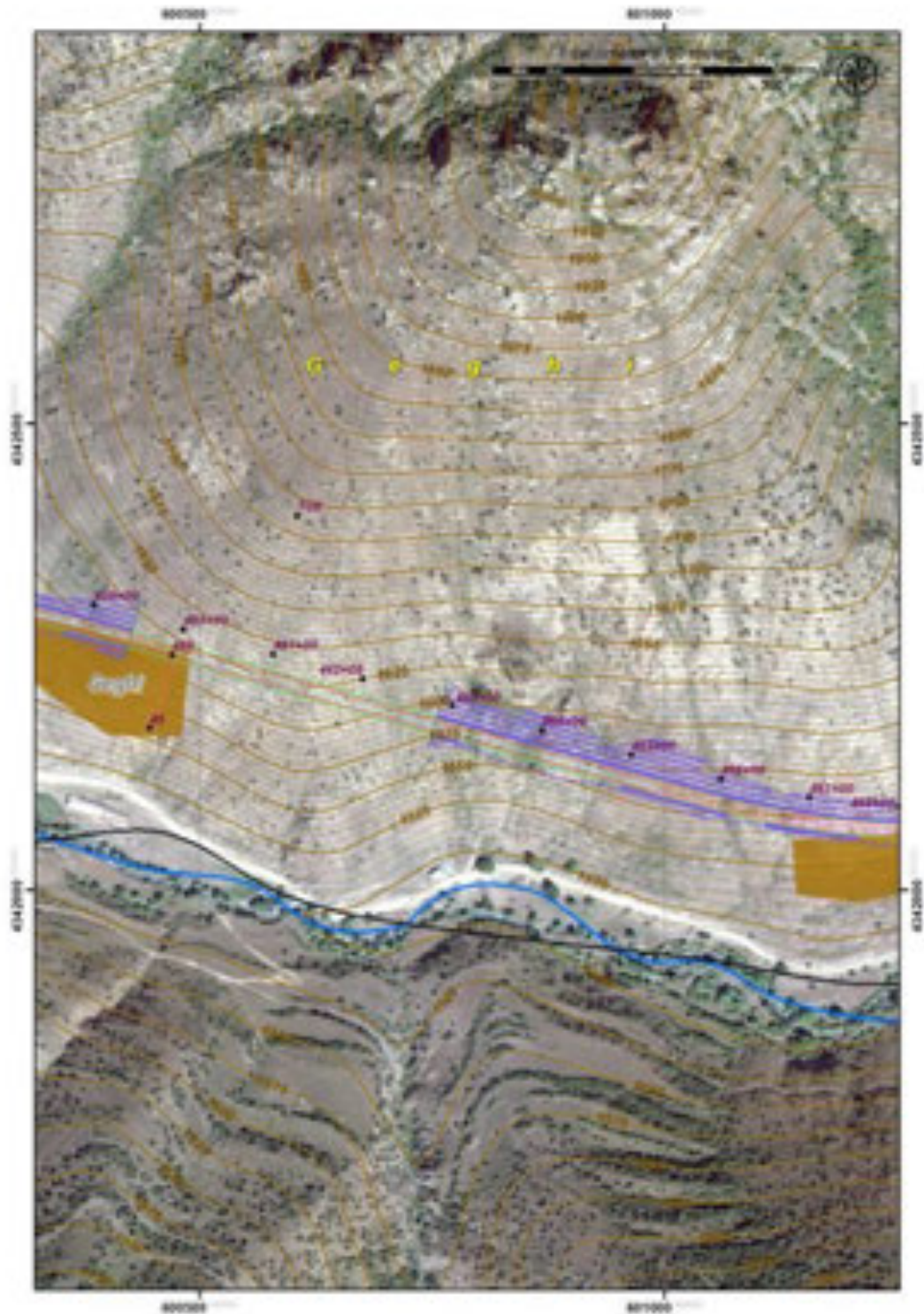




Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 45.9+00 – pk 46.7+00

(1: 5000)

Map 31a

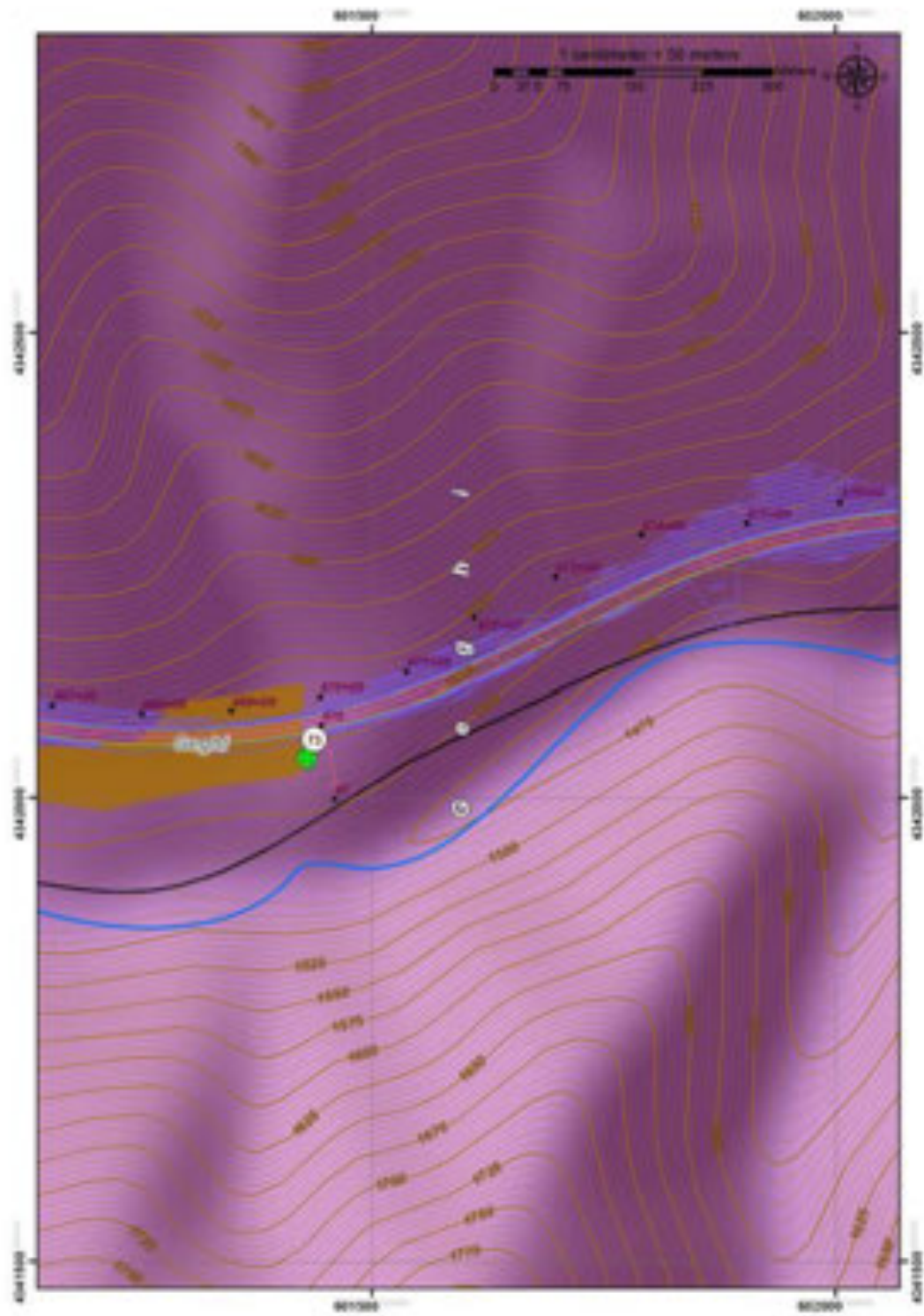




Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 45.9+00 – pk 46.7+00

(1: 5000)

Map 32



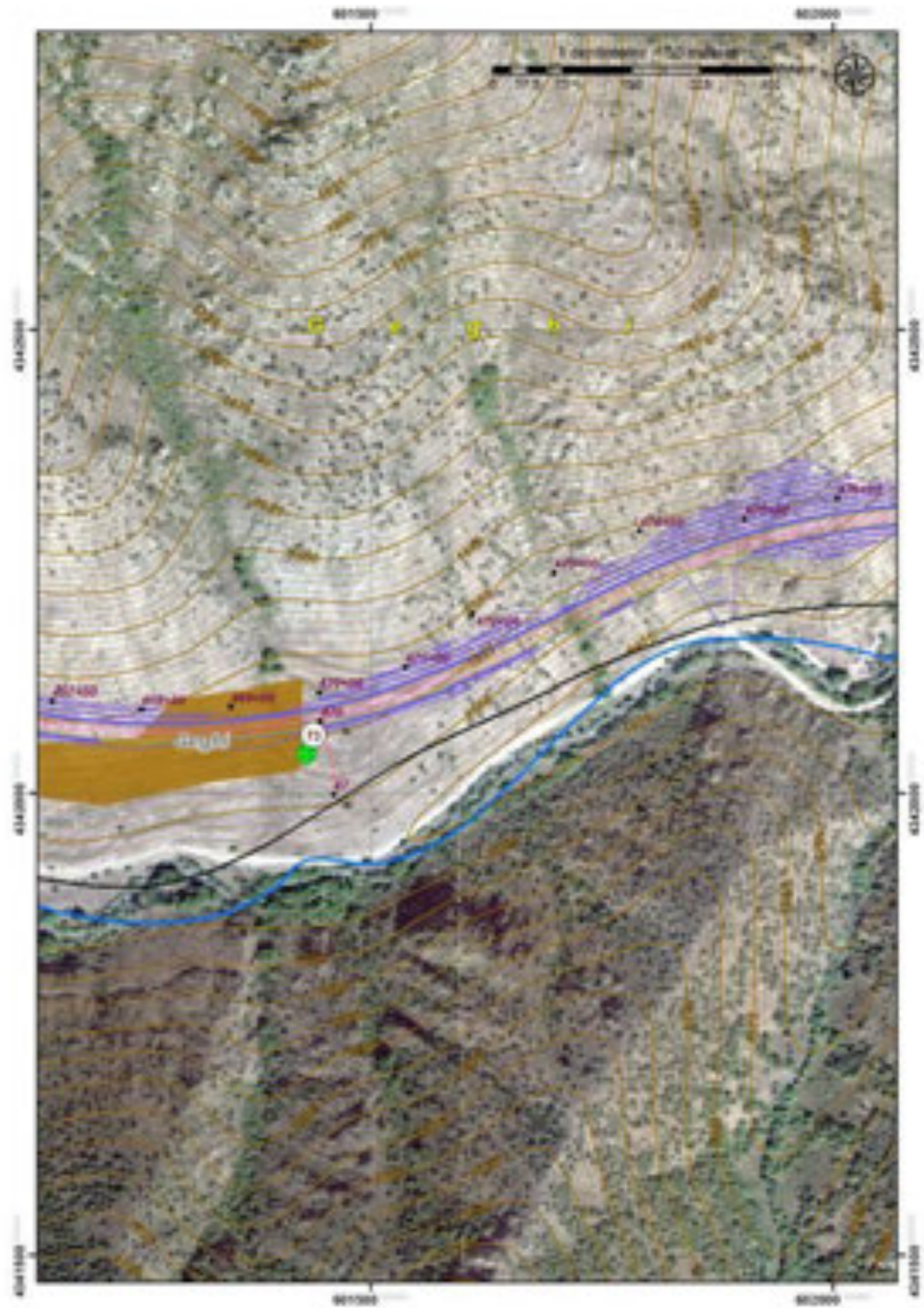




Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 46.7+00 – pk 47.6+00

(1: 5000)

Map 32a

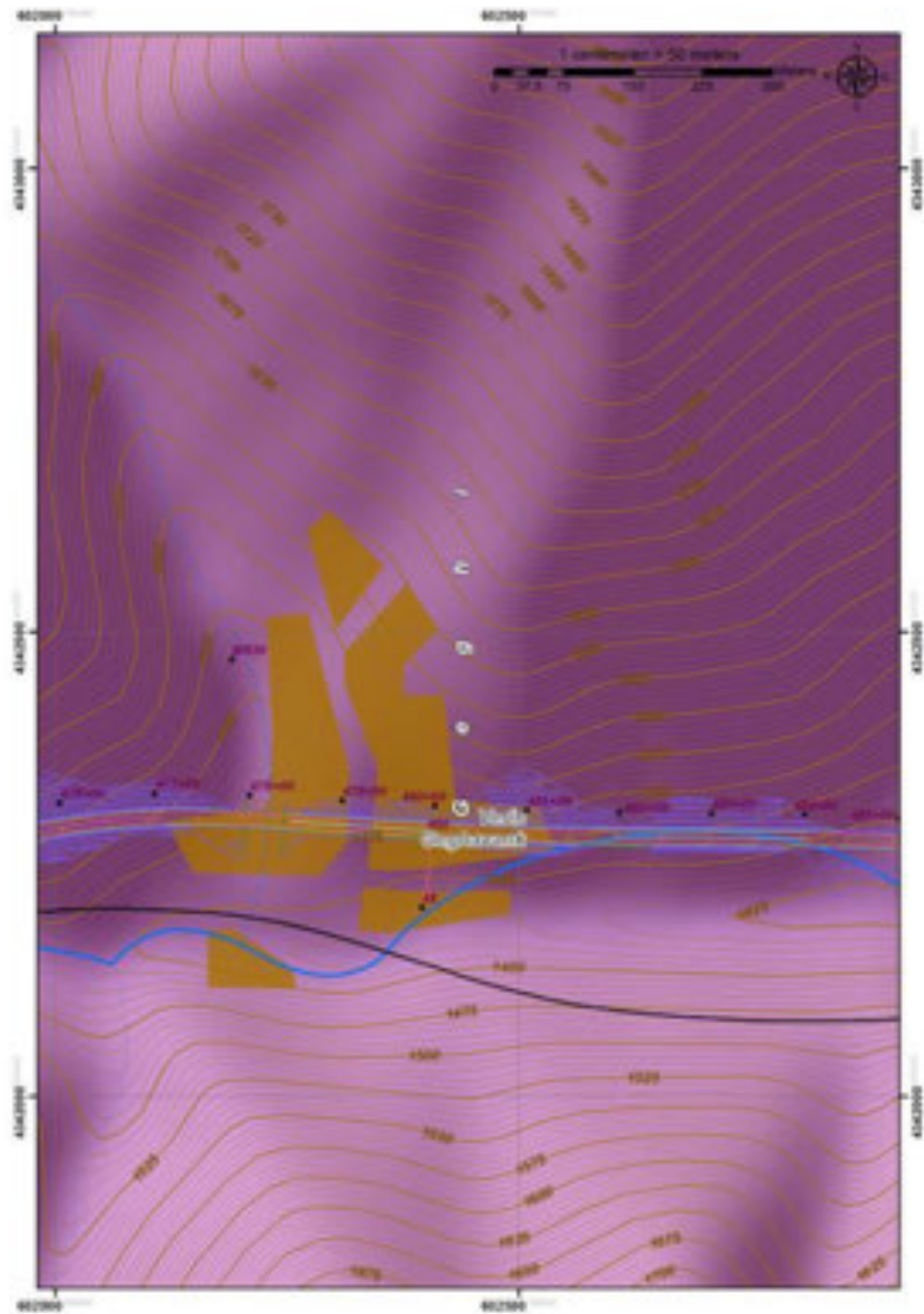




Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 46.7+00 – pk 47.6+00

(1: 5000)

Map 33



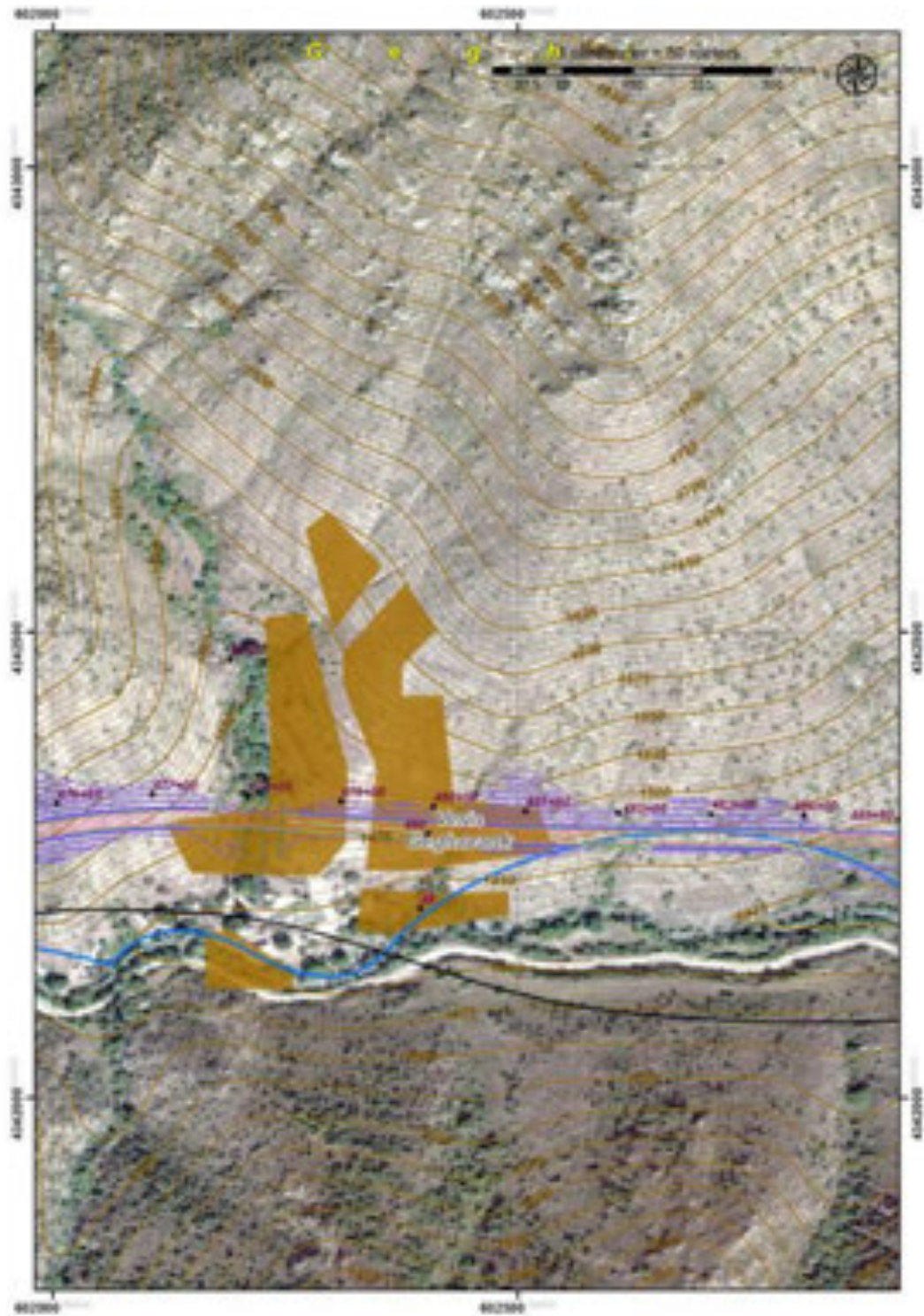




Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 47.6+00 – pk 48.5+00

(1: 5000)

Map 33a



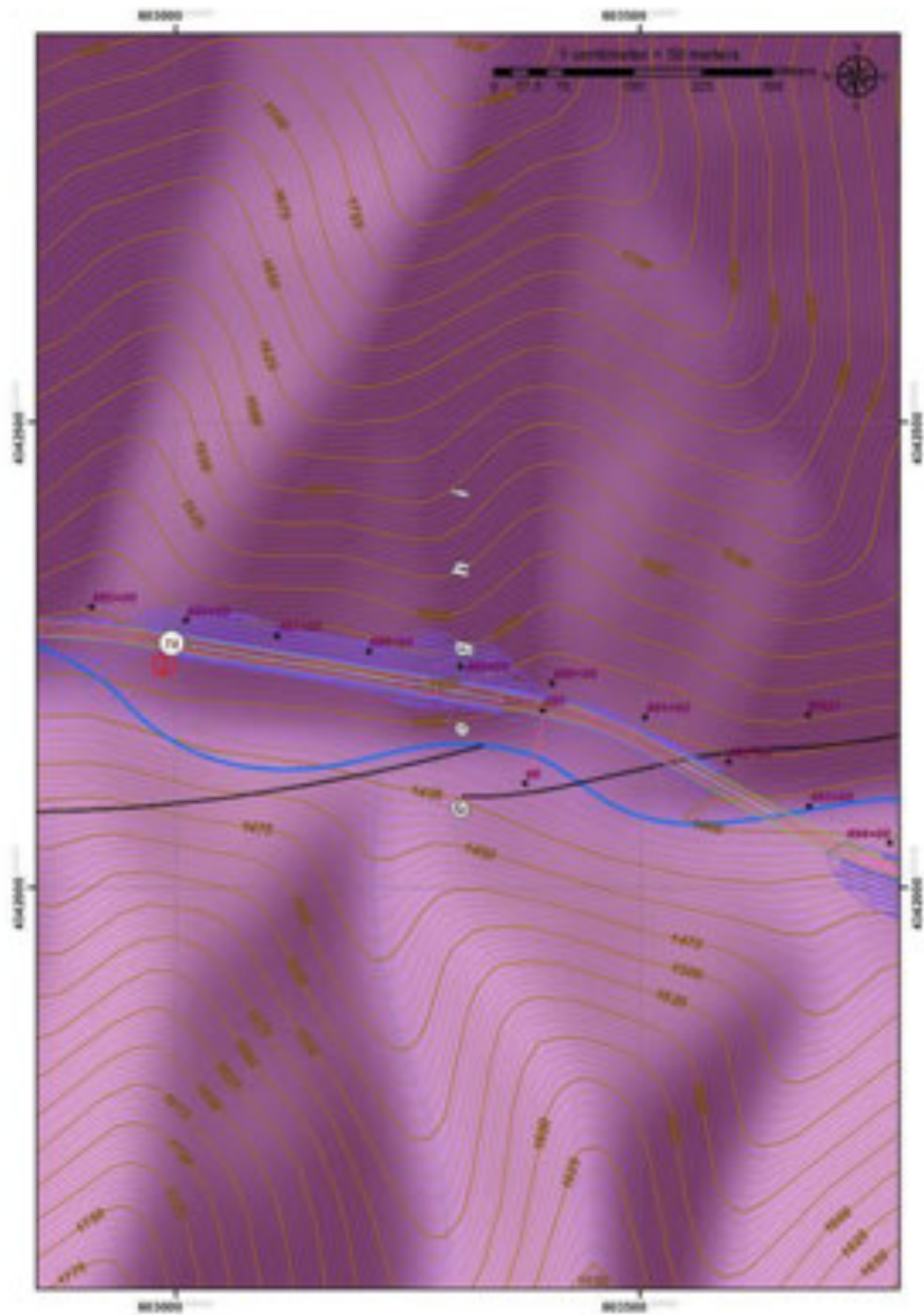




**Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 47.6+00 – pk 48.5+00**

(1: 5000)

**Map 34**

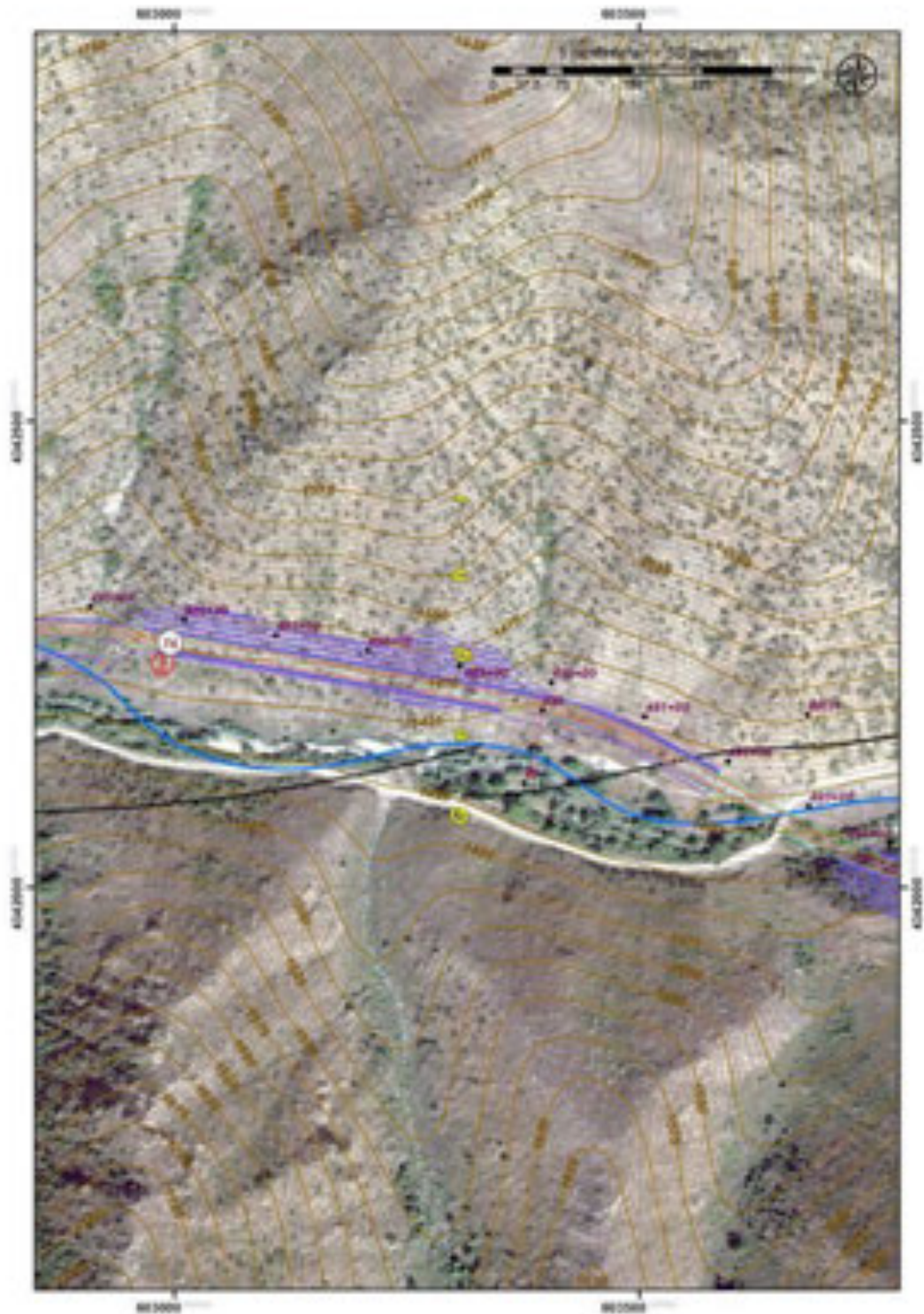




Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 48.5+00 – pk 49.4+00

(1: 5000)

Map 34a



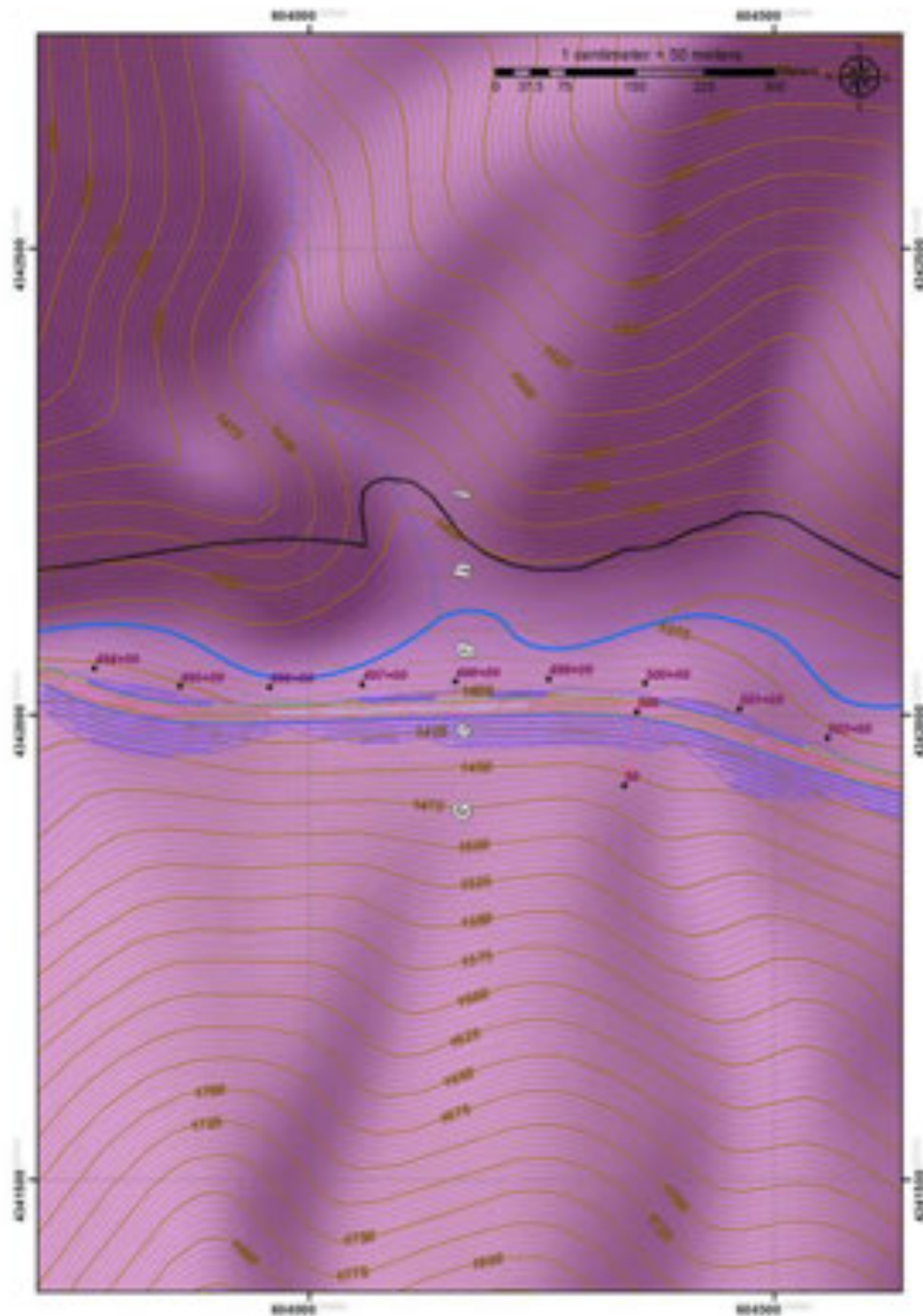




**Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 48.5+00 – pk 49.4+00**

(1: 5000)

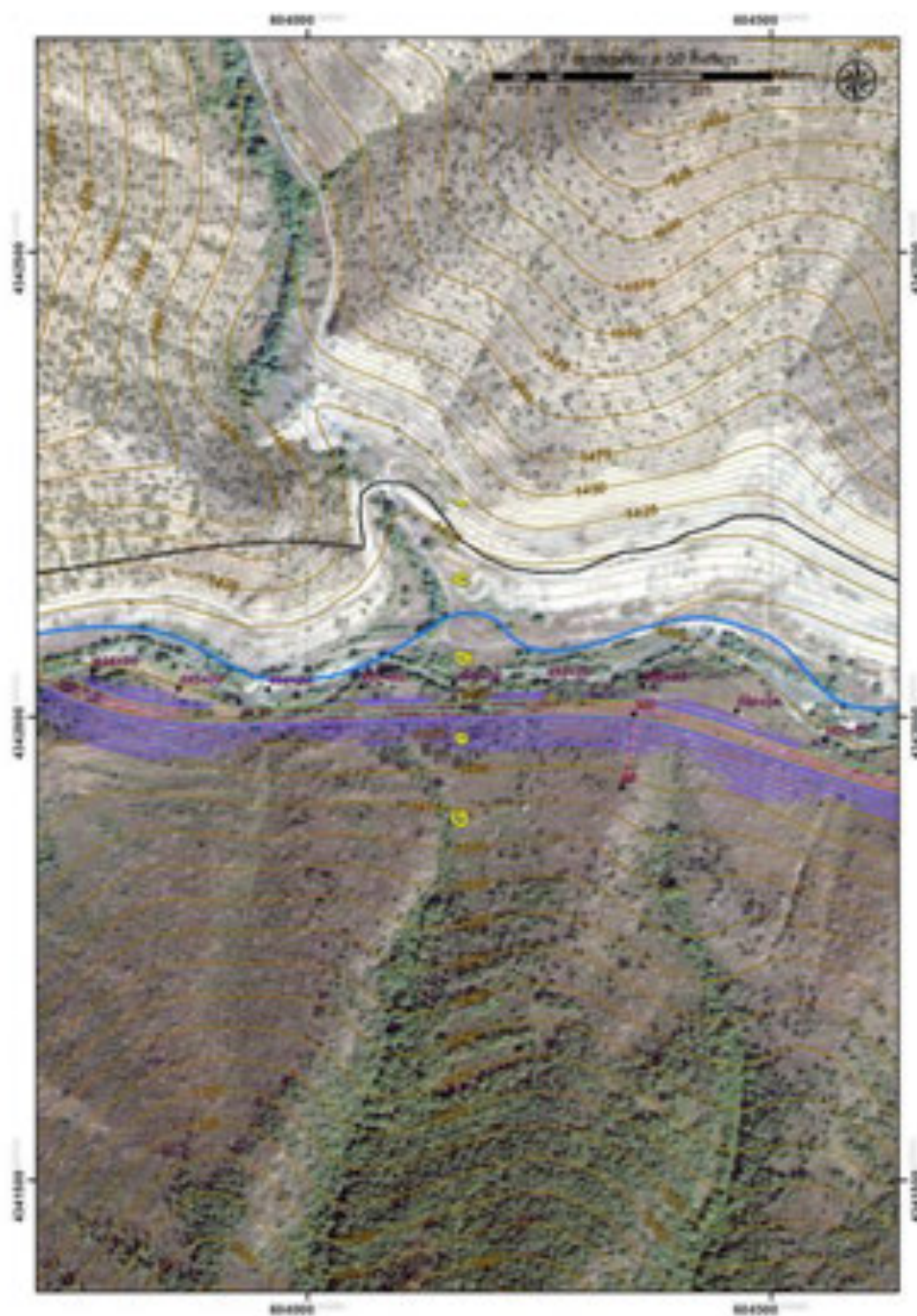
**Map 35**



**Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road project design - pk 49.4+00 – pk 50.2+00**

**(1: 5000)**

### Map 35a



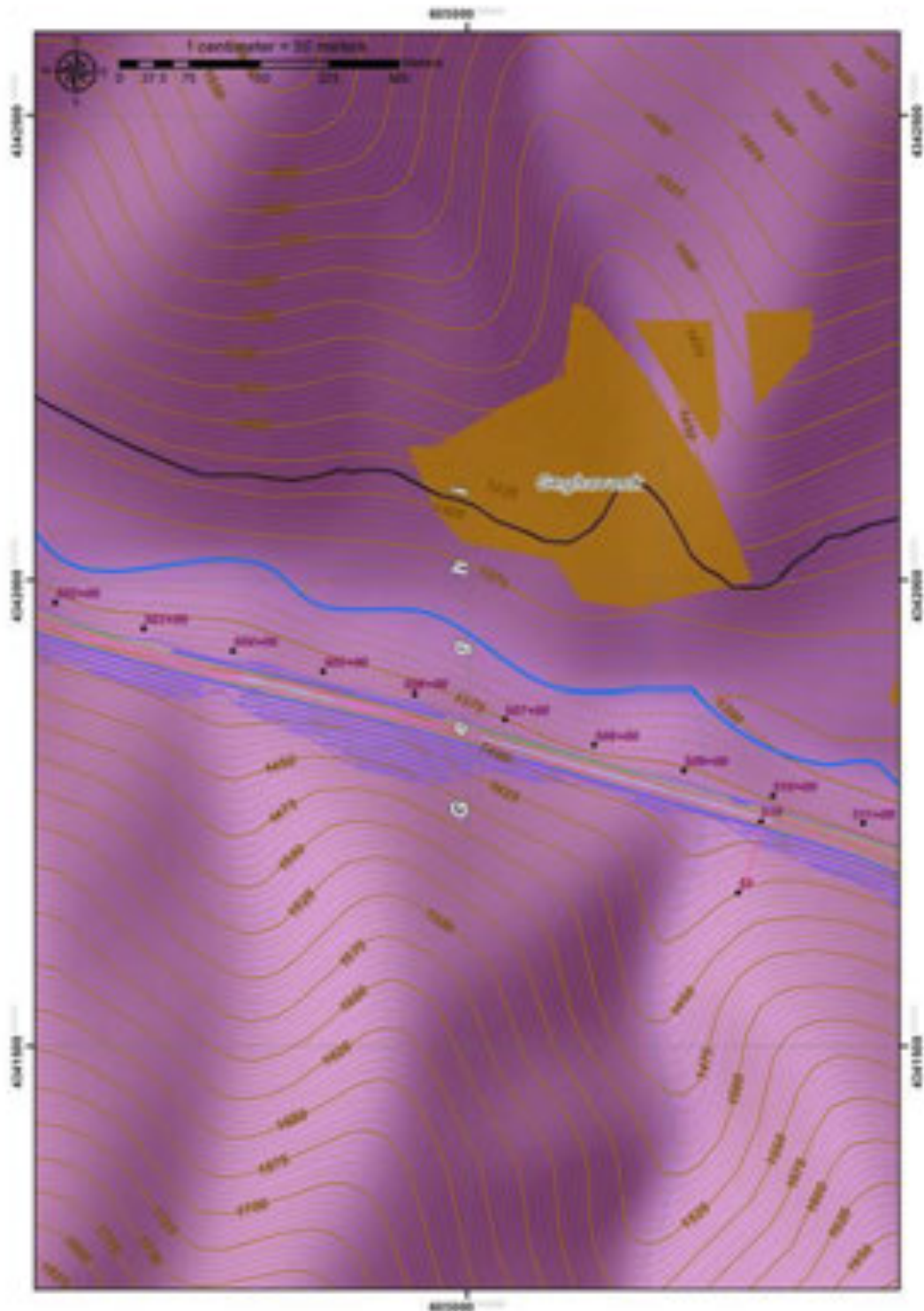




Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 49.4+00 – pk 50.2+00

(1: 5000)

Map 36



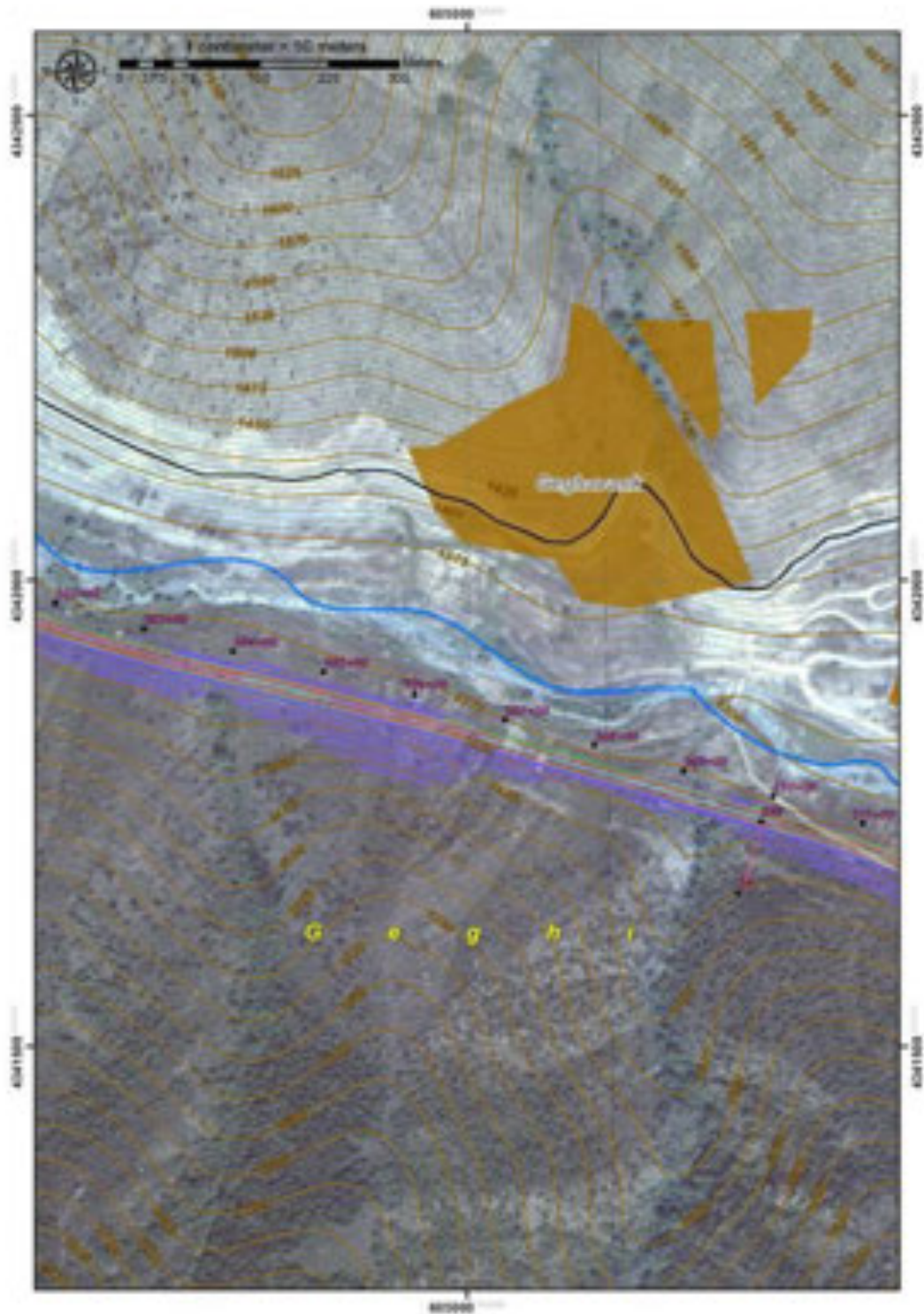




Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 50.2+00 – pk 51.1+00

(1: 5000)

Map 36a

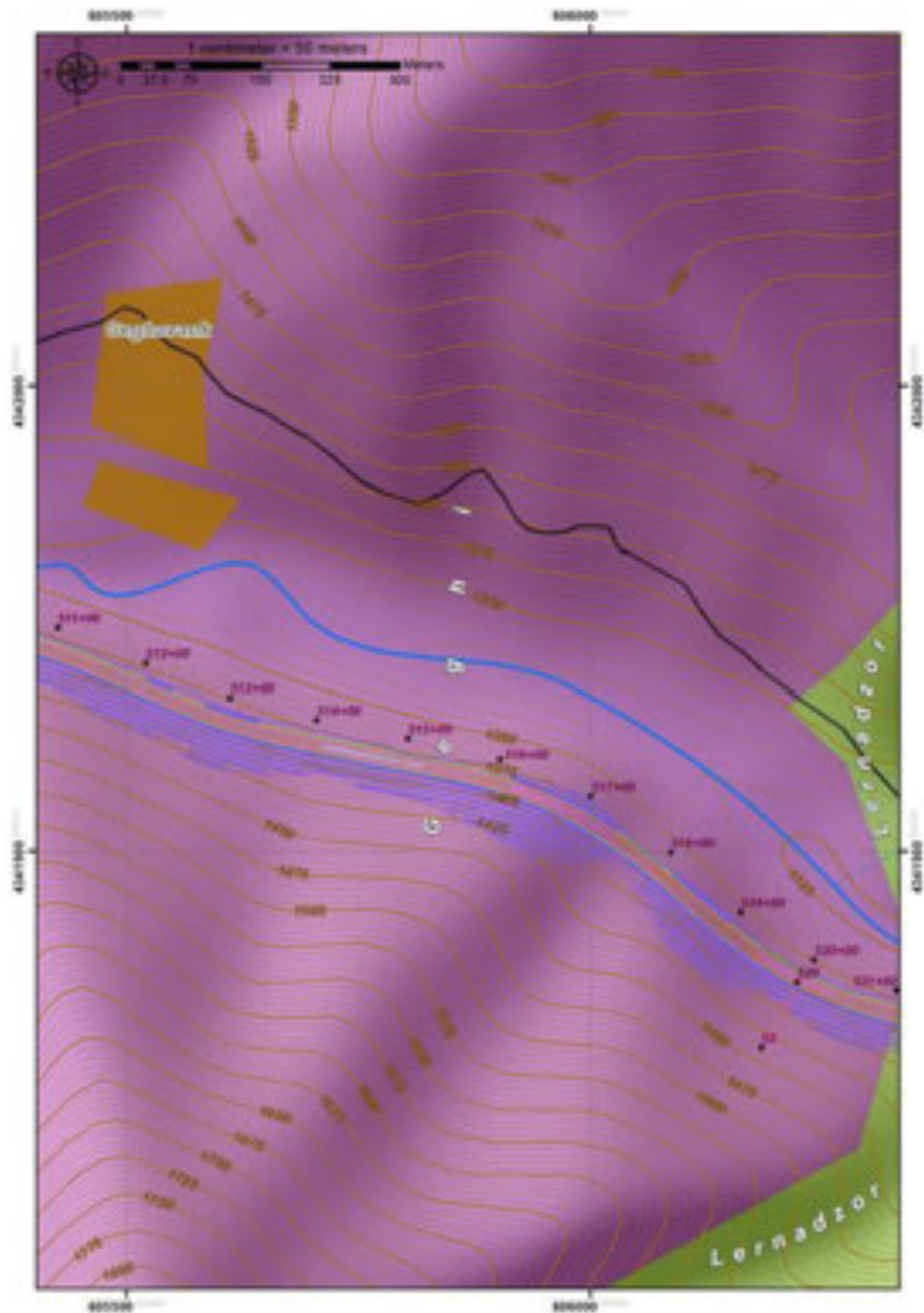




Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 50.2+00 – pk 51.1+00

(1: 5000)

Map 37



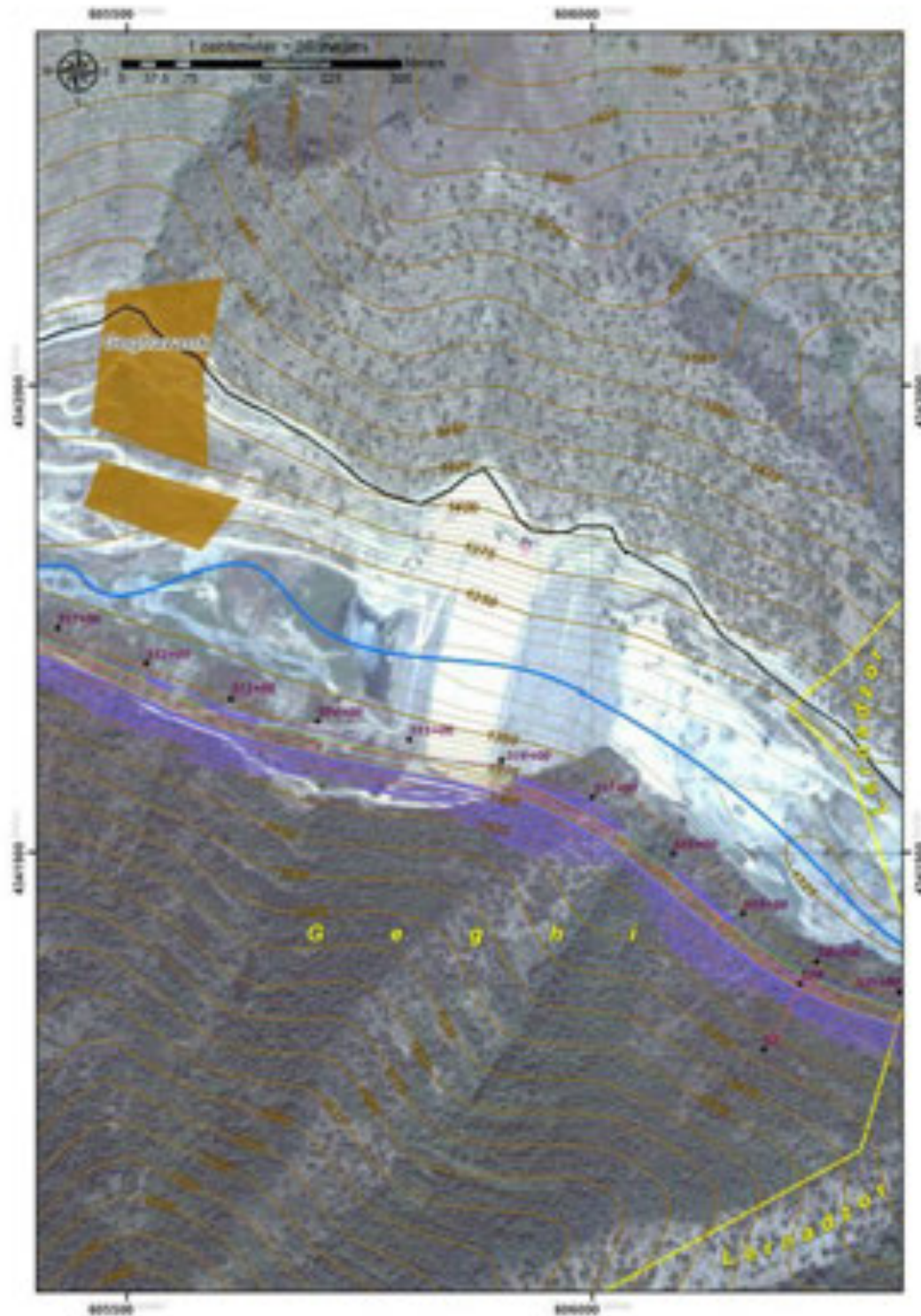




Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 51.1+00 – pk 52.1+00

(1: 5000)

Map 37a

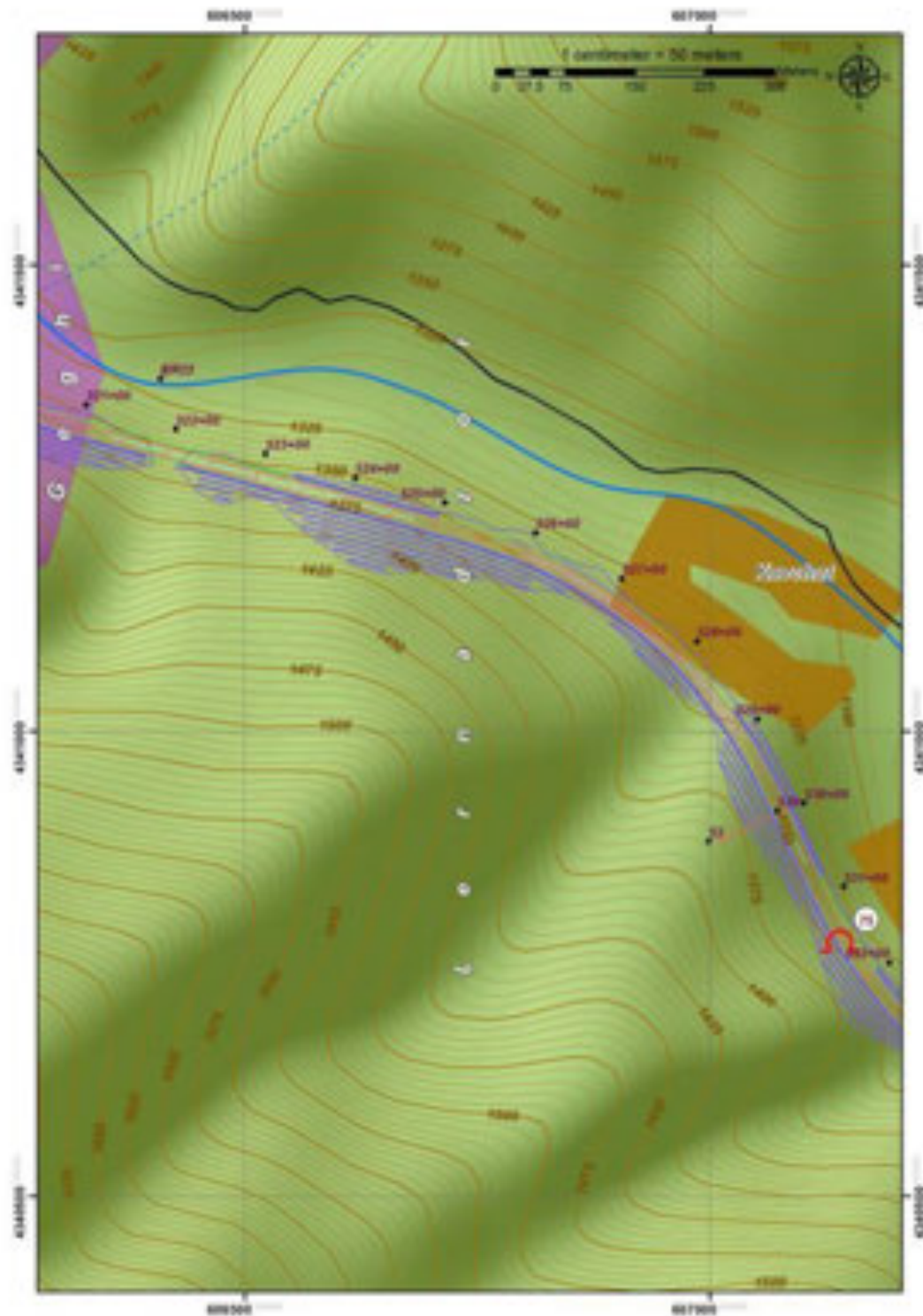




Units recorded in the area of the Geghi community. Geghi-Kajaran section of the road  
project design - pk 51.1+00 – pk 52.1+00

(1: 5000)

Map 38



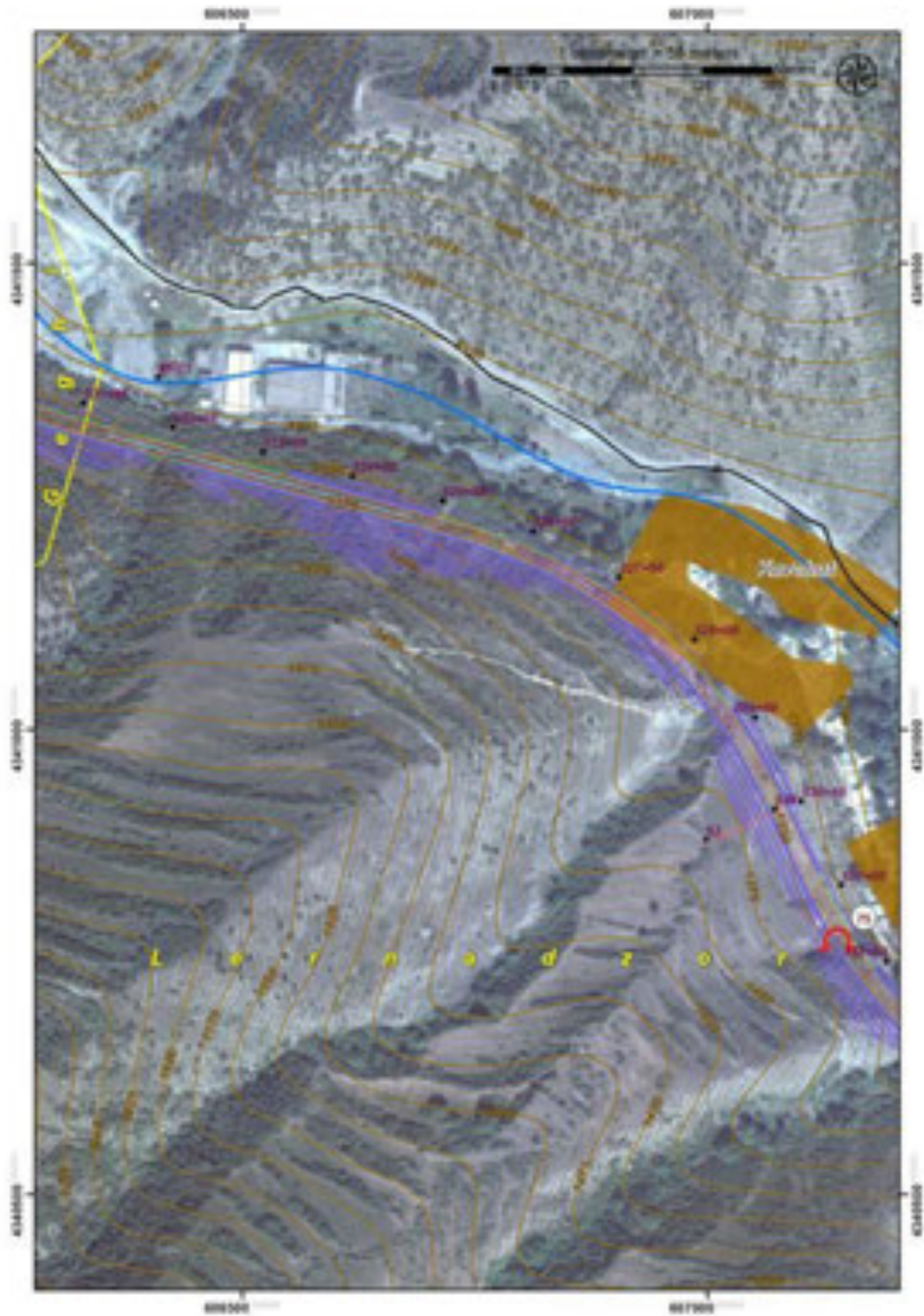




Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road  
project design - pk 52.1+00 – pk 53.2+00

(1: 5000)

Map 38a



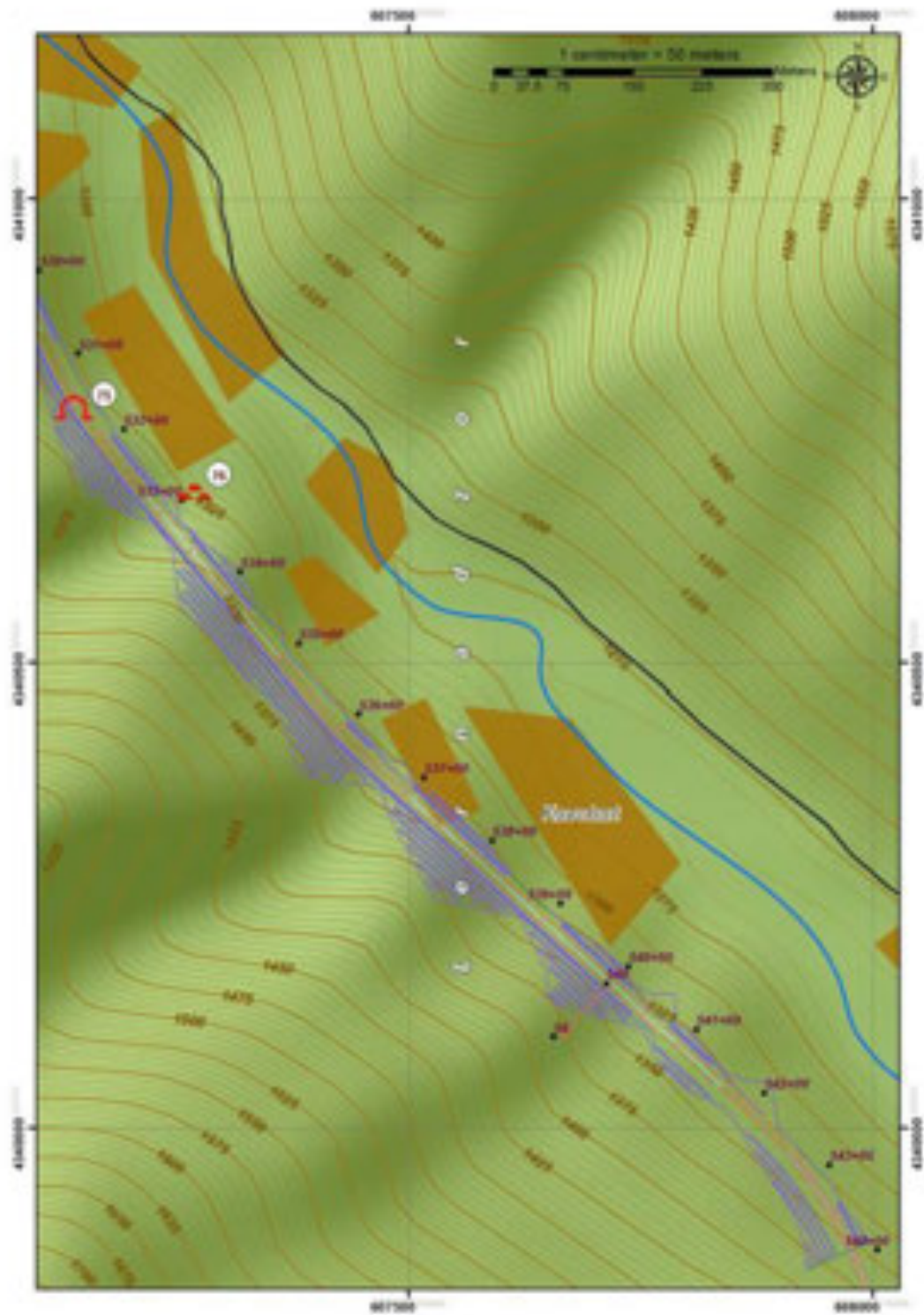




Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 52.1+00 – pk 53.2+00

(1: 5000)

Map 39

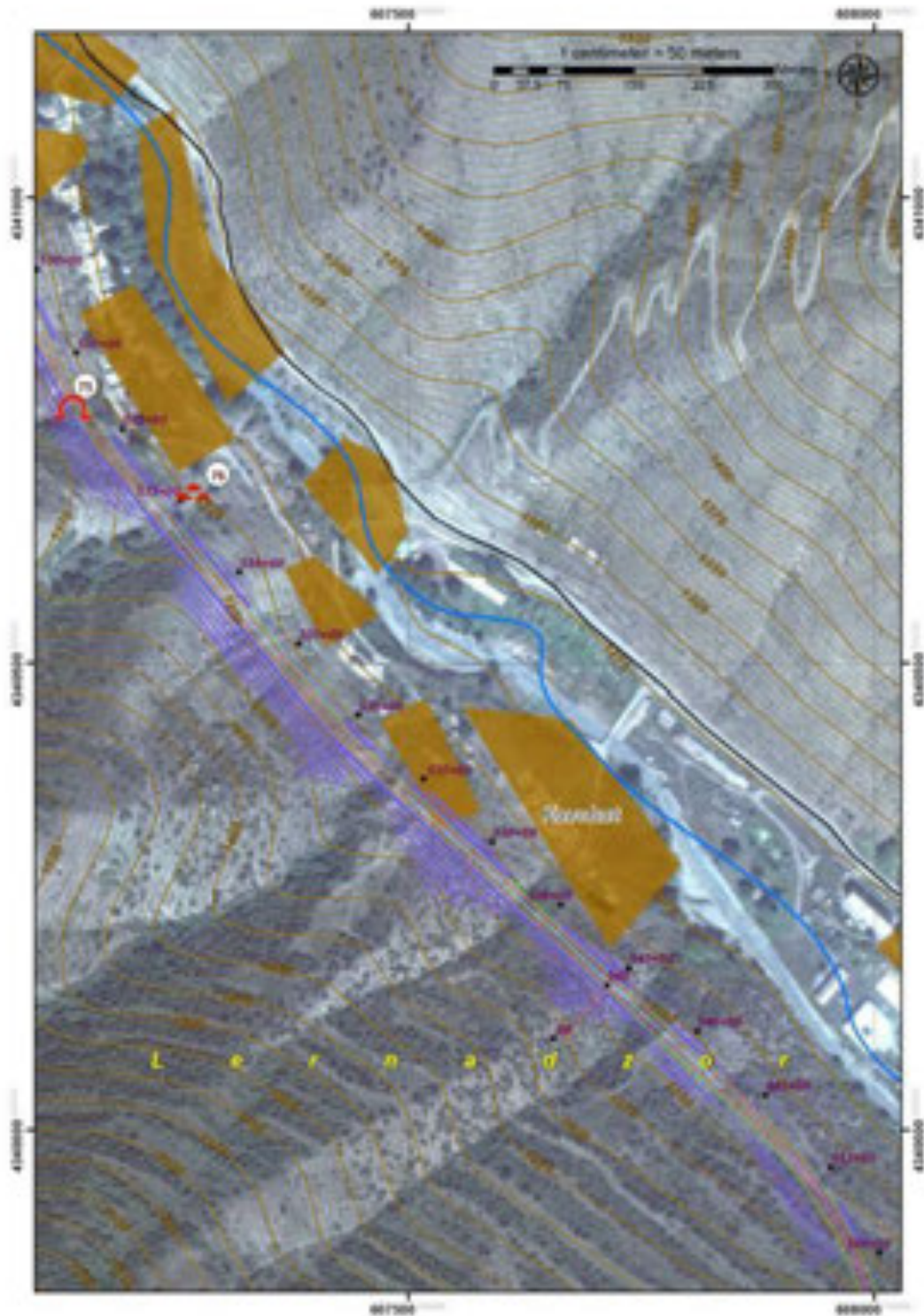




Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 53.1+00 – pk 54.4+00

(1: 5000)

Map 39a



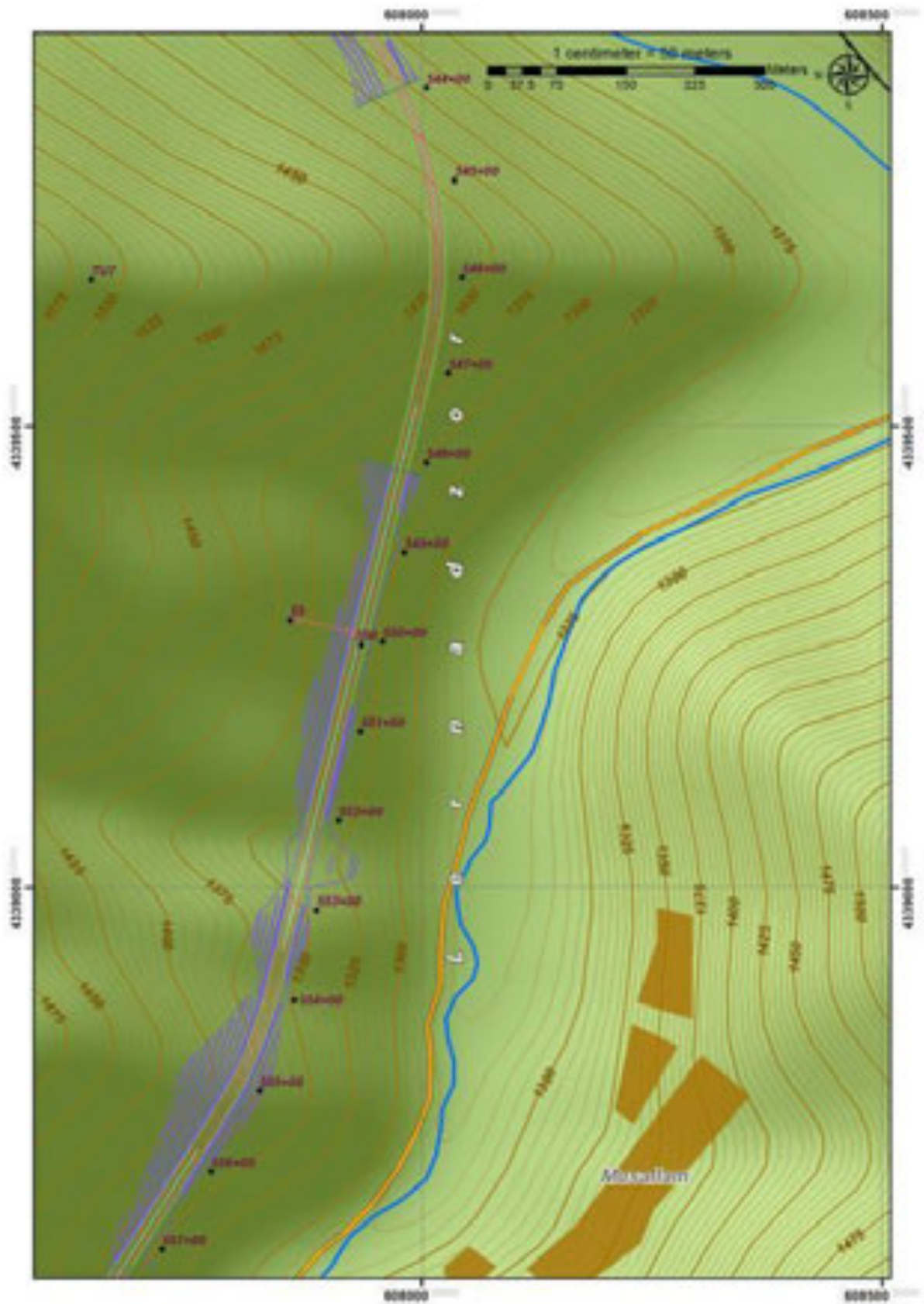


**Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road  
project design - pk 53.1+00 – pk 54.4+00**

**(1: 5000)**

**Map 40**





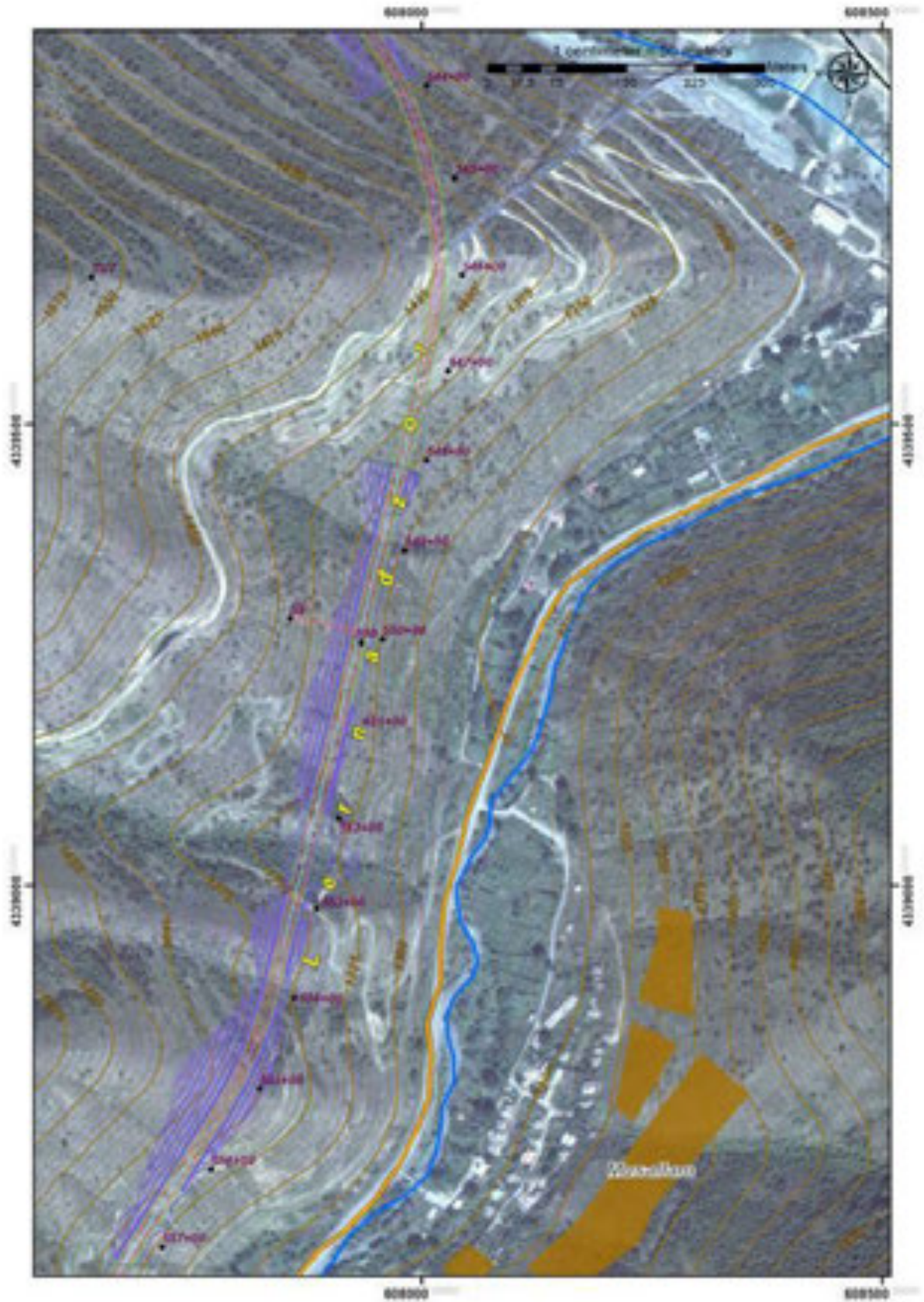
Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 54.4+00 – pk 55.7+00



**(1: 5000)**

**Map 40a**



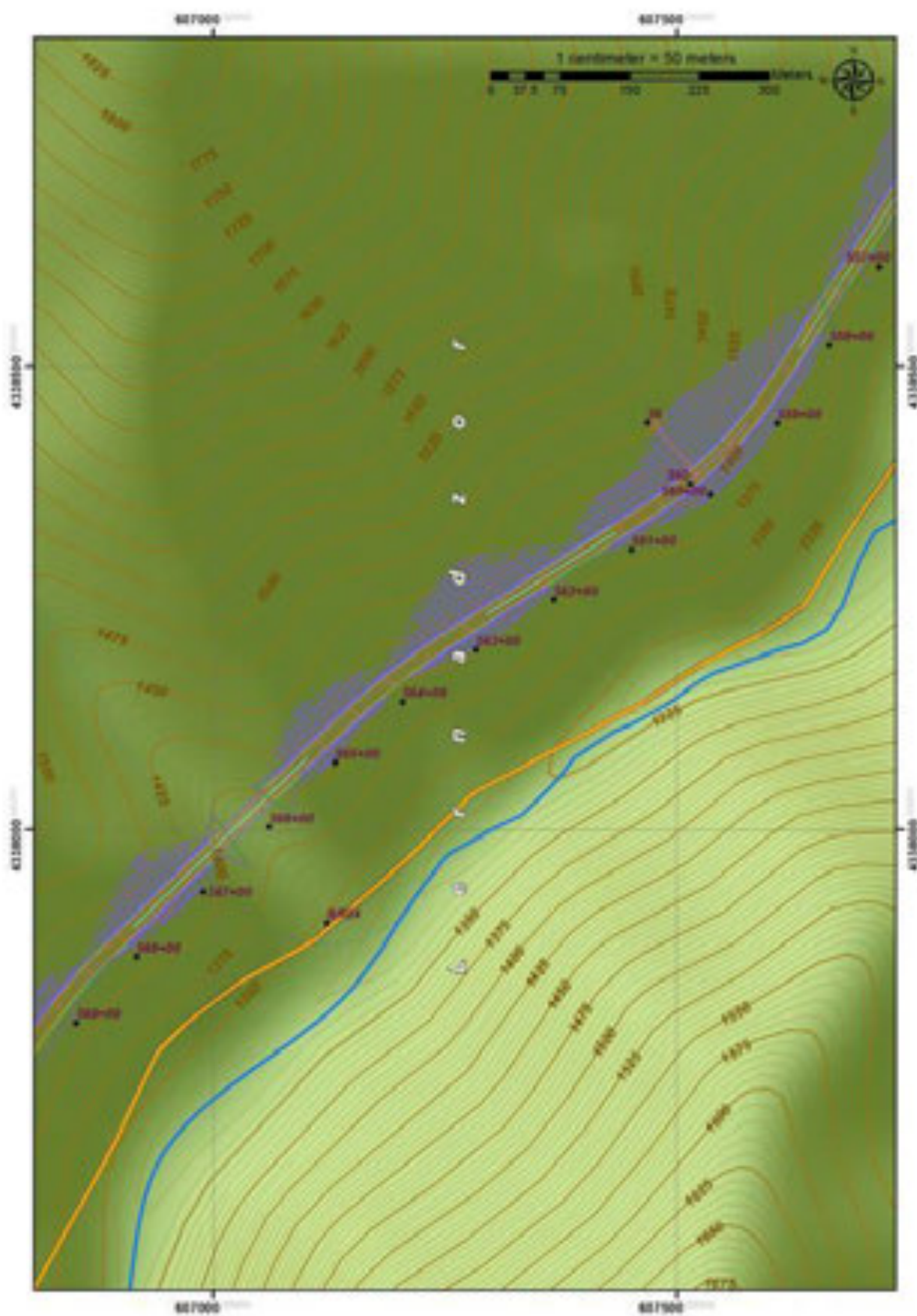


Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 54.4+00 – pk 55.7+00



(1: 5000)

Map 41



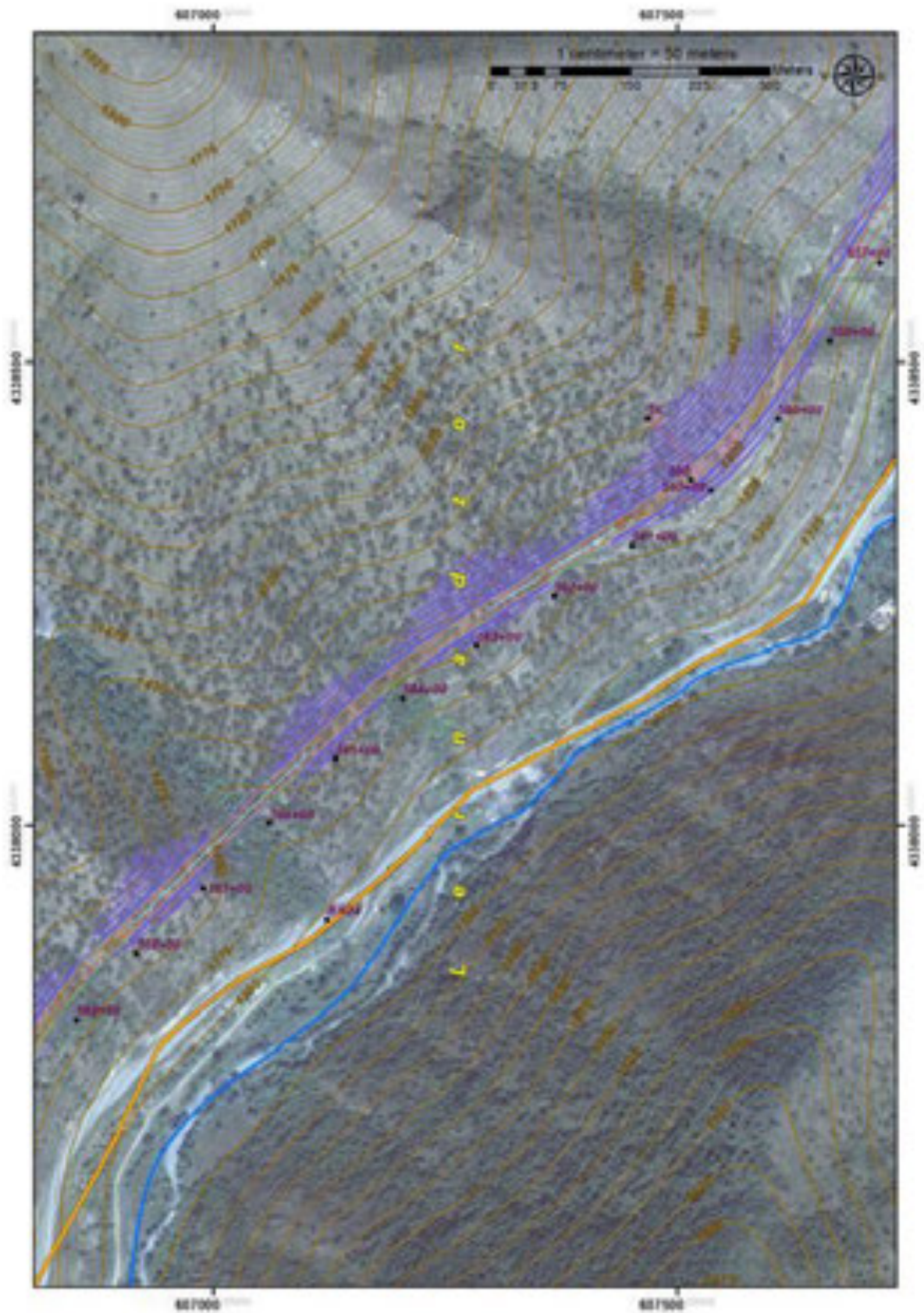
**Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road  
project design - pk 55.7+00 – pk 56.9+00**



(1: 5000)

**Map 41a**





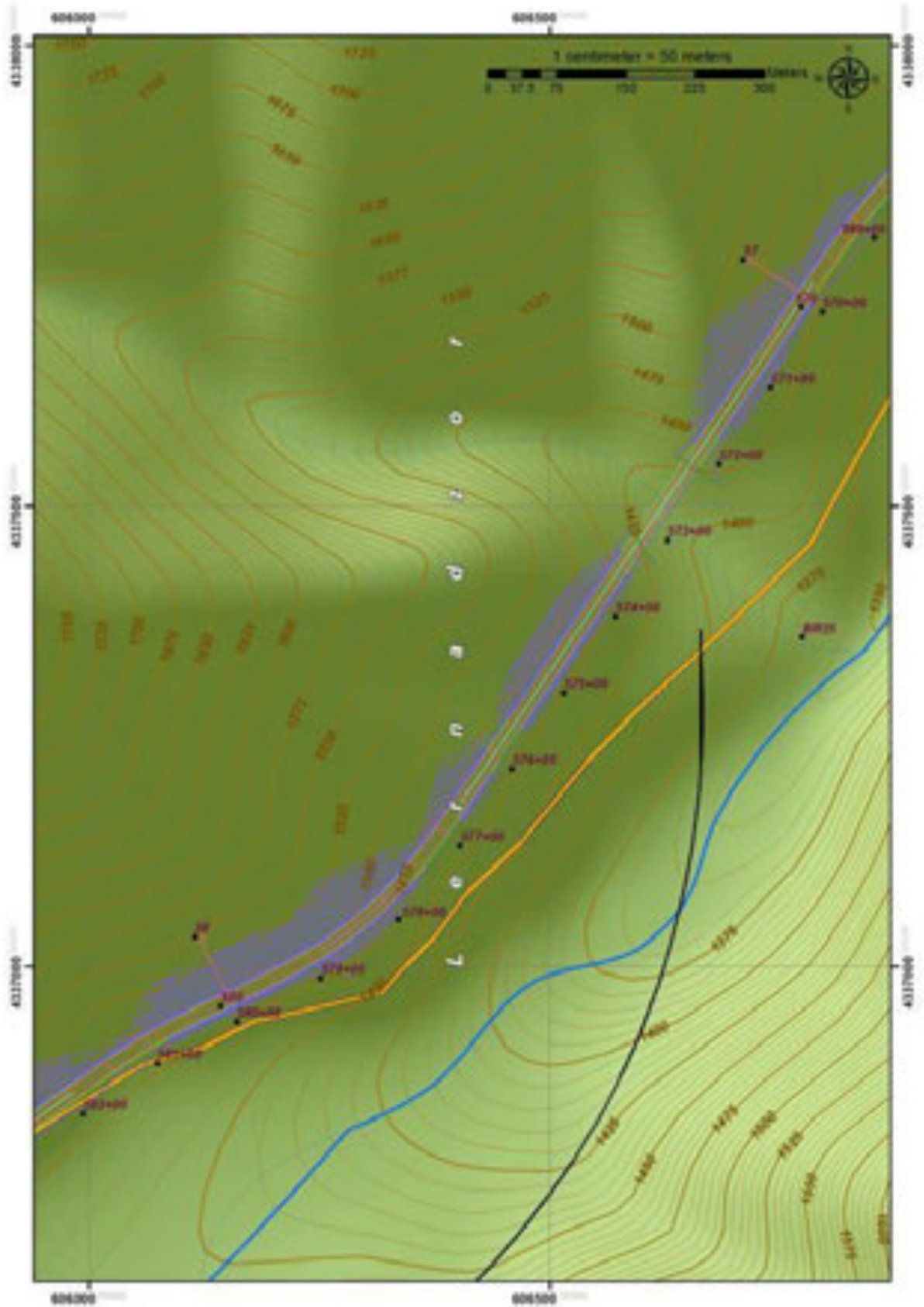
Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 55.7+00 – pk 56.9+00





(1: 5000)

Map 42

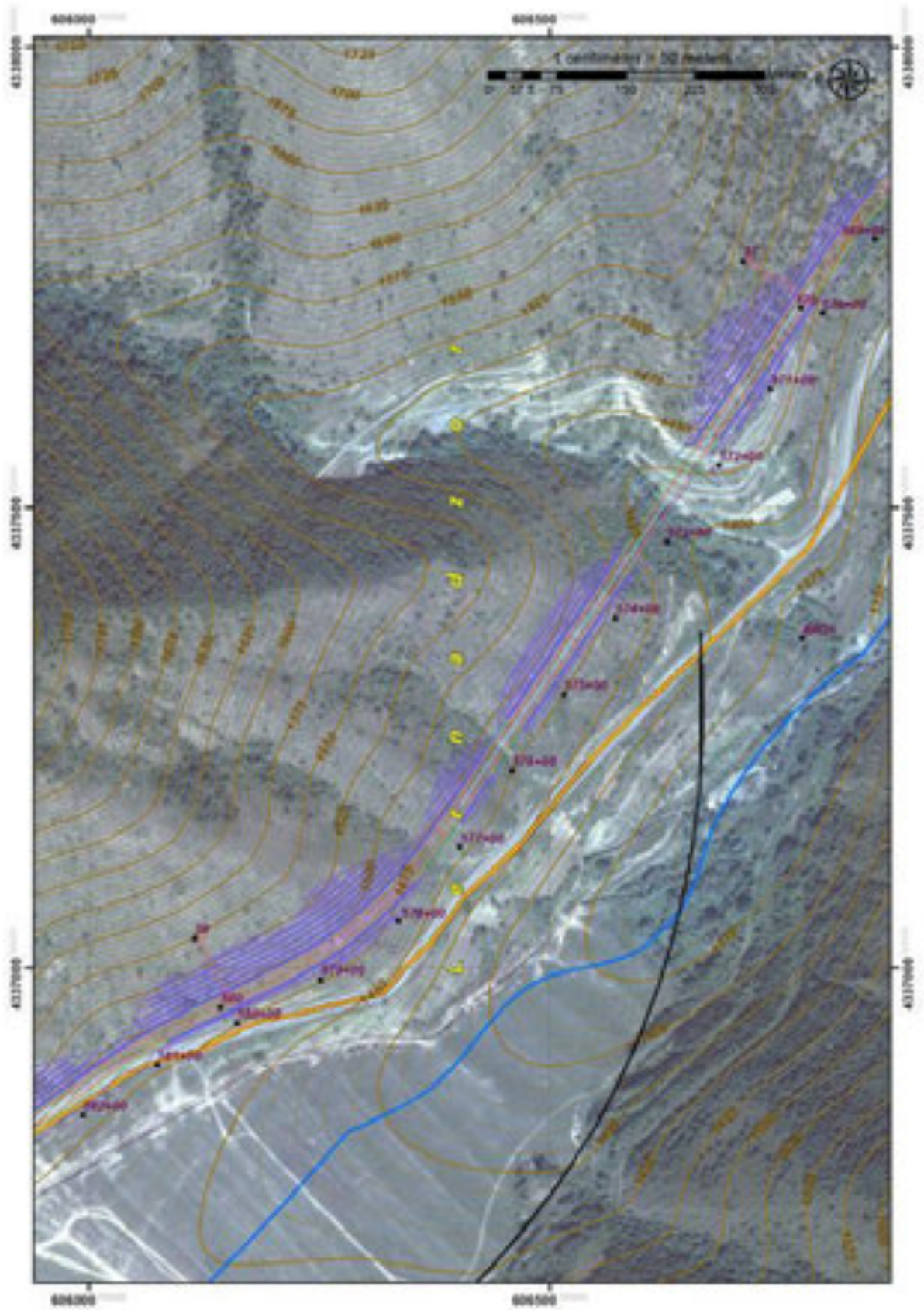


Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 56.9+00 – pk 58.2+00



(1: 5000)

Map 42a



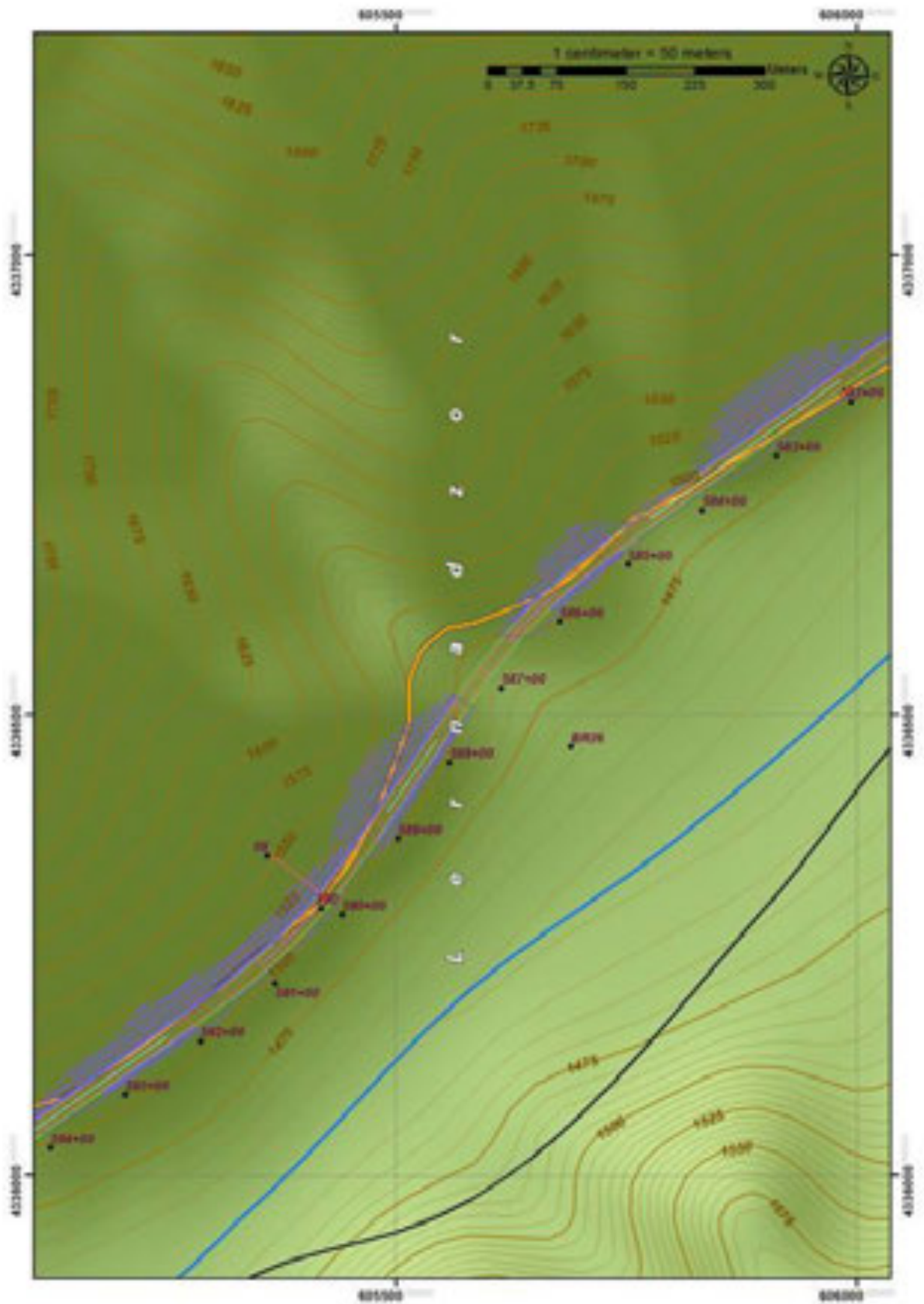
Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 56.9+00 – pk 58.2+00



(1: 5000)

Map 43



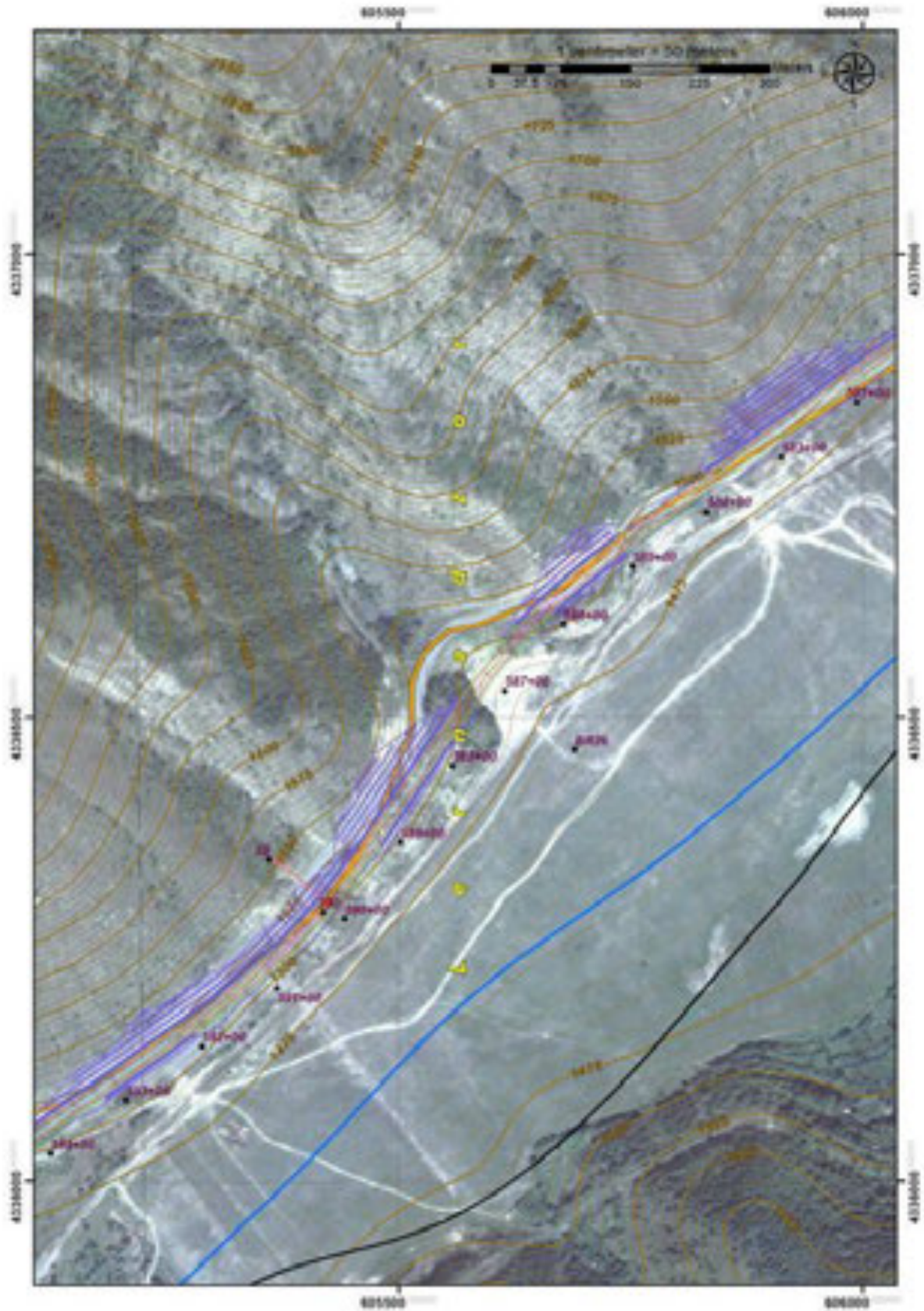


Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 58.2+00 – pk 59.4+00



(1: 5000)

Map 43a



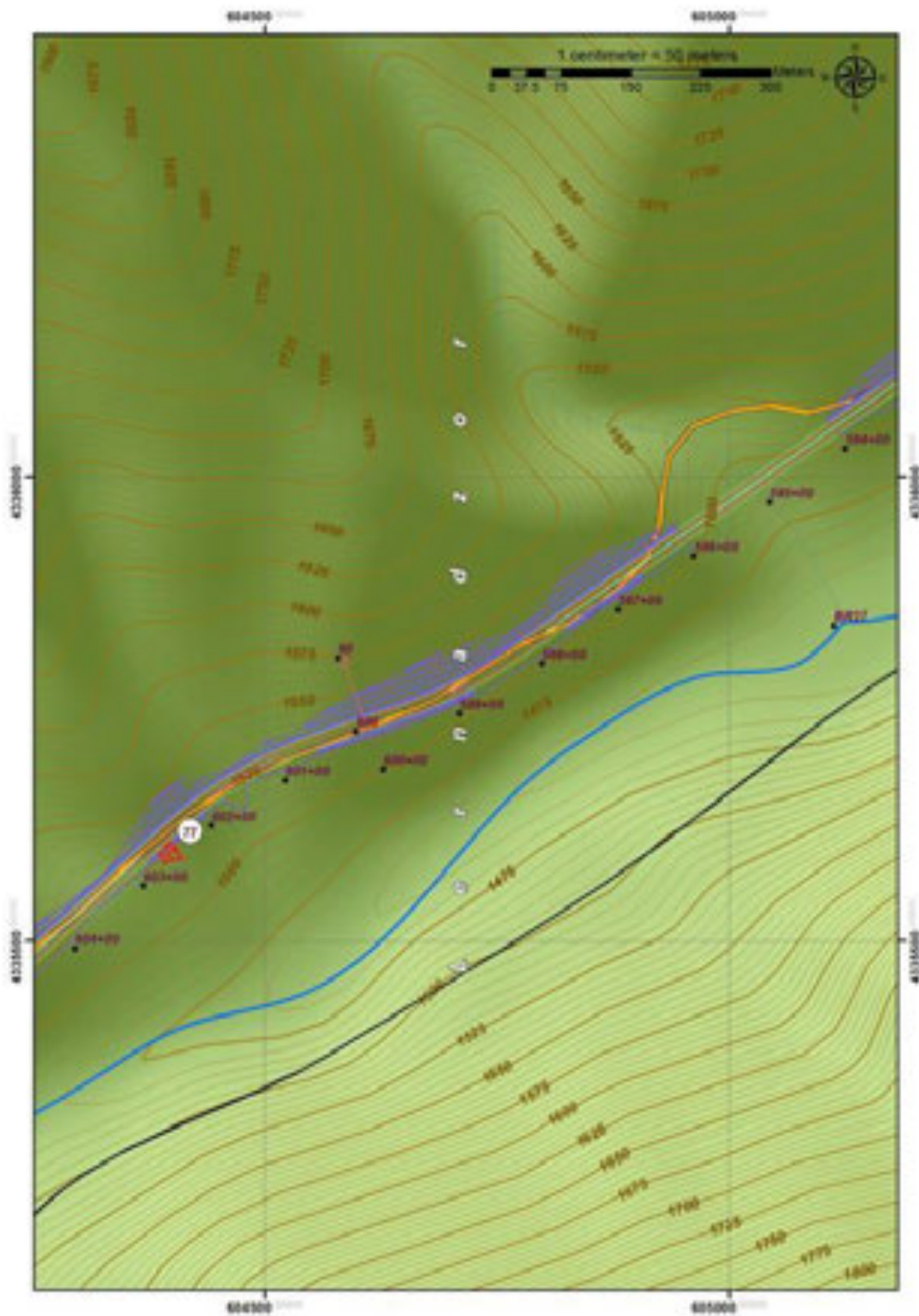
Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 58.2+00 – pk 59.4+00



(1: 5000)

**Map 44**





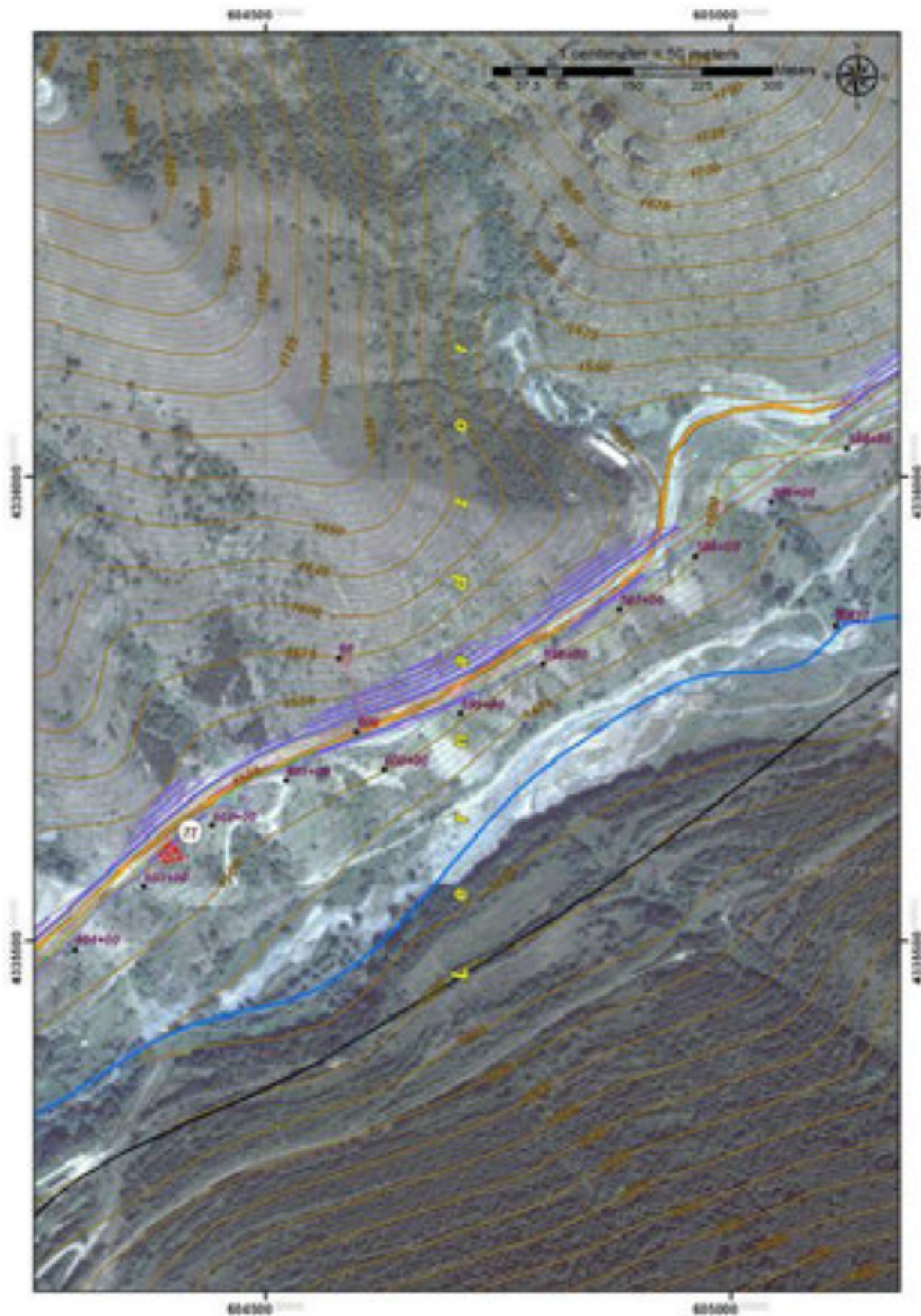
Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 59.4+00 – pk 60.4+00





(1: 5000)

Map 44a

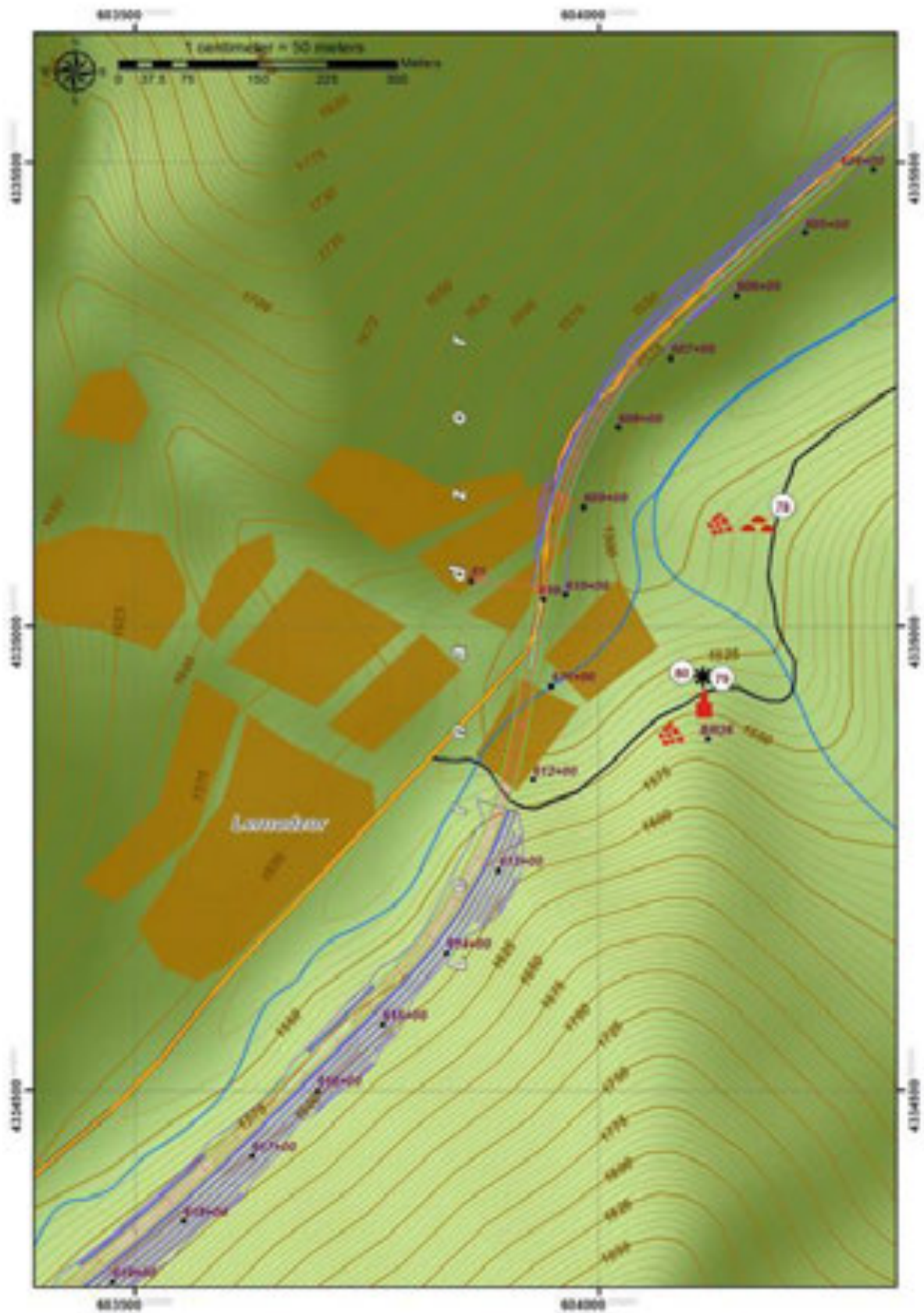


Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 59.4+00 – pk 60.4+00



(1: 5000)

Map 45



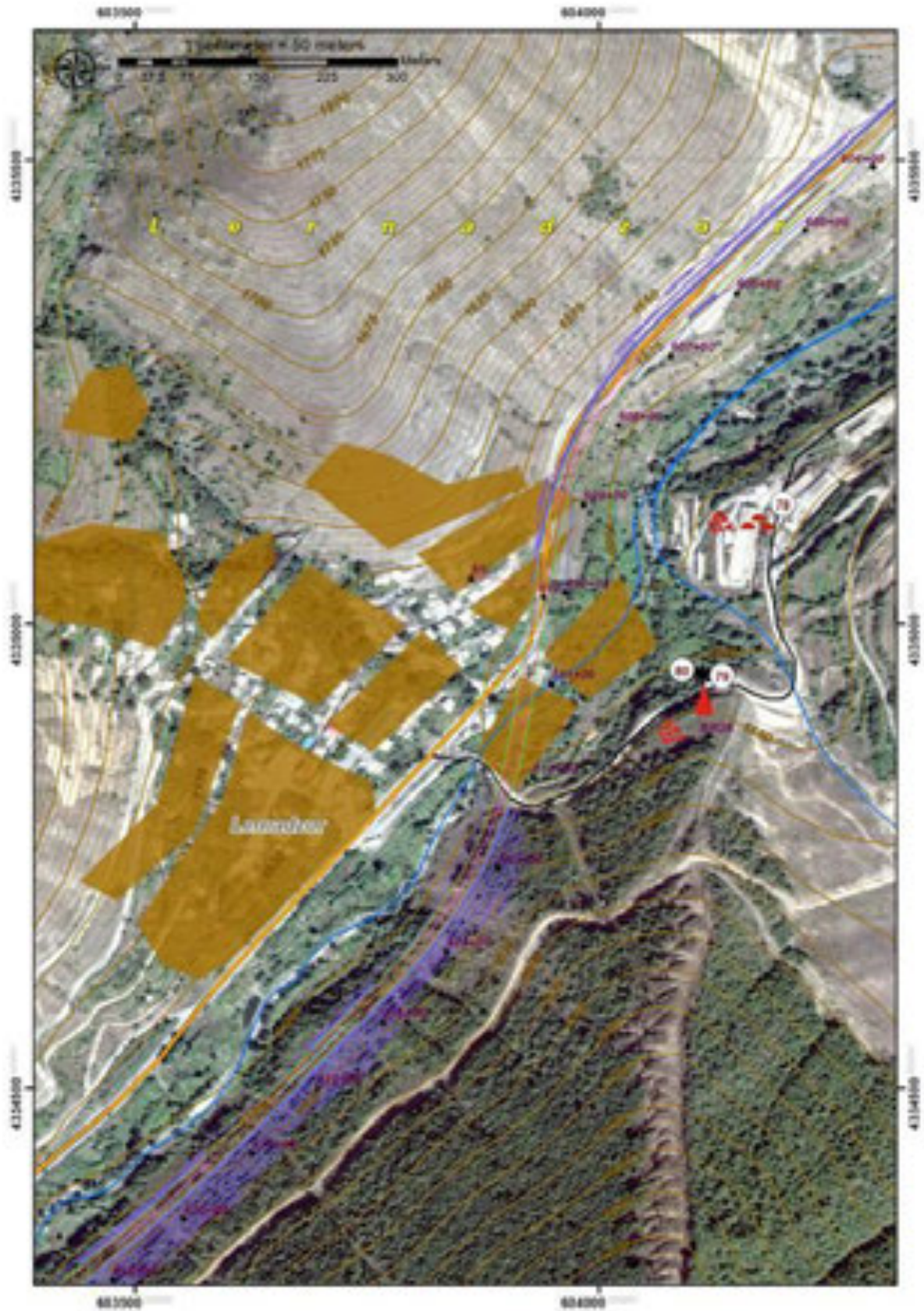
Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 60.4+00 – pk 61.9+00



(1: 5000)

Map 45a





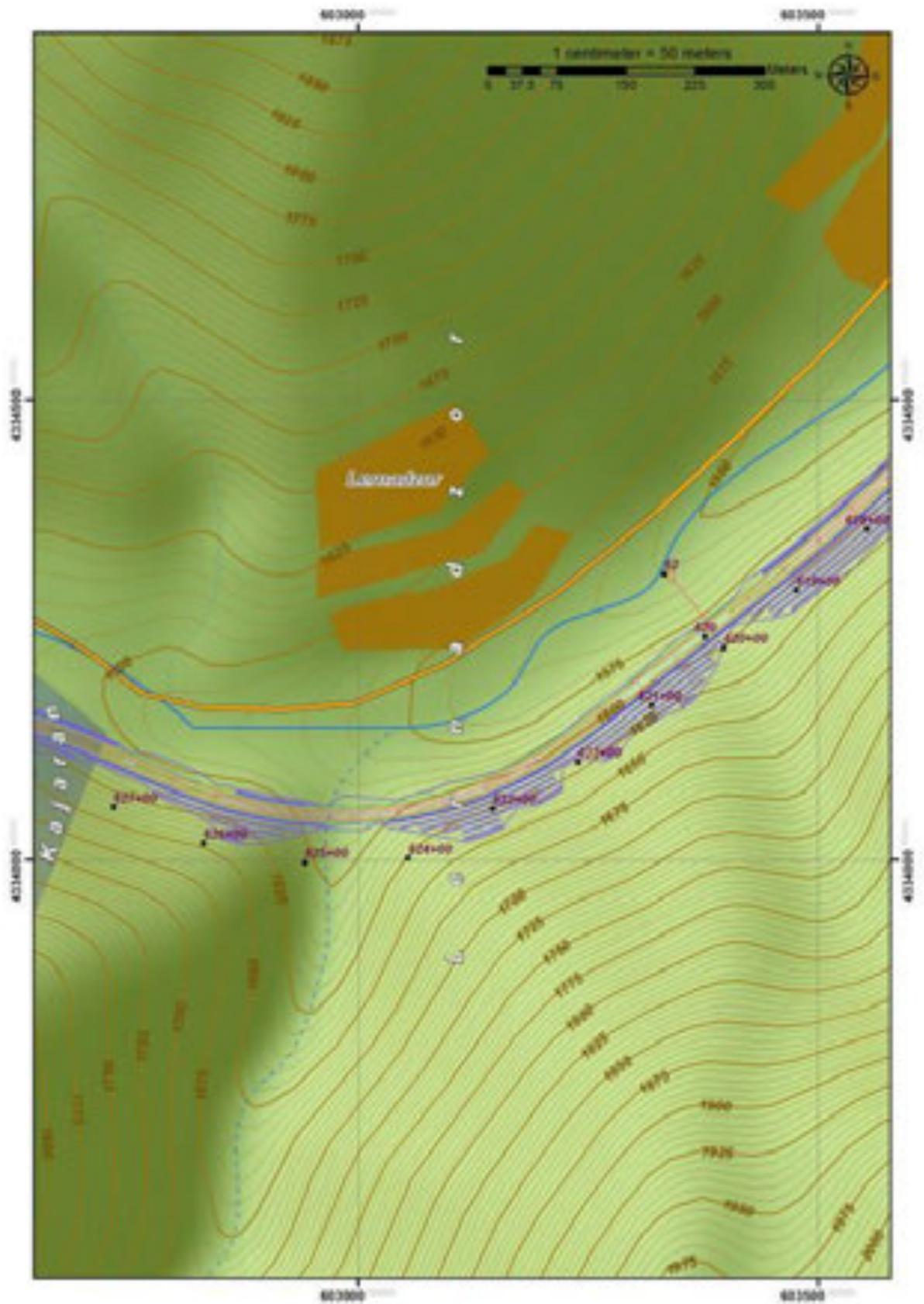
Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 60.4+00 – pk 61.9+00



(1: 5000)

Map 46





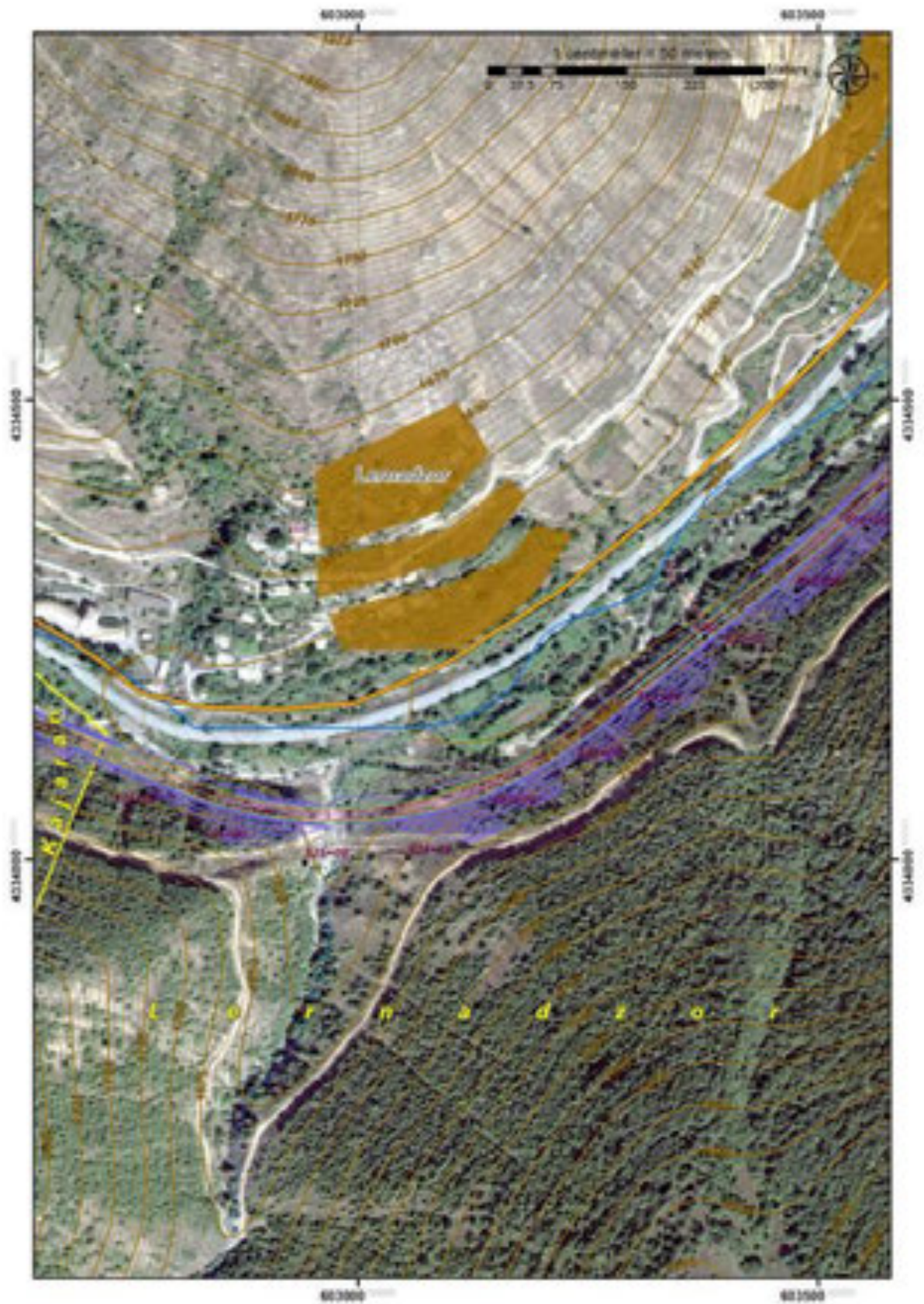
Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 61.9+00 – pk 62.8+00



(1: 5000)

Map 46a





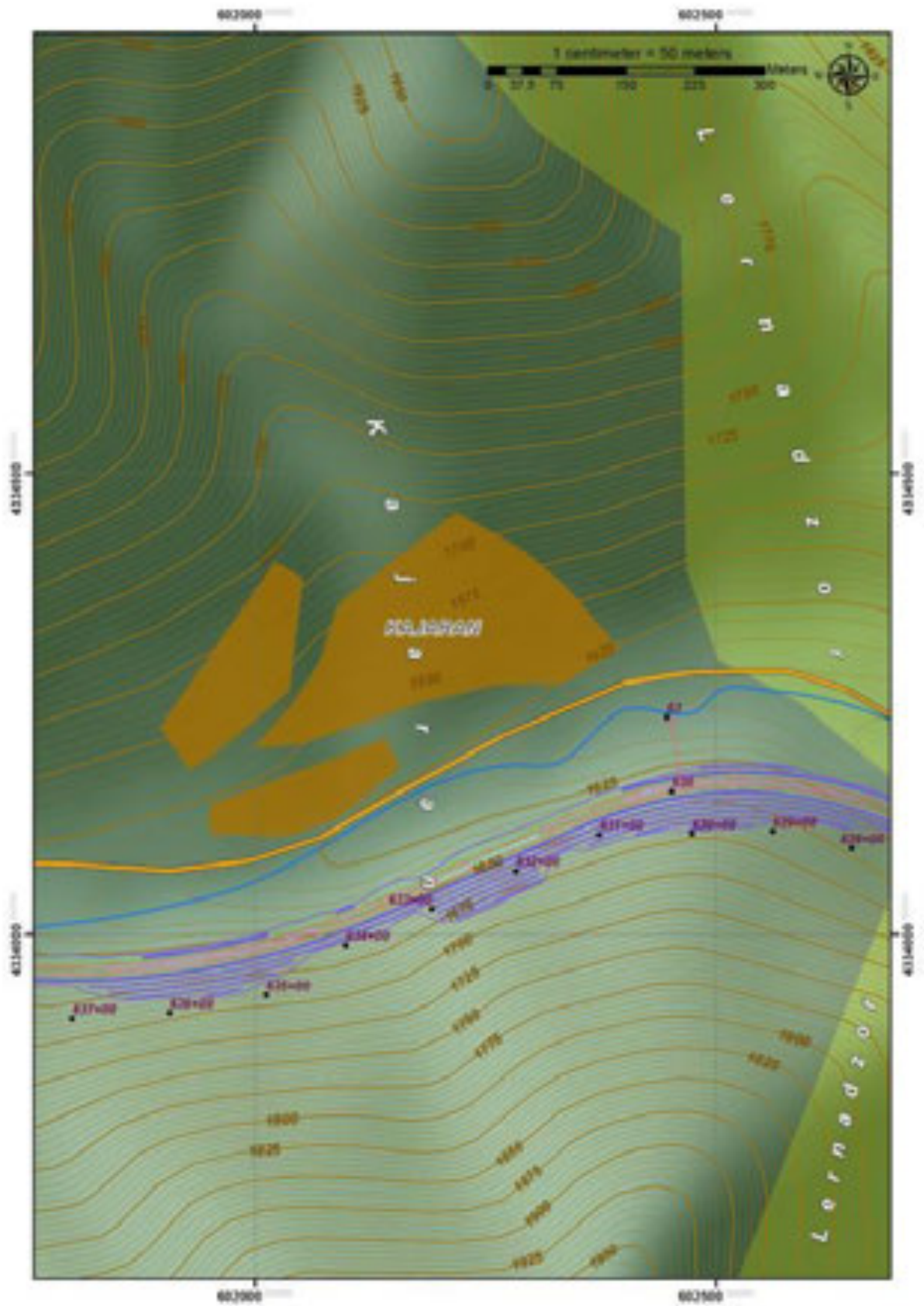
Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 61.9+00 – pk 62.8+00





(1: 5000)

**Map 47**

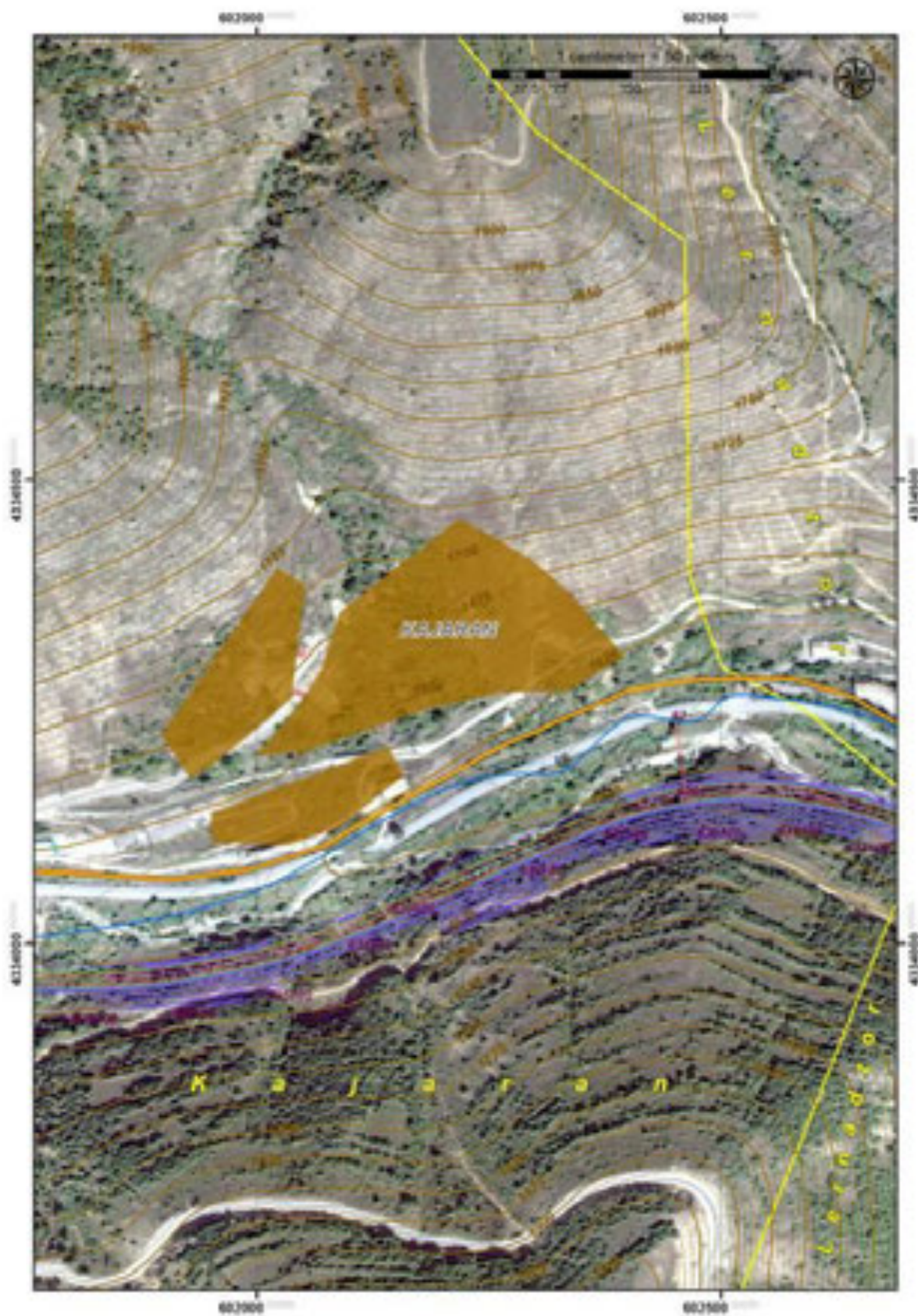


Units recorded in the areas of the Lernadzor and Kajaran communities. Geghi-Kajaran section of the road project design - pk 62.8+00 – pk 63.7+00



(1: 5000)

Map 47a



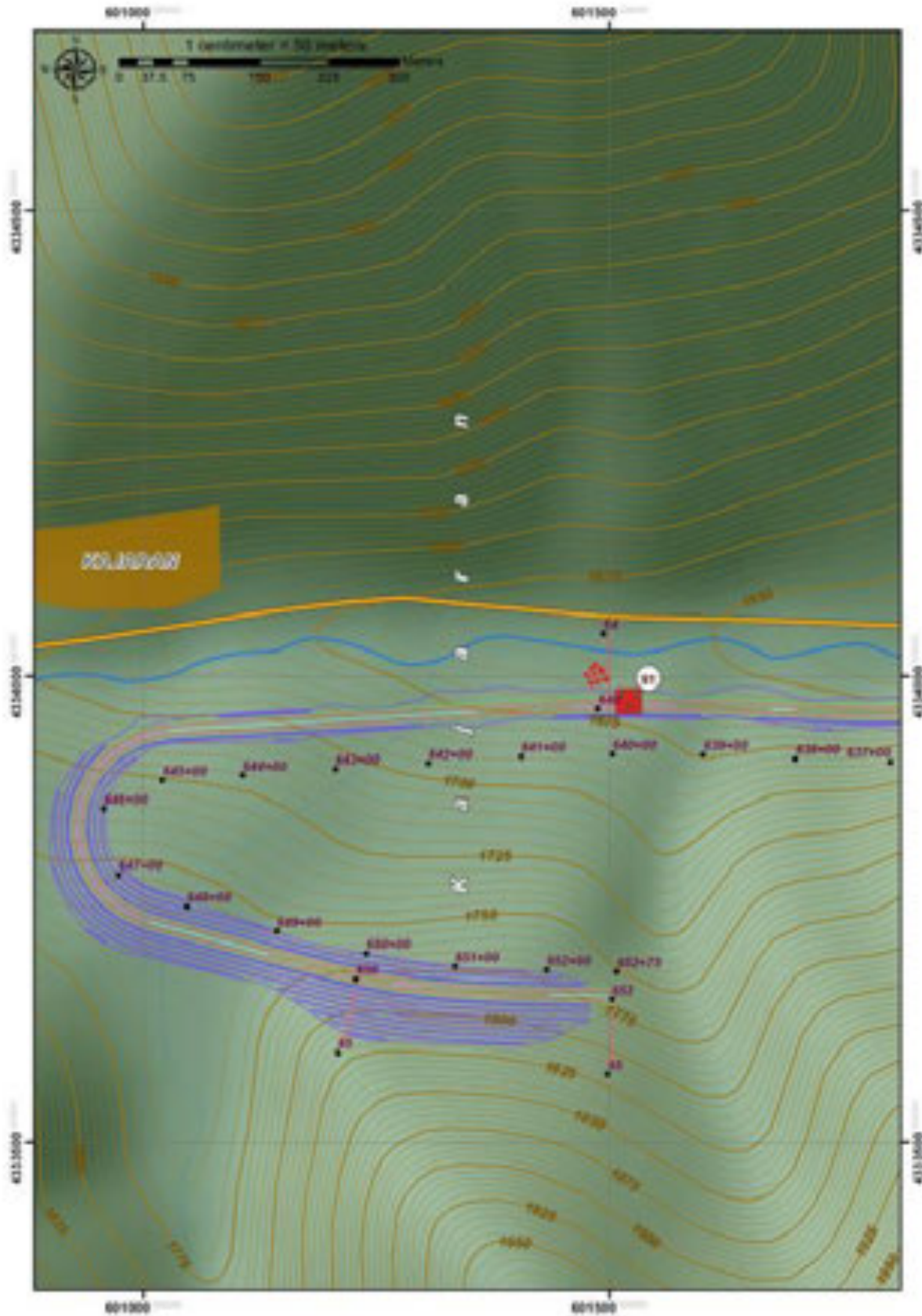
**Units recorded in the areas of the Lernadzor and Kajaran communities. Geghi-Kajaran section of the road project design - pk 62.8+00 – pk 63.7+00**



(1: 5000)

Map 48



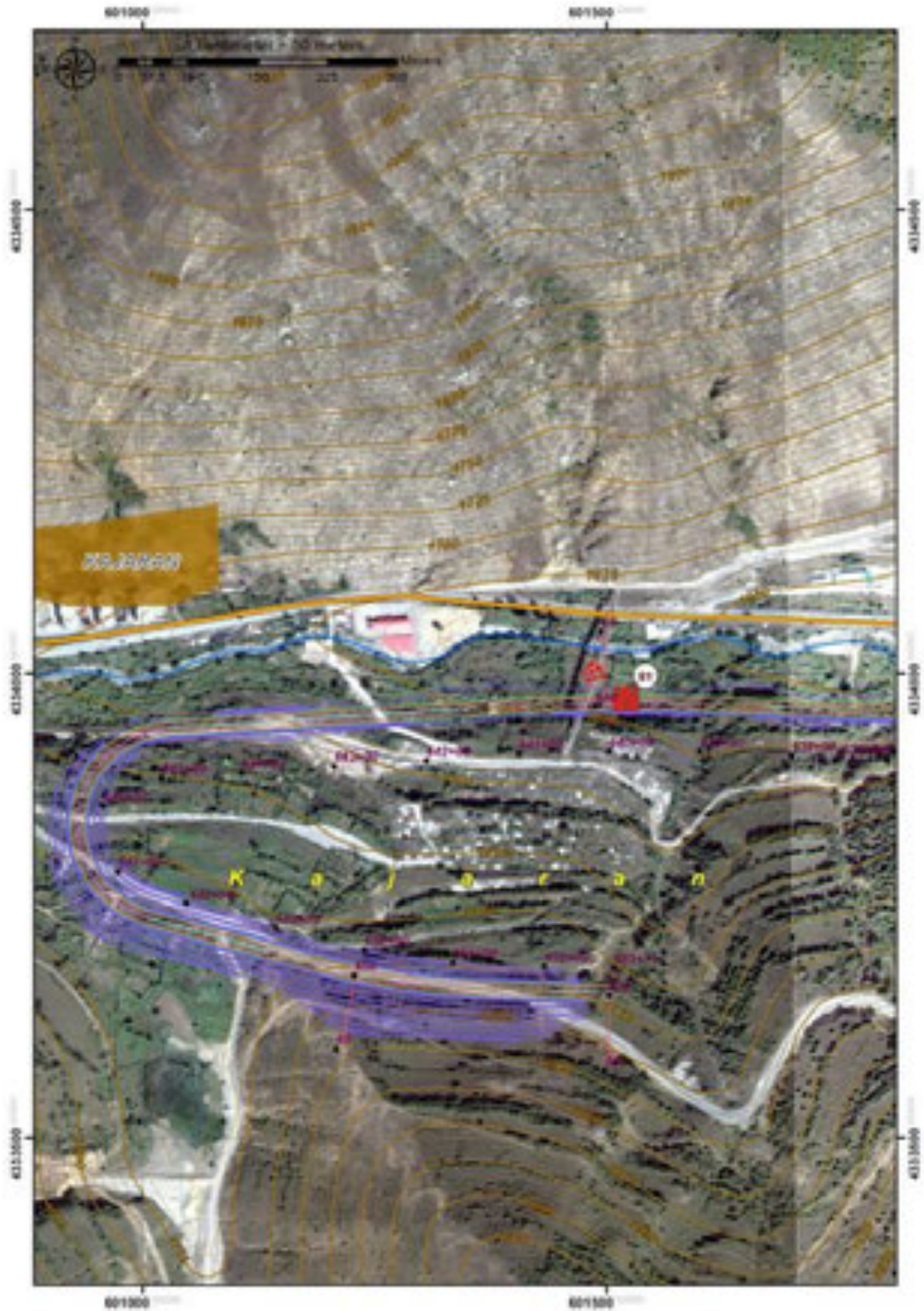


Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 63.7+00 – pk 65.2+75



(1: 5000)

Map 48a



Units recorded in the area of the Lernadzor community. Geghi-Kajaran section of the road project design - pk 63.7+00 – pk 65.2+75





(1: 5000)



**Image 1. Sisian community. Natural monument recorded at pk 1.4+50**



**Image 2. Sisian community. “Stepan ukht” shrine-sanctuary at pk 2.3+20**





**Image 3. Sisian community. North-Western part of the settlement and tomb field located between pk 2.5+50 – pk 3.7+50**



**Image 4. Sisian community. One of the tombs of the settlement and tomb field located between pk 2.5+50 – pk 3.7+50**



**Image 5. Sisian community. One of the tombs of the settlement and tomb field located between pk 2.5+50 – pk 3.7+50**



**Image 6. Sisian community. Circular house remains in the settlement and tomb field located between pk 2.5+50 – pk 3.7+50**





**Image 7. Sisian community. South-Eastern part of the settlement and tomb field located between pk 2.5+50 – pk 3.7+50**



**Image 8. Sisian community. Circular house remains in the settlement and tomb field located between pk 2.5+50 – pk 3.7+50**



**Image 9. Sisian community. Section of diatomite origin lacustrine sediments 1 at pk 4.6+00**





**Image 10. Sisian community. Section of diatomite origin lacustrine sediments 2 at pk 4.9+50**



**Image 11. Uyts community. Main view of the tomb field attached to the Bronze Age fortress at pk 5.1+00**



**Image 12. Uyts community. A large burial mound in the tomb field attached to the Bronze Age fortress (unit 19)**



**Image 13. Uyts community. Main view of the tomb field attached to the Bronze Age fortress at pk 5.5+00 (unit 20 is in frontal view)**





**Image 14. Aghitu community. Natural monument 1 recorded at pk 6.0+40, which was used as a shelter**



**Image 15. Aghitu community, Structure remains or settlement 1 recorded at pk 6.8+50**



**Image 16. Aghitu community, Early Medieval Period cemetery or tomb field recorded at pk 7.0+20**





**Image 17. Funerary monument in the village of Aghitu (6th - 7th centuries AD)**



**Image 18. Aghitu community. Wall structure remnants recorded at pk 7.6+30**





**Image 19. Aghitu community. Concentration of pottery sherds recorded at pk 7.6+30**





**Image 20. Aghitu community. High Medieval Period pottery fragments recorded at pk 7.6+30**



**Image 21. Columnar basalt structures in the Vorotan River Gorge near Aghitu**





**Image 22. Columnar basalt structures in the Vorotan River Gorge near Aghitu**



**Image 23. Aghitu community. Structure remnants in shape of tombs 1 recorded between pk 8.7+90 – pk 8.8+30**



**Image 24. Aghitu community. Structure remnants in shape of walls recorded between pk 8.7+90 – pk 8.8+30**





**Image 25. Aghitu community. Natural monument 2 recorded pk 9.0+30**



**Image 26. Aghitu community. Natural monument 2 recorded pk 9.0+30**



**Image 27. Aghitu community. Complex of rock-shelters separated by a wall structure at pk 9.0+90**



**Image 28. Aghitu community. Structure remnants in shape of tombs 2 recorded at pk 9.0+90**





**Image 29. Aghitu community. Wall structure remains in front of the Natural monument 3 recorded at pk 9.7+00**



**Image 30. Aghitu community. Fragment of the Natural monument 3 recorded at pk 9.7+00**





**Image 31. Aghitu community. Fragment of the Natural monument 3 recorded at pk 9.7+00**



**Image 32. Noravan community. Natural monument 1 recorded at pk 9.2+20**



**Image 33. Noravan community. Natural monument 2 recorded at pk 9.2+50**





**Image 34. Noravan community. Wall structure remnants at the base of Natural monument 2 recorded at pk 9.2+50**



**Image 35. Noravan community. Natural monument 3 recorded at pk 9.4+00**



**Image 36. Noravan community. Truncated settlement recorded at pk 9.5+00**



**Image 37. Noravan community. Section of preserved wall at the truncated settlement recorded at pk 9.5+00**





**Image 38. Vaghatin community. Section of diatomite origin lacustrine sediments recorded  
pk 10.6+00**



**Image 39. Vaghatin community. The place of surface finds around structure remnants in shape of walls recorded at pk 10.8+90**





**Image 40. Vaghatin community. Wall structure remnants recorded at pk 11.2+30**



**Image 41. Vaghatin community. Vorotnavank Monastic complex in the vicinity of pk 11.5+00 (11th-14th centuries AD)**



**Image 42. Vaghatin community. Medieval village remains and Spring-monument recorded at pk 11.9+00**



**Image 43. Vaghatin community. Wall structure preserved in the area of old gardens recorded at pk 12.1+00**





**Image 44. Vaghatin community. Wall structure preserved in the area of old gardens recorded at pk 12.1+00**



**Image 45. Vaghatin community. Wall structure preserved in the area of old gardens recorded at pk 12.5+90**



**Image 46. Vorotan community. Famous Melik Tangi bridge (1885) located close to the pk 13.200**





**Image 47. Vorotan community. Vorotnaberd fortress on the left bank cliff of the Vorotan River close to pk 13.200 (5th-18th centuries AD)**



**Image 48. Vorotan community. Section of diatomite origin lacustrine sediments recorded at pk 12.5+90**



**Image 49. Vorotan community. Vorotan (Voroṭn) Medieval village remains at pk 13.2+40**





**Image 50. Vorotan community. Stella at the first portion of the cemetery of the Vorotan (Vorotn) Medieval village remains at pk 13.2+40**



**Image 51. Vorotan community. Stella at the first portion of the cemetery of the Vorotan (Vorotn) Medieval village remains at pk 13.2+40**



**Image 52. Vorotan community. Tomb in the first portion of the cemetery of the Vorotan (Voroṭn) Medieval village remains at pk 13.2+40**





**Image 53. Vorotan community. Second portion of the cemetery of the Vorotan (Vorotn)  
Medieval village remains and the tomb field at pk 13.5+50**



**Image 54. Vorotan community. Second portion of the cemetery of the Vorotan (Vorotn) Medieval village remains and the tomb field at pk 13.5+50**



**Image 55. Vorotan community. Kahchkar at the second portion of the cemetery of the Vorotan (Vorotn) Medieval village remains at pk 13.5+50**



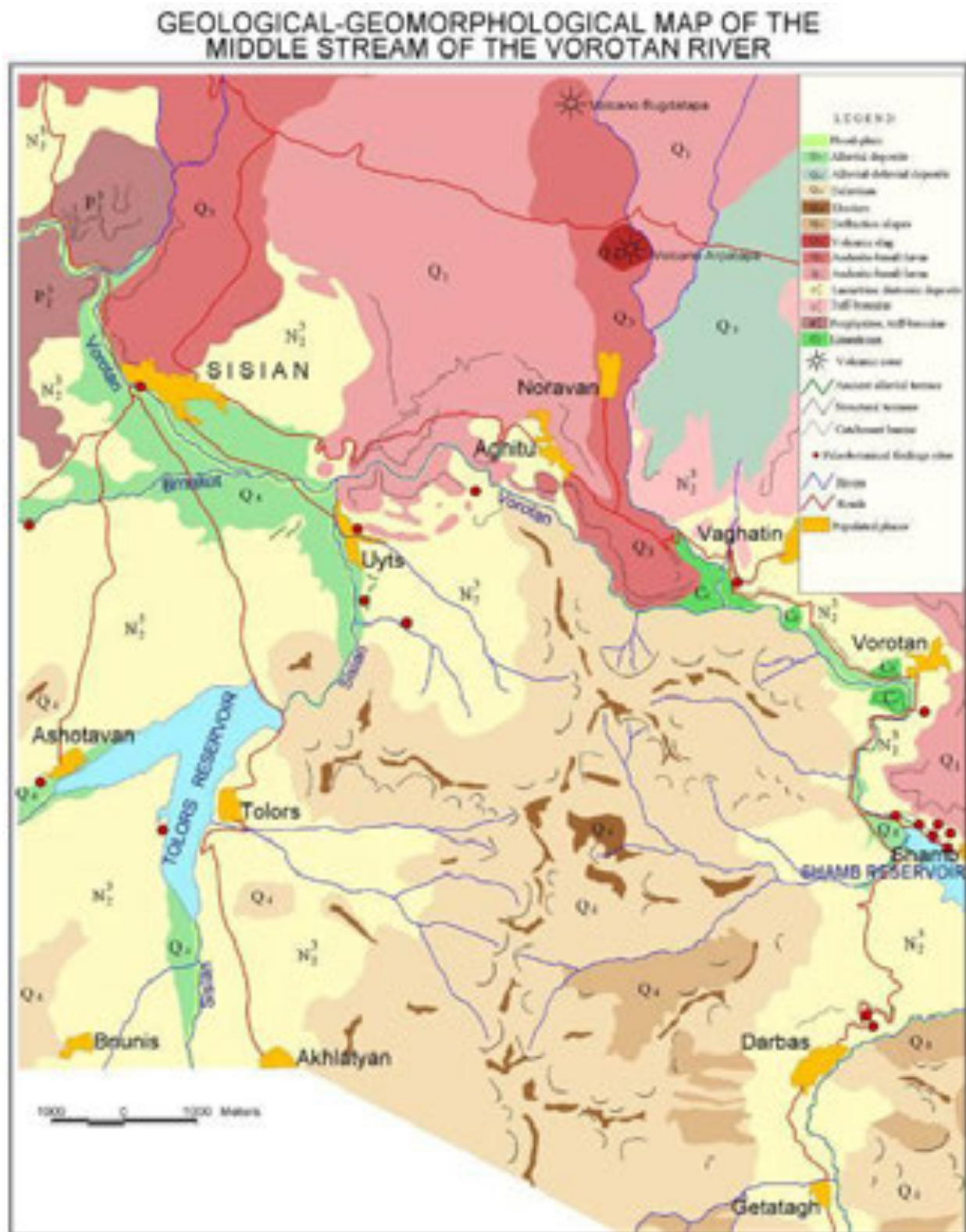
**Image 56. View of the Shamb Reservoir with a huge sequence of diatomite origin lacustrine deposits opened at pk 15.0+00**





**Image 57. Huge sequence of diatomite origin lacustrine deposits in the neighborhood of the Vorotan hydroelectric power station near pk 15.0+00**

**Map 50**



Geological-geomorphological map of distribution of the diatomite origin lacustrine deposits and paleontological localities in the middle stream of the Vorotan River





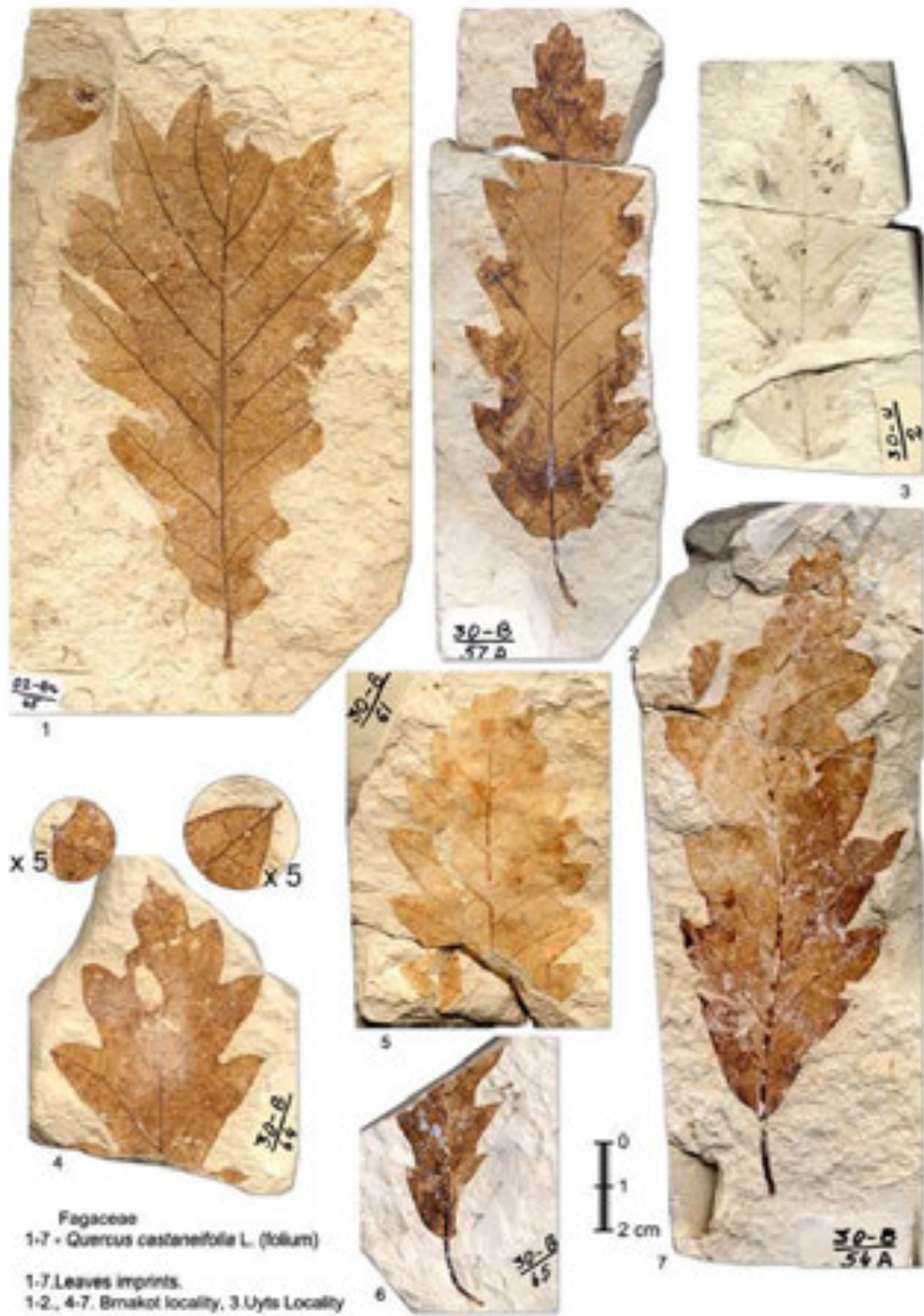


**Image 58. Samples of fossil leaf imprints from the paleontological localities of the Vorotan group**

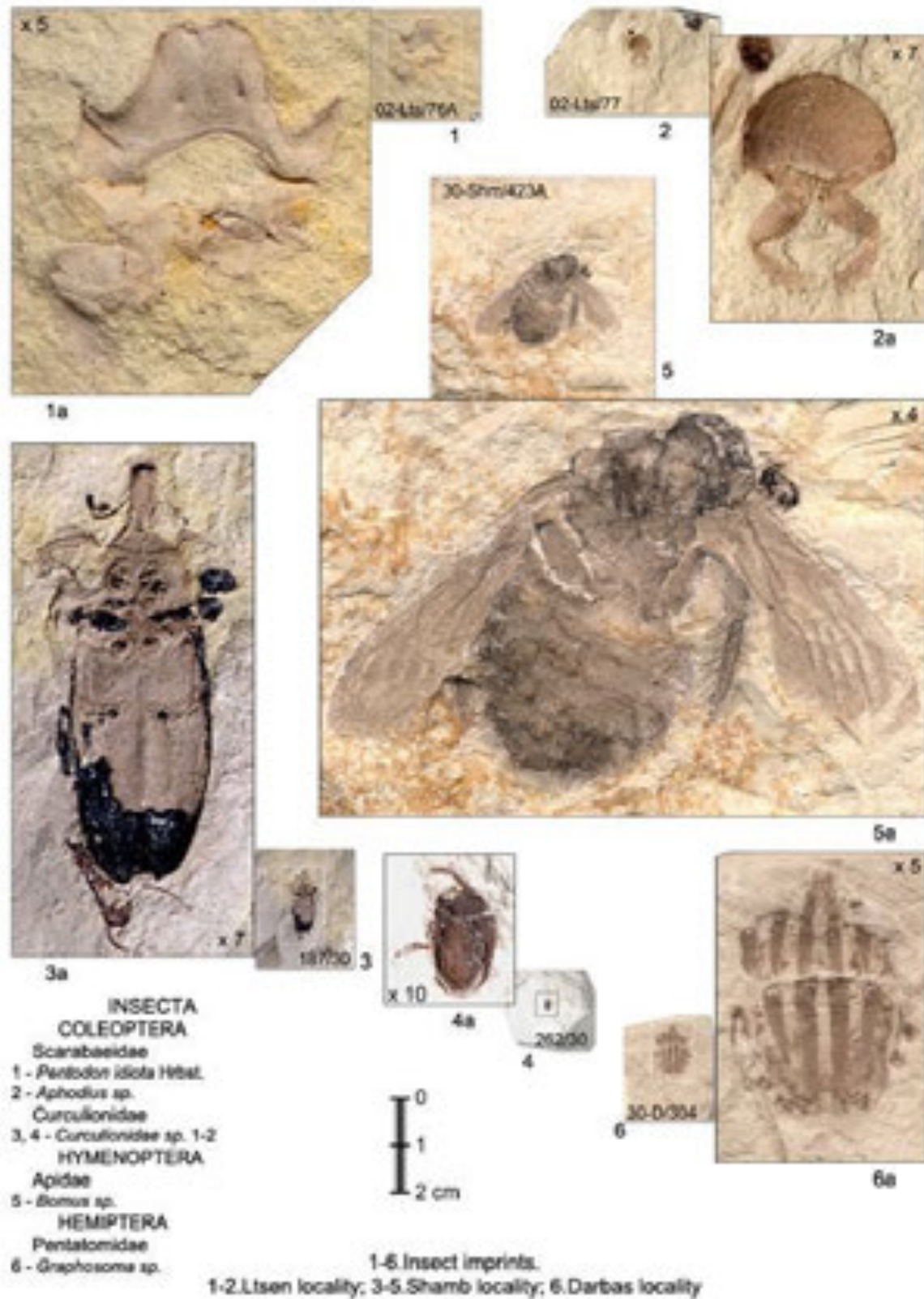




**Image 59. Samples of fossil insect imprints from the paleontological localities of the Vorotan group**



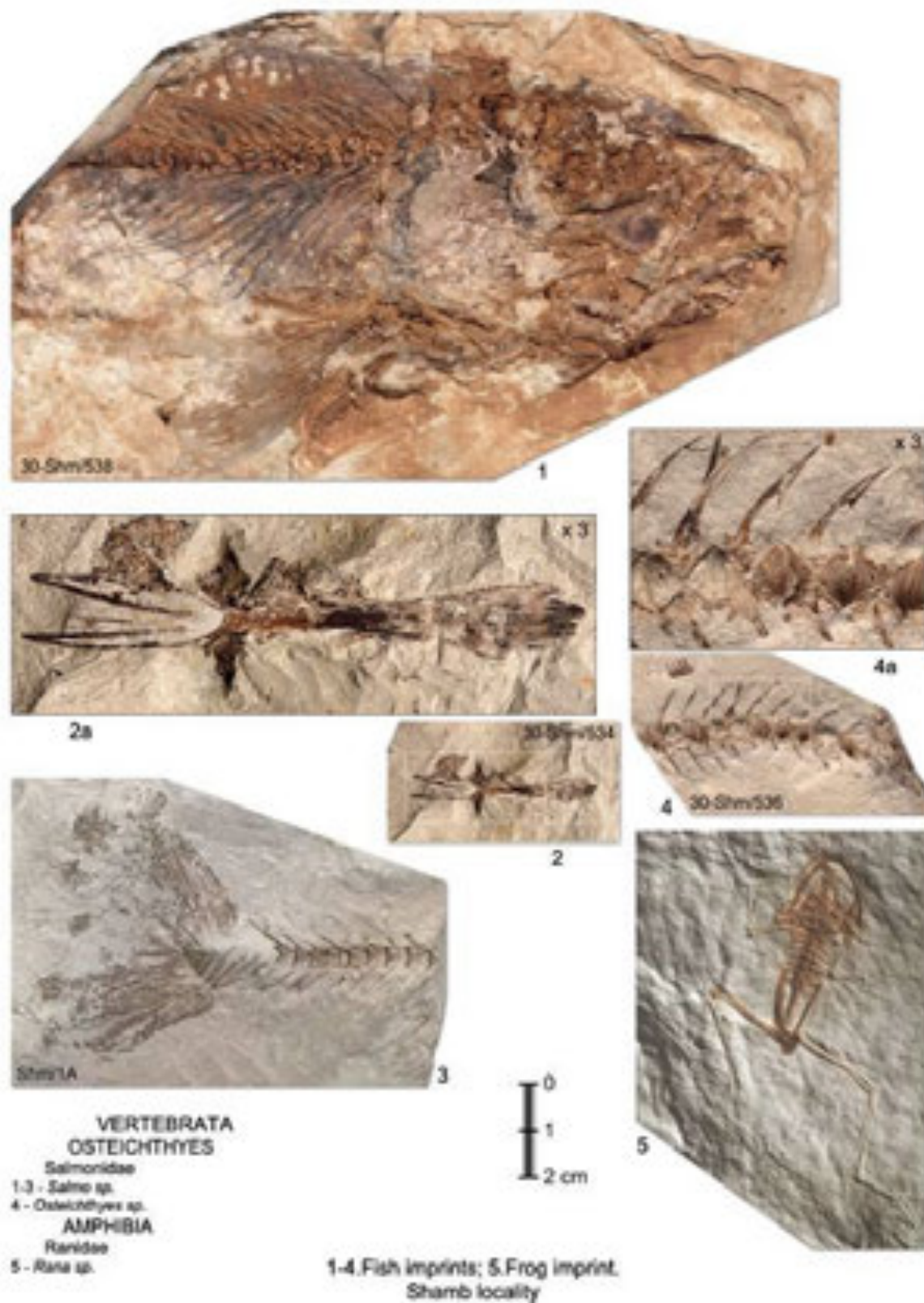


Image 60. Samples of fossil fish and frog imprints from the paleontological localities of the Vorotan group



**Image 61. Darbas community. Flint raw-material source for making stone tools recorded at pk 15.2+00**





Նկար 62. Darbas community. Structure remnants in shape of tombs recorded at pk 15.6+60





**Image 63. Darbas community. Shrine (church) ruins, cemetery and khachkas (Parvants) at pk 17.6+90**



**Image 64. Darbas community. Shrine (church) ruins, cemetery and khachkas (Parvants) at pk 17.6+90**





**Image 65. Darbas community. Kahchkar fragment in the shrine (church) ruins (Parvants) at pk 17.6+90**



**Image 66. Darbas community. Kahchkar lying near the shrine (church) ruins (Parvants) at pk 17.6+90**



**Image 67. Darbas community. “Arzuman’s bridge” (1675) located West from the pk 18.6+00**





**Image 68. Darbas community. Traces of a medieval road, preserved at the Western end of the “Arzuman’s bridge”**





**Image 69. View of the village of Darbas with diatomite origin lacustrine deposits at the background**



**Image 70. Section of diatomite sediments near the village of Darbas, which will stay under the future highway**



**Image 71. Main view of the Lor community at pk 22.5+00 (from south-east)**



**Image 72. Lor community. Section of diatomite origin lacustrine sediments at pk 21.8+00**







**Image 73. Enclosed Khachkar or “Lorik’s Cross” (1271) erected in the cemetery at the entrance of the Lor community**



**Image 74. S. Gevorg basilica church (1666) in the center of the Lor community**



Image 75. Southern entrance of the S. Gevorg church in the center of the Lor community



**Image 76. Lor community. Cave complex carved in a section of diatomite origin lacustrine sediments at pk 22.7+50**



**Image 77. Lor community. Pk 23.1+60, where the Mardakayr Medieval village remains, Tsaru S. Hovhannes church and II-I Millennium BC tomb field are reported**





**Image 78. Lor community. One of the khachkars (14th-15th centuries) recorded at pk 23.1+60**





**Image 79. Lor community. Medieval village remains recorded at pk 23.3+90**



**Image 80. Lor community. Medieval village remains recorded at pk 23.3+90**



**Image 81. Lor community. Section of diatomite origin lacustrine sediments recorded at pk 23.9+50**





**Image 82. Main view of the Shenatagh village from the North, from the Lor-Shenatagh road**



**Image 83. Shenatagh community. Cave complex carved in a section of diatomite origin lacustrine sediments at the North-Eastern side of the village (Late Medieval Period-Modern)**





**Image 84. Shenatagh community. Mineral water spring monument dedicated to the memory of geologist Yegor Harutyunyan (1981)**



**Image 85. Shenatagh community. Inscription of the spring-monument dedicated to the memory of geologist Yegor Harutyunyan**



**Image 86. Shenatagh community. Western view of the Iron Age fortress at pk 25.6+00**



**Image 87. Shenatagh community. The place of the surface archaeological finds at the base of the hill with an Iron Age fortress at pk 25.6+60**



**Image 88. Shenatagh community, Cave complex carved in a section of diatomite origin lacustrine sediments at pk 25.7+00 (Late Medieval Period-Modern)**





**Image 89. Shenatagh community. One of the caves carved in a section of diatomite origin lacustrine sediments at pk 25.7+00 (Late Medieval Period-Modern)**



**Image 90. Shenatagh community. Fragment of the fortification wall of the “Sagu ghala”  
Medieval fortress at pk 26.5+00**



**Image 91. Shenatagh community. Fragment of the fortification wall of the “Sagu ghala”  
Medieval fortress at pk 26.5+00**





**Image 92. Shenatagh community. Main view of S. Sargis church from south-west**



**Image 93. Shenatagh community. Main view of S. Sargis church from north-east**





**Image 94. Shenatagh community. Main view of the S. Martiros church built in 1704 from north-west**



**Image 95. Shenatagh community. Gravestone enclosed at the left side of the entrance of the S. Martiros church**



**Image 96. Shenatagh community. Natural monument complex 1 recorded at pk 26.9+20**



**Image 97. Shenatagh community. Natural monument complex 1 recorded at pk 26.9+90**





**Image 98. Geghi community. Medieval village remains 1 recorded at pk 36.1+40 (Kitsk (Kirs) area)**



**Image 99. Geghi community. Medieval village remains 1 recorded at pk 36.1+40 (Kitsk (Kirs) area)**





**Image 100. Archaeological materials which have scientific importance discovered during study of the Geghi-Kajaran section of the road:**

**1-3. Upper Paleolithic cores made from flint (Lernadzor community. Archaeological complex – Upper Paleolithic open-air site, Chalcolithic settlement and Early medieval tomb field); 4. Late Chalcolithic (First half of the IV Millennium BC) obsidian blade (Lernadzor community. Archaeological complex – Upper Paleolithic open-air site, Chalcolithic settlement and Early medieval tomb field); 5-6. Late Chalcolithic (First half of the IV Millennium BC) ceramic fragments; 7. High Medieval (13th-15th centuries) handle (Geghi community. Medieval village remains 1 at the Kitsk (Kirs) area)**



**Image 101. Geghi community. External view of the church (18th century) at pk 36.3+00 (Kitsk (Kirs) area)**



**Image 102. Geghi community. Internal view of the church (18th century) at pk 36.3+00 (Kitsk (Kirs) area)**





**Image 103. Geghi community. Medieval village remains 2 recorded at pk 36.6+50 (Kitsk (Kirs) area)**



**Image 104. Geghi community. Medieval through modern cemetery at pk 36.7+20 (Kitsk (Kirs) area)**





**Image 105. Geghi community. Azeri gravestone in Medieval through modern cemetery at pk 36.7+20 (Kitsk (Kirs) area)**



**Image 106. Geghi community. Silicified limestone raw-material source 1 for making stone tools recorded West from pk 42.3+00**



**Image 107. Geghi community. Cilicified limestone raw-material source 2 for making stone tools recorded at pk 47.0+00**





**Image 108. Geghi community. Structure remains (Medieval village remains) recorded at pk 48.6+00 (Verin Geghavank (Baharlu) area)**





**Image 109. Nor Astghaberd community. Natural monument 1 recorded at pk 42.5+10**



**Image 110. Nor Astghaberd community. Natural monument 2 recorded at pk 42.5+80**



**Image 111. Lernadzor community. Main view of the Lernadzor-1 cave complex recorded at pk 53.1+80 (Kavchut area)**





**Image 112. Lernadzor community. Wall fragment in front of the central niche of the Lernadzor-1 cave complex recorded at pk 53.1+80 (Kavchut area)**



**Image 113. Lernadzor community. Entrance of the central niche of the Lernadzor-1 cave complex recorded at pk 53.1+80 (Kavchut area)**



**Image 114. Lernadzor community. Internal view of the central niche of the Lernadzor-1 cave complex recorded at pk 53.1+80 (Kavchut area)**





**Image 115. Lernadzor community. Portion of the tomb field recorded at pk 53.3+00 (Kavchut area)**



**Image 116. Lernadzor community. Portion of the tomb field recorded at pk 53.3+00 (Kavchut area)**





**Image 117. Lernadzor community. Portion of a wall structure in the Chalcolithic settlement recorded at pk 60.2+70**



**Image 118. Lernadzor community. Palesol containing Upper Paleolithic stone implements opened in the section of the Archaeological complex recorded East from pk 60.9+00**





**Image 119. Lernadzor community. Chalcolithic vessel visible in the section of the Archaeological complex recorded East from pk 60.9+00**



**Image 120. Lernadzor community. Slab grave visible in the section of the Archaeological complex recorded East from pk 60.9+00**



**Image 121. Lernadzor community. S. Gevorg church (12th century) at Kolagegh Medieval village remains located East from pk 61.1+00**





**Image 122. Lernadzor community. Main view of the archaeozoological site recorded East from pk 61.1+00**



**Image 123. Lernadzor community. Fossilized mammal tooth in the section of the archaeozoological site recorded East from pk 61.1+00**





**Image 124. Kajaran community. Area of the ruined cemetery existing at pk 64.0+00**



**Image 125. Main view of the city of Kajaran and the Voghji River valley**



**Image 126. View of the city of Kapan**



**Image 127. View of the Mt. Khustup from the city of Kapan**





**Image 128. Vahanavank Monastic Complex (founded in 911)**





**Image 129. Main view of the Baghaberd fortress (9th-12th centuries)**

## Annex 9: Minutes of the Public consultations

### MINUTES OF MEETING OF PUBLIC HEARINGS ON SISIAN-KAJARAN (km 0+000 - km 60+022) ROAD SECTION'S DRAFT DESIGN, DRAFT LAND ACQUISITION AND RESETTLEMENT PLAN AND PRELIMINARY ASSESSMENT OF ENVIRONMENTAL IMPACT

Under North-South Road Corridor - Tranche 4 project financed by the Asian Development Bank, there were held public hearings on the draft design of Sisian-Kajaran road section, preliminary assessment of environmental impact, and land acquisition and resettlement plan. The hearings were held in conference halls of Sisian Municipality on 17 November, 2016, at 14:00, and Syunik Municipality on 18 November, 2016, at 12:00. The details of representatives of North-South Road Corridor Investment Program and other consultants attending the public hearings are presented in the table below. Representatives of “Spea Ingegneria Europea S.p.A. and IRD Engineering S.R.L.” JV, as well as the senior site engineer and specialists on social development and resettlement, environmental management and archaeology of “North-South Road Corridor Investment Program Implementation Organization” SNCO (hereinafter referred to as PIO) presented the program and the purpose of hearings under the general program to the community.

All attendees of meetings were handed out information notes detailing Program implementation stages, rights and responsibilities of interested parties, compensation calculation methods, frequently asked questions, and grievance resolution mechanisms.

| Participants                                                                                                                                                   | The Community and date of the meeting |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|------------|
|                                                                                                                                                                | Sisian                                | Kapan      |
|                                                                                                                                                                | 17.11.2016                            | 18.11.2016 |
| <b>Sona Poghosyan</b> – “North-South Road Corridor Investment Program Implementation Organization” SNCO, social development and resettlement specialist        | √                                     | √          |
| <b>Tigran Oganessov</b> – “North-South Road Corridor Investment Program Implementation Organization” SNCO, environmental management and archaeology specialist | √                                     | √          |
| <b>Arthur Sanoyan</b> – “North-South Road Corridor Investment Program Implementation Organization” SNCO, senior site engineer                                  | √                                     | √          |
| <b>Aram Avetisyan</b> – representative of “Spea Ingegneria Europea S.p.A. and IRD Engineering S.R.L.” JV                                                       | √                                     | √          |
| <b>Lilit Tadevosyan</b> – representative of “Spea Ingegneria Europea S.p.A. and IRD Engineering S.R.L.” JV                                                     | √                                     | √          |

## Public meeting agenda

Sona Poghosyan, a social development and resettlement specialist of “North-South Road Corridor Investment Program Implementation Organization” SNCO, addressed welcoming speech. Sona Poghosyan pointed out that the main purpose of the meeting was presenting information on Sisian-Kajaran draft design, preliminary environmental impact assessment, draft land acquisition and resettlement plans to the communities, especially to affected households by clarifying the necessity of land acquisition, the right-of-way process, required documents, compensation policy, compensation payment procedure, rights and obligations of affected persons, grievance resolution mechanism, etc. Generally, the following issues were raised during hearings, where the team answered a number of questions asked by interested parties.

Each of specific questions and their answers are presented in this separate appendix.

## **DRAFT DESIGN**

The “North-South Road Corridor Investment Program”-Tranche 4 Sisian-Kajaran section (km 00+000 – km 60+022) is a speedway with 100 km/h design speed. This section is an alternative option because the existing M-2 interstate road shall be maintained. The new designed road will make the existing Sisian-Kajaran road section shorter by 60 km. There were conducted geological surveys of the site and existing utilities investigations, and design works were carried out based on their results.

- ***Technical description of the designed road***

The design is implemented as per Client’s technical specification in compliance with local and international standards.

The total length of the road alignment is 60 km passing through the following communities: Ishkhanasar, Sisian, Uyts, Aghitu, Noravan, Vaghatin, Vorotan, Darbas, Getatagh, Lor, Shenatagh, Geghi, Lernadzor, Nor Astghaberd:

The road has 3 traffic lanes (it is provided for an additional lane for passing in the direction of ascent). The design provides for 16.5 m wide subgrade, of which asphalt-concrete pavement comprises 11.10 m. The maximum longitudinal slope is 5%, the minimum radius of horizontal curves is 425 m.

The road alignment mainly passes through semi-fill - semi-cut sections. On some excavation sections, there are provided for shape-protecting activities for the carriageway.

According to the geological surveys, some sections of the road alignment pass through rocky grounds, where appropriate safety measures are taken for their blasting.

As per initial calculations, the excavation volume is 16 000 000 m<sup>3</sup>, and the volume of embankment is 3 500 000 m<sup>3</sup>.



At the intersection of the existing M-2 interstate road and the new designed road, it is provided for transport interchanges and one traffic center at km 15+850. As a result, the design provides for 3 transport interchanges with the potential of movement in all directions.

- **Artificial structures**

Because the new road alignment crosses rivers and water-collecting ravines, the design provides for 27 bridges, 5 out of which are reinforced concrete, and the remaining 22 are metal bridges with large spans. 3 overbridges are provided in traffic centres.

In order not to hinder agricultural works, it is provided for construction of 4 crossings for the agricultural machinery, and 9 animal crossings.

Along the whole road alignment, it is provided for construction of 9 tunnels, where the biggest one - 8650 m long - will have a special shelter and exit to ensure humans' safety in emergency situations.

To insure drainage of rainwater and snowmelt in small ravines, as well as from the carriageway, it is provided for 107 culverts along the road. On some sections, it is provided for in-situ concrete chutes to protect shoulders from washout.

To reduce boundaries of acquired lands on steep slope sites and some sections, it is provided for reinforced concrete retaining walls.

All of the artificial structures will be built in accordance with international standards.

- **Traffic safety management**

Road signs, marking and guardrails are provided in accordance with design speed at 100km/h. For convenience of road users, individual guide and information signs are provided for. Traffic safety management complies with existing norms (GOST R 52289-2004, GOST R 52290-2004).

## **PRELIMINARY ASSESSMENT OF ENVIRONMENTAL IMPACT**

The assessment of environmental impact has been done within the framework of international agreements of the Armenian legislation and ADB Safeguards Policy Statement (2009).

The provisions of ADB Safeguards policy are aimed at avoiding, reducing or mitigating negative environmental impacts resulting from the Program implementation. This purpose will be achieved by the following means:

- ✓ Identification of potential impacts in the initial stage of the Program
- ✓ Development of mitigation measures
- ✓ Conducting meetings with affected parties

The following activities are implemented to reduce the environmental impact:

- Initial environmental study
- Environmental impact assessment
- Development and implementation of environmental management plans (BMP), including mitigation measures





- Office studies of affected areas,
- Field studies of fauna and flora,
- Laboratory study of the air, water, and soil quality
- Archaeological field studies.

It was mentioned at the meeting that the conducted studies made clear that possible negative impacts during the Program implementation would be of temporary nature, mitigated and minimised due to measures defined by the environmental management plan.

### **Flora and fauna studies**

During flora studies, there were discovered 10 species of plant registered in the Red Book mainly encountered in the basin of Shenatagh River and territories adjacent to Kajaran community, 8 endemic species. However, it was pointed out that the mentioned trees might be relocated during implementation of the construction stage in case they appeared in the affected zone. About 6000 trees and 10000 shrubs will be cut due to the Program implementation.

Fauna studies discovered:

- 29 species of invertebrates, 13 of which are registered in the Red Book of the RA
- 4 species of amphibia and 24 species of reptiles, 4 of which are registered in the Red Book of the RA
- 68 species of birds, 7 of which are registered in the Red Book of the RA
- 50 species of mammals, 11 of which are registered in the Red Book of the RA

*The most vulnerable section along the Project is ("ZANGEZUR" STATE RESERVE and nearby areas)*

The following has been discovered on Kitsk-Geghi section:

- 13 species of fauna registered in the Red Book of the RA, out of which:
  - ✓ 6 mammals,
  - ✓ 2 birds
  - ✓ 5 reptiles

***To mitigate the mentioned negative impacts, the following mitigation measures have been proposed:***

Flora

- Trees at 1:6 proportion will be replanted against each cut tree.
- There will be carried out ecosystem recovery works and detailed monitoring.

## Fauna

- It is proposed to build crossings for small mammals on sections Sisian-Darbas, Darbas-Shenatagh, Kitsk-Geghi
- It is proposed to build a barrier to prevent animals from entering the road
- Green bridges are necessary on Kitsk-Geghi section as there is a rich assortment of large mammals: For this purpose, it is necessary to conduct a detailed survey to ensure daily and seasonal migration of the Armenian mouflon, Bezoar goat, and other mammals.

It was pointed out the purpose of Program's Environmental management plan is the management of Program's potential impacts and their prevention or mitigation. BMP presents the basic principles and general mitigation measures.

**Possible complaints and proposals.** It was pointed out that, according to the ADB Safeguards policy statement, the affected population, as well as any interested party might submit their complaints and proposals on issues emerged during Program implementation.

## **DRAFT LAND ACQUISITION AND RESETTLEMENT PLAN**

### **1. Stages of the land acquisition and resettlement process**

- **The initial road design** is already ready. Also, the draft land acquisition and resettlement plan is ready. After that, there will start preparation of final land acquisition and resettlement plan. This stage will be followed by acquisition and compensation (LARP implementation) stage. Construction works will start after completion of this stage. Construction works may not start until acquisition of affected lands and payment of compensation amounts to their owners.
- The draft LARP is prepared by combining draft design, cadastre maps, and conducted surveys providing an idea on affected communities, land lots and buildings.
- The preparation of the final LARP assumes the following stages:
  - 1) Resolution on recognition of affected land lots as prevailing public interest,
  - 2) Public discussions in communities,
  - 3) Detailed measurement survey,
  - 4) Registration of affected property, including trees and crops,
  - 5) Census and social-economic survey,
  - 6) Drafting and signing of description protocol,
  - 7) Assessment of affected property, determination of the compensation amount,
  - 8) Approval of the Final LARP by RA Government and donor organisation.
- Implementation of the Final LARP
  - a. Notifying on draft contract to the affected persons,
  - b. Preparation and signing of the final contract with affected persons,
  - c. Resolution of issues related to heritage and absence of the owner from the country,

- d. State registration of the acquired property and part of the property.

## 2. Compensation principles and approaches

Under the Program, "Land acquisition and resettlement framework" (LARF) is prepared and approved by the government resolution defining the approaches to implementation of compensation. This resolution also approved by the Asian Development Bank has been developed in combination of our laws and the Asian Development Bank's principles. With this respect, in comparison with similar projects implemented with non-international financing in the Republic of Armenia, the approaches are much favourable for affected persons.

Detailed measurement and assessment are done by qualified specialist and organisation. This process has not started yet. It will start after preparation of the final design.

## 3. Compensation mechanisms

- Real estate (lands). In case of agricultural and non-agricultural lands, owners, i.e. those persons whose names are listed in the certificate of title will receive compensation equal to the market or cadastre value of the land (whichever is higher) plus 15%. Usually, the market value is higher than the cadastre value. The market value is determined on the basis of values of deals performed in the particular community during the previous 1 or 2 years; the sold lots are compared to the lot being acquired, and the price is determined based on values of similar lots. If there are no registered deals in that community, then deals performed in the neighbouring community will be taken into account. Different lots in the same community may have different prices: the price depends on the type of land such as arable land, pasture, orchard, etc., it depends on the land slope, being in the first or second line, the extent of stoniness, etc. Therefore, there is no unified price for the program or community. Calculation of compensation value is the same for both agricultural and non-agricultural lands.
  - If there are tenant farmers, i.e. persons having land title by lease contract and an appropriate certificate from cadastre, then the lessee will also get compensation. In this case, the lessee will, receive some portion of the estimated <market value plus 15%> compensation amount depending on the expiry date of the lease contract. If up to one year remains to expiration of the lease contract, the lessee's compensation will amount to 5% of the total compensation value; in case of expiry date up to 15 years, it will be 14%; in case of expiry date up to 25 years, it will be 20%, and in case of expiry date of 25 and more years, it will be 25%.
  - **Owners subject to legalisation.** This group involves persons who had received lots in time of land allocation but did not make official their title of ownership and did not hold a certificate from the cadastre. Only after registering the right of ownership and obtaining a certificate from the cadastre, these persons can receive compensation calculated and paid as in the case of owners.
4. **Buildings and structures.** The approaches vary for residential and non-residential buildings. In case of residential buildings, regardless of the structure's status or being registered or not, the owner must receive replacement value plus 15% as compensation. To determine the replacement value, it is calculated how much money is needed for the citizen to be able to build

a similar new structure. Calculation includes cost of construction materials, labour expenditures, cost of the design, etc.. But the structures depreciation is not deducted from the compensation value, that is, if there are, for example, old wood windows on the structure, then cost of installation of new wood windows is calculated. However, if the structure does not have windows, then no amount will be calculated for installation of windows in the compensation value, as well. Regardless of compensation, the owner also has the right to remove and take all types of materials or construction materials from the old structure within certain period after signing the acquisition contract.

- Calculation of compensation value for residential and non-residential buildings is the same, However, unlike residential buildings, illegal non-residential buildings shall not be compensated: If there are such buildings, the owner must start a process for their legalisation to be eligible for compensation. Legalisation should be conducted within certain time period after which no compensation will be paid for legalised buildings. For support in this issue, owners may contact SNCO, as well.
5. **Resettlers** will also receive resettlement benefits and benefits for being affected that include all expenses for resettlement and transportation of the property.
  6. **Compensation for crops.** Here too, the logic of replacement value applies, that is the citizen will grant enough amount to be able to create the same. In case of crops, compensation for harvest will be calculated at market prices for the expected gross yield. The quantity and type of crops available on the lot to be acquired will be described in protocols.
  7. Compensation for trees. Loss of trees is calculated differently for different trees: 3 types of trees are distinguished - fruit trees, ornamental trees, and timber trees. Fruit trees themselves are divided into young plants, not yet fertile trees, and fertile trees. Compensation for young plants will be given at the value of the young plant, that is the value, at which the young plant can be procured in the market. In case of not yet fertile trees, calculation involves the young plant's value and those investments to be made on that tree during several years: the costs of watering, fertilizers, etc. In case of fertile, the compensation value is calculated as follows: the potential yield of the tree in 1 year is multiplied by the number of years needed for the tree to reach the period of fruitfulness. For instance, if the apple-tree begins giving yield in 5 years after planting, and a citizen already has a fertile apple-tree, then apple-tree's potential yield in 1 year will be calculated and multiplied by 5 years, during which the newly planted tree will to yield yet. Ornamental trees will be assessed by their market value. Timber trees are assessed by timber volume calculated using a specific methodology.
  8. Compensation for business. There are two options of the impact on business: permanent and temporary. With permanent impact, the property is fully acquired, and there is no possibility to be engaged in the same business anymore. In case of temporary impact, the entrance, for example, may be closed, or the impact may be on a part of the structure or on one of the buildings. In case of temporary impact, there will be calculated the months of impact, and how many months are required for the business to resume its operations. In case of permanent business if it is legal and has tax declarations, the income received in the previous 1 year is calculated as per tax declarations, and is compensated in the amount of that income. If the business is illegal and unregistered, the compensation is calculated as twelve-fold of the minimum wage. In case of both temporary and permanent loss, employees of the business also receive compensation. With permanent impact, the employee's average monthly salary in the last one year is calculated and compensated for six months so that the employee has enough time for finding a new job.
  9. Additional assistance.
    - Besides main compensation amount, the program provides for additional benefits in some instances. The first instance is assistance under extreme impact to be provided in two circumstances. The first is when the benefit is granted in case of a big loss of agricultural income, where the income obtained from use of the acquired portion comprises more than 10% of household's total income. In this case, one-year yield expected from the acquired portion is calculated and paid. This is paid additionally, regardless of compensation for trees and crops. And the second circumstance when the benefit is granted is the case of moving





from residential houses. In this case, the household is paid a benefit equal to the six fold of the minimum wage.

- Families moving out of residential houses will also get resettlement benefit, which includes one-month life sustenance expenses and the costs of transportation.
- Vulnerable households will also receive additional benefit equal to the sixfold of the minimum wage. Three types of households are considered vulnerable: the first type is poor households that are beneficiaries of “Paros” system. If there are households that meet requirements of “Paros” system but for some reasons not enrolled in the system yet, they can be enrolled now by submitting registration documents to the program and receive the additional benefit. The second group is households headed by lone mothers, and the third one is households headed by lonely pensioners.

### QUESTIONS AND ANSWERS

| Question                                                                                                                                                                                                                                                                                                                                                | Asker                                       | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Answerer         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| During the previous public hearings held in Kapan, the presented road alignment was passing on the north of Noravan community. Based on that, a certificate for the location of a dumping place was issued. Now, the suggested road alignment passes on the south of Noravan. Can the location of the dumping place be changed?                         | Head of Uyts community                      | There were presented 4 options in the previous hearing in Kapan, and one was selected. As this is only a draft design, locations of final dumping places will be discussed with the head of each community for the final design.                                                                                                                                                                                                                                                                                                                                  | Arthur Sanoyan   |
| Does the new road pass near the sand pit in Ishkhanasar community?                                                                                                                                                                                                                                                                                      | Head of Ishkhanasar community               | The designed new road does not pass nearby Ishkhanasar sand pit.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Aram Avetisyan   |
| For alienation of lands of agricultural significance, before the target significance can be changed, approved by communities' Councils of the Elders, and before a new certificate is obtained, and then the lands are acquired, this will take several months. Is it possible to alienate the land of agricultural significance without a certificate? | Head of Sisian urban development department | Because community lands do not have a separate certificate of titles, they are registered within the Program based on the results of actual measurement of the affected section performed at the cadastre, and they get separate codes. After that, they are alienated by a separate contract. After acquisition, when land lots become property of the Republic of Armenia, their target significance will be changed. The process of change is initiated by the RA Ministry of Transport, Communication and Information Technologies together with communities. | Sona Poghosyan   |
| There are archaeological special protection zones on the area. How will archaeological monuments be protected?                                                                                                                                                                                                                                          | Head of Darbas community                    | There have been conducted studies for all archaeological places. Based on their results, appropriate measures will be taken during construction to preserve the monuments of archaeological value.                                                                                                                                                                                                                                                                                                                                                                | Tigran Oganessov |



|                                                                                                                                                                               |                                                |                                                                                                                                                                                                                                                                                  |                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| If the owner has granted his property on lease, who will receive compensation in that case?                                                                                   | Head of Aghitu community                       | Both the owner and the lessee will receive compensation in that case but the owner receives compensation in the amount of lot's market value plus 15 percent, while the lessee receives compensation for crops sown and/or trees planted by him.                                 |                  |
| The design crosses Shamb HPP supply pipeline. Were proper studies conducted?                                                                                                  | Head of Vorotan community                      | Yes, appropriate studies are conducted for approval of the final design.                                                                                                                                                                                                         | Aram Avetisyan   |
| In case of the tunnel to be built near the settlement, is it possible that the water course supplying water to the settlement be lost and leave the settlement without water? | Head of Darbas community                       | Prior to approval of the final design, respective specialists will carry out appropriate field studies.                                                                                                                                                                          | Aram Avetisyan   |
| The RA legislation prohibits allocations of community lands along roads. Will these laws take effect within the framework of this project?                                    | Head of Lernadzor community                    | In those communities, where there is no final design yet, the prohibition will be maintained. At present, efforts are put to alter the government's resolution, which will make it possible to cancel the prohibition in communities, where already exists a clear final design. | Sona Poghosyan   |
| Are the design approval deadlines specified?                                                                                                                                  | Head of Syunik Regional Department of Cadastre | The final design will undergo complex expertise, after which it will be approved. It is planned to have the final design in spring 2017.                                                                                                                                         | Sona Poghosyan   |
| It was mentioned that 6 new trees would be planted against each cut tree. Does planting so many trees will compensate caused damages.                                         | Director of "Kapan Forestry" Branch            | It is envisaged to ensure 80% establishment of young plants by taking care over 3 years. Otherwise, re-planting should be implemented.                                                                                                                                           | Tigran Oganessov |
| Is it possible to tell certainly, what is the size of affected section in Kapan Forestry zone?                                                                                | Director of "Kapan Forestry" Branch            | As this is a draft design, and data are general, no one can provide accurate data in this case. Respective specialists will distinguish and provide appropriate information to be submitted to relevant bodies.                                                                  | Tigran Oganessov |
| Where can we obtain information on studies carried out under the project from?                                                                                                | Kajaran municipality                           | Because the design is still in the initial stage, providing detailed information is not possible yet. After approval of the design, related information will be provided in the website of "North-South Road Corridor Investment Program Implementation Organization" SNCO.      | Tigran Oganessov |



ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅԱՆ ՄԻՋԱԿԱՆ  
ՆԱԽՆԵՐՄԱՏՈՒՄԻ ՓԵՐՈՒՄԻ ՏՐԱՆՇԵ 4  
ՍՈՒՄԱԿԱՅԱՆ (60ԿՄ) ՀԱՆՈՒՑՈՒ ՆԱԽԱՄԵԼ  
ՆԱԽՄԱՏՈՒՄ

Ըստառաններին հետ հանրային խորհրդակցություն

Նախնական նախագիծ, քաղաքականության ազդեցության  
նախնական գնահատման, նախնական հողերի տարածման և  
առաքելակների խնդիրներ

Իրականացնող՝ «Սիսիակ Ունիվերսալ Էնթերթեյնմենթ Մա.Ս.Կ. և Ս.Ս.Ս.Ս. Ունիվերսալ Մա.Ս.Կ.» ՀԸ

Անցկացման վայրը՝ Սիսիակի քաղաքականություն

NORTH-SOUTH ROAD CORRIDOR INVESTMENT PROGRAM  
TRANCHE 4  
PRELIMINARY DESIGN OF SISIAKAJARAN (60 KM) ROAD  
SECTION

Stakeholders Consultation

Issues of preliminary design, environmental impact preliminary  
assessment, preliminary land acquisition and resettlement

Implementing SPEA Engineering and IRD Engineering JV

Place: Sisiat municipality

#### ՄԱՍՈՒՄԱՆԱԿԱՆ ԲԱՏԱՆԱԿԱՆ ԱՏՄԱՆԱԿԱՆ ԼՍՏ

17.11.2016

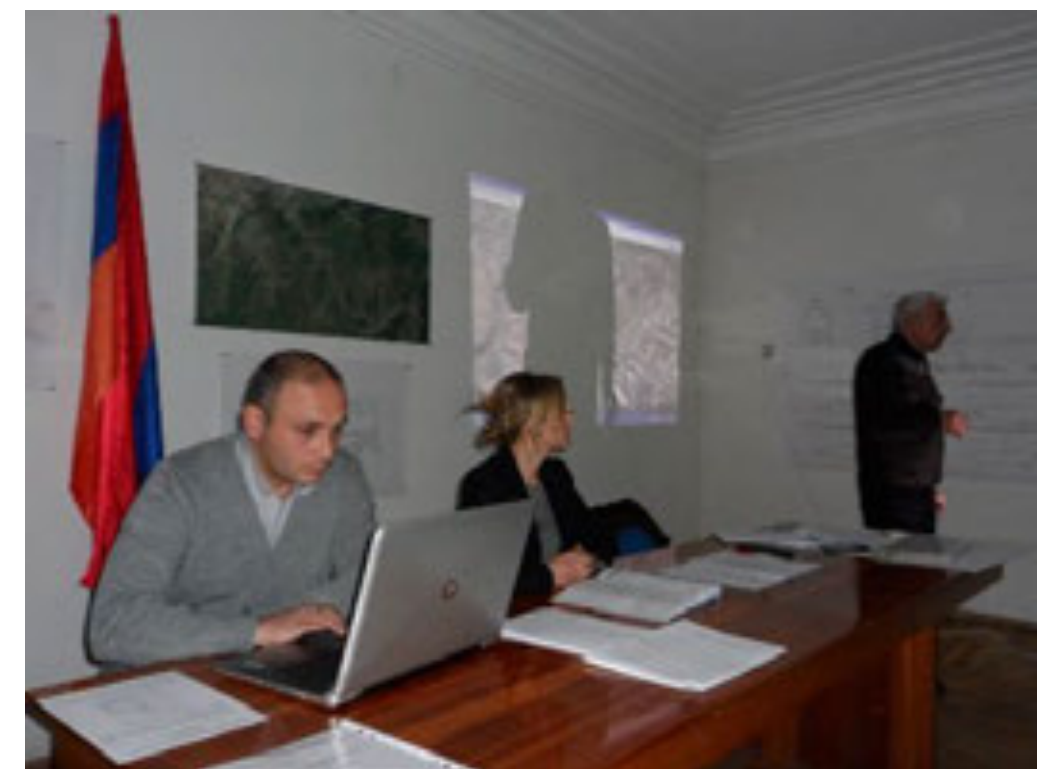
| N | Անուն, ազգանուն<br>Name | Կառավարություն<br>Community | Փոստ, էլ. փոստ<br>Tel/Email | Ստորագրող<br>Signature |
|---|-------------------------|-----------------------------|-----------------------------|------------------------|
| 1 | Սիսիակ Սիսիակյան        | Սիսիակ համայնություն        | 093361369                   | [Signature]            |
| 2 | Սիսիակյան Սիսիակ        | Սիսիակ համայնություն        | 034-33-62-81                | [Signature]            |
| 3 | Սիսիակյան Սիսիակ        | Սիսիակ համայնություն        | 096 185228                  | [Signature]            |
| 4 | Սիսիակյան Սիսիակ        | Սիսիակ համայնություն        | 092.74-48-48                | [Signature]            |
| 5 | Սիսիակյան Սիսիակ        | Սիսիակ համայնություն        | 093 60 60 95                | [Signature]            |
| 6 | Սիսիակ Սիսիակ           | Սիսիակ համայնություն        | 093 12 58 78                | [Signature]            |
| 7 | Սիսիակ Սիսիակյան        | Սիսիակ համայնություն        | 098-03-55-03                | [Signature]            |
| 8 | Սիսիակ Սիսիակյան        | Սիսիակ համայնություն        | 093-15-82-58                | [Signature]            |

| N  | Անուն, ազգանուն<br>Name | Կառավարություն<br>Community | Փոստ, էլ. փոստ<br>Tel/Email | Ստորագրող<br>Signature |
|----|-------------------------|-----------------------------|-----------------------------|------------------------|
| 9  | Սիսիակ Սիսիակ           | Սիսիակ համայնություն        | 093361369                   | [Signature]            |
| 10 | Սիսիակ Սիսիակյան        | Սիսիակ համայնություն        | 093 12 58 78                | [Signature]            |
| 11 | Սիսիակ Սիսիակյան        | Սիսիակ համայնություն        | 093 60 60 95                | [Signature]            |
| 12 | Սիսիակ Սիսիակյան        | Սիսիակ համայնություն        | 092.74-48-48                | [Signature]            |
| 13 | Սիսիակ Սիսիակյան        | Սիսիակ համայնություն        | 096 185228                  | [Signature]            |
| 14 | Սիսիակ Սիսիակյան        | Սիսիակ համայնություն        | 093 60 60 95                | [Signature]            |
| 15 | Սիսիակ Սիսիակյան        | Սիսիակ համայնություն        | 093 12 58 78                | [Signature]            |
| 16 | Սիսիակ Սիսիակյան        | Սիսիակ համայնություն        | 098-03-55-03                | [Signature]            |
| 17 | Սիսիակ Սիսիակյան        | Սիսիակ համայնություն        | 093-15-82-58                | [Signature]            |
| 18 |                         |                             |                             |                        |
| 19 |                         |                             |                             |                        |
| 20 |                         |                             |                             |                        |
| 21 |                         |                             |                             |                        |
| 22 |                         |                             |                             |                        |
| 23 |                         |                             |                             |                        |
| 24 |                         |                             |                             |                        |





| No. | Block, neighborhood<br>Name | Existing<br>Community                             | Chs. by phone<br>Tel./Fax# | University/Agency<br>Signature                                                      |
|-----|-----------------------------|---------------------------------------------------|----------------------------|-------------------------------------------------------------------------------------|
| 25  | Apal 4/4/4/4/4/4            | 1000 existing and 400<br>existing 400 4/4/4/4/4/4 | 000 00 000                 |  |
| 26  | Apal 4/4/4/4/4/4            | 1000 existing and 400<br>existing 400 4/4/4/4/4/4 | 000 00 000                 |                                                                                     |
| 27  |                             |                                                   |                            |                                                                                     |
| 28  |                             |                                                   |                            |                                                                                     |
| 29  |                             |                                                   |                            |                                                                                     |
| 30  |                             |                                                   |                            |                                                                                     |
| 31  |                             |                                                   |                            |                                                                                     |
| 32  |                             |                                                   |                            |                                                                                     |
| 33  |                             |                                                   |                            |                                                                                     |
| 34  |                             |                                                   |                            |                                                                                     |
| 35  |                             |                                                   |                            |                                                                                     |
| 36  |                             |                                                   |                            |                                                                                     |
| 37  |                             |                                                   |                            |                                                                                     |
| 38  |                             |                                                   |                            |                                                                                     |
| 39  |                             |                                                   |                            |                                                                                     |





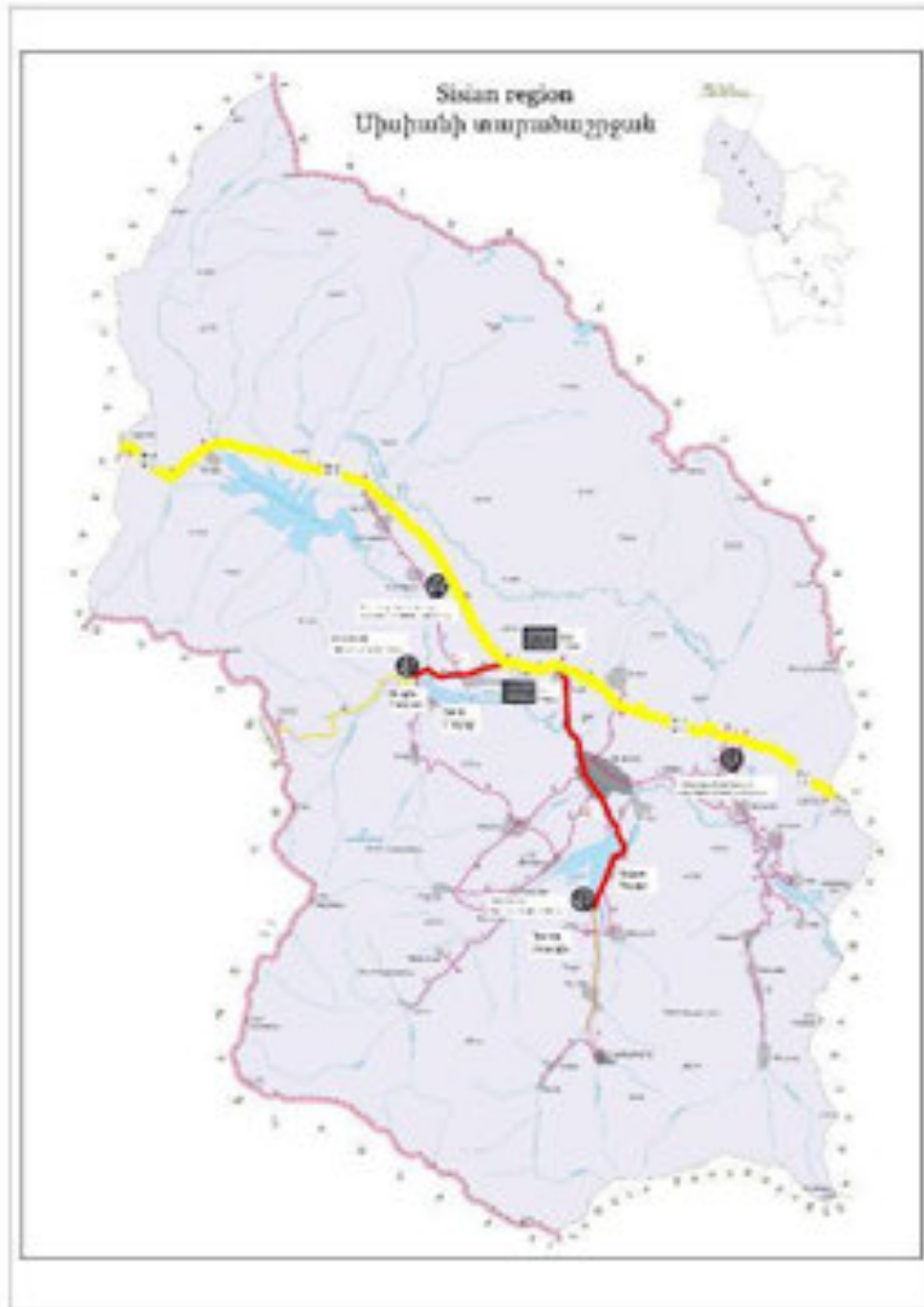




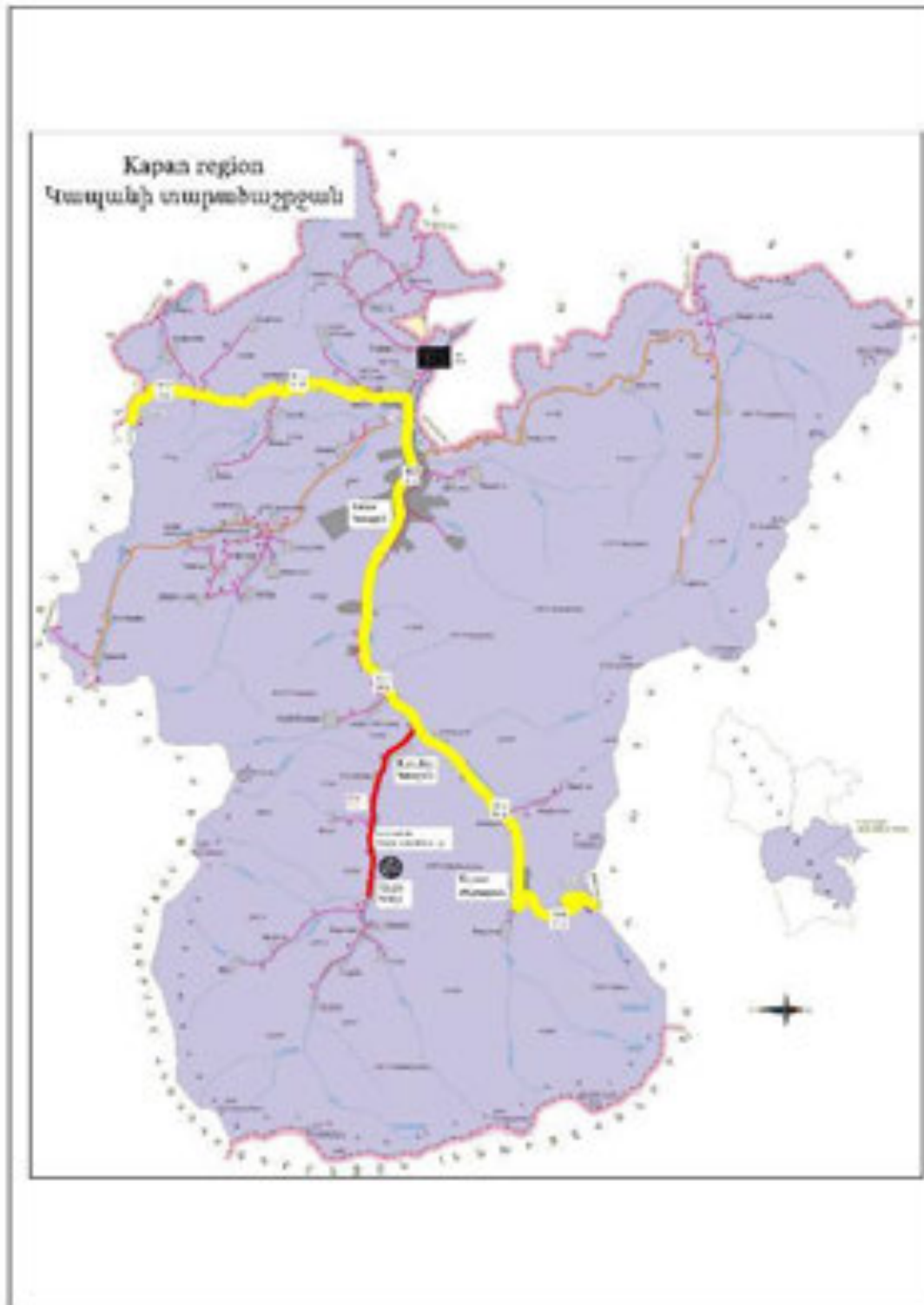






**Annex 10: The location of deposit**





**Annex 11: Dumping place**

ՏԵՂԵԼ/ԳԵՂԵՐ

*«14» հոկտեմբեր» 2016թ.*

Նախատեսվում է կազմել «ՀՀ Ենթակառուցվածքային ծրագրով Ցրանշ 4 ափամերձաօդային  
Սիմֆերոփոպոլիսի համայնքի մարզադաշտ, որը տեղակայվում է Արարատի  
համայնքում՝ համայնքով նախատեսված շինարարական աշխատանքները կատարելու նպատակով:  
Նախատեսվում է Արարատի համայնքի Գեորգի Գևորգյանի անունի վարչական տարածքում  
համայնքի տարածքում համայնքի տարածքում համայնքի տարածքում  
— փոքր:

Համայնքի տարածքում բնակվող համայնքում է տեղակայվել կապիտալ 3.0  
կմ երկարությամբ փող:

Արարատի համայնքի պետության Ն. Ն. Ն. Ն. Ն.





ՏԵՂԵԿԱԾ

14 հոկտեմբեր 2016թ.

Նախատեսվում է կազմել ՀՀ ենթակառուցվածքային ծրագրով հրահան 4 տվյալներով  
Սիմֆոնի-Փաշարյան հատվածի մախազներ, որը տնցնում է ՈւյՏԻ

\_\_\_\_\_ համայնքով: Նախագծով նախատեսվում է շինարարական աղբի  
համար ռաբոտա լցակայան նախատեսվում է Օգոստոսյան փողոցում  
կից փառքախմբի փառքալի փառքախմբի  
\_\_\_\_\_ փողոց:

Հանույթների տվյալներով ընտելաց նախատեսվում է տեղափոխել ռաբոտա 40  
կմ հեռավորության վրա:

ՈւյՏ \_\_\_\_\_ համայնքի ղեկավար \_\_\_\_\_ Ն. Միսկյան





## ՏԵՂԵԿԱՆՈՒՄ

17 հոկտեմբեր 2016թ.

Նախատեսվում է կազմել ՀՀ Եկեղեցումայի ծրագրով Տրանչ 4 ավազանառարարի  
Արարի-Փայտառարի հողակամի նախագիծը, որը անցնում է Շեքերյան

համայնքով: Նախագծով նախատեսվում շինարարական առջի  
համար որպես կազմելու նախատեսվում է Շեքերյան համայնք

գնալու 7.0 գրեկոյ քաղաքում

վայր:

Հանրային տնտեսական քաղաքում նախատեսվում է տնտեսական քաղաք՝ 7.0  
կմ հեռավորության վրա:

Շեքերյան համայնքի ղեկավար Շեքերյան Շեքերյան







ՏԵՂԵԿԱԶ

14 հոկտեմբեր 2016թ.

Նախատեսվում է կազմել ՀՀ ներդրումային ծրագրով Տրանչ 4 տնտեսաապրի  
Սիսիան-Բաջարան հատվածի նախագիծը, որը տնցնում է Առաջին

----- համայնքով: Նախագծով նախատեսված շինարարական աղբի  
համար որպես ցանկային նախատեսվում է Շիրազի Գյուլից Գևորգի  
Կյուսիս Է.Տ-Յ.Տ.Կ.Տ հեռագրությունը վրա ցրվող  
փտարաններ

Հանույնների տվյալաձև ըստ հոգևոր նախատեսվում է տեղադրվել ցանկային Կ.Ս  
կմ հեռավորության վրա:

Առաջին համայնքի ղեկավար՝



Ա. Մանյան



ՏԵՂԵԳՈՒՄ

14 հունիսի 2016թ.

Նախատեսվում է կազմել ՀՀ ենթակառուցվածքային ծրագրով Տրանշ 4 ավտոճանապարհի  
Միջանկ-Փնգարուն հատվածի նախագիծը, որը անցնում է Վաղարշապատ

----- համայնքով: Նախատեսվում է փնտրարանում ուղի  
համար որպես լցակայան նախատեսվում է Վաղարշապատ ք. 93 հրդ.  
245 և հյուսիս և հարավ ճյուղերով

-----վայր:

Հանույթների տվյալները բնակավայրի նախատեսվում է տեղադրվել լցակայան 4.0  
կմ հեռավորության վրա:

Վաղարշապատ համայնքի ղեկավար



Բ. Գրիգորյան

## ՏՆՐԱԿԱՆՈՒՄ

14 հոկտեմբեր 2016թ.

Նախատեսվում է կազմել ՀՀ Եկեղեցու մայրիկ ծրագրով Ցրան 4 սվտոմեռապարի

Սիսիան Կաթարան հուստի մախազիմը, որը անցնում է Պրոպան

համայնքով: Նախագծով մախառեսվում շինարարական աղբի

համար որպես լցանք յո մախառեսվում է Պրոպան Գյուլիս

Պրոպան Գերիս ախուլ 2045 ԻԿ Եկեղեցու մայրիկ  
Վրա Երուսաղեմում

Հանրային սվտոմեռապարի լցանքը մախառեսվում է տեղադրվել լցանքում 20

կմ հեռավորության վրա:

Պրոպան համայնքի ղեկավար՝



Ս. Զեմբրյանյան



## ՏԵՂԵԿԱՆՔ

«19» «հոկտեմբեր» 2016թ.

Նախատեսվում է կազմել ՀՀ ներքառնույթին ծրագրով Տրանչ 4 աֆոռնանսապահի

Միսիան Ժառանգան հաստիանի մախազիմը, որը անցնում է Պարբրա

----- համայնքով: Նախագծով մախառնական շինարարական աղբի

համար որակը լցակույտ մախառնական է: Պարբրա համայնքի

պաշտաճի, Պարբրա Գյուլից Կյուսիս 3.0 Կմ հեռ.  
Վրա վայր:

Հանայանի աֆառնած քանիցը մախառնական է, տեղաիիից լցակույտ Զ.Բ

կմ հեռալորոքան վրա:

Պարբրա համայնքի ղեկավար



Ա. Արեգյան







## ՏԵՐԻՖԻԿԱՆԸ

«17» հոկտեմբեր 2016թ.

Նախատեսվում է կազմել ՀՀ եկոլոգիա մայիս ծրագրով Ցրակ 4 տվյալներ հաշվարկի  
միջանկյալ փաթեթի հաշվարկի մախաղանը, որը առկա է Գեյրաթյան

համայնքով: Նախատեսվում է շինարարական առջի  
համար տրված լիցենզիայի մոխառնական է Պետր Լոր Գևորգյան  
Քանապուրի ցուր Կոնստանտին Եկն Կապուրյան  
վրա վաղը:

Հանդիմանի տվյալում բնակող նախատեսվում է տեղափոխել լիցենզիա՝ 30  
կմ հեռավորության վրա:

Գեյրաթյան համայնքի նախագահ



Ն. Մանգյան



ՏԱՐԱԳԱՆՈՒՄ

14 հոկտեմբեր 2016թ.

Նախատեսվում է կազմել ՀՀ ներքին մարզի ծրագրով Տրանչ 4 ամփոփանալարի

Արաբոս-Վաղարշապատի հատվածի մայրաքվե, որը անցնում է ՀԱՐ

\_\_\_\_\_ համայնքով: Նախագծով նախատեսված շինարարական առջի

համար որպես իրականացում է Հ. Երզնկյան փողոցիփոփոխություն

\_\_\_\_\_ վայր:

Հանրային տեղագրության բնույթը նախատեսվում է տեղափոխել Հ.Ե.

կմ հեռավորության վրա:

ՀԱՐ \_\_\_\_\_ համայնքի ղեկավարՄ. Ներսիսյան



## ՏԵՂԵԿԱՆՔ

«14» «հոկտեմբեր» 2014թ.

Նախատեսվում է կազմել ՀՀ ներդրումային ծրագրով Տրանշ 4 ավտոմեքանային

Սիսիան-Քաղարան հատվածի նախագիծը, որը անցնում է Յենակարազ

..... համայնքով: Նախագծով նախատեսվում է շինարարական առջի

խմբի որպես լցակայան նախատեսվում է Յենակարազ գյուղից քիչ

կլորսի 2,0 ԿՎ հեռավորության վրա չարաններում

..... վայրը:

Հստակեցնելի սակերացած բնակիչի նախատեսվում է տեղափոխել լցակայան 4.0

կմ հեռավորության վրա:



Յենակարազ համայնքի ղեկավար Աննա Ն. Մարտիրոսյան



ՏԵՐՄԻՆԱԼ

14 Նոյեմբեր 2016թ.

Նախատեսվում է կազմել ՀՀ տեղաբնակչության ծրագրով Տրանչ 4 ավանանադարձի

Լիպյան-Վաղարշի համայնքի մայրավանդ, որը անցնում է Նոր Մարտիրոսի

\_\_\_\_\_ համայնքով: Նախատեսվում է շինարարական աշխ

խմար որպես լցակայան նախատեսվում է Ք. Նիգարյանի ցեղկայան 1.0 կմ մ. (պղծամբարից համայնքի կենտրոն)

\_\_\_\_\_ վայր:

Հանրային տնտեսական օգուտը բնակչությանը է տեղափոխվել լցակայան \_\_\_\_\_

կմ հեռավորության վրա:

Նոր Մարտիրոսի համայնքի ղեկավար

Ս. Քանյան





## ՏԵՂԵԳՈՒՄ

14. Զեկարկեր 2016թ.

Նախատեսվում է կազմել ՀՀ ներդրումային ծրագրով Տրանշ 4 ավտոմեքանայրի Միսիս-Բաղարան հատվածի նախագիծը, ուղղակիցում է. 76 զհ

համայնքով: Նախագծով նախատեսված շինարարական աղբի համար որպես լցակայան նախատեսվում է. Զիրենք գ. Զեկարկ հայրամարտ  
500 մ հեռավորության վրա չորսկենյան  
-----վայր:

Հանույրների տվյալները բնակողը նախատեսվում է տեղափոխել որպես ԷԸ  
կմ հեռավորության վրա:



Զեկարկ գ. Զեկարկ հայրամարտ

Ն. Զիրենք



ՏԵՐԵՑԱՆՔ

14 հոկտեմբեր 2016թ.

Նախատեսվում է կազմել ՀՀ ներքին մարզի ծրագրով հրահչ 4 տվյալներում  
(Սիմիոն-Մուսարան համալսարանի մասնաճյուղ, որը անցնում է Գեղի

..... համայնքով: Նախատեսվում է ֆինանսական աջակցություն

համայնքի զարգացման նպատակով: Գ. Գեղի, Գեղի, Կարապետ  
6005 հեռախոսային համար՝ 010 24 24 24 24

..... փաշտ:

Համայնքի ղեկավարը համաձայնում է անդամակցել Կարապետ 20  
կմ հեռավորության վրա:



Գեղի համայնքի ղեկավար:

Ն. Գրիգորյան



ՏԵՐԱԺԱՂԱՔ

14 հոկտեմբեր 2016թ.

Նախատեսվում է կազմել ՀՀ ներդրումային ծրագրով Ցրանչ 4 տնտեսականության

Սիմֆան-Բաբարան հատվածի մախուդիքը, որը անցնում է Գեղթ

\_\_\_\_\_ համայնքով: Նախատեսվում է փնտրարական աղբի

համար որպես լցակայան նախատեսվում է Քարաւոր գ. ԳեղթԿյուսիս ՏԵՇԻ Կենտրոն, որը պատկերված է մասնագիտական

\_\_\_\_\_ փայլով:

Հանույանի ափսոսանքով բնակաբնակչությունը նախատեսվում է անհրաժեշտ լցակայան՝ ԿԵԹ

կմ հեռավորության վրա:

Գեղթ \_\_\_\_\_ Կենտրոնի տնօրեն

Գ. ԳրիգորյանՎ. Գրիգորյան

ST/UT/UN-2

14. кыркызыл 2014

Նախատեսվում է կազմել ՀՀ Լեզուամայրիկի ծրագրով Տրեսչ 4 ափամանասարսիկի  
Մթնոլորտ-Գազարտի հատվածի նախագիծը, որը անցնում է Վահագնյան

..... համայնքով: Լավագույնով նախատեսված շինարարական տարի  
համար որպես ընտրության նախատեսվում է 2016 թ. համայնքի

պատկերացրե՛ք ինքնուրույն լուրջ հետազոտություն  
հանդիմանելու և զգուշացնելու փորձերը։

Կնիքի տեղում: *Արմեն Մանուկյան*

Հանձնար Խաղաղության զինուոր — Ա. Գրիգորյան Ա. Մարտիրոսյան





***Annex 12: Environmental Expertise Conclusion***

|                                                                                                                    |                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                   |                                                                                                                                                                                                                            |
| <p>ՀԱՅԱՏԱՏՈՒՄ ԵՄ՝<br/>ՀՀ ՔՆԱԳԱՇՊԱՆՈՒԹՅԱՆ<br/>ՆԱԽԱՐԱՐ<br/><i>[Signature]</i><br/>Ա. ՄԻՆԱՍՅԱՆ<br/>«16» 03 2018թ.</p> |                                                                                                                                                                                                                            |
| <h2>ՊԵՏԱԿԱՆ ՓՈՐՁԱՔՆՆԱԿԱՆ ԵԶՐԱԿԱՑՈՒԹՅՈՒՆ</h2>                                                                       |                                                                                                                                                                                                                            |
| <h3>ՇՐՋԱԿԱ ՄԻՋԱԿԱՅՐԻ ՎՐԱ ԱԶԴԵՑՈՒԹՅԱՆ<br/>ՓՈՐՁԱՔՆՆՈՒԹՅԱՆ</h3>                                                       |                                                                                                                                                                                                                            |
| <p>ԲՓ <u>18</u></p>                                                                                                |                                                                                                                                                                                                                            |
| Ձեռնարկողը՝                                                                                                        | <<ԾԱՆՆԱԽԱԳԻԾ>> ինստիտուտ ՍՊԸ<br><small>Ք. Շրճակ, Աննայան ՅԵՐ</small>                                                                                                                                                       |
| Գործունեությունը՝                                                                                                  | Հյուսիս-Հարավ ճանապարհային միջազգային<br>ներդրումային ծրագիր Տրանշ-4, Սիսիան-Քաջարան<br>ճանապարհափակման կառուցման շրջակա միջավայրի<br>վրա ազդեցության գնահատման հաշվետվություն<br><small>ՀՀ Արտերկրյա ծառայություն</small> |
| <<Շրջակա միջավայրի վրա ազդեցության<br>փորձաքննական կենտրոն>> ՊՈԱԿ-ի<br>տնօրեն՝                                     | <br>Վ. Սահակյան                                                                                                                         |
| Առկա եզրակացություն՝ 7 թերթ                                                                                        |                                                                                                                                                                                                                            |



**ՊԵՏԱԿԱՆ ՓՈՐՁԱՔԵՆՆԱԿԱՆ ԵԶՐԱԿԱՑՈՒԹՅՈՒՆ**  
**ԵՐԶԱԿԱ ՄԻՋԱԿԱՅՐԻ ՎՐԱ ԱԶԴԵՑՈՒԹՅԱՆ ՓՈՐՁԱՔԵՆՆՈՒԹՅԱՆ**

Թիվ ԲՓ 16  
 « 16 » 03 2018թ.

**<<Հյուսիս- Հարավ ճանապարհային միջանցքի ենթակառուցային ծրագիր**  
**Տրանշ 4. Միսիան- Բաջարան ճանապարհի հատվածի>> շրջակա**  
**միջավայրի վրա ազդեցության գնահատման հաշվետվություն**

|                                            |                                                                                          |
|--------------------------------------------|------------------------------------------------------------------------------------------|
| Զեմաբերող՝                                 | <<ՃԱՆՆԱԿԱԳԻՇ>> ինստիտուտ ՍՊԸ                                                             |
| Ծառատաքցի տեսակը՝                          | Շրջակա միջավայրի վրա ազդեցության գնահատման / ԵԱԿԳ/ հաշվետվություն, նախագծային փաստաթղթեր |
| Գործունեության կատեգորիան Տնդարժման վայրը՝ | /Բ կատեգորիա/<br>ՀՀ Արմինյի մարզի Միսիան և Բաջարան համայնքների վարչական շրջաններ         |

Հյուսիս-հարավ ճանապարհային միջանցքի ենթակառուցային ծրագրի՝ Տրանշ 4-ի տնխնիկատնեսական ուսումնասիրության արդյունքում SPEA-IRՃ կոնսոլցիոնը մշակել է Տրանշ 4՝ Միսիան-Բաջարան ճանապարհային հատվածի մանրամասն նախագիծը: Նախագծումը ֆինանսավորվել է Ասիական զարգացման բանկի կողմից տրամադրվող ֆարկով: Ծրագիրը նախատեսում է մոտավորապես 60 կմ երկարության մեկ երթևեկելի մասով՝ մեկ ուղղությամբ երկու երթևեկելի գոտիներով, իսկ հանդիպակաց ուղղությամբ՝ 1 երթևեկելի գոտիով ճանապարհ: Միսիան-Բաջարան ճանապարհահատվածի ուղեգծի տեղադրության համար առաջարկել է ալցնտրանցային տարրերովներ՝ ֆինանսական, տնխնիկական, տնեսական, և քնապահպանական տեսանկյունից ընտրվել է նպատակահարմարը:

Տրանշ 4՝ Միսիան-Բաջարան 60 կմ ճանապարհահատվածը սկսվում է ՄԵՃ Իշխանասար լեռան հարավից (3550 մ), հառում է ՄԶ մայրուղին, անցնում Որոտան գետին հարող տարի ձախ լսելով, հառում Որոտան գետը՝ Ըամրի ջրամբարի վերին հատվածով, անցնում Բարգուշատ լեռաշղթայով (3000 մ և բարձր)՝ Լրամոր վտակի ձախ եզրով, անցնում Ողջի գետի հովիտային աջ մասով՝ Նոր Աստղաբերդ (Գեղի) համայնքի մոտակայքով, հառում է Կապան-Բաջարան ճանապարհային հատվածի աջ կողմի լեռնալսել՝ շարունակվելով դեպի Բաջարան քաղաքի մոտքը:

Ճանապարհն անցնում է 6 ուղղահայաց բսելշախտային գոտիներով (ցածր և միջին լեռներ, միջին լեռնային անտառ, միջին լեռնային տափաստան, միջին լեռնային մարգագետնային տափաստան, բարձր ենթաալպան լեռներ, բարձր ալպան լեռներ) և զատուցումը կարող է ունենալ անմիջական և անուղղակի ազդեցություններ՝ շրջակա միջավայրի ֆիզիկական և կենսաբանական ռեսուրսների վրա, հնագիտական/պատմական վայրերի և մշակութային հուշարձանների վրա:

Նախագծված ճանապարհափակումներն մոտ տեղակայված բնակավայրերն են՝ ՀՀ Արմավիրի մարզի Ախիան համայնքի (Դշխանասար, Ույծ, Ամիրու, Լորափան, Վարդաթին, Որստուխան, Դարբաս, Գետաթաղ, Լոր, Ենեաթաղ բնակավայրեր) գյուղերը և Քաջարան համայնքի (Գեղի, Լեռնաձոր, Լոր Աստղածերկ) գյուղերը: Համայնքների միմյանցից կտրված լինելու պատճառով՝ սոցիալական ազդեցությունները հաղթահարելու համար նախատեսված է կառուցել երեք տարբեր մակարդակների վրա գտնվող փոխհատումներ՝ ուղեանցներ, որոնք կապահովեն կապը տեղական ճանապարհների և համայնքների հետ: Հիմնվելով վերջնական նախագծի վրա, երբ օտարման գոտին կաթնանցի հողի և սեփականության օտարում սեփականատերերը, որոնք կհեռացվեն, կվերաբնակեցվեն և/կամ կփոխհատուցվեն:

Լոր ճանապարհափակումի ծրագրից նախագծված է և կկառուցվի այնպիսի յափանցիկներով, որոնց արդյունքում կապահովվի ճանապարհային զննելունը, ճանապարհային եղանների համակարգը, ակնբարի W-ան մոտարկան արգելափակումներ, ցրանոսացման համակարգեր, ջրերի խողովակներ, ուղեանցներ, ստորգետնյա անցումներ և կոլեակներ: Ընդհանուր առմամբ կլինեն՝

- 3 երկ տարբեր մակարդակների վրա գտնվող փոխհատումներ (որոնք բոլորն էլ ուղեանցներ են) և մեկ ստորգետնյա անցում:

- 4 գյուղատնտեսական ստորգետնյա անցումներ՝ մեքենա-միասնիզմների, հետիոտների և կենդանիների համար (կմ 5+780, կմ 7+055, կմ 15+310, կմ 21+ 854) վայրի կենդանիների և անասունների համար

երկաթբետոնե կառույցներն ընդգրկում են՝

- 22 կամուրջներ, որոնցից երեքն անցնում են Որստան, Լորաձոր և Գեղի գետերի վրայով, իսկ մյուսները կիճների վրայով: Կամուրջներից հինգը երկաթբետոնե են, 22-ը՝ պողպատե:

- խողովակներ՝ մակերևութային ջրերի և ոռոգման համակարգի համար և 6295 հաճաքով՝ B-I-22 տիպի երկաթբետոնե վազեր:

- 9-ը թունելներ՝ մոտ 12.5 կմ ընդհանուր երկարությամբ: Ամենակարճ թունելի երկարությունը 359 մ է, իսկ ամենաերկարը, որը կոչվում է «Բարգուշատ», ունի 8.6կմ երկարություն:

8 թունելների օդափոխությունը իրականացվում է քնական օդափոխությունով, ելնելով թունելների երկայնական թեքությունից և երկարությունից, իսկ ամենաերկար թունելի համար նախատեսված է հատուկ օդափոխության համակարգ: Այս թունելի համարի տաժանակի է նախագծման բարձր յափանցիկներ /էլեկտրականություն, լուսավորություն, ագրանշանում, հրդեհաշիջում, տեսահսկում, ոսպի և այլն/: Ճանապարհային լուսավորության համակարգը կապահովվի միայն փոխհատումներով:

Ճանապարհի՝ 31+820 կետից 34+000 կետն ընկած հատվածն անցնում է «Ճանգելուր» պետական արգելավայրի տակով՝ թունելով, որից հետո մոտ 1800մ երկարությամբ շարունակվելով՝ դուրս է գալիս երկրի մակերևույթ: Արգելավայրի սահմաններում թունելն անցնում է երկրի մակերևույթից 600 - 1300 մ խորության վրա:

Ծրագրի օտարման գոտում տեղակայված հաղորդակցիկները ներառում են՝ զազի վերգետնյա խողովակները, ոռոգման խողովակները, ստորգետնյա էլեկտրական լարերը, ցրամասակարարման խողովակները և օդային բարձր լարման հոսանքի մալոնները, որոնք պետք է տեղափոխվեն: Ստորգետնյա զազատար խողովակների տեղափոխությունը ևս ներառված է նախագծում:

Ճանապարհի պատվանդը կազմված կլինի 10 սմ հաստությամբ ափազակույանցի, 30 սմ խճաքարային-ափազային չերտից՝ C-5, 8 սմ հաստությամբ բարձր ծակուկեկտրայան խճաղի ա/բ, 7 սմ խոշորահատիկ խիտ ա/բ (առաջին կարգ, 8 տիպ) և 5 սմ մանրահատիկ, խիտ ա/բ (առաջին կարգ, A տիպ): Կոլեակները կենթարկվեն մակերեսային մշակման:





Երկրաբանական հետազոտությունների ընթացքում տեղորոշվել են հնարավոր տղանքների տարածքներ, որն ընկնում է Նախագծված ճանապարհի՝ կմ10+820-կմ10+950 հատվածում (H-8 B3 կմ 10+900): Որպես միջոցառում, բնօրինակ թերթերում մեղմացնելու նպատակով նախատեսված է՝ վերին հենասլաքի իրականացում, բնօրինակ թերթերի անվանում՝ 1:1.5 - 1:2.0, բնօրինակ իրականացնելու ժամկետը՝ 2024 թ. 12.31-ը:

Կատարվելիք աշխատանքների հիմնական ծավալները ներառում են՝ 5 671 476.80 մ<sup>3</sup> հանույթ (որից 34,361 խոր մոտակայի հենացում) 66. 9 147 683.2 մ<sup>3</sup>, ժայռային հանույթ, 1 437 295.30 մ<sup>3</sup> ափսոսանքի հանույթ, 3,311,148 խոր միջոց, 47 4612 ջրում պատված (տարածված): ժայռային տեղանքի պատճառով իջնելու կանաչապատում նախատեսված չէ:

Գործունեության ազդեցության ենթակա տարածքներում բացահայտվել են Մրգերի ազդեցությունները (բացասական և դրական) ֆիզիկական, կերպարային, հնարավորության և սոցիալ-մշակութային և տնտեսական ռեսուրսների վրա, ներառյալ՝ աշխատողների և համայնքների բնակչության առողջությունն ու անվտանգությունը: Առաջարկվել է համապատասխան մեղմացնող միջոցառումներ՝ սկսած նախագծումից, շինարարությանը նախորդող և ընթացիկ փուլերից, մինչև շահագործման և պահպանման ժամանակահատվածը: Մեղմացնող միջոցառումները ներկայացված են ԲԿԴ-ում (Բնապահպանական կառավարման պալատ):

Դաշտային հետազոտությունների ընթացքում Միսիան-Քաջարան միջպետական ավտոճանապարհի երկայնքով զբաղեցվել են պատմամշակութային, հնարավորության և բնության հուշարձաններ, որոնք նախագծված ճանապարհի ծրագրի երկայնքով կարող են կրել ուղղակի և անուղղակի ազդեցություններ: Հնարավոր ազդեցությունները մեղմելու համար ըստ անվտանգության կիրականացվեն՝ ծրագրային փոփոխություններ, պեղման տեղափոխման աշխատանքներ, կամ պահպանական պատվերների կատարման աշխատանքներ: Մշակութային և բնության հուշարձանների պահպանության միջոցառումները պետք է իրականացվեն՝ ՀՀ մշակույթի և քաղաքականության նախարարության ընթացակարգերի համապատասխան:

Նախագծված տարածքում իրականացվել է ֆունկցիոնալ և ֆորմալ հետազոտություններ, ուսումնասիրվել են էկոլոգիկ և փոխազդեցիկ տեսակները (որոնք ունեն հատուկ պահպանության կարգի և զբաղեցված են ՀՀ Կարմիր գրքում և ԲԴՄԴ Կարմիր ցուցակում), որոնք կարող են հանդիպել ուսումնասիրված տարածքում (կամ դրա հարակից տարածքներում): Նշված տեսակները ճանապարհի ինչպես շինարարության, այնպես էլ շահագործման ընթացքում կարող են ենթարկվել հնարավոր ազդեցությունների հիմնականում՝ Շենքաղ գետի ալյուվիում և Քաջարան համայնքի հարակից տարածքներում: Ազդեցությունները կառավարել են և ազդեցության գոտում նման քոսական, կամ կենդանական տեսակների հայտնաբերման դեպքում ԲԿԴ-ում նախատեսվել են հատուկ մեղմացնող միջոցառումներ (տեղափոխում), որոնք իրականացվելու են համապատասխան մասնագետների կողմից՝ սահմանված զործընթացներով:

Դաշտային ազդեցությունների ընթացքում ուսումնասիրվել է նաև հնարավոր միգրացիոն ուղիների տեղակայությունը, և բացահայտվել են կենդանիների միգրացիոն անցումների տեղադրման հնարավոր վայրերը: Զբոսաշրջության համակարգի (ցրտի խորվաճներ, ուղիակներ խորվաճներ) որոշ տարրերի ափսոսանքը հանգեցնում է կենդանիների միգրացիայի համար նախատեսված անցումների տեղակայման վայրերի ծնունդ: Մացուրու երկայնքով (Միսիան - Դարբաս, Դարբաս - Շենքաղ, Կիցք - Գեղի հատվածներ) նախատեսվել են անցումներ փոքր կաթնասունների համար՝ դրանց հնարավորությունն տարվա անվտանգ անցնելու ճանապարհը: Կիցք-Գեղի հատվածում (որոնք գտնվում է ափսոսանքի բնակատեղից ծնունդի բնակատեղի անցնելու արահետը) նախատեսվել են նաև -կանաչ կամուրջներ-՝ ալյուվիալ ապրող խոզեր կաթնասունների փոխազդեցիկ տեսակների մեծ քաղաքականության տեղադրման համար: Այնուամենայնիվ, տարածքում պետք է կատարվի

ժանրամասն հետազոտություն՝ հայկական մոֆոնների և քեզուսքյան պծերի միգրացիոն ճշգրիտ ուղիները գտնելու համար: Որպես պաշտպանիչ միջոցառում՝ պահանջվող վայրում մայրուղին պետք է պաշտպանված լինի ցանկապատով՝ թույլ չտալով կենդանիների մուտքը դեպի ճանապարհ: Իսկ շինարարության փուլի համար նախատեսված է ժամանակավոր պաշտպանիչ պատնեշներ այն հատվածներում, որտեղ կենդանիները հաճախ են հանդիպում:

«Միսիան-Քաջարան» միջանաքական տնտեսաբանական շինարարական աշխատանքների ընթացքում նախնական հաշվարկներով կհատվեն ավելի քան 6000 (6068) ծառեր, մոտ 10000 քվեթեր հետևյալ 4 հատվածներում՝ Դարբաս - Շենաթաղ-Քաղցուշատ խոնաշրջանի թունել (354 ծառեր), Քաբրուտ - Վերին Գեղավանք (1276 ծառ), Վերին Գեղավանք - Կալճուտ (542 ծառ), Լեռնաձոր - Քաջարան (2971 ծառ), որոնք գտնվում են ՀՀ Այրմիջի մարզի անտառտնտեսությունների տարածքներում: Կտրված ծառերը հնարավոր դեպքերում պետք է վերականգնվեն, կամ փոխադրվեն նոր ծառերով և քվեթերով՝ 6:1 հարաբերակցությամբ: Տեղված ծառերը պետք է խնամվեն 3 տարի՝ մինչև դրանց կենսունակ դառնալը: Ըստ կարևոր է օգտագործել չոր կլիմայական պայմաններին և փոշու ազդեցություններին դիմացկուն ծառատեսակներ:

Կենսաֆիզիկական միջավայրի վրա Ծրագրից ակնկալվող հնարավոր ազդեցությունները ներառում են հետևյալները՝ հողի էրոզիան, աղմուկի և թրթռման քարծրացած մակերդակները, օդի, հողի ցրի որակը, աշխատանքների հետևանքով և թունելների փորումից ու պաշտպանիչ առաջացած հատուկ ազդեցությունները, աղբազանի ազդեցությունները և այլն: Լշխմ ազդեցությունները ի հայտ կգան միայն շինարարության ընթացքում, արտահայտվելով՝ ծխազազերի և փոշու, աղմուկի մասցերդաշին գործերի առաջացմամբ, յուղի և վառելանյութի արտահոսքերով, պինդ և հեղուկ քաֆոնների առաջացմամբ, շինիրապարակի տեղադրմամբ և կարող են կոել ժամանակավոր քոյք:

Շինարարական աշխատանքների ժամանակահատվածը կկազմի մոտ 5 տարի: ԸՄԱԳ հաշվետվությունում գնահատվել է շինարարական ածխատանքների ազդեցությունը՝ մթնոլորտային օդի, ջրային և հողային ռեսուրսների, կենսաբազմազանության և պատմամշակութային ռեսուրսների վրա: Շինարարական աշխատանքների ընթացքում մթնոլորտային օդի էրմնական արտանետումներն առաջանում են հողային աշխատանքներից /փոշու արտանետումների մեով/ և շինարարական տեխնիկայի և տրանսպորտային միջոցների շահագործումից՝ դիզելային վառելիքի շահագործման արդյունքում: Հաշվարկվել են արտանետումների ընդհանուր քանակները, որոնց արդյունքները կազմում են՝ անօրգանական փոշի՝ 8876.0տ, ածխածնի մոնօքսիդ՝ 56.8տ, ածխաջրածիներ՝ 13.1տ, ազոտի եկլօքսիդ՝ 66.2 տ, պինդ մասիկներ՝ 6.7տ, ծծմբի եկլօքսիդ՝ 6.24տ: Արտանետումների կոնստանտ նպատակով P4Դ-ում ևս նախատեսվել են միջոցառումներ:

Քաջարան - Միսիան ճանապարհի շինարարության արդյունքում չլքվա միջավայրի վրա հնարավոր տնտեսական վառի գնահատումներն իրականացվել է ըստ չլքվա միջավայրի բարդացիկների: Ամնոլորտային օդին հասցվող տնտեսական վնասը գնահատվել է՝ 13881474 դրամ (13.88մլն դրամ), որը հաշվարկվել է շարժական և անշարժ արջուրների արտանետումների էրմնա վրա, իսկ հողային ռեսուրսներին հասցված տնտեսական վնասը գնահատվել է՝ 7233238 դրամ:

Շինարարության ժամանակ ցորը օգտագործվելու է աշխատանքների երապարակների ջրցանի, հողային զանգվածների խոնախցման, ինչպես նաև շինարարական անմնակազմի խմելու կենցարային նպատակների համար: Իրականացվել են ջրապահանքի ծախսերի հաշվարկներ՝ ըստ նպատակային օգտագործման:

Անմիջապես տնտեսաապարի շինարարության արդյունքում արտոսված արտահոսք չի առաջանում, քանի որ աննրկացրերի և ծնիացի հոսքերը աշխատանքների ընթացքում կհեռացվեն տնրանքից կազմակերպված մեով, հետևաբար, տնտեսական վնաս չի հաշվարկվել:

Ջրի որակի վառքառացման կանխարգելիչ միջոցառումները ներառում են հետևյալները.



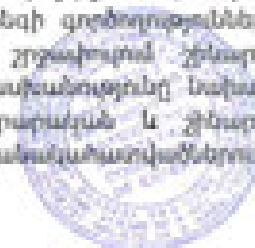
- թունկներում ջրահեռացումն իրականացնել ինցեստրու խողովակների միջոցով, /դրենաձալին համակարգը հերձվաչքերի հորերի միջոցով կմիանա սփռնային համակարգին/:
- կանոցների վրա հավաքված անձրևաջրերը մաքրել կանոցների տակ տեղադրված նախափորների զատիչ սարքերով՝ կանխելով աղտոտիչ նյութերի հոսքը գետ
- շինհրապարակից կեղտաջրերի և անձրևաջրերի հեռացում հատուկ մաքրող սարքավորումների միջոցով՝ ջրահեռացման համակարգով
- տեղադրել պաշտպանիչ շերտերով ջրակամեկուսիչ համակարգ
- ճրահավաք ազանները կտեղադրվեն ճակատային մուտքներում, որտեղ կհավաքվեն ջրահեռացման համակարգով հեռացվող ջրերը:
- Հինարարության փուլում աշխատողների կենցաղային կեղտաջրերի հեռացում սահմանված կարգով՝ գործող կանոնների համաձայն:

Հինարարության հետևանքով խախտված հողերի տեխնիկական վերականգնումը ներառում է միայն շինարարական երապարակների մակերևույթի հարթեցման աշխատանքները, որոնց մակերեսը ըստ խոշորացված հաշվարկի կկազմի 35200մ² (3.52 հա): Հարթեցումից հետո կիրականացվի կենսաբանական վերակուլտիվացում՝ ստեղծելով բուսական ծածկ: Հինհրապարակների տեղադրումից հանձնող և վրանգի ներսկա քուսաձողի հաշվարկային ծավալը ընդհանուր կկազմի՝ 7040 մ³, որը պահեստավորվելու է սահմանված կարգով: Հինհրապարակի տեղակցի հարթեցումից հետո քուսաձողը կտեղափոխվի և կփոխվի հարթեցված տարածքում՝ ռեկուլտիվացիայի նպատակով: Ռեկուլտիվացիոն աշխատանքների ծախսը 35200մ² մակերեսում կկազմի՝ 774400 հրամ:

Շրջակա միջավայրի վրա հնարավոր ազդեցություններից խոսափելու համար շինարարության ընթացքում նախապատվություն պետք է տրվի գյուղային ունեցող քաղաքներին, բնորոշ դրավորման և աճալի գործարաններին՝ երբեք քայքայի փոխարեն: Նոր քաղաքների օգտագործումը կիրականացվի ՀՀ-ում գործող օրենսդրական պահանջներին համապատասխան: Նախագծային փաթեթում անկա են ազդակից համայնքների ղեկավարների և վարչական ղեկավարների նախնական համաձայնեցումները՝ շինարարական աղյի տեղադրման վերաբերյալ:

Հինարարական աշխատանքների ավարտից հետո տարածքը քաղաքացիներու է մաքրվելու է շինարարական աղբից և քափոններից: Նախագիծը ներառում է ճանապարհի կողակների երկայնքով կանաչապատում (խառնի տնկում, խոտի ցանում և սերմնացանում)՝ որդաքաղաքումից խոսափելու համար: Կանաչապատումը կնպաստի քաղաքացիները էկոլոգիական արժեքը, արտահոսքի ներծնկելուն, շրջակայքի գեղագիտական տեսքին, աղմուկի նվազեցմանը և հողի կառուցվածքի կայունացմանը, (Պատկապն, որտեղ ճանապարհին անցնելու է համայնքների մոտով, ինչպիսիք են՝ Ափսոն, Վաղատինը, Շենարանը, Լեռնամորը և Քաջարանը):

ՀԱՄԳ հաշվետվությունում ստացարկվող մեղհացող միջոցառումները ներկայացվել են 17 ներառվածներով, որոնց (իմնված են ըսվագույն բնապահպանական կառավարման միջազգային փորձի վրա) սահմանվել են բոլոր այն սկզբունքները և անհրաժեշտ միջոցառումները, որոնց կիրառմամբ կկանխարգելի, կամ կմեղմացվի ծրագրի իրականացման ընթացքում հնարավոր ծագառական ազդեցությունները (տարածքներին հասցվող վնասը): ԲԿԴ-ում նկարագրվում է այդ միջոցառումների կառավարման կարգը ծախսերը, պատասխանատու կազմակերպությունները, ում կողմից և որտեղ պետք է իրականացվեն դրանք: ԲԿԴ-ն ներառում է նաև մոնիթորինգի գործողություններ, որոնց միջոցով պետք է ստուգվեն ծրագրի իրականացման շրջանքում շինարարական աշխատանքների իրականացման գործընթացի համապատասխանությունը նախատեսված մեղհացող միջոցառումներին՝ նախագծման, նախաշինարարական և շինարարական փուլերում, շահագործման և պահպանման/նպատարական ժամանակահատվածներում: ԲԿԴ-ն



հանդիսանում է վերջնական ՀԱՄԿ-ի անբաժանելի մաս և այն կներառվի մրցույթային և պայմանագրային փաստաթղթերում:

Ծրագրի իրականացման արդյունքում սպասվում է, որ «Ամիսիան-Քաջարան» միջպետական ավտոմայրուղին կապահովի կապ՝ Միսիսի և Քաջարանի տարածաշրջանների հեռավոր համայնքների միջև և կոնեկտ դրական ազդեցություն՝ ապահովելով նաև կրանց կարճատև աշխատատեղերով: Նոր ճանապարհի ծրագիծը կնվազեցնի հեռավորությունը Միսիսի և Քաջարանի միջև մոտ 60 կմ-ով: Ծրագիրը կոնեկտ նաև անդրապահմանային ազդեցություն, այն կխթանի Հայաստանի տնտեսական աճին և տնտեսական կապերի զարգացմանը հարևան երկրների հետ /Թարափային սահմանում Իրանի հետ, իսկ հյուսիսայինում՝ Վրաստանի հետ/: Երևարարության ընթացքում ճանապարհի մոտակա համայնքները ժամանակավոր կենթարկվեն բացառական ազդեցությունների (վնաս արտանետումներ, աղմուկ, ճանապարհների անհասանելիություն և այլն), սակայն դրանք կլինեն կարճաժամկետ և ԲԿԴ-ում նախատեսված միջոցառումների իրականացման շնորհիվ կհասցվեն թույլատրելի նորմերի սահմաններին:

Փորձաքննության գործընթացում ծրագրի վերաբերյալ առաջվել են՝ ՀՀ մշակույթի նախարարության, ՀՀ բնապահպանության նախարարության մասնագիտացված ստորաբաժանումների կարծիքները: Երջակա միջավայրի վրա ազդեցության գնահատման և փորձաքննության գործընթացներում ՀՀ օրենսդրությամբ սահմանված կարգով իրականացվել են հակադիմ իրազեկումներ և ցենսրկումներ (ՀՀ Այրոնիցի մարզի Միսիս և Քաջարան համայնքներում, Այրոնիցի մարզպետարանում), հանրության կողմից ինչպես դիտողություններն ու առաջարկություններն ցելունվել և հաշվի են առնվել չրջակա միջավայրի վրա ազդեցության գնահատման և փորձաքննության գործընթացներում:

#### Փորձաքննական պահանջներ

1. ՀՀ օրենսդրությամբ սահմանված կարգով անհրաժեշտ է ստանալ համապատասխան համաձայնությունները և թույլտվությունները (ներառյալ քուզուազորմունը, ցրահնացումը, հողերի գործարանական նշանակության փոփոխությունը և այլն):
2. Գործունեությունն իրականացնելիս անհրաժեշտ է առաջնորդվել՝ ԲՀԴՏ-ների մասին ՀՀ օրենքի և ՀՀ կառավարության 19 դեկտեմբերի 2013 թվականի N 1465-Ն որոշման պահանջներով, ինչպես նաև՝ ՀՀ կառավարության՝ 14.08.2008թ. N 967-Ն, 29.01.2010թ. «ՀՀ թույլների և կենդանիների՝ հարմիր գիրըը հաստատելու մասին» N71-Ն և N72-Ն և 31.07.2014թ. N781-Ն որոշումների պահանջներով:
3. «Անտառատնտեսություն» մասնամյուղերում օտարվող հողերի անտառային տնտեսությանը հասցված վնասի փոխհատուցմանն ուղղված միջոցառումներն անհրաժեշտ է իրականացնել ՀՀ կառավարության 30 օգոստոսի 2007 թվականի N 1045-Ն որոշման պահանջներով:
4. Ծրագրի երկայնքով աղյուցության ենթակա պատմամշակութային հուշարձանների պահպանության խնդիրներն ու մեթոդներն (ուսումնասիրություն, պեղում, ուղեգծի տեղափոխում, այլընտրանքների դիտարկում) անհրաժեշտ է իրականացնել ՀՀ մշակույթի նախարարության գործառուղիներին համապատասխան:
5. Այնլև գործունեության իրականացումն ազդակի համայնքների ղեկավարներինց ստանալ համապատասխան համաձայնեցումներ՝ շինարարական հրադարակներին տեղադրման, քուացերի ժամանակավոր պահեստադրման, շինարարական աղբի և թափոնների հեռացման փայերի վերաբերյալ:
6. Ծառերի և թփերի տնկման, կամ վերատնկման համար անհրաժեշտ է մշակել ղեկորդուղեղի նախագծեր, որոնց պեղը է համաձայնեցվեն համայնքների ղեկավարների և համապատասխան մասնագետների հետ:



7. Ճանապարհի շինարարության ընթացքում նոր հանգավայրերի շահագործման անհրաժեշտության դեպքում, գործընթացն իրականացնել ՀՀ օրենսդրությամբ սահմանված կարգով:
8. Շինարարության ընթացքում անհրաժեշտ է ապահովել ՔԿԴ-ում և բնապահպանական մոնիթորինգի պլանում առաջարկվող միջոցառումների և մոնիթորինգային դիտարկումների իրականացումը և ժամանակացույցերը, որոնց արդյունքները պետք է հասանելի լինեն պետական շահագրգիռ մարմիններին և հանրությանը:

#### ԵԶՐԱԿԱՑՈՒԹՅՈՒՆ

«Հյուսիս-Հարավ Ճանապարհային միջանցքի ներդրումային ծրագիր, Տրանշ 4. Միսիան-Քաջարան Ճանապարհահատվածի չրջակա միջավայրի վրա ազդեցության գնահատման հաշվետվության վերաբերյալ տրվում է դրական եզրակացություն, վերը նշված պահանջների պարտադիր կատարման ապահովում:

Գլխ. մասնագետ՝



Հ. Մկրտչյան

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