

Environmental Assessment Report

Initial Environmental Examination for
Argavand Highway to Shirak Street Upgrade (Project 1)
Document Stage: Final
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September 2010

Armenia: Sustainable Urban Development Investment Program

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Fw: ARM Yerevan Sustainable Urban Transport MFF
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FYI

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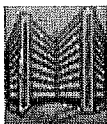
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Dear Arno,

I would like to confirm that LARF, LARPs and EARF have been approved by the ministerial committee chaired by the PM, and will be approved next Thursday. Therefore, we are in the schedule agreed during the teleconference.


I also would like to suggest the you discuss with Mushegh Tumasyan the Municipality co financing and project governance issues via phone.

Best regards,



Nerses Yeritsyan | Minister

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ABBREVIATIONS

ADB	Asian Development Bank
BOD	Biochemical oxygen demand
EA	Executing Agency
EARF	Environmental Assessment and Review Framework
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
EMP	Environmental Management and Monitoring Plan
ERT	Emergency Response Team
IA	Implementing Agency
IEE	Initial Environmental Examination
IMF	International Monetary Fund
IFI	International financial institution
IUCN	International Union for Conservation of Nature
LARP	Land Acquisition and Resettlement Plan
Master Plan	Yerevan City Master Plan, Vol.5, 2004
MFF	Multi-tranche Financing Facility
MNP	Ministry of Nature Protection
MOC	Ministry of Culture
MPC	Maximum permissible concentration
NO ₂	Nitrogen dioxide
NO	Nitrogen oxide
NPE	Nature Protection Expertise
NGO	Non-governmental organization
PIU	Project Implementation Unit
PPMU	Program Preparation and Management Unit
PPTA	Project Preparatory Technical Assistance
RAMSAR	Ramsar Convention on Wetlands
RA	Republic of Armenia
REA	Rapid Environmental Assessment
SEI	State Environmental Inspectorate
SNCO	State Non-commercial Organization
SO ₂	Sulfur dioxide
TSS	Total suspended solids
UNESCO	United Nations Educational, Scientific and Cultural Organization

WEIGHTS AND MEASURES

dB(A)	decibel (A-weighted)
km	kilometer(s)
km ²	square kilometer(s)
L	liter
m	meter(s)
mg/m ³	milligram(s) per cubic meter

GLOSSARY

Karmir Blur	Red Hill (Citadel of Teyshabaini)
marz	Province, administrative division

NOTE

In this report, "\$" refers to US dollars.

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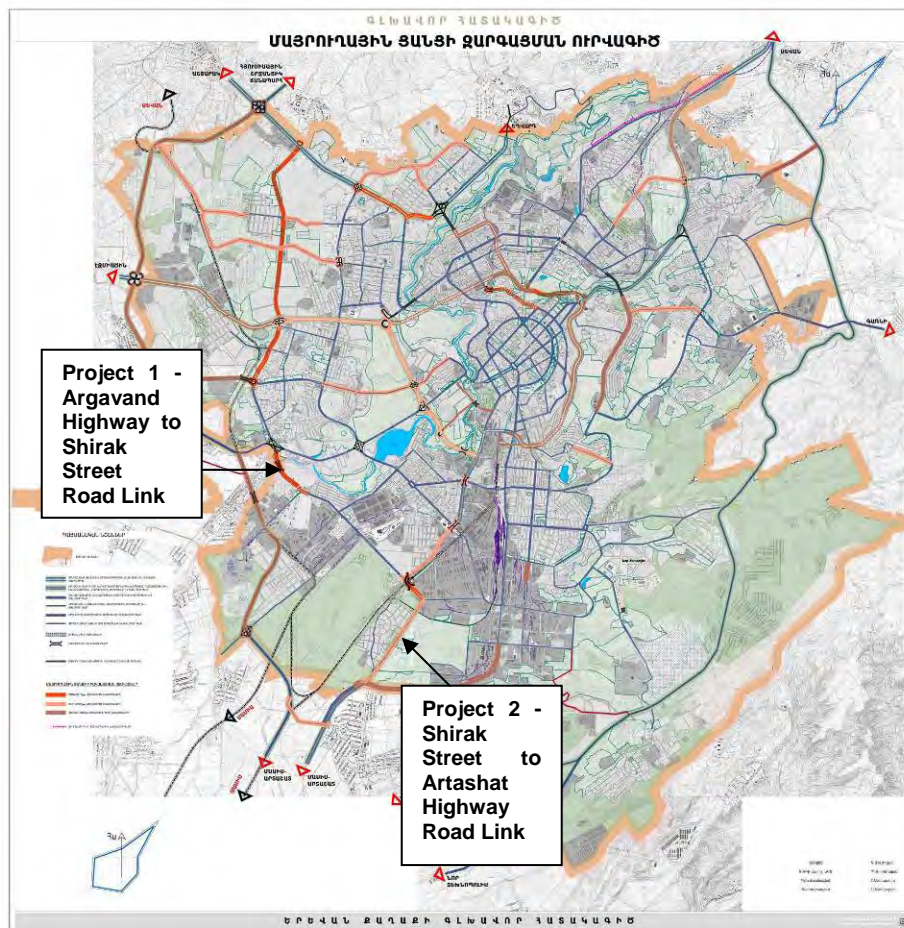
APPENDIXES

1. Rapid Environmental Assessment (REA) – Roads and Highways
2. Ecological investigation
3. Archaeological investigation
4. Consultation Meeting Advertisement and Attendance Sheet

Figure 1: Armenia showing the location of Yerevan

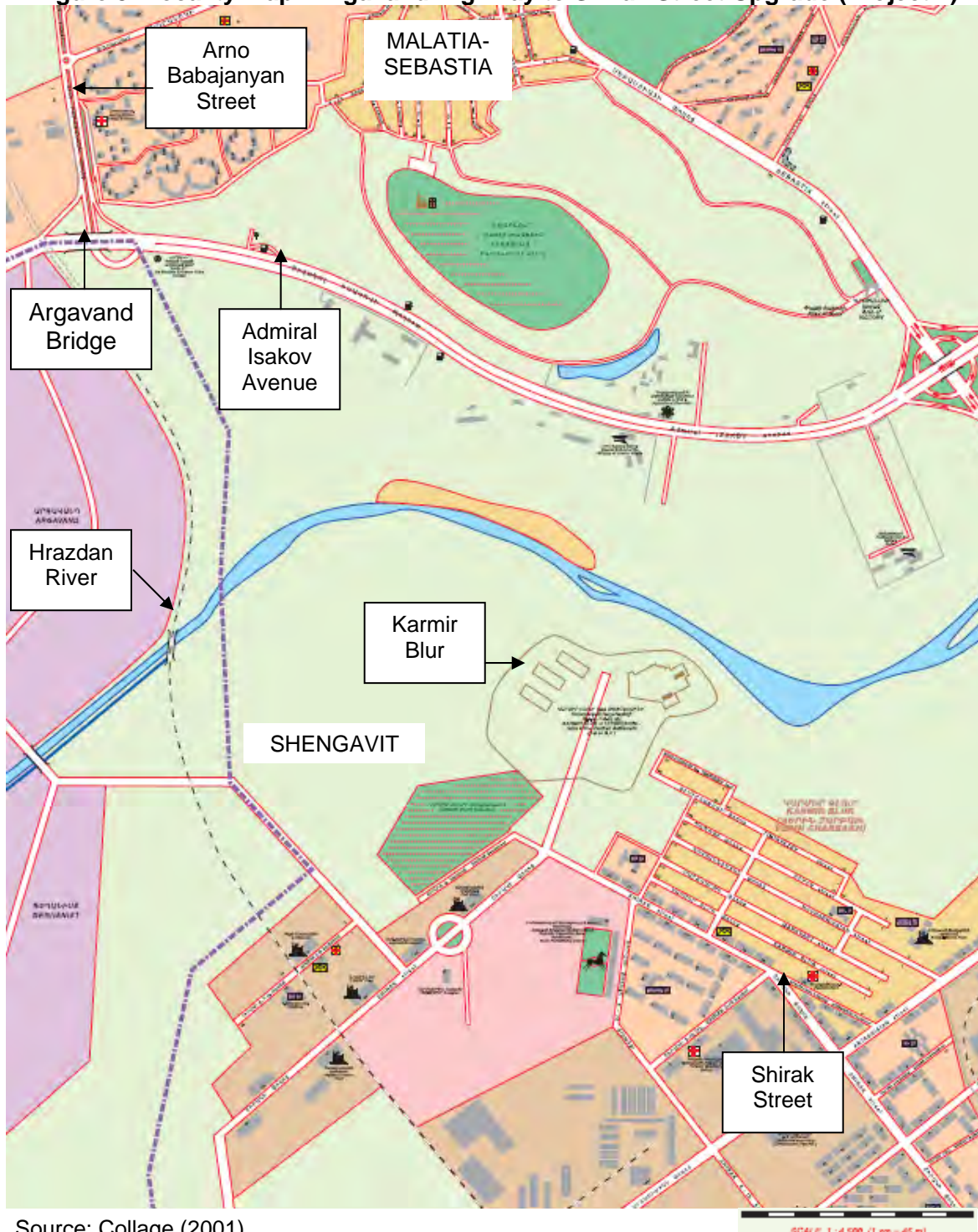


Figure 2: Program project locations



Source: Municipality of Yerevan Master Plan (2006)

Figure 3: Locality map - Argavand Highway to Shirak Street Upgrade (Project 1)



Source: Collage (2001)

Figure 4: Project layout

v



Municipality of Yerevan (2010)

I. INTRODUCTION

A. Project Background and Purpose of Report

1. The Republic of Armenia is a landlocked country between the Black and the Caspian Seas, bordered on the north by Georgia, to the east by Azerbaijan, on the south by Iran, and to the west by Turkey as shown in Figure 1. Yerevan covers an area of 260km² extending 18km north-south and 16km east-west with the centre and the south of the City at a lower geographic level.

1. Project Background

2. Like other New Independent States of the former Soviet Union, Armenia's economy still suffers from the legacy of a centrally planned economy and the breakdown of former Soviet trading networks. Investment from these states in support of Armenian industry has virtually disappeared, and consequently few major enterprises are still able to function. The structure of Armenia's economy has changed substantially since 1991, with sectors such as construction and services replacing agriculture and industry as the main contributors to the economic growth. Other industrial sectors driving industrial growth include energy, metallurgy, and food processing.

3. Steady economic progress has earned Armenia increasing support from international institutions. The International Monetary Fund (IMF), World Bank, European Bank for Reconstruction and Development (EBRD), as well as other international financial institutions (IFIs) and foreign countries are extending considerable grants and loans. These loans are targeted at reducing the budget deficit; stabilizing the local currency; developing private businesses related to energy, agriculture, food processing, transportation, and health and education sectors. In December 2005, the U.S. Millennium Challenge Corporation approved a 5-year \$235 million contract with the Government of Armenia, which was to focus on rehabilitation of irrigation networks and upgrading of rural transport infrastructure.

4. There has been little traffic forecasting, with the last study conducted in 2007 through the Millennium Challenge Corporation, by engineering consultancy SWECO. That study used gross domestic product (GDP) per capita to forecast the future growth in car ownership. This is based on car ownership of 80 per 1,000 of population in 2007, projected to increase to 344 per 1,000 by 2026. The carbon dioxide emissions related to passenger transport are expected to increase by 160% over this period resulting in increased greenhouse gas emissions which contribute to climate change. Other adverse effects of passenger transport such as air pollution, traffic congestion and noise are also likely to increasingly affect the environment and quality of life in a negative way.

5. Yerevan has seen increasing and rapid economic development, resulting in:

- (i) Growing car ownership and increasing congestion;
- (ii) Outdated public transport;
- (iii) Safety issues; and
- (iv) Decreased air quality linked to vehicle emissions.

6. Yerevan has a high road traffic accident rate with the number of recorded accidents increasing 65% from 2001 to 2006, with steady increases over these years. Approximately one-fifth of these accidents are fatal.

2. The Project

7. During 2007, the Municipality of Yerevan worked with the World Bank on the public transport network, traffic management, parking and ticketing systems and has set relevant objectives. The Asian Development Bank (ADB) is now working with Government of Armenia and the Municipality to address some of the objectives by improving municipal infrastructure and reducing road transportation constraints on economic activity. The program aims to promote efficient and effective urban transport services with incentives and capacity to improve the quality, reliability, accessibility, affordability, integration and coverage of transport services. The Urban Infrastructure and Sustainable City Development Program has been developed and is to be funded by the ADB under a Multi-tranche Financing Facility (MFF) Investment Program. The two proposed engineering projects under Tranche 1 of the Program, as shown in Figure 2, are:

- (i) Project 1 - Argavand Highway to Shirak Street Road Link; and
- (ii) Project 2 - Shirak Street to Artashat Highway Road Link.

8. The two road projects will complete the missing road links of the Yerevan west bypass to divert through-traffic around the City centre. This report presents the findings of an Initial Environmental Examination (IEE) of Project 1 - Argavand Highway to Shirak Street.

B. IEE Report Outline and Methodology

9. This Initial Environmental Examination (IEE) report comprises the following key components:

- (i) Description of the project;
- (ii) Description of the environment;
- (iii) Screening of the potential environmental impacts and mitigation;
- (iv) Environmental Management and Monitoring Plan (EMP);
- (v) Public consultation and information disclosure; and
- (vi) Findings, recommendation, and conclusion on whether there is a need for a full EIA.

10. The study has been undertaken in accordance with the ADB's *Safeguard Policy Statement* (2009), *Environmental Assessment Guidelines* (2003) and *Armenia: Urban Infrastructure and Sustainable City Development Program Environmental Assessment and Review Framework* (September 2010). Internationally recognized standards and guidelines have provided guidance where local standards are not available and/or where referred to by the ADB on particular environmental aspects. This includes World Bank's *Pollution Prevention and Abatement Handbook* (1998) and *Environment, Health, and Safety General Guidelines* (2007).

11. 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. The Yerevan City Master Plan Vol.5, (2006) (Master Plan) is a primary source of baseline data, and has been supplemented by other information sources and specialist studies.

12. Site inspections were conducted by the International Environment Specialist and National Environment Specialist during January, February, and March 2010. The site inspections included driving the route of existing roads and walking sections of the route, including areas of potential environmental significance or likely impact.

13. Meetings were held with stakeholder authorities to discuss the relevant environmental aspects of the project, obtain information and gauge any specific environmental concerns. A consultation event was held to present the project to the public and allow opportunity for comment. Refer to Section VI of this report for further detail on consultation activities.

C. Armenian and ADB Environmental Assessment Requirements

14. This environmental assessment has been undertaken to satisfy both the ADB and Republic of Armenia requirements with regard to environmental protection and management. This IEE has been prepared in English as a safeguard requirement of ADB and a separate EIA report in has been prepared in Armenian language.

1. Armenian Laws Governing Environmental Management and Assessment

15. After Armenia gained its independence in 1991, the deteriorating environmental condition of the country became more apparent and, as environmental concerns became high priority political issues, the process of development of environmental legislation was initiated. The 10th Article of the Constitution of the Republic of Armenia (passed in 1995) outlines the State responsibility for environmental protection, reproduction, and use of natural resources. Some 33 relevant national laws have been promulgated to protect the environment. There are two main laws administered by the Ministry of Nature Protection (MNP):

- (i) Law on the Principles of Environmental Protection (1991); and
- (ii) Law on Environmental Impact Assessment (EIA) (1995).

Law on the Principles of Environmental Protection (1991)

16. The Law on the Principles of Environmental Protection (1991) outlines the environmental protection policy of the Republic of Armenia. Its purpose is to ensure state regulation of environmental protection and use within the territory of the Republic. It provides a legal basis for the development of environmental legislation regulating the protection and use of forest, water, flora and fauna, and the atmosphere. This law also grants every citizen the right to obtain reliable information on environmental conditions.

Law on Environmental Impact Assessment (EIA) (1995)

17. The Law on Environmental Impact Assessment (EIA) (1995) contains the standard steps of the EIA process for various projects and activities in Armenia. It establishes, in Articles 2-5, the general legal, economic, and organizational principles for conducting mandatory state EIA of various types of projects and “concepts” of sectoral development, which includes construction and infrastructure. The law forbids any economic unit to operate or any concept, program, plan or master plan to be implemented without a positive conclusion of an EIA. This right was given to local authorities, ministries, local communities, and non-governmental organizations (NGOs) in Article 4. The MNP can initiate a review of environmental impact when it deems it to be necessary. The EIA Law specifies notification, documentation, public consultations, and appeal procedures and requirements (Articles 6-11).

18. The key departments within the MNP that have administrative authority over EIA and the project approval process are two State Non-commercial Organizations (SNCOs):

- (i) The SNCO Nature Protection Expertise (NPE) is responsible for reviewing and approving EIA reports and projects for implementation and adding conditions when necessary to protect the environment; and
- (ii) The SNCO State Environmental Inspectorate (SEI) is responsible for inspecting projects to ensure compliance with conditions imposed by the NPE and with the project EMP.

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

20. To satisfy relevant regulations and to gain project approval of the MNP, an EIA, in accordance with the Law on Environmental Impact Assessment (EIA) (1995), has been prepared. The MNP EIA will have similar, if not identical, requirements as the ADB IEE.

Other Relevant Environmental Legislation

21. Other pieces of pertinent environmental legislation have also been considered during the assessment, which include specially protected natural areas, air protection, cultural and historical monuments, flora, fauna, water use, seismic defense, waste, hygiene, and workers' protection.

22. The Republic of Armenia has also signed and ratified International Conventions and Protocols on environmental protection.

2. ADB Environmental Assessment Requirements

23. ADB's *Safeguard Policy Statement* (2009) sets the requirements of environmental assessment for all projects supported by the ADB. At an early stage of project preparation, the policy requires that the project's potential risks and their significance be identified and in consultation with stakeholders. 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.

24. Under the ADB's *Environmental Assessment Guidelines* (2003), preliminary assessment of Project 1 was undertaken through a Rapid Environmental Assessment (REA) checklist for road improvements (see Appendix 1). The assessment indicates an environment category 'B' which means that impacts that may arise from the implementation of all the components will generally be minor and measures to mitigate them will be provided and instituted without difficulty. The Safeguard Policy requires that risks and potential impacts be identified and reported in an IEE report.

D. Extent of the IEE Study

25. The IEE study for the sub-project was carried out by the Project Preparatory Technical Assistance (PPTA) consultants, in accordance with ADB guidance, and where relevant environmental policies and guidelines of the Government of Armenia were not available, international guidance. Environment Specialists of the PPTA consultants visited the sub-project site and also carried out public consultation prior to preparation of this report. The IEE involved the following activities:

- (i) gathering of baseline information on the physical, biological, and socio-economic environment of the project area and understanding the technical, social, and institutional aspects;
- (ii) field visits;
- (iii) discussions with officers of the relevant agencies;
- (iv) public consultation;
- (v) screening of potential issues, concerns, and impacts relative to location, design, construction, and operation to distinguish those that are likely to be significant and warrant further study;
- (vi) preparing an EMP indicating impact areas, recommended mitigation measures, method of monitoring the impacts, responsible agencies/persons, and associated costs; and
- (vii) proposing the institutional set-up for implementation of the EMP.

26. Findings of site reconnaissance, technical descriptions based on the engineering designs, and outcomes of discussions with officers of the relevant agencies and the general public are integrated into this IEE report.

II. DESCRIPTION OF THE PROJECT

A. Type of Project

27. This is a Multi-tranche Financing Facility (MFF) Investment Program. This IEE assesses Project 1 of the first tranche of the MFF.

B. Project Location

28. The project site is located in Armenia's capital of Yerevan within Yerevan's Shengavit district and Malatia-Sebastia district, approximately 6 km south-west of the City centre (refer to Figures 2, 3, and 4). The 1.2km alignment, along with approximately 0.3km of ramps, will connect Argavand Bridge at the existing intersection of and Arno Babajanyan Street and Admiral Isakov Avenue (M-5) (the main highway between Yerevan, Zvartnots Airport, and Echmiadzin) to the northern end of Shirak Street. The new road will cross the Hrazdan River. The alignment is confined within a previously established right-of-way ('red lines') as indicated on the Master Plan.

29. On the south of the Hrazdan River, the alignment is located between the Nerkin Charbakh cemetery and an archaeological site known locally as 'Karmir Blur' which translates to Red Hill.

C. Magnitude of Operation

30. This section of road is part of a program of road section upgrades to complete the Yerevan western bypass, aiming to divert through-traffic around Yerevan's City centre, which will improve traffic flow and reduce congestion on local roads. More specifically, this project together with Project 2 will provide a new link between Shirak Street and Artashat Highway, which will allow distribution of the road traffic arriving from the west to the southern suburbs of Yerevan to access the part of the City directly and reduce the traffic in the Shengavit neighborhood. There are two other road section upgrades in this tranche, one of which provides a new link between Davitashen Bridge and Ashtarak Highway (Project 1) which will form part of the western bypass. As identified under Section I, further upgrades have been defined

conceptually under Tranches 2 and 3 to the north of Yerevan and these projects are likely to be constructed following those within Tranche 1.

D. Project Description

31. The project includes the construction of a new 6-lane divided road over a length of approximately 1.2km, plus 0.3km of ramps, linking Argavand Bridge to Shirak Street. The design includes an interchange at Argavand Highway and a round-about at Shirak Street as illustrated in Figure 4.

32. The roads and bridges have been designed in accordance with:

- (i) Road Design Building Code SNIP 2.07.01-89;
- (ii) Bridge Design Building Code SNIP 2.05.03.84; and
- (iii) Construction Norm of Republic of Armenia IV11.05.02-99.

33. A bridge will be constructed over the Hrazdan River. The bridge design includes three spans at 42m allowing the piers to be located outside the 1 in 100 year (1%) flood level, which has a 36m width at this point. The bridge will be made of pre-cast concrete elements and will be incrementally launched from the northern side. Due to the topography of the riverbanks, launching cannot be undertaken from the southern side.

34. The approach viaduct on the southern side of the main bridge will comprise four or five 28m viaduct spans and will be constructed of pre-cast beams. The abutment walls on both sides of the river will be constructed of reinforced concrete and will be filled with clean material. All piers will be supported by raft foundations.

35. The 1.2m wide median strip will include concrete barriers. The new road will be comprised of base and sub-base material, and a concrete asphalt layer laid over the road and shoulders. The design includes road-side drainage and a permanent oil/water separator beneath the bridge to collect oils and prevent them from entering the river. The oil/water separator will need ongoing maintenance to clean out build-up of oils and debris. Allowance has been made for a pedestrian walkway on both sides of the road. A permanent separation wall will be constructed between the road and cemetery. Road traffic safety measures will be installed including signage and traffic markings.

36. Other activities associated with construction include:

- (i) Identification and protection or relocation of existing utilities including water and gas mains, sewers, electricity and communication lines. It is likely that the small (possibly 22kV) overhead electricity line will be relocated to allow clearance for the road;
- (ii) Installing measures to protect the cemetery; Karmir Blur in agreement with the MOC; and caves on the north of the river by creating fenced 'no-go' areas in agreement with the MNP;
- (iii) Establishing secure construction camps for worker facilities and offices; and storage of materials and machinery. Installed gated security fences around the camps;
- (iv) Removal of existing waste material along the route;
- (v) Excavation and grading of the alignment;
- (vi) Establishing wheel-wash facilities for vehicles leaving the site;

- (vii) Installing measures, as agreed with the MNP, to stabilize and protect the Hrazdan River during construction; and
- (viii) Landscaping of the shoulders and median following construction.

37. As the Karmir Blur archaeological area is thought to be rich in archaeological vestiges, the assessment and management of the cultural heritage within the project area is a priority. In order to mitigate any adverse impacts during construction, ADB is willing to take advantage of the project to enhance the appeal of the site for tourists. Specialists will develop plans for an archaeological park to preserve the area and enhance Karmir Blur to become a tourist landmark in Yerevan. This will be undertaken in consultation with the Municipality of Yerevan and the MOC, and it is envisaged that there will be the support of several Armenian cultural foundations.

38. Detailed design has been completed for this project and it is expected that construction will begin in 2011 and will be undertaken over a period of up to three years.

E. Alternatives to the Proposed Project

39. The ADB's *Environmental Assessment Guidelines* (2003) 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.

40. The City of Yerevan has been planned with the central area connected by radial roads to the suburbs. This directs through-traffic into the City centre as there is currently no complete link directing through-traffic around the City centre. The heavy congestion along the existing sections of road contributes to high noise, vehicle emissions and traffic incidents. A complex transport development scheme for Yerevan was originally included in the Master Plan in 1981 and construction of some sections of the scheme began in the 1980's but was never completed. The current 2004 Master Plan began to be developed in 2000, at which time the transport development scheme was reviewed, and the proposed scheme essentially remains similar to the original design. Construction of this new section of road will complete a section of the Yerevan western bypass to divert through-traffic off local roads. This will ease congestion, improve traffic conditions and contribute to improving economic factors, and improve regional air quality.

41. There are no practicable alternatives in terms of location, design, construction methodology, and social and environmental impacts. The no-go option is not considered viable as the conditions will worsen as traffic congestion on current routes would increase over time.

III. DESCRIPTION OF THE ENVIRONMENT – BASELINE

A. Physical Resources

1. Climate, Air Quality, and Noise

42. **Climate.** Based on weather results from the Zvartnots monitoring station, approximately 1.5km west/south-west of the site, the site experiences a continental climate, with hot and dry summers and moderately cold winters with unstable snow coverage. The average annual air temperature near the project site is 12°C, whilst the average low is -4°C in January and the average high of 26.1°C is in July. Humidity is generally low with 46%-50% in summer and 76%-82% in winter. Average annual precipitation is 286mm with the highest level in May at 42mm and the lowest in August at only 9mm. The prevailing wind direction is north-east.

43. **Air Quality.** Yerevan is surrounded by mountains on three sides which does not allow for natural dispersion of pollutants in the atmosphere, thereby resulting in high concentrations in the air. The main source of air pollutants are emissions arising from automobiles which is exacerbated by a congested road network. It is estimated in the Master Plan that approximately 95% of the pollutants in the air are the result of transport emissions.

44. According to the Master Plan, the north-western extent of the alignment is located within a 'moderate air pollution' zone and the south-eastern areas are considered 'permissible'¹. Table III.1 shows the measured concentrations from a monitoring station located at the Erebuni airport, approximately 3.2km east of the closest point to the project site. The table compares the maximum permissible concentration (MPC) of air pollutants based on the Armenian standard *Maximum Permissible Concentration (MPC) for Ambient Air in Human Settlements*. Based on the annual average measured, the table indicates that pollutants sometimes exceed the respective MPC. The table indicates that over the years 2007 to 2009, the average annual measured nitrogen dioxide consistently exceeded the MPC.

Table III.1: Measured Concentrations and Maximum Permissible Concentration of Air Pollutants

Pollutant	Annual average measured at monitoring station N7 – Erebuni airport (mg/m ³) ¹				Maximum permissible concentration (mg/m ³) ²	
	2007	2008	2009	TOTAL AVERAGE 2007 - 2009	Maximum single event	Daily medium
Dust	0.16	0.15	0.07	0.13	0.5	0.15
Sulfur Dioxide (SO ₂)	0.07	0.05	0.04	0.05	0.5	0.05
Nitrogen Dioxide (NO ₂)	0.085	0.052	0.061	0.066	0.085	0.04
Nitrogen Oxide (NO)	0.04	0.02	0.02	0.03	0.4	0.06

¹ Data supplied by the Environmental Impact Monitoring Centre, dated 24/03/2010.

² According to *Maximum Permissible Concentration (MPC) for Ambient Air in Human Settlements*, Republic of Armenia government decision N160-N, 02/02/2006.

45. In addition to pollution caused by vehicle emissions, a significant proportion of dust is present in the atmosphere. This is largely due to extensive deforestation which has occurred in the region in close proximity to the City borders. These large areas of arid landscape produce significant dust during the dry summer months. Table III.1 indicates that the yearly averages of dust concentrations measured in 2007 and 2008 exceeded or equaled the daily medium MPC; however, the figure was below in 2009. However, the average dust recorded in Yerevan between March to May is recorded as considerably higher than other months.

46. Yerevan also experiences a high concentration of ground ozone, especially in summer, which results in the development of a photochemical smog due to Yerevan's geographical location and emissions from transport.

¹ According to the Master Plan, the City is separated to two air quality zones, 'moderate air pollution' and 'permissible air pollution'. The zone classification is based on a pollution index calculation of parameters including nitrogen oxide, carbon oxide and dust, and takes into account of exceedance of MPCs, harmfulness, and other aspects. The methodology is based on 'Methodical guidelines of sanitary supervision in the regional planning' (USSR, 1990).

47. **Noise.** Currently, the dominant noise source in Yerevan is associated with transportation (approximately 90%). The end extents of the project alignment are exposed to noise from road traffic. Ambient noise is considerably lower towards the middle of the alignment where the area is not exposed to road traffic noise and there are no other dominating noise sources. The Armenian noise standard limits are outlined in Table III.2.

Table III.2 Maximum Permissible Noise Levels¹

Receptor	Time (hours)	Level of noise LA and level of equivalent noise L _{Aeq} dBA	Maximum level of noise L _{Amax} dBA
Close territories of apartment buildings, polyclinics, dispensaries, rest homes, boarding houses, home for senior or disabled citizens, preschools, schools and other educational institutions, libraries	06.00 – 22.00	55	70
	22.00 – 06.00	45	60

¹ Source: Ministry of Health, Republic of Armenia, Order N138, 6 March, 2002, Order on adoption of N2-III-11.3 sanitary norms "Noise in workplaces, apartment and public buildings, territories of urban construction".

2. Surface and Groundwater

48. In the vicinity of Project 1, the Hrazdan River flows along a gorge in a south-west direction. The river is predominantly snow-fed and highly regulated, with the nearest upstream regulation at Yerevan Lake, approximately 2.5km west.

49. Water quality of the Hrazdan River is generally poor. Table III.3 and Table III.4 set out the average annual concentrations of water quality at monitoring stations at Yerevan Lake (approximately 2.5km upstream of the project site) and Geghanist (approximately 7.5km downstream of the project site) between 2007 and 2009. Although these monitoring stations are located at a distance from the project site, they indicate the quality of the river water. The data show that biochemical oxygen demand (BOD) concentrations exceeded the MPCs, COD exceeded limits downstream of the project site, and the majority of metals measured consistently exceeded MPCs.

50. A canal from Yerevan Lake is located adjacent to the Hrazdan River on its north-western side. The canal follows the river from Yerevan Lake, then just beyond the project site where the built-up area begins, the canal diverts from the river to flow directly east. A redundant irrigation canal is also located adjacent to the river on its south-eastern side. Neither canal is connected to the river.

51. Based on the MNP's database of water abstractions for 2008/2009, there are no abstractions downstream within 700m of the project site.

Table III.3 Average Annual Concentrations of Pollutants in Yerevan Lake (station N. 112) ¹

Name of pollutant	Concentration			
	MPC ²	2007	2008	2009
BOD ₅ (mg/L)	3	3.06	3.25	3.78
COD _{Cr} (mg/L)	30	17.5	24.2	29.9
Nitrite ion (mgN/L)	0.024	0.065	0.149	0.115
Ammonium ion (mgN/L)	0.39	0.805	1.427	1.646
Sulfate ion (mg/L)	100	81.4	101.2	68.6
Aluminum (mg/L)	0.04	0.121	0.144	0.159
Vanadium (mg/L)	0.001	0.023	0.020	0.018
Chrome (mg/L)	0.001	0.004	0.006	0.005
Iron (mg/L)	0.5	0.443	0.186	0.224
Manganese (mg/L)	0.01	0.054	0.055	0.036
Copper (mg/L)	0.001	0.003	0.002	0.002
Bromine (mg/L)	0.2	0.210	0.260	0.188
Selenium (mg/L)	0.001	0.003	0.002	0.002

¹ Monitoring station is approximately 2.5km north of the project site. Data provided by the MNP's ArmMonitoring Centre, 29/03/10.

² Ministry of Fish Industry of USSR, M. VNIERKH, (1990), Integrated list of MPCs and nearly safe levels of influence of pollutants on water in fishing reservoirs. p.44.

Table III.4 Average Annual Concentrations of Pollutants in the Hrazdan River near Geghanist (station N. 55-1) ¹

Name of pollutant	Concentration			
	MPC ²	2007	2008	2009
BOD ₅ (mg/L)	3	4.87	3.92	4.43
COD _{Cr} (mgO/L)	30	23.8	32.2	34.8
Nitrite ion (mgN/L)	0.024	0.116	0.182	0.156
Ammonium ion (mgN/L)	0.39	4.551	5.985	3.757
Sulfate ion (mg/L)	100	104.4	103.8	72.4
Aluminum (mg/L)	0.04	0.820	0.210	0.120

Name of pollutant	Concentration			
	MPC ²	2007	2008	2009
Vanadium (mg/L)	0.001	0.023	0.014	0.020
Chrome (mg/L)	0.001	0.004	0.003	0.014
Iron (mg/L)	0.5	0.499	0.187	0.141
Manganese (mg/L)	0.01	0.043	0.054	0.047
Copper (mg/L)	0.001	0.004	0.019	0.003
Bromine (mg/L)	0.2	0.199	0.180	0.174
Selenium (mg/L)	0.001	0.004	0.001	0.002

¹ Monitoring station is approximately 7.5km south of the project site. Data provided by the MNP's ArmMonitoring Centre, 29/03/10.

² Ministry of Fish Industry of USSR, M. VNIERKH, (1990), Integrated list of MPCs and nearly safe levels of influence of pollutants on water in fishing reservoirs. p.44.

52. A sewer pipeline discharges untreated sewage directly into the river approximately 10m south of the alignment.

53. The Hrazdan River is highly regulated to control flow, including via Yerevan Lake further upstream of the site. The Master Plan indicates that there is essentially no risk of flooding in the vicinity of the project site. On the south of the Hrazdan River, a natural drainage line follows the project alignment.

54. The project site slopes towards the Hrazdan River before it drops into the gorge. It is likely that the groundwater beneath the site varies between 5 and 10m at the north-western and south-eastern extents.

3. Topography, Soils, Geology, and Seismology

55. The project site is located in the western part of Yerevan within the Ararat valley. The altitude of project site is approximately 870-900m above sea level.

56. Yerevan City and the adjacent regions are located in a seismic area and are considered to have a high degree of seismic risk along existing fault lines. Earthquakes in the area can reach up to the magnitude of 9 and above on the Richter scale and maximum horizontal acceleration of 0.4 g. There was a serious earthquake in 1988 in the north of the country, measuring 6.9 on the Richter scale, which led to a large loss of life.

57. The northern side of the Hrazdan River is covered by large boulders, construction debris, and general refuse whilst the southern side comprises exposed soils overlain by rubble and loose gravel, and randomly dumped construction debris and refuse. The Master Plan indicates that the underlying geology of the project site consists of lake and alluvial sediments. The soil mainly comprises interbedded clay and sand.

58. The Master Plan indicates that soils in the project area have low levels of contamination. Soils along the route alignment contain concentrations of chromium, nickel, lead, silver, zinc, cobalt, copper and molybdenum.

B. Ecological Resources

59. In Armenia the Law on Flora and the Law on Fauna set out 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. The Armenian Red Book has been developed which lists all rare and vanishing species that need to be protected. The International Union for Conservation of Nature (IUCN) has developed an IUCN Red Data Book and the IUCN Red List of Threatened Species, which highlights those plants and animals that are facing a higher risk of global extinction and are therefore listed as critically endangered, endangered or vulnerable). Species endemic to Yerevan have been identified; however, they are expected to be commonly found within the Yerevan and surrounding regions.

60. A preliminary investigation was undertaken by an ecologist in March and April 2010 to verify the Master Plan or identify any protected species and the potential impact from the project on them (see Appendix 2). The season over which the study was undertaken was not favorable from the vegetation, migration, wintering, ovipositing (egg-laying), and other biological perspectives. Based on the preliminary investigation, it was determined that there is likely to be protected species present at the site; however, this will need to be confirmed through further investigation prior to construction.

61. The project site is located in a semi-desert landscape zone with elements of desert. In this landscape are different types of flora and fauna species which are typical of Yerevan. In general, Yerevan contains the following flora and fauna types Yavruyan, 2010):

- (i) **Plants** - 900 types of vascular plants, 15 are included in the Armenian Red Book, among them one endemic species is included on the IUCN Red List.
- (ii) **Mammals** - 25 species, three are included in the Armenian Red Book, 5 are on the IUCN Red List.
- (iii) **Birds** – about 170 species, 29 are registered in the Armenian Red Book. At least 100 types, of which 15 are included in the Armenian Red Book, build nests. Birds are also regularly present during seasonal migration, wintering and feeding time. The most numerous are synanthropic types, such as the sparrow, grey crow, magpie, rock pigeon (including feral pigeon) and Eurasian Collared Dove.
- (iv) **Reptiles** - 25 species, five are included in the Armenian Red Book.
- (v) **Amphibians** - the Syrian spadefooted Toad (*Pelobates syriacus*), listed in the Armenian Red Book, is likely to have disappeared due to landscape alteration and alterations to water reservoir flows.
- (vi) **Invertebrates** – there are many throughout Yerevan. The most investigated are beetles: about 700 known species, most of which are endemic to Armenia and some endemic to Yerevan. Known insect species include 60 fly species (dipterans); 40 wasp, bee and ant species (hymenopterans); 130 butterfly species; between 10 to 20 types of grasshopper, cricket and locust species (orthoptera); spiders; snails (molluscs); and about 30 types of gnawing beetle and tick species.
- (vii) **Fish** – 10 species are registered in the rivers Hrazdan and Getar.

62. There are caves located on the north-western side of the Hrazdan River approximately 100m north of the project alignment. Colonies of rare and endangered bat species have reportedly been found and identified in these caves (refer to Appendix 2).

63. Notwithstanding the above, the project site is within an area affected by urban development and activities. Much of the alignment contains deposited construction waste and limited vegetation cover comprising of low lying grasses.

64. According to the Master Plan there are natural biodiversity sites in the vicinity of the project site which contain registered species that need special protection (registered in Armenian Red Book, Armenian endemic, original ecosystems). The Master Plan indicates that the semi-desert original territories natural biodiversity site of Red Hill is located approximately 1km north of the project site on the northern side of the Hrazdan River. At this same location is a site described as the cave of Red Hill which is designated as an area of special significance for the protection of rare bats; the bats are Schreiber's Long-Fingered Bat (*Miniopterus schreibersi*) and Mehely's Horseshoe Bat (*Rhinolophus mehelyi*).

C. Economic Development

65. Just north of the Hrazdan River are a police academy, small military facility, and numerous retail outlets and other commercial operations along the highway. Admiral Isakov Avenue is the highway that connects Yerevan to Zvartnots international airport, approximately 2km south-west of the project site.

66. The Shengavit district is characterized by large industrial factories. Near the project alignment are also large commercial precincts and an equestrian racecourse located just south of Shirak Street on the southern extent of the alignment. A few small commercial premises are located on Shirak Street at the eastern extent of the alignment, of which a number of associated buildings are situated within the current route of the alignment, reportedly constructed without Municipality approval.

67. Within the alignment are above ground gas pipes, large diameter sewers, and overhead electricity lines that pass over the river and a sewage outfall into the river. Other utilities including communications line, and water and sewage mains, within or near the alignment will be confirmed through a survey by the Contractor prior to construction. An operational canal runs along the north of the river and a disused underground irrigation channel crosses the path of the alignment.

D. Social and Cultural Resources

68. In 2001-2006 34.3% of the Armenian population lived within Yerevan's 12 districts. 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; which has since led to a static population in Yerevan. Statistically 28% of the population in Yerevan is categorized as below the UNDP poverty line. Poverty reduction targets aim to decrease the percentage of classified poor in Yerevan to a target figure of 2.6% by 2021.

69. Overall employment has stagnated although the economic recovery has led to an increase in employment sectors benefiting from foreign investment. The unemployment rate has fallen from 10.1% in 2003 to 6.5% in 2008 in Yerevan, but this rate remains high and official figures may underestimate the true situation. According to household surveys carried out by the

National Statistical Service of the Republic of Armenia (NSS, 2001), the unemployment rate exceeds 30%.

70. Just west of the alignment north of the river is a medium-density residential neighborhood of Argavand. South-east of the river are scattered residences; a property containing an orchard on the Hrazdan River, approximately 100m north of the site; and a school approximately 100m east of the site.

71. A preliminary archaeological investigation was undertaken, including fieldwork over three days. Refer to the full report in Appendix 3. The investigation identifies two archaeological sites or settlements, Old Argavand and Karmir Blur. Although the investigation identified finds in the area of the Old Argavand settlement on the western side of the Hrazdan River, the scientific value of the settlement has been lost as the area has been destroyed by modern urban construction activities (building housing and utilities). The investigation concludes that there is no need for protection or recovery excavations in the Old Argavand area prior to the start of construction activities.

72. Karmir Blur is named after the color of the local reddish sediments used to make the mud bricks for structures in the Urartian period. It occupies an area of approximately 50 hectares. The archaeological features associated with Karmir Blur, which are listed as protected by the MOC, are:

- (i) Teyshebaini-Karmir Blur archaeological site (Inventory number 1.11.22), where the remnants and constructions of the citadel (Inventory number 1.11.22.2), living quarters of the city (Inventory number 1.11.22.1), and the dwellings of Pre-Urartian settlement (Inventory numbers 1.11.22.1.1-1, 1-2, 1-3) are still visible;
- (ii) Karmir Blur cave on the north-western side of the Hrazdan River gorge (Inventory number 1.11.27); and
- (iii) Umeshin or Ejmiatsin irrigation channel of the 7th century BC (Inventory number 1.7.7), which was rebuilt several times, including at the end of the 17th century, in 1815 and in 1922. This canal is still active.

73. The alignment of the road project is located along the southern extent of the Karmir Blur site, approximately 250m south/south-west of the Karmir Blur citadel, with the foundations of associated outbuildings adjacent to the alignment. During early planning of this road project, the Department of Historic and Cultural Monuments of the MOC agreed with the need for the new road link (letter dated 7 June 2002) based on six provisions which have been addressed in this report. The provisions are:

- (i) Review the design to position the alignment as far from the protected area as is possible. (The design has been reviewed, however cannot be shifted as the boundary of the cemetery has shifted further north.)
- (ii) Include pedestrian underpasses beneath the road to allow access between archaeological areas.
- (iii) As part of the project and prior to construction, undertake a phase 1 archaeological investigation and a phase 2 investigation if necessary. The cost of the investigations should be included in the project.
- (iv) In the case of discovery of historical and cultural monuments of significance, their transportation and appropriate financing should be included in the project.
- (v) Construction of a fence along the road alignment.
- (vi) Submit the revised project for approval by the MOC.

74. A Municipal cemetery is located adjacent to the alignment. Within Yerevan, cemeteries are designated as 'special protected areas' on the Master Plan. The 'Eagle' monument indicating the western entrance to Yerevan is located near Argavand Bridge within the existing southern clover is listed as a historical cultural monument on the Master Plan. The Master Plan indicates that a 'historical garden territory', an area of potential archaeological excavation, known as Dalma Gardens is located approximately 700m north-east of the project site. There are no cultural heritage or archaeological sites designated by UNESCO located in the vicinity of the site.

75. The alignment follows a previously established right-of-way ('red lines') and previously established alignment, as indicated in the Master Plan.

IV. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION

A. Environmental Parameters That May Be Impacted

76. There are likely to be both beneficial and adverse impacts associated with Project 1, including on:

- (i) Physical environment – air quality, water, and soil and landscape;
- (ii) Ecological resources – flora and fauna;
- (iii) Economic development – industry and commerce, local and regional roads and public transport; and
- (iv) Social and cultural – noise; human health and safety; income and employment; cultural and heritage sites.

77. The potential issues, concerns, and/or impacts relative to location, design, and construction and operation phases of the project are outlined below. The significance of any impact and need for mitigation or opportunity for enhancement are also discussed below. Detailed mitigation measures are included in Section V.

B. Impacts Due to Location

78. The project alignment is located within a right-of-way that was established during the 1980's and is owned by the Municipality of Yerevan. However, several buildings are situated within the right-of-way, reportedly constructed without Municipal approval. These buildings would be demolished and the owners/operators compensated in accordance with the Land Acquisition and Resettlement Plan (LARP) prepared for the Program.

79. The purpose of constructing the new section of road is to provide a link between the Argavand Bridge intersection and Shirak Street which will form part of the Yerevan western bypass. Completion of this bypass will divert through-traffic around the City centre and will ease congestion on existing routes. The new link is expected to reduce congestion and improve regional air quality.

80. The alignment of the road project is located adjacent to the foundations of outbuildings associated with the citadel of the Karmir Blur archaeological site. A separation wall is proposed to ensure that construction activities and operational maintenance activities do not encroach on this area. Furthermore, archaeological excavations are required along the extent of the road to gain a full understanding of the sub-surface archaeology, and to identify an appropriate solution.

This would likely include ten 5m² test trenches along the road to test the soil for archaeological potential and to identify the extent of further investigation. The test excavations would be carried out over a one to two month period. This will then establish if full excavation is required, or whether an approach can be adopted whereby an archaeologist is present during carefully controlled road excavation, and to stop works when an item of potential archaeological interest is found. The MOC's chance-find procedures would be followed.

81. The new link road will increase the accessibility to the Karmir Blur archaeological site and there will be an opportunity for the project to include enhancement of the site as a tourist attraction. The proposal includes engaging an international team of consultants, comprised of an architect-engineer, an architect-urban planner, and an archeologist to identify development potential of the site as an archaeological park. The objective is to preserve the cultural heritage of the site and allow dissemination of Yerevan's history. This will have long-term benefits. Access between the Karmir Blur site and the area further south will be maintained for pedestrians by walking beneath the proposed Hrazdan River bridge.

82. No part of the project passes through or near any internationally designated ecologically sensitive areas, designated wildlife or other sanctuary, national park, botanical garden, nor area of international significance (e.g. IUCN, RAMSAR site). The alignment does not pass through or near any cultural heritage or archaeological sites designated by UNESCO. Based on this, the project will not adversely impact any internationally designated sensitive areas.

83. The project site is located approximately 100m from caves where colonies of rare and endangered bat species have reportedly been identified (Yavruyan and Barsegyan, 1975, in Yavruyan, 2010). The population of bats will be further investigated by a bat specialist. The design of the bridge will be reviewed and the need for any mitigation during construction and operation will be identified.

C. Impacts Related to Design

84. The project includes construction of a bridge over the Hrazdan River. The bridge design includes piers outside the 1 in 100 year (1%) flood line, thereby reducing the operational phase impact on the river hydrogeology and water quality from obstructions and scour effects. Pier locations on the north-western side of the river will be positioned to ensure that they do not interfere with the canal.

85. Drainage has been incorporated into the road design to control flow, thereby minimizing erosion of soils and local flooding. Drainage on the bridge would flow through an oil separator beneath the bridge to prevent oils on the road from draining into the river in run-off.

86. The road will be designed and constructed to current high standards, facilitating driver safety.

87. The structural elements of the project have been designed with consideration to the high risk of seismic activity of the region. This will enhance the sustainability of the project.

88. The design includes landscaping along the shoulders of the road. Benefits of landscaping include enhancing ecological value, facilitating infiltration of run-off, stabilizing soil structure, enhancing visual aesthetics of the locality.

D. Impacts during Construction

89. Activities during the pre-construction, site preparation, and construction phases are outlined below and the potential impacts assessed and mitigation measures recommended. This includes all elements of the road construction including the Argavand Bridge interchange, bridge over the Hrazdan River, and round-about at Shirak Street. Section V of this report outlines more detailed mitigation measures including the requirement to prepare detailed operating plans for specific aspects for inclusion in the EMP. Regulations on environmental protection, safety of the public, and safety and hygiene of workers should be fully complied with in all phases of constructing the project.

90. There is potential for the project to generate employment opportunities for locals. It is recommended that recruitment be offered in the local community as it is likely to promote good community relations and encourage good work practices. Procurement of local workers will also minimize social problems otherwise caused by the provision of temporary worker accommodation, with non-local workers attracting camp followers.

91. On-site workers should be made aware of, and trained in, standard environmental protection requirements and the IEE requirements. The Contractor will be contractually required to include environmental training and monitoring as part of its management of the project.

92. Potentially sensitive receptors will be notified by the contractor 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.

1. Site Preparation Activities

93. Prior to the start of construction, the occupants of the buildings within the right-of-way will need to be resettled and the buildings demolished. The full social impact of this is being assessed a social analysis report, and resettlement will be undertaken in accordance with the LARP.

94. Prior to construction, the Contractor will prepare a site plan showing suitable locations for construction site entry/exit points and vehicle access tracks, vehicle parking, works compounds, site offices and facilities, and materials and equipment stores. The plan will clearly define 'no-go' zones to prevent access to sensitive areas including the cemetery; Karmir Blur archaeological site; the Eagle monument; the river (especially near the sewage outflow) and nearby the bat caves. Boundary fencing will be established at the beginning of site preparation and access restrictions will be strictly enforced.

95. Construction waste that has been deposited along the alignment will be moved prior to grading activities. Clearing will be undertaken under the supervision of a suitably qualified and experienced archaeologist, and any find will be managed through chance-find provisions. The waste will not be used as fill material on the project and will be transported and disposed of in accordance with MNP requirements.

96. There is potential for disruption to both above and below-ground utilities during construction. This will likely include relocation of the small electricity line which passes above the alignment of the proposed bridge; and might also include gas mains, water mains, and

electricity and communications lines. Surveys will be undertaken by the Contractor prior to construction to identify operational and redundant utilities. Plans will be prepared to set out temporary or permanent relocation and/or protection measures prior to construction. Any disruption to services would be short-term and localized. Consideration will need to be given to the time of year; week and day for any disruption and those potentially affected should be notified prior to the works.

97. The canal along the north-western side of the Hrazdan River will need to be protected during construction. That is, protection in terms of quality of water flowing through the canal, and archaeological value of the structure. Consideration should be given to temporarily covering the canal to prevent sediment and other pollutants from entering. The structural integrity of the canal should also be protected from vehicle movements.

98. Construction site safety for workers and residents of the nearby communities is of concern to the ADB. There are a number of potential hazards at the site including steep slopes, unsteady ground, the Hrazdan River, and overhead electricity lines. The construction site layout should be planned and areas and machinery secured as required prior to and during construction to ensure health and safety. First aid facilities will be provided and safety and environmental emergency response plans prepared and appropriate training provided prior to the start of site works.

2. Vehicle Movements, Machinery Operation, Excavation, and Grading

99. Earthmoving activities and other construction activities have the potential to impact on other flora and fauna. There are no plant species considered at risk of being affected by the project so plants are not listed in Table IV.1. However, the preliminary ecological investigation (Appendix 2) identified that it is likely that protected fauna are present at the site. Table IV.1 lists those protected species that may be potentially impacted by construction activities associated with the project, if present on site.

100. The protected species composition and abundance of specific types of species during different seasons will need to be identified before mitigation measures for protection can be developed. Site clearing will be undertaken during late autumn and/or winter which are seasons most favorable to avoid impact on protected species; however, noisier and vibration-generating activities will not be undertaken in the vicinity of the caves during the winter to avoid disturbing hibernating bats.

101. As ground cover is removed, exposed soils on the site will provide a potential dust source causing nuisance to nearby receptors and a reduction in local air and water quality. The generation of dust should be mitigated primarily through maintaining vegetation cover as long as practicable, and surfacing site haul roads with gravel. Other measures include spraying the haul roads with water to suppress dust. Exposed surfaces should be grass-seeded by a fast-growing species to provide temporary cover. Loads should be covered when transporting sand, soil, and spoil material.

102. Particulate matter and nitrogen dioxide will be generated by construction vehicle exhaust. The exposure to potential receptors is expected to be insignificant because of the limited level, duration of exposure, and likely adequate dispersion of pollutants before they reach receptors. Exhaust attenuation such as scrubbers or diesel particulate filters, should still be applied to vehicles.

Table IV.1 Protected Species that Would Potentially be Impacted

Common name	Scientific name	ARDB ¹	IUCN ²	Note
Mammals				
Long-Eared Hedgehog	<i>Hemiechinus auritus</i>	✓		
Schreiber's Long-Fingered Bat	<i>Miniopterus schreibersi</i>	✓	LR/NT	Wintering
Mehely's Horseshoe Bat	<i>Rhinolophus mehelyi</i>	✓	VU	Wintering
Greater Horseshoe Bat	<i>Rhinolophus ferrumequinum</i>		LR/CD	
Lesser Horseshoe Bat	<i>Rhinolophus hipposideros</i>		VU	
Birds				
Lammergeier	<i>Gypaetus barbatus</i>	✓		Migration, feeding
Eurasian Griffon Vulture	<i>Gyps fulvus</i>	✓		Migration, feeding
Black (Monk) Vulture	<i>Aegypius monachus</i>	✓	LR/NT	Migration, feeding
Reptiles				
Transcaucasian Ratsnake	<i>Elaphe hohenackeri</i>	✓		
Amphibians				
Syrian spadefooted Toad	<i>Pelobates syriacus</i>	✓	✓	Possibly disappeared

¹ ARDB – Armenian Red Data Book

² IUCN - International Union for Conservation of Nature Red List of Threatened Species.

IUCN Red List Categories: CD - conservation dependent, NT - Near Threatened, VU – Vulnerable, LR - Low Risk.

103. A barrier will be installed along the edge of the Karmir Blur site and 'no-go' areas established to protect the archaeological site from construction activities. To ensure that any chance-finds are identified during excavation activities, a qualified and experienced archaeologist will supervise excavation activities. If any item of cultural heritage or archaeological interest is uncovered during excavation activities, works must stop and the MOC notified. Construction activities cannot commence until the chance-find has been investigated and written permission given by the MOC. Contractors will be obliged to familiarize themselves with the chance-find procedure of the MOC and will be contractually required to implement them strictly.

104. Noise will be generated from the operation of vehicles and machinery (including excavators, compactors, vehicle reversing alarms, etc), verbal communications and other construction-related activities. The most sensitive receptors are occupants of residential properties and other buildings at the eastern extent of the alignment and north-east of the river, and visitors at the cemetery. Bats are also receptors and these were discussed earlier. Although temporary and localized, noise levels could result in impact to nearby receptors without mitigation. Attenuation measures in the EMP include scheduling of noisy activities towards the middle of the day; distancing construction camps and noisier activities away from receptors

where practicable; installation of temporary hoarding; and mechanical attenuation on vehicles and equipment. After applying mitigation, residual noise will not result in significant impact.

105. Construction equipment including compactors and other heavy vehicle movements may generate vibration at the cemetery and archaeological foundations adjoining the alignment. Any vibration will be localized and temporary and will unlikely result in any structural damage.

106. There is deposited construction waste within this alignment on both sides of the Hrazdan River which will need to be cleared prior to construction and disposed of in suitable locations approved by the Municipality of Yerevan and MNP, another task that may be included in the construction contract. Reuse or disposal options will also be considered for surplus excavation soil.

107. There is potential for spill or leak of fuels and oils from inappropriately stored material or when refueling. This would contaminate the soil and could infiltrate into the groundwater or enter the Hrazdan River. Mitigation measures in the EMP set out recommendations for avoiding on-site maintenance and refueling where practicable, providing bunded areas for fuel storage and maintenance where on-site maintenance activities cannot be avoided, clean-up of any spill/leak, and reporting to the MNP in case of spills and leaks.

3. Vehicle Movements on Local Roads and Altered Access

108. The project will increase heavy vehicle movements on public roads throughout construction from transport of waste, spoil, and construction materials and machinery. There is potential for disruption to public road access, including diversions, and increased road traffic conflict. A Traffic and Transport Management Plan will be prepared by the Contractor to set out safe entry and exit points, enforce strict safety on public roads in conjunction with Yerevan police force, specify timing for deliveries, and, in conjunction with Yerevan Municipality, determine routes on local roads to manage traffic and minimize potential conflict.

109. Dirt and mud carried onto public roads from construction vehicles exiting the site has the potential to cause safety hazard. Graveled site exits and wheel wash facilities will mitigate this potential impact.

110. The haul roads to the project site are in poor condition, some of which are minor local unpaved roads. Heavy vehicle movements on these roads during construction have the potential to result in further dilapidation. These roads should be inspected by the Armenian Roads Directorate within the Municipality and will require maintenance during and following construction if road conditions become unsafe. A dilapidation survey will be undertaken by the Contractor prior to construction and after and an approach to repair agreed with the Municipality

4. Bridge Construction

111. Most of the bridge elements will be pre-cast off site. This will minimize the impact of cumulative noise associated with on-site construction of these elements, should speed up construction, and reduce cost.

112. There is potential for earthmoving activities and bridge construction over the Hrazdan River to result in hazardous substances polluting the river. . Reduced water quality would impact on aquatic ecology and downstream users (i.e., any water abstractions for drinking water or

agricultural use; recreational use). The Contractor will develop a Water Quality Management Plan prior to construction which will include:

- (i) limiting activities and vehicle movements near the river;
- (ii) preventing runoff from construction areas by installing sediment traps;
- (iii) consideration for provision of netting or sheeting beneath the bridge during construction to catch any materials that may be dropped;
- (iv) a program of water quality monitoring both up and downstream of the project site prior to construction to obtain a baseline against which, as well as existing monitoring data, to compare subsequent monitoring results, with reporting to authorities and actions to be taken in the case of an exceedance of MPCs; and
- (v) requirements for visual inspections of the river and river banks to identify any impact and reinforce/develop measures to prevent further impact.

5. Solid and Liquid Waste Generation

113. Solid waste that may be generated during construction includes redundant road surface, 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 MNP and Municipality requirements.

6. Site Reinstatement

114. Following construction, and prior to handover of the site to the Municipality by the Contractor, the Contractor should reinstate the site which will include clearing the site of all construction-related material and waste, and landscaping. The landscaping activities should include grass-seeding and planting trees along the road shoulders.

115. The river banks will be inspected to identify any impact as a result of construction and the area reinstated as practicable to a state agreed by the MNP. Inspections will be undertaken of the cemetery by the Municipality of Yerevan and of Karmir Blur by the MOC; and reinstatement undertaken as required.

7. Summary of Construction Impact

116. In summary, adverse impacts due to the construction of the project will be temporary, short-term, and can be mitigated in accordance with the EMP to insignificant levels. Any archaeological finds will be managed through chance-find provisions. Short-term employment of local population in construction will result in low to moderate positive impacts.

E. Impacts Related to Operations

117. The Karmir Blur archaeological site will be enhanced to preserve its cultural heritage and to promote the site as a tourist attraction. This will have long-term benefits.

118. Traffic flow will be improved by diverting traffic from local roads, thereby improving air quality. Other than the few commercial properties that will be acquired at the Shirak Street extent of the alignment, it is envisaged that the resulting effect will be an enhancement of the amenity along surrounding local roads thereby attracting new business and customers with positive socio-economic effects.

119. The improved road link, along with completion of the other Yerevan west bypass sections, will induce regional economic growth by enhancing accessibility between the north and south of Yerevan.

F. Cumulative Environmental Effects

120. 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.

121. Project 1 is one of two projects within Tranche 1. Based in the close proximity of this scheme to Project 2 (a new link between Shirak Street and Artashat Highway), it is likely that the road traffic disruption and increased construction vehicle movements on surrounding roads will result in cumulative effects which will need to be coordinated and addressed in the Traffic Management Plan.

122. Combined with the other two road upgrade projects and possible future tranche projects to upgrade road sections, Project 1 will improve the links within the regional through-traffic road network. This will contribute to economic benefits as well as reducing air quality impacts associated with the currently congested road network.

123. Further upgrades have been defined conceptually under Tranches 2 and 3 to the north of Yerevan and these projects are likely to be constructed following those within Tranche 1. These projects are likely to result in similar nuisance impacts during construction including temporary noise and traffic disruption. The cumulative outcome of these projects is for medium to long-term road improvements. There are no other known current or planned construction projects in the vicinity of the project area. As such, there will be no cumulative impacts in this respect.

V. ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

124. Environmental management involves the implementation of environmental protection and mitigation measures and monitoring for environmental impacts. The purpose of the EMP document is to set the framework for ensuring compliance with the ADB's environmental requirements and all applicable Government of Armenia environmental laws, regulations and standards for environmental protection.

125. Environmental protection measures are taken to:

- (i) mitigate environmental impacts,
- (ii) provide in-kind compensation for lost environmental resources, or
- (iii) enhance environmental resources.

126. The plan covers all phases of the project which includes pre-construction, construction, and operation. Provisions set out in the Environmental Management Plan of the EMP will be implemented by the Contractor and monitored by the PIU Environment Specialist.

A. Environmental Management Plan

127. The Environmental Management Plan in Table V.1 summarizes the anticipated environmental impacts as identified in Section IV, mitigation measures, required environmental

monitoring activities, and the entities responsible for carrying out those activities together with estimated costs of implementation.

128. The purpose of the EMP is to guide engineers and contractors in the prevention and mitigation of environmental impacts related to construction activities, to guide monitoring by the relevant authorities including the SEI, and to guide the Municipality in the subsequent operation of the road. The EMP:

- (i) links road works activities, their potential impacts and their prevention or mitigation;
- (ii) provides the basis for updating by the Contractor prior to commencement of specific identified activities; and
- (iii) forms the basis for preparing a program of monitoring for checking on compliance with impact prevention and mitigation measures.

129. The Environmental Management Plan and the Environmental Monitoring Plan will be updated during detailed engineering design when more information is available, and will be reviewed and approved by ADB before included in the bid and contract documents. They will then be further refined by the contractor based on the construction contract and thereafter as required by changing conditions.

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)				
Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
Detail Design Phase (To be updated as required by Detail Design Consultant and PPMU & PIU Environment Specialists)				
Fauna investigation	Degradation of flora and fauna species, including protected fauna	<ul style="list-style-type: none"> • Undertake fauna surveys to confirm findings of the preliminary ecological investigation. The investigation is to be first agreed with the MNP and shall be guided by the following: <ul style="list-style-type: none"> ○ Establish a team of qualified and experienced botanists and zoologist. ○ Program fieldwork to collect reliable data. (The timing of the fauna investigation is dependant on the species status; i.e., migrating, nesting, stable habitat, etc. ○ Include in the outputs a site biodiversity and protected species database, detailed descriptions of possible environmental impact, and recommendations for the relevant mitigation measures for inclusion in the Flora and Fauna Management Plan, which includes protected fauna. ○ Develop protection measures and/or a relocation program in consultation with the MNP if the specialist identifies protected species on the site that would be affected. 	<u>PIU</u> Hire specialists	PPMU \$20,000+ for specialist investigation
Hiring of Contractor's labor force	Social impacts from non-local workers	<ul style="list-style-type: none"> • Maximize employment opportunities for local people by employing them as part of the project labor force. 	<u>PPMU</u> Ensure provision is included in bid and contract documents and review bids	Cost savings envisaged
Land acquisition and resettlement	Social impacts associated with land acquisition and resettlement	<ul style="list-style-type: none"> • Implement LARP and social assessment. 	<u>PIU</u> Implement LARP <u>ADB</u> Review	Costed under LARP
Environment protection and preservation of archaeology	Protection and preservation requirements do not reflect detail design	<ul style="list-style-type: none"> • Update EMP to reflect detail design and incorporate in bid and contract documents • Include specific requirement in bid and contract documents: <ul style="list-style-type: none"> ○ withholding of payment or penalty clauses, to ensure contractor's implementation of environmental and archeological mitigation measures; ○ employment of a designated Environmental Specialist and a designated 	<u>Detail Design Consultant</u> Update EMP and include appropriate clauses in bid and contract documents <u>PIU</u>	Detail Design Consultant included in contract PIU included in

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<p>Archeologist to oversee environmental and archeological issues and mitigation; and</p> <ul style="list-style-type: none"> provision of environmental and archaeological awareness training to all staff and periodic reinforcement training and effectiveness monitoring. 	<p>Review updated EMP and bid and contract documents</p> <p>ADB</p> <p>Review updated EMP and bid and contract documents and provide non-objections</p>	<p>environmental due diligence budget</p> <p>ADB</p> <p>included in corporate environmental due diligence budget</p>
Archaeological investigation	Destroying items of archaeological significance	<ul style="list-style-type: none"> Prepare an investigation plan and submit to the MOC for review prior to beginning the investigations. Undertake further archaeological excavations along the road alignment within the Karmir Blur archaeological site based on the preliminary investigation in Appendix 3. This will likely include 10 test trenches to identify the extent of further investigation. Depending on the outcome of the investigation, develop mitigation measures in discussions with the PIU Environment Specialist, the archaeologist, and MOC staff and management. 	<p>PIU</p> <p>Hire archaeologist</p>	<p>PPMU</p> <p>\$20,000+ for specialist investigation</p>
<p style="text-align: center;">Construction Phase</p> <p style="text-align: center;">(To be updated by the Contractor together with the PIU Environment Specialist prior to beginning construction and thereafter, as required)</p>				
		<ul style="list-style-type: none"> Update EMP to reflect contract documents Update EMP to reflect changed conditions 	<p>Contractor</p> <p>Update EMP</p> <p>PIU</p> <p>Review updated EMP</p> <p>ADB</p> <p>Review updated EMP and provide non-objection</p>	<p>Contractor</p> <ul style="list-style-type: none"> included in construction contract <p>PIU</p> <p>included in environmental due diligence budget</p> <p>ADB</p> <p>included in corporate environmental due diligence budget</p>
Construction planning	Damage to utilities and interruption of services	<ul style="list-style-type: none"> Undertake prior to construction a utilities survey for protection and/or relocation of water mains, gas mains, sewers, electricity, and communication lines 	Contractor	<p>Contractor</p> <ul style="list-style-type: none"> included in construction contract

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
Construction transport planning	Damage to public roads and property	<ul style="list-style-type: none"> • Obtain necessary approvals from the Armenian Roads Directorate and Municipality for occupation of roads. • Undertake a Pre-Construction Road and Property Dilapidation Survey to document the condition of the road. 	<u>Contractor</u>	Contractor <ul style="list-style-type: none"> • Included in construction contract
Construction planning for archaeology	Impact to archaeological find	<ul style="list-style-type: none"> • Obtain necessary approvals from MOC for construction in areas where archaeological finds have been identified. 	<u>Contractor</u> Hire an archaeologist	Contractor <ul style="list-style-type: none"> • \$20,000+ for archaeologist
Construction planning for working over the river	River bank stability Pollution of river	<ul style="list-style-type: none"> • Obtain necessary approvals from the MNP for working near and over the Hrazdan River. • Schedule construction near and over the river during low flows • Strictly control solid and liquid wastes entering the river 	<u>Contractor</u> <u>PIU</u> Monitor the Contractor and representative environmental parameters and reports to MNP and ADB through EA. <u>MNP's State Expertise Department</u> ² Monitor the Contractor. <u>ADB</u> Monitor EA/IA based on reports and through periodic missions	Contractor <ul style="list-style-type: none"> • Included in construction contract IA/EA monitoring and reporting included in environmental due diligence budget MNP State budget ADB included in corporate environmental due diligence budget
Contractor or workers not following environmental requirements	Insufficient environmental controls implemented	<ul style="list-style-type: none"> • Contract to include specific contractual requirement; e.g., withholding of payment or penalty clauses, to ensure contractor's implementation of environmental mitigation measures. • Contract to include the requirement that the contractor has on staff a designated Environmental Specialist to oversee environmental issues and mitigation. • Contract to include the requirement for the contractor to provide environmental induction training to all staff. 	<u>Contractor</u> Monitor environmental parameters and report to PIU. <u>PIU</u> Monitor the Contractor and representative environmental parameters and reports	Contractor <ul style="list-style-type: none"> • \$5,000 per year Env. Protection team IA/EA monitoring and reporting included in environmental due diligence budget

² Yerevan Municipality is the Implementing Agency (IA) and MNP's State Expertise Department will provide an Environment Specialist to participate in a Program Preparation and Management Unit (PPMU).

³ Yerevan Municipality is the Implementing Agency (IA) and MNP's State Expertise Department will provide an Environment Specialist to participate in a Program Preparation and Management Unit (PPMU).

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
			to MNP and ADB through EA. <u>MNP's State Expertise Department</u> ³ Monitor the Contractor. <u>ADB</u> Monitor EA/IA based on reports and through periodic missions	MNP State budget ADB included in corporate environmental due diligence budget
All site activities	<p>Degradation of environment</p> <p>Degradation of archaeological, historical, and cultural sites and monuments</p> <p>Deleterious effects on nearby residents from air and noise pollution</p> <p>Health hazards to workers and nearby residents</p>	<ul style="list-style-type: none"> • Prepare and submit, within 30 days of contract effectiveness, the following environmental management sub-plans: <ol style="list-style-type: none"> 1. Health, Safety, and Environment Emergency Response Plan 2. Public Relations and Communications Plan 3. Flora and Fauna Plan 4. Physical Cultural Resources Plan 5. Utility Protection and Relocation Plan 6. Drainage, Slope Stability, Erosion, and Sediment Control Plan 7. Construction Work Camps Plan 8. Traffic and Access Plan 9. Spoil Disposal Planning and Management Plan 10. Emergency Plan For Hazardous Materials 11. Water Quality Management Plan 12. Vegetation Clearing Plan 13. Dust and Emissions Control Plan 14. Noise and Vibration Control Plan 15. Waste Management and Disposal Plan 	<u>Contractor</u> Update and implement PIU Review and monitor implementation <u>ADB</u> Review and issue non-objection prior to construction	Contractor <ul style="list-style-type: none"> • included in construction contract PIU included in environmental due diligence budget ADB included in corporate environmental due diligence budget

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<p>16. Site Reinstatement, Landscaping, and Revegetation Plan</p> <ul style="list-style-type: none"> Base the sub-plans on the EIA report, bid and contract documents, best international environmental management practices, and as briefly outlined below. 		
<p>All site activities</p> <p>Worksite safety</p>	<p>Workers damage environment and archaeological, historical, and cultural sites and monuments.</p> <p>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>	<p>1. Health, Safety, and Environment Emergency Response Plan</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the general contractor⁴ (GC), subcontractors (SCs), and their workers in the implementation of a training program for construction workers in relation to environmental, archaeological, and occupational health and safety issues. Training rationale. The implementation of the EMP will require the involvement of all construction personnel. The nature of the EMP is such that personnel at all levels have a degree of responsibility in relation to environmental, archaeological, and occupational health and safety issues and the implementation of measures contained in the EMP. As such, training for all personnel in relation to environmental issues and the implementation of the EMP will be critical to ensuring the effectiveness of the EMP. Training objective. The objective of the training program is to raise the awareness and enhance the skills of the construction workforce in relation to relevant legislation and the following issues: <ul style="list-style-type: none"> general environmental awareness, including rules and regulations to be followed on the construction site and in the construction camps; general health and safety awareness, including an AIDS/HIV and STD awareness program; safety of the public; restricting access to the river banks and slopes/areas that might result in slips, trips, or falls; job-specific training for workers with responsibility for activities that could have adverse impacts on the environment or humans (e.g., PAH); and requirements for worker personal protective equipment including hard hats, safety boots, high-visibility vests, gloves, eye-glasses and ear defenders, 	<p>Contractor</p> <p>Hire training specialist to devise plan and implement training program</p> <p>Record and report environment and safety incidents to relevant authorities.</p> <p>PIU</p> <p>Review plan and monitor implementation</p> <p>Review incident logs</p> <p>ADB</p> <p>Review and issue non-objection prior to construction</p>	<p>Contractor</p> <ul style="list-style-type: none"> Personal protective equipment – \$5,000 (at \$40/worker) Security fencing purchased: Metal wire and concrete supports –\$30,000 (at 2.2m high - \$36/m). Plus optional plastic fencing – \$3,500 (\$2-4/m) Alternative option is metallic hoarding with concrete supports – \$220,000 (at 2m height - \$220-250/m) Other costs covered by labor cost of the construction budget <p>PPMU & PIU</p> <p>included in environmental due diligence budget</p> <p>ADB</p> <p>included in corporate environmental due</p>

⁴ The general contractor is the entity who enters into a contract for the works with the IA and who is responsible, by contract, for the work and conduct of its subcontractors.

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<p>and PAH masks or equivalent, as required.</p> <ul style="list-style-type: none"> The training should include posters in work camps that illustrate the Red Book species likely to be found in various areas of the project. Contractor should post a progressive penalty plan to discourage the hunting and consuming of wildlife. Blasting. Training should include a module on the safety aspects of blasting (if blasting is contemplated). Topics should include: <ul style="list-style-type: none"> public meetings to introduce the concept of blasting, signs posted that contain times of blasting, alarms prior to blasting, the use of blasting mattresses, and proper handling and storage of explosives. Health risks and prevention. Training should include information and education on sexually transmitted diseases and HIV/AIDS for construction workers as part of the health and safety program at campsites during the construction period. 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.. 		diligence budget
Public consultation and awareness building	Lack of information and understanding by communities and affected parties about the planned works activities and schedule of implementation can lead to frustration and complaints,	<p>2. Public Relations and Communications Plan</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of a plan to relate to the general public and nearby residents prior to commencing site preparation and construction activities and during construction. This plan should be consistent with the LARP and social assessment, and should include the following: <ul style="list-style-type: none"> Procedures for communicating with local residents and other nearby receptors developed in advance of activities, particularly when noise, vibration, utility service disturbance, or other nuisances may be generated. Details on the dedicated project phone line. 	<p>Contractor Hire public liaison and awareness specialist to devise plan and implement awareness and grievance redress program PIU Review plan and monitor the implementation ADB</p>	<p>Contractor</p> <ul style="list-style-type: none"> \$2,000 for advertising and dedicated project phone line Other costs covered by labor cost of the construction budget <p>PIU included in environmental due diligence budget</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
	which could result in delays.	<ul style="list-style-type: none"> Complaints process developed whereby the public and other stakeholders may make complaints and be assured of receiving responses within a reasonable period, consistent with the requirements of the Grievance Redress Mechanism in ADB's <i>Safeguard Policy Statement</i> (2009). Maintain a register of complaints received (name, issue, date, response, date of response, further follow-up action, date closed out). Hold meetings with community representatives to discuss the project, its impacts, etc. Provide community leaders and local newspapers with notices on project progress and anticipated issues. Post clear signs and notices around construction sites to provide project information, including the Contractor's environmental "hot line" number. 	Review and issue non-objection prior to construction Review consultation reports	ADB included in corporate environmental due diligence budget
Construction	Unabated damage to flora and fauna, especially Red Book flora species	3. Flora and Fauna Plan <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers to minimize the impact on flora and fauna and to protect areas that contain known Red Book species and Red Book species that are encountered during construction. The plan should comply with MNP policy and the RA laws on flora and fauna and include the following provisions: <ul style="list-style-type: none"> Vegetation removal and site clearing should be undertaken during late autumn and/or winter which are seasons most favorable to avoid impact to protected flora and fauna species. No clearance of vegetation other than that outlined within the plan. If Red Book plant and/or nesting places, burrows, and holes of animals discovered, inform to PIU environmental specialist and MNP for future actions. Reporting any observation of animals on site to the MNP. Contacting an animal rescue centre in the case of an injured animal being found. See also Vegetation Clearing Plan 	Contractor Hire botanist and zoologist to report on extent of Red Book flora and Red Book fauna respectively and provide recommendations to minimize impact on each. PIU Review plans and monitor the implementation ADB Review implementation reports	Contractor <ul style="list-style-type: none"> Cost covered by labor cost of the construction budget PIU included in environmental due diligence budget ADB included in corporate environmental due diligence budget
All site	Unabated	4. Physical Cultural Resources (PCR) Plan	Contractor	Contractor

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
activities	damage to archaeological, historical, and cultural sites and monuments	<ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC and SCs 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. The plan should comply with procedures set by MOC. The plan should include protection measures for the listed Karmir Blur archaeological site, Karmir Blur caves, and Umeshin/Ejmiatsin irrigation canal. The alignment of the bridge passes over the canal. Measures shall be required to: <ul style="list-style-type: none"> prohibit or restrict access by installing barriers and establishing 'no-go' areas with a suitable buffer around the protected sites, where practicable; protect the structural integrity of the canal from vehicle movements and from construction of the bridge over the canal; establish designated vehicle routes; provide temporary cover at high risk areas; and review the construction methodology for activities near the canal when preparing the plan and develop further mitigation measures as required. The plan should delineate clearance boundaries to avoid impact on areas of known archaeological and cultural interest. In the event of an archaeological chance-find: <ul style="list-style-type: none"> stop work immediately; notify the PIU; isolate the site; inform the MOC's Department for Protection of Historical and Cultural Monuments and hire an experienced and qualified archaeologist to determine whether and how the chance-find should be preserved; document and photograph the find and area immediately around it; when advised and as directed by the MOC, excavate and remove the find; and resume construction only following clearance from the MOC. 	<p>Hire archaeologist to report on extent of archaeological impacts, provide recommendations to minimize impact on each, and supervise excavations, if any.</p> <p>Hire sub-contractors to excavate any chance finds.</p> <p>PIU</p> <p>Review plan and monitor implementation.</p> <p>Provide liaison with MOC</p> <p>ADB</p> <p>Review implementation reports</p>	<ul style="list-style-type: none"> \$5,000 for protection measures \$5,000+ for chance-find investigation specialist services (if required) Cost for chance-find excavation to be determined by negotiated extra cost. <p>PIU</p> <p>included in environmental due diligence budget</p> <p>ADB</p> <p>included in corporate environmental due diligence budget</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
Utilities protection and relocation	Disruption to services impacting on end users	<p>5. Utility Protection and Relocation Plan</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC to protect or relocate identified utilities and to manage the protection or relocation of any utilities that are encountered during the construction works. Undertake a utilities survey and prepare a Utility Protection and Relocation Plan in consultation with relevant government agencies, user groups, and service providers. If there is potential for disturbance to services (i.e. cut off for periods), schedule the disturbances to take account of the time of year, week, and day to minimize the disturbance. Notify the potentially affected receptors well in advance of the works. 	<p><u>Contractor</u> Survey utilities and prepare plan Liaise with local representatives, especially for irrigation facilities, and service providers</p> <p><u>PIU</u> Review plan and monitor implementation. Assist with liaison with local representatives and service providers</p> <p><u>ADB</u> Review implementation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> Cost will be determined following completion of survey and development of plan Majority of costs covered by labor cost of the construction budget and service provider <p>PIU included in environmental due diligence budget</p> <p>ADB included in corporate environmental due diligence budget</p>
Earthworks	Erosion of soil and material piles, and discharge of sediment and pollutants into water courses and/or aquifers	<p>6. Drainage, Slope Stability, Erosion, and Sediment Control Plan</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of measures to manage erosion and sedimentation caused as a result of the construction activities. One of the main risks to water quality during construction arises from the erosion of soils and the resulting effects of sediment-laden pollutants entering watercourses. Several elements of the construction activities have the potential to cause erosion and generate sediment that can have adverse effects on the surrounding environment in terms of water quality. However, the implementation of the following erosion and sediment control measures should reduce the risk of any impacts to an acceptable level: <ul style="list-style-type: none"> Preserve existing ground cover where practicable. Stabilize the banks of the river to prevent erosion by seeding the banks or 	<p><u>Contractor</u> Prepare plan</p> <p><u>PIU</u> Review plan and monitor implementation.</p> <p><u>ADB</u> Review implementation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> Contractor Plastic sediment fencing– \$5,000 (at \$2-4/m) Grass seeding for temporary ground cover –\$3,000 (at \$0.8/m²) <p>PIU included in environmental due diligence budget</p> <p>ADB</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<p>placing biodegradable geo-textile sheeting.</p> <ul style="list-style-type: none"> Where ground cover is removed and if ground is to be exposed for long periods, provide temporary cover such as fast-growing grass species. Avoid erosion and therefore, generation of sediment-laden runoff, through appropriate siting of works and minimization of exposed areas. Treat sediment-laden runoff generated by construction activities prior to it entering the river by sediment traps, straw bales, and/or other measures to less than 30mg/L TSS. Monitor discharge from treatment facilities daily and report to PIU monthly. Ensure clean runoff is diverted around the construction site where possible. Regularly monitor operation and effectiveness of mitigation measures, record the results, and submit to PIU on a monthly basis. Regularly maintain drains, runoff, erosion and sedimentation protective measures to ensure effectiveness. Inspect and repair or modify drainage structures and erosion controls as soon as practicable after rain events. 		included in corporate environmental due diligence budget
Accommodation of workers and equipment and materials storage	Adverse health and aesthetic effects on work force and nearby residents	<p>7. Construction Work Camps Plan</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of measures to manage construction work camps that will be part of the project. 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 and maximize worker health, safety, and amenity. The following aspects of camp development should be addressed in this sub-plan: <ul style="list-style-type: none"> Definition of elements to be included in construction work camps. Criteria/principles for the location of components of the work camps to minimize soil and water pollution, diseases and possible outbreaks, and conflict situation with villagers, local/central authorities and/or the contractor. Specific management requirements for construction of components of the work camps. 	<p>Contractor Prepare plan PIU Review plan and monitor implementation. ADB Review implementation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> included in construction contract <p>PIU included in environmental due diligence budget</p> <p>ADB included in corporate environmental due diligence budget</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<ul style="list-style-type: none"> Management of camp operation. See also Emergency Plan for Hazardous Materials. 		
Vehicle movements on and off-site	Dust and emissions Noise and vibration Traffic hazards and safety Dirt and mud carried onto public roads causing traffic hazard and sediment in drainage system Damage to roads from heavy vehicles	<p>8. Traffic and Access Plan</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of measures to manage traffic and access on the construction site during the construction works. The sub-plan will cover vehicle management on and off-site and will include: <ul style="list-style-type: none"> Driver requirements (license, training) and safety requirements. Carefully selected construction vehicle routes including safe entry and exit points. Clear route directions. Designated parking areas. Appropriate signage. Established speed limits. Scheduling of vehicle movements to avoid peak periods where practicable. Traffic diversions on public roads including direction signs, markings, traffic signals, lighting, clearly visible solid barriers to channel traffic, flagmen employed as needed, and maintenance of diversions. Vehicles requirements including covering loads (when carrying sand, soil, spoil and waste material), exhaust attenuators, silencers, regular maintenance of vehicles to prevent fuel and oil leaks to meet national standards requirements and to ensure compliance. Provision for graveled surfaces and vehicle wash facilities at site exits with suitable runoff protection. Inspecting dirt and mud on roads from the construction site and sweeping as needed and when safe. Provisions to use and using water spray of road surfaces to control dust. Undertake a Post-Construction Road Dilapidation Survey and agree the repair or restoration of any roads with Armenian Roads Directorate and the Municipality. 	<p>Contractor Prepare plan PIU Review plan and monitor implementation. ADB Review implementation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> Repair and/or restoration of roads to be agreed with the Armenian Roads Directorate and the Municipality Traffic management measures not in environmental budget Road and property dilapidation survey, provisionally \$10,000, however not in environmental budget The road and property dilapidation survey and other costs covered by labor cost in the construction budget <p>PIU included in environmental due diligence budget</p> <p>ADB included in corporate environmental due diligence budget</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
Earthworks	<p>Spoil is disposed in inappropriate locations.</p> <p>Topsoil is wasted</p>	<p>9. Spoil Disposal Planning and Management Plan</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of measures to manage spoil generated by the construction of the project. Spoil should be disposed of in locations approved by MNP and local government. Topsoil should be stored for site restoration and in medians. Surplus top soil should be distributed in the area based on recommendations by the local government. 	<p><u>Contractor</u> Prepare plan Coordinate disposal of surplus soil and excess topsoil with heads of local communities <u>PIU</u> Review plan and monitor implementation. Provide liaison with local communities <u>ADB</u> Review implementation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> included in construction contract <p>PIU included in environmental due diligence budget</p> <p>ADB included in corporate environmental due diligence budget</p>
Handling hazardous substances	<p>Leakage or spillage of diesel or oil may result in the substance to enter the soil, surface water and/or groundwater. These substances are toxic to living organisms.</p>	<p>10. Emergency Plan For Hazardous Materials</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers for the handling, storage, use, and disposal of chemicals and in the implementation of measures in the event of spills or accidental releases of hazardous materials during the construction works. The implementation of the following measures should reduce the risk of any impacts to an acceptable level: <ul style="list-style-type: none"> Develop and implement procedures to ensure safe handling and storage of hazardous substances, e.g., diesel, waste oil. Material safety data sheets, emergency response procedures, and clean-up materials should be readily available on site and their proper use should be part of the workers' training. Spill clean-up materials should be appropriately located and stored to ensure availability. An Emergency Response Team (ERT) that is part of the Environment Protection team should be identified, include an organizational diagram, work and out of hours phone numbers, and reporting lines. Ensure that the ERT receives emergency response training. Ensure that the ERT and all personnel handling chemicals and hazardous substances receive hazard and risk management training. 	<p><u>Contractor</u> Prepare plan Dispose of hazardous materials per MNP directive <u>PIU</u> Review plan and monitor implementation. Provide liaison with MNP <u>ADB</u> Review implementation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> \$5,000 – 10,000 for designated materials storage area Spill clean-up material - \$2,490 (at \$83/spill kit) plus \$500 material for working near water \$1,000 for specialist trainer Other labor costs covered by the construction budget <p>PIU included in environmental due diligence budget</p> <p>ADB</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<ul style="list-style-type: none"> ○ The area of spill should be cleaned in a timely manner to prevent potential contamination of surface and groundwater and soil and the spilled material, together with contaminated soil and absorbent materials should be disposed of in a site approved by MNP. ● Only necessary chemicals, hazardous substances, and fuel should be stored on site, within a covered, secure and naturally ventilated area that has an impervious floor and impervious bund around it. The bund should have a capacity of at least 150% of the capacity of the largest tank. ● The storage area should be located away from drainage lines and danger areas. 		included in corporate environmental due diligence budget
		<p>11. Water Quality Management Plan</p> <ul style="list-style-type: none"> ● The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers to water quality management during construction, pertaining in particular to the Hrazdan River. The plan should comply with MNP policy and relevant river water quality regulations and should include the following: <ul style="list-style-type: none"> ○ Prohibit access or workers and construction vehicles and equipment at river banks. ○ Install netting or sheeting beneath the bridge during construction to catch any materials that may be dropped. ○ As much as practicable, limit construction near and over the river to the low-flow season. ○ Water quality monitoring program and visual inspections. 	<p>Contractor Prepare plan PIU Review plan and monitor implementation. Provide liaison with MNP ADB Review implementation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> ● \$4,000 for water quality monitoring <p>PIU included in environmental due diligence budget</p> <p>ADB included in corporate environmental due diligence budget</p>
Site clearing	Overclearing of vegetation Clearing of vegetation at times detrimental to fauna habitat	<p>12. Vegetation Clearing Plan</p> <ul style="list-style-type: none"> ● The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers to vegetation clearing activities during construction. The plan should comply with MNP policy and the RA Law on Flora and include the following provisions: <ul style="list-style-type: none"> ○ Guidance on mulching removed vegetation, storage, and use. ○ Storing and managing removed topsoil (graded, stabilized and drained) for re-use for landscaping activities. ○ Vegetation removal and site clearing should be undertaken during late autumn and/or winter which are seasons most favorable to avoid impact to protected flora and fauna species. 	<p>Contractor Prepare plan Hire arborist to devise dendro design for tree replanting or replacement Report results monthly PIU Review plan and monitor implementation. Provide liaison with MNP</p>	<p>Contractor</p> <ul style="list-style-type: none"> ● included in construction contract <p>PIU included in environmental due diligence budget</p> <p>ADB included in corporate environmental due diligence budget</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<ul style="list-style-type: none"> No clearance of vegetation other than that outlined within the plan. See also Flora and Fauna Plan 	ADB Review implementation reports	
Materials hauling	Excessive dust and air pollution due to vehicle emissions	13. Dust and Emissions Control Plan <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of measures to control gaseous emissions and dust resulting from the construction activities, including quarry sites, crushing plants, road construction, haulage of materials, and establishment of construction work camps. The management measures in this sub-plan have been developed to minimize potential health and nuisance impacts by incorporating the following principles: <ul style="list-style-type: none"> Preserve existing ground cover where practicable. Provisions to use and using water spray of road surfaces to control dust. Minimize the amount of excavated material held on site and cover all materials wherever possible to prevent generation of dust. Avoid double handling of material. Ensure that vehicles used should be at their maximum load capacity to minimize the number of vehicles and journeys to and from the site. Do not leave construction equipment idling when not in use. Use mains electricity or battery power where possible (or practical for hand tools) rather than diesel. Avoid the use of diesel or petrol powered generators where practicable. Spray aggregate loading point at quarries and crusher plants 	Contractor Prepare plan Hire local water trucks for dust control Report results monthly PIU Review plan and monitor implementation. ADB Review implementation reports	Contractor <ul style="list-style-type: none"> included in construction contract PIU included in environmental due diligence budget ADB included in corporate environmental due diligence budget
All site activities	Excessive noise resulting from construction activities	14. Noise Control Plan <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of measures to minimize and manage the impacts of noise generated during construction. A number of elements of the construction activities have the potential to cause noise impacts. The health effects of noise range from annoyance to hearing impairment and can impact both construction workers and nearby villages or settlements. The management measures in this sub-plan have been developed 	Contractor Prepare plan Report results monthly PIU Review plan and monitor implementation. ADB Review implementation	Contractor <ul style="list-style-type: none"> Separation wall costed in design Cost of labor covered by construction budget PIU included in

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<p>to minimize potential health and nuisance impacts by incorporating the following principles:</p> <ul style="list-style-type: none"> ○ minimization of noise generation at source; ○ reduction of the transmission of noise from the source to sensitive receivers including nearby villages and settlements and construction workers on the construction site; ○ schedule noisier activities towards the middle of the day where practicable; ○ locate noisier activities away from sensitive receptors where practicable; ○ fit vehicles and equipment with silencers to meet national noise standards and regularly check to ensure compliance; ○ install noise control barriers (e.g. solid walls, earth barriers, noise-reflective panels, double-glazed windows) when necessary and practicable to shield houses and other sensitive receptors; ○ construct a permanent separation barrier along the cemetery early in construction; ○ unless agreed with the relevant authorities, noise levels at receptors shall not exceed: <ul style="list-style-type: none"> 8am to 8pm (day) – 55dBA L_{Aeq}, 70dBA L_{Amax} 8pm to 8am (night) – 45dBA L_{Aeq}, 60dBA L_{Amax}; and ○ provide response mechanism for noise-related complaints. <p>Note: This time requirement is more stringent than the Armenian standard which sets out a day-time limit of 6am to 10pm and night-time limit of 10pm to 6am, respectively. The standard is Order N138, 6 March, 2002, Order on adoption of N2-III-11.3 sanitary norms "Noise in workplaces, apartment and public buildings, territories of urban construction".</p>	reports	<p>environmental due diligence budget</p> <p>ADB</p> <p>included in corporate environmental due diligence budget</p>
Generating and handling hazardous and non-hazardous substances from all activities	Waste and pollutants entering drainage system and/or infiltrating into groundwater Litter in public places	<p>15. Waste Management and Disposal Plan</p> <ul style="list-style-type: none"> • The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of measures for the management of wastes produced during construction. • Several elements of the construction activities have the potential to generate waste that can have adverse effects on the surrounding environment in terms of water quality, soil quality, air quality (odor and pollutants) and human health: • Non-hazardous solid waste includes construction waste and domestic refuse. 	<p>Contractor</p> <p>Prepare plan</p> <p>Hire sub-contractors to load and haul wastes to sites approved by MNP</p> <p>PIU</p> <p>Review plan and monitor implementation.</p>	<p>Contractor</p> <p>Environmental charge \$80,000 (according to waste categorization under the Armenian Law on Rates of Environmental Charges (2006), Article 3:</p> <ul style="list-style-type: none"> • Category 1 – \$133/t

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
<ul style="list-style-type: none"> - solid waste streams - removed vegetation - spoil - contaminated spoil liquid wastes 	Worker and public safety hazard	<p>Improper storage, handling, and disposal may cause adverse effects via spills or being carried away by wind or vectors, may affect health and be unsightly. Non-hazardous solid waste can be further divided into putrescible and non-putrescible waste streams.</p> <ul style="list-style-type: none"> • Hazardous solid wastes can have the most severe impacts. A material is hazardous if it is ignitable; corrosive; reactive; or toxic (causing bodily damage, sickness, or death). The following categories of hazardous wastes will potentially be generated by the project: <ul style="list-style-type: none"> ○ Chemical wastes ○ Medical wastes ○ Batteries, paint, and solvents ○ Used oil and grease • Wastewater includes wastewater from construction activities (e.g. sediment pond outlets, crushing plant operation), domestic wastewater from activities such as from kitchens or showers (grey water) and may contain pollutants such as grease, soap and mild detergents, and liquid sanitary waste (black water) that contains nutrients, organic substances, and pathogens. • The key waste management philosophy that is applied in this sub-plan is based on the following hierarchy of waste management approaches (highest to lowest priority) <ol style="list-style-type: none"> 1. Avoid waste generation 2. Minimize waste generation 3. Reuse as much waste as practical 4. Recycle as much waste as practical 5. Dispose of any remaining waste in an environmentally suitable manner in locations approved by the MNP • Implementation of this hierarchy, together with the use of appropriate collection, segregation, storage, disposal and education/training methods will ensure that the level of risk associated with waste management is low. <ul style="list-style-type: none"> ○ Maintain the site clear of litter and ensure litter does not enter the river and canal. ○ Hold sewage in sealed tanks for proper disposal. ○ Categorize spoil and other construction wastes in terms of hazard level. ○ Manage hazardous wastes in accordance with the Health, Safety, and 	<p>Provide liaison with MNP</p> <p>ADB</p> <p>Review implementation reports</p>	<ul style="list-style-type: none"> • Category 2 - \$72/t • Category 3 – \$13/t • Category 4 – \$4/t • Non hazardous – \$2/t) • Non-hazardous produced during land excavation and construction - \$0.2/t <p>PIU</p> <p>included in environmental due diligence budget</p> <p>ADB</p> <p>included in corporate environmental due diligence budget</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<p>Environment Emergency Response Plan and the Emergency Plan For Hazardous Materials</p> <ul style="list-style-type: none"> Remove wastes from the site regularly to avoid dust and litter generation, attracting pests, and reducing visual amenity. Transport waste in accordance with the Traffic and Access Plan. 		
Site re-instatement of all areas Re-vegetation, landscaping	<p>Construction materials that are not cleared from the site are potential safety hazards</p> <p>Localized flooding from impermeable surfaces if inadequate drainage</p> <p>Sediment and erosion of uncovered areas</p>	<p>16. Site Reinstatement, Landscaping, and Revegetation Plan</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of site clearance and restoration, landscaping, and revegetation measures as part of the construction works. The sub-plan should include the following: <ul style="list-style-type: none"> Clear all construction-related materials and equipment from the site including waste, unused materials, fencing etc. Reinstate natural drainage lines. Landscape site following a plan approved by PIU. Implement check-list to be prepared for final sign-off by PIU. Procedures for planting, maintenance and monitoring to ensure stable growth of trees and groundcover. <ul style="list-style-type: none"> (i) Species MUST be <ul style="list-style-type: none"> endemic to entire site or specific area, readily available (commercially or from seed collection), and relatively easy to propagate. Species should ideally be <ul style="list-style-type: none"> easily seeded (manual or mechanical methods), and relatively easy to maintain. Replant trees and bushes according to dendro design and agreements with heads of affected communities. Plant new trees at a ratio of 10 new trees per 1 tree cut. Maintain new trees until viable or 3 years, whichever comes first as certified by qualified arborist (Note: 80% survival is considered excellent). 	<p>Contractor</p> <p>Prepare plan</p> <p>Hire arborist to prepare dendro design</p> <p>Hire landscape contractor to implement plan</p> <p>PIU</p> <p>Review plan and monitor implementation.</p> <p>Monitor tree survival</p> <p>ADB</p> <p>Review implementation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> Arborist - \$2,000 Tree planting – \$1,400 (at \$14/tree) Landscaping with grass – \$2,000 (at \$0.8/m²) <p>PIU</p> <p>included in environmental due diligence budget</p> <p>ADB</p> <p>included in corporate environmental due diligence budget</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<ul style="list-style-type: none"> See also Waste Management and Disposal Plan 		
Operation and Maintenance Phase (If required, to be updated by the PIU Environment Specialist prior to operation of the road)				
Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
Traffic movements	Noise impacts Air pollutants from vehicle emissions	<ul style="list-style-type: none"> Hire an acoustic specialist to monitor noise on a periodic basis and in response to any complaints. Hire a specialist to monitor air quality associated with vehicle emissions on a periodic basis and in response to any complaints. Identify the need for further investigation or mitigation. 	PPMU Hire acoustic and air quality monitoring specialists	PPMU <ul style="list-style-type: none"> \$5,000 for purchase of air quality monitoring equipment Labor within Municipality budget
Vegetation	Vegetation does not establish	<ul style="list-style-type: none"> Include project area in Municipality of Yerevan vegetation maintenance operations. Monitor the health of vegetation and trees and replace as required. 	Contractor Maintain trees for 3 years after planting Municipality of Yerevan Maintain trees thereafter	Contractor <ul style="list-style-type: none"> As required – part of Site Reinstatement, Landscaping, and Revegetation Plan budget Municipality <ul style="list-style-type: none"> Within Municipality budget
Roadside drainage	Pollution of the river	<ul style="list-style-type: none"> Check oil/water separators regularly and clean of oil and debris to ensure effectiveness is maintained. 	Municipality of Yerevan Maintain oil/water separators	Municipality <ul style="list-style-type: none"> Within Municipality budget

B. Environmental Monitoring Plan

130. The environmental monitoring plan within the EMP is the framework within which environmental monitoring will be conducted. It will guide the PIU in determining if the recommended mitigation measures during the pre-construction, construction, and operation phases are being implemented effectively. The basic framework for environmental monitoring is provided in Table V.2. In addition to the responsible entities below, each item will be monitored by the PIU Environment Specialist monthly, or at a frequency deemed appropriate. Quarterly reviews will also be undertaken of Contractor records to satisfy that monitoring has been undertaken, as appropriate

131. Environmental monitoring results will be documented to record that signs of adverse impacts are detected at the earliest time practicable. Where monitoring results do not meet the environmental performance indicator, action taken will also be recorded. Monitoring results will be reported monthly by the PIU Environment Specialist to the Municipality of Yerevan (as the Tranche 1 IA), who will compile the monthly reports into semi-annual reports to the ADB. Annual reporting and end of phase reporting will be undertaken for submission to the PPMU head, who will in turn submit to MNP for endorsement and to the ADB.

132. The format for the monthly and annual environmental monitoring report will be developed during project implementation by the PIU Environment Specialist.

Table V.2: Monitoring Requirements – Site Preparation and Construction

Location / Activity / Phase (as relevant)	Parameters to be monitored	Monitoring location/s	Method of monitoring	Environmental performance indicator	Responsible entities	Frequency (formal monitoring)
Construction Phase						
(To be updated by the Contractor together with the Environment Specialist prior to beginning construction and thereafter, as required)						
All areas	Noise	To be agreed by the complainant, Contractor and PIU Environment Specialist	Noise meter	Maximum at monitoring location: - 8am to 8pm (day) – 55dBA L _{Aeq} , 70dBA L _{Amax} - 8pm to 8am (night) – 45dBA L _{Aeq} , 60dBA L _{Amax}	Contractor to hire noise specialist	If complaint received
		Records	Review complaints records, monitoring records	or as agreed with the relevant authority ⁵	PIU Environment Specialist	If complaint received Monthly
Waste management and disposal	Solid waste (general domestic, construction, hazardous)	Designated waste receptacles All site areas	Visual inspection	No litter No waste outside designated areas	Contractor	Ongoing Formally weekly
					PIU Environment Specialist	Monthly
Material stockpiles	Stockpiled material	Stockpile locations	Visual	Within designated area Stockpiled correctly Topsoil stockpiled correctly and not within drainage line	Contractor	Weekly
					PIU Environment Specialist	Monthly
All areas	Slope protection and drainage Run-off control	Site boundary and downhill	Visual and by sample, if required	Water is clear and does not exceed measured baseline levels prior to construction or USSR standard <i>Integrated list of MPCs and nearly safe levels of influence of pollutants on water in fishing reservoirs</i> for Total suspended solids (TSS) being <30mg/L	Contractor	Weekly Following a rain event
			Visual and review of monitoring records		PIU Environment Specialist	Monthly Following a rain event

⁵ This time requirement is more stringent than the Armenian standard which sets out the day-time limit of 6am to 10pm and night-time limit of 10pm to 6am, respectively. The standard is Order N138, 6 March, 2002, Order on adoption of N2-III-11.3 sanitary norms "Noise in workplaces, apartment and public buildings, territories of urban construction".

Location / Activity / Phase (as relevant)	Parameters to be monitored	Monitoring location/s	Method of monitoring	Environmental performance indicator	Responsible entities	Frequency (formal monitoring)
				No evidence of erosion Drainage control measures in place		
Secured construction sites/camps	Security fence	Boundary	Visual	Security fence in place	Contractor	Weekly
					PIU Environment Specialist	Monthly
Transportation	Dust Vehicles covered if transporting domestic wastes, soil, spoil, sand and other materials	All site areas	Visual	No visible suspended dust Vehicles covered	Contractor	Ongoing and weekly inspection Daily during earthmoving activities
					PIU Environment Specialist	Monthly
All site areas	Air pollution – dust	Representative boundary of residence north of the river. Boundary of the school south of the river	Dust deposition gauge or other method approved by PPMU (e.g., sticky pad, gravimetric)	Dust deposited below 0.15 mg/m ³ daily average in accordance with standard <i>Maximum Permissible Concentration (MPC)</i> for Ambient Air in Human Settlements, Republic of Armenia government decision N160-N, 02/02/2006	Contractor	Samples analyzed monthly
			Review of monitoring records		PIU Environment Specialist	Monthly
Traffic and road safety	Mud and dirt on public roads	Site exits	Visual inspection	No mud and dirt on public roads Vehicles leaving site: - loads covered - tires do not contain excessive mud/dirt	Contractor	Daily
					PIU Environment Specialist	PIU Environment Specialist
Traffic and road safety	Traffic diversion measures and signage	Public roads	Visual and records	Measures in place in accordance with the Traffic and Transport Management Plan No accidents	Contractor PPMU and relevant authority	When measures/signage is installed Monthly
					PIU	Monthly

Location / Activity / Phase (as relevant)	Parameters to be monitored	Monitoring location/s	Method of monitoring	Environmental performance indicator	Responsible entities	Frequency (formal monitoring)
					Environment Specialist	
Work site safety	Personal protective equipment Knowledge of procedures, points of contact	All workers	Visual Question a sample of workers as specified in Health, Safety and Environment Emergency Response Plan	Personal protective equipment worn Safety signage appropriately displayed Demonstrated knowledge of workers	Contractor	Ongoing and weekly
					PIU Environment Specialist	Monthly
Public relations	Public notices around the site Complaints register	At gates	Visual Review of documents	Notices in place Complaints documented per requirements of the Grievance Redress Mechanism in ADB's <i>Safeguard Policy Statement</i> (2009) Complaints resolved and resolutions recorded	Contractor	Monthly
					PPMU safeguard unit	Monthly
During phases of all activities within 100m of the river	Water quality: - Turbidity - Total suspended solids (TSS) - Total Dissolved Solids (TDS) - Acidity (pH) - Temperature - Dissolved oxygen - Biochemical oxygen demand (BOD ₅) - Chemical oxygen demand	Approximately 250m and 500m upstream of the site (two monitoring points) Approximately 100m, 250m, and 500m downstream of the site (three monitoring points)	Water quality meter and laboratory analysis	Results do not exceed measured baseline levels prior to construction or USSR standard <i>Integrated list of MPCs and nearly safe levels of influence of pollutants on water in fishing reservoirs</i> as:	Contractor to hire specialist and have analyzed in laboratory	Prior to the start of construction Monthly thereafter If complaint is received
		Records	Review records and monitoring points as required	- Total suspended solids (TSS) - < 30mg/L - Total Dissolved Solids (TDS) - < 1000mg/L - Acidity (pH) – 6.5 - 8.5 - Dissolved oxygen - < 6mg/L	PIU Environment Specialist to review and include in report to the PPMU	Monthly If complaint is received

Location / Activity / Phase (as relevant)	Parameters to be monitored	Monitoring location/s	Method of monitoring	Environmental performance indicator	Responsible entities	Frequency (formal monitoring)
	(COD)					
River	Construction related litter or material	River banks	Visual	No construction related litter, fuels or material	Contractor	Daily
					PIU Environment Specialist	Monthly
Handling hazardous materials	Hazardous materials	Designated hazardous material storage area All site areas	Visual	Appropriately stored and in designated areas	Contractor	Weekly
					PIU Environment Specialist	Monthly
Revegetation	Vegetation cover	All soil exposed surfaces	Visual	Exposed soils for extended periods	Contractor PIU Environment Specialist	Monthly
Revegetation for site reinstatement	Vegetation	All soil exposed surfaces	Visual	Revegetation as per Landscaping and Site Reinstatement Plan	Contractor PIU Environment Specialist	As required at the end of works until signed off as acceptable
Site rehabilitation	Waste Drainage lines	All sites as construction is completed	Visual	Waste, materials and equipment removed Drainage lines reinstated	Contractor PIU Environment Specialist	As required at the end of works until signed off as acceptable
Records and reporting	Inspection checklist Complaints log Consultation record Training records Licenses, approvals, permits	Recorded information	Visual review	All available, recorded correctly, any follow-up has been carried out as required	Contractor	Monthly
					PIU Environment Specialist to EA via PIU head and PPMU director. EA reports to ADB	Bi-annually

Location / Activity / Phase (as relevant)	Parameters to be monitored	Monitoring location/s	Method of monitoring	Environmental performance indicator	Responsible entities	Frequency (formal monitoring)
Operation and Maintenance Phase (To be updated by the PPMU Environment Specialist prior to operation of the road if required)						
Landscaped areas	Landscaping	Landscaped areas	Visual	No dead trees No exposed soils	Contractor for period specified in contract Municipality of Yerevan thereafter	Quarterly over the first 2 years the bi-annually for the next 2 years
Oil/water separator	Correct functioning and maintenance of oil/water separator	Beneath bridge	Visual	Adequate capacity – remove sediment No evidence of oil overflow	Municipality of Yerevan	Monthly over the first year then frequency amended as required

133. Although monitoring will be formally undertaken at a frequency specified in Table V.2, visual observation should be undertaken by all workers (especially supervisors and other trained personnel) on a daily basis and during key activities, and any potential or actual issues reported to the PIU's Environment Specialist.

C. Institutional Arrangements and Responsibilities

1. Institutional Arrangements

134. The Ministry of Economy will be the Executing Agency (EA) and the Municipality of Yerevan is the Implementing Agency (IA) of Project 1 and the other projects within Tranche 1 of this MFF. The Municipality will establish a Program Preparation and Management Unit (PPMU) with the assistance of the Project Management Facility to manage and monitor all implementation activities of the program and the projects with the Yerevan Development Project Implementation Unit (Yerevan PIU). The role of Yerevan PIU is to manage day-to-day coordination, implementation, monitoring, and administration activities of individual projects through a Program Implementation Team including expertise in social and environmental safeguards and whose Environment and Resettlement Specialists are to provide immediate oversight for environmental and social safeguards.

2. Responsibilities

135. The Program Preparation and Management Unit (PPMU) of the Implementing Agency's (IA's):

- (i) Establish a safeguard unit that includes a PPMU Environment Specialist for at least the duration of Tranche 1, preferably for the duration of the Program, and ideally as the core for future projects that involve environment safeguards;
- (ii) Monitor the PIU safeguard unit; and
- (iii) Report regularly to the ADB.

136. The Yerevan Development Project Implementation Unit (Yerevan PIU):

- (i) Establish a safeguard unit that includes a PIU Environment Specialist for at least the duration of Tranche 1, preferably for the duration of the Program, and ideally as the core for future projects that involve environment safeguards; and
- (ii) Report regularly to the EA.

137. The IA's Environment Specialist (PIU Environment Specialist):

- (i) Assist the Yerevan PIU in procuring the Contractor, in particular, ensure that bid and contract documents include specific environmental safeguard provisions that reflect the IEE EMP;
- (ii) Work with the Contractor in further developing an EMP based on the IEE EMP;
- (iii) Assist the Contractor to provide environmental awareness training to site supervisors and workers;
- (iv) Support the PPMU Environment Specialist in implementing mitigation measures as specified in the EMP;
- (v) Undertake monitoring activities as specified in the IEE EMP;

- (vi) Report on compliance with ADB and Government of Armenia requirements;
- (vii) Be a point of public contact for any complaints or concerns;
- (viii) Respond to emergencies and notify the relevant authorities within reasonable times; and
- (ix) Keep updated with changes in authority requirements and legislation and respond as appropriate.

138. *The Contractor:*

- (i) Hire the services of a Contractor Environment Specialist;
- (ii) Develop an EMP based on the IEE EMP;
- (iii) Update the IEE EMP based on the actual contract and thereafter based on actual conditions prevailing on site;
- (iv) Implement the construction phase components of the EMP;
- (v) Support the PPMU/PIU Environment Specialist in implementing various components of the EMP including the provision of training and monitoring; and
- (vi) Respond to emergencies and notify the PPMU/PIU Environment Specialist and emergency authorities.

139. *Independent Environment Specialist:*

- (i) Monitor compliance of the project with the EMP and any other authority requirements.

3. **Recommended Environmental Safeguard Clauses for Civil Works Contracts**

Clause 1 – Environmental Safeguards

140. The Contractor shall:

- (i) Provide facilities for the on-site Environment Specialist;
- (ii) Allow access to the site for environmental inspection at any time requested, pending completion of appropriate safety training;
- (iii) Undertake the following investigations prior to construction:
 - a. Utilities survey for protection and/or relocation of water mains, gas mains, sewers, electricity and communication lines;
 - b. Road dilapidation survey; and
 - c. Protected species investigation and develop mitigation.
- (iv) Within 30 calendar days of contract effectiveness, submit for approval by the PIU and non-objection by ADB a detailed EMP based on the measures outlined in the IEE report and incorporating the following operating plans:
 - 1. Health, Safety, and Environment Emergency Response Plan
 - 2. Public Relations and Communications Plan
 - 3. Flora and Fauna Plan
 - 4. Physical Cultural Resources Plan
 - 5. Utility Protection and Relocation Plan
 - 6. Drainage, Slope Stability, Erosion and Sediment Control Plan
 - 7. Construction Work Camps Plan
 - 8. Traffic and Access Plan
 - 9. Spoil Disposal Planning and Management Plan
 - 10. Emergency Plan For Hazardous Materials

11. Water Quality Monitoring Plan
 12. Vegetation Clearing Plan
 13. Dust and Emissions Control Plan
 14. Noise Control Plan
 15. Waste Management and Disposal Plan
 16. Site Reinstatement, Landscaping, and Revegetation Plan
- (v) Implement the EMP and operating plans, including undertaking monitoring, maintenance, reporting, etc. Any departure from the EMP must first be agreed in writing with the PIU Environment Specialist and be approved by relevant authorities and ADB;
- (vi) Execute, upon work completion, all work necessary to reinstate all unconstructed areas of the site as near to its original condition. This work will be complete when the PIU Environment Specialist provides written certification of reinstatement to a reasonable level.

D. Cost of Implementation

141. The cost of environmental monitoring will be that required for the remuneration of staff involved in EMP activities and their traveling expenses as well as any direct cost for monitoring activities.

142. The monitoring plan includes periodic monitoring to obtain specific measurements, such as noise level and air quality. However, if any unexpected impact or complaint arises it is recommended that the Environment Specialist take the necessary action in coordination with the PIU. It is recommended that the PIU set up a working arrangement with the relevant Government agency to use its facilities and/or equipment in taking samples for analyses and/or in the analyses, whichever is/are applicable.

VI. CONSULTATION AND INFORMATION DISCLOSURE

A. Stakeholder Meetings

143. Meetings were held with representatives of a number of stakeholder groups and will be ongoing with the same and different stakeholder groups during the preparation of other projects planned to be funded under the MFF.

144. Stakeholder meetings as at the date of this report include:

- (i) Ministry of Economy – the Executing Agency
- (ii) Municipality of Yerevan – the Implementing Agency
- (iii) Yerevan Development Project Implementation Unit (Yerevan PIU)
- (iv) Ministry of Nature Protection
 - o Department of Economics
 - o Environmental Protection Department
- (v) Ministry of Culture
 - o Agency for Protection of Historical and Cultural Monuments
 - o Department of Cultural Heritage
- (vi) Non-government organizations (NGOs)
 - o Public Environmental Alliance (an alliance of NGOs)
 - o Association for Sustainable Human Development.

B. Public Consultation

145. An advertisement (see Appendix 4) was placed in The Armenian Times newspaper and on the Municipality of Yerevan website and sent directly to key authority stakeholders inviting interested persons to a formal public consultation event on Friday 19 March 2010 at Yerevan Municipality. Amongst the attendees were fifteen recorded participants who attended the event, including representatives of relevant government agencies and NGOs and members of the general public (listed in Appendix 4). Few issues were raised specific to this project; however, discussions included the possibility of uncovering new historical remnants during excavation; and sustainability of the projects and greater program. ADB's Social Safeguards Specialist generally addressed resettlement and compensation questions.

C. Information Disclosed

146. The IEE will be made publicly available on the ADB website (in English only) and an EIA in the Armenian language will be submitted to the MNP and made publicly available on the MNP and the Municipality of Yerevan websites. This will ensure the disclosure of environmental concerns and proposed mitigation measures to the relevant authorities and other interested parties.

D. Future Consultation

147. A workshop will be held in early May 2010 and will provide a platform to discuss the projects with key stakeholders. The two projects will be assessed during this workshop by participating stakeholders with concerns and issues captured and where appropriate further actions taken to alleviate concerns raised at the event. The display material from the workshop will remain within the foyer of the Municipality building for public viewing.

148. Under Armenia's EIA legislation, the EIA will be subject to public hearings conducted by the MNP '... for the public opinion, the opinions of affected community leaders, the opinions of affected communities, and relevant state bodies.'

VII. FINDINGS AND RECOMMENDATIONS

149. Based on the environmental screening carried out for the IEE study, the proposed project is unlikely to cause significant, irreversible adverse impacts on the environment.

150. The benefits of the project will include:

- (i) Reduced traffic congestion, thereby reducing air pollution, and improved safety on surrounding roads once operational;
- (ii) Economic benefits by generating employment opportunities during construction;
- (iii) Enhancement of the Karmir Blur archaeological area to preserve cultural heritage and attracting tourism resulting in long-term archaeological and economic benefits. This will require further investigation and planning to ensure that the archaeological integrity of the Karmir Blur area, and any further find, is appropriately retained;
- (iv) Long-term regional improvements in air quality;
- (v) Landscaping on the road shoulders to improve ecological value and amenity; and
- (vi) Deposited waste removed from the area.

151. The potential adverse impacts that are associated with location, design, construction, and operation of the project will mostly be of low magnitude and localized, and can be mitigated to acceptable levels without difficulty. The impacts during constructions will be temporary and can be minimized by following the construction management and supervision outlined in the EMP. Care will need to be taken for construction activities near the Hrazdan River to protect the water quality and ensure flow is not obstructed. Further ecological surveys will need to be undertaken to identify protected species at the site, and if required, develop mitigation measures.

152. It is recommended that:

- (i) The clauses set out in the EMP be included in the Bid Documents and Contract Documents;
- (ii) The Contractor prepare a detailed EMP based on the EMP contained in this IEE;
- (iii) The EA, the PPMU, and the PIU ensure that the impact prevention and mitigation measures specified in the IEE and EMP be implemented; and
- (iv) Environmental monitoring be carried out as specified in the monitoring plan within the EMP.

153. All project activities prior to construction, during construction, and during operation will be monitored in accordance with relevant Government of Armenia regulations and ADB policy.

VIII. CONCLUSIONS

154. Based on the indication of the Rapid Environmental Assessment in Appendix 1 and the findings of the IEE, the classification of the subproject as Category “B” is confirmed, and no detailed EIA will be needed to comply with the environmental policies of the ADB. Any additional studies proposed or deemed necessary based on site conditions not yet known are expected to result in mitigation measures that are routine and can be easily incorporated within the construction schedule. Accordingly, the IEE with the recommended institutional arrangements and monitoring program given in the EMP will become the completed Environmental Assessment.

155. Nuisance impacts, including noise, dust, traffic and access changes, are likely to be experienced by nearby receptors during construction. Key benefits of this project include a reduction in traffic congestion; economic benefits; and improvements to air quality once operational.

156. There is potential for impact on protected fauna species and this will be further investigated. Further archaeological investigation will also be required to recover and preserve any further archaeological finds.

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APPENDIX 1**Rapid Environmental Assessment (REA) Checklist****Roads and Highways****Instructions:**

- ☐ This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional and Sustainable Development Department.
- ☐ This checklist is to be completed with the assistance of an Environment Specialist in a Regional Department.
- ☐ This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on (i) involuntary resettlement, (ii) indigenous peoples planning, (iii) poverty reduction, (iv) participation, and (v) gender and development.
- ☐ 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 / Yerevan Sustainable Urban Transport Project

Argavand Highway - Shirak Street

Sector Division: Roads and Highways

Conducted by / date: Arman Vermishyan and Klaus Schonfeld, 26 Jan 2010

Naomi Hull and Klaus Schonfeld, 10 Feb 2010

Naomi Hull, Davit Yavruyan, and Klaus Schonfeld, 17 Mar 2010

SCREENING QUESTIONS	Yes	No	REMARKS
A. PROJECT SITING			
Is the Project area adjacent to or within any of the following environmentally sensitive areas?			
1. Cultural heritage site	X		A suitable separation wall will be constructed to shield the cemetery from the noise and dust of the near-by Road.
2. Protected area		X	
3. Wetland		X	
4. Mangrove		X	
5. Estuarine		X	
6. Buffer zone of protected area		X	
7. Special area for protecting biodiversity		X	
B. POTENTIAL ENVIRONMENTAL IMPACTS			
Will the Project cause...			
1. Encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?		X	
2. Encroachment on precious ecology (e.g.			

SCREENING QUESTIONS	Yes	No	REMARKS
Sensitive or protected areas)?		X	
3. Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?		X	
4. Deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?		X	No surface water bodies. Discharges onto surrounding land that may affect groundwater will be minimized through routine mitigation measures during construction as set out in EMP.
5. Increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	X		Routine mitigation during construction as set out in EMP.
6. Noise and vibration due to blasting and other civil works?	X		Routine mitigation during construction as set out in EMP.
7. Dislocation or involuntary resettlement of people	X		Land Acquisition and Resettlement Plan (LARP) refers.
8. Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?		X	Generation of dust, which is a normal occurrence during this kind of construction, will be minimized through routine mitigation measures as set out in EMP
9. Hazardous driving conditions where construction interferes with pre-existing roads?	X		Routine mitigation during construction as set out in EMP.
10. Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations?	X		Routine mitigation during construction as set out in EMP.
11. Creation of temporary breeding habitats for mosquito vectors of disease?		X	
12. Dislocation and compulsory resettlement of people living in right-of-way?	X		LARP refers.
13. Accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials and loss of life?		X	While improved roads are expected to result in increased traffic volumes, better alignment, surfacing, signage, and controls (traffic lights) are expected to result in overall decrease of accident risks.
14. Increased noise and air pollution resulting from traffic volume?	X		Routine mitigation during construction as set out in EMP.
15. Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?		X	No surface water bodies. B.13 also refers.

APPENDIX 2

ECOLOGICAL INVESTIGATION

Yerevan Sustainable Urban Transport Program Ecological Investigation Report for Project 1: Argavand Highway to Shirak Street Road Link

This ecological study has been undertaken as part of environmental assessments for Argavand Highway –Shirak Street road link. The key purpose of the study is to identify protected flora and fauna and to develop mitigation measures for their protection.

1. Study approach and limitations

The site has been visited with the purpose of ecological survey. During the visits investigations of the current general environmental situation have been implemented and relevant professional study, as well as overview study of the zoological and biological variety has been fulfilled.

The preliminary environmental research was implemented in the period 17-26 March, 2010, the field visit on 17 March 2010. The study was undertaken within tight time limitations and over a season which did not allow full investigation of the variety and quantity composition of the flora and fauna. The season over which the study was undertaken was not a favorable season from the vegetation, migration, wintering, ovipositing (egg-laying) and other biological perspectives.

Thus, with the purpose of professional investigation aimed at the development of preliminary environmental research, results have been gathered from the field visit, as well as a number of other informational sources; the list of the latter is included in Annex 4. Meetings have been organized and discussions held with relevant professionals (zoologists and biologists) who have previously implemented research in the areas under discussion.

In general, Yerevan contains the following flora and fauna types:

- According to the expert evaluation, the natural flora of Yerevan includes about 900 types of vascular (high class) plants; 15 of them are included in Armenian Red Book, among them one endemic species included in the IUCN Red List.
- Yerevan's fauna diverse. There are 25 mammal types, among them 3 included in Armenian Red Book and 5 – in IUCN Red List.
- The City area is widely populated by undesirable mammal species, such as grey rats and house mouse.
- From about 170 bird types 29 are registered in Armenian Red Book. At least 100 types, of which 15 types included in the Armenian Red Book, build nests. The other types are regularly present at seasonal migration, wintering and feeding time. The most numerous are synanthropic types, such as sparrow, grey crow, magpie, rock pigeon (including feral pigeon), in recent years also Eurasian Collared Dove.
- There are 25 types of reptiles, of which 5 are included in Armenian Red Book.
- The Armenian Red Book includes amphibians, including Syrian spade-footed Toad (*Pelobates syriacus*), which has most likely disappeared due to the devastation of landscapes and unfavorable alterations of the water reservoir schedules.
- There are a number of invertebrates spread within the city. The most investigated ones are the beetles: there are known about 700 types of beetles; most of them are Armenian and some even Yerevan endemic. Of these insects, those known are 60 dipterans, 40 hymenopterans, 130 butterflies, from 10 to 20 types of orthopterous insects (Orthoptera), spiders, mollusks (Mollusca), about 30 types of gnawing beetles (Ostomatidae) and ticks.
- There are 10 types of fish registered in the rivers Hrazdan and Getar.

Construction works can result in the impact on the flora and fauna. In this report, the focus is only on direct impacts on vegetation removal, habitat removal and harming protected species. Other impacts on flora and fauna have been identified in the complete Initial Environmental Examination report and mitigation measures are provided. This ecological investigation focus' on the impact on flora and fauna and provides recommendations for mitigation including protection and compensation for trees removed.

2. Basic description of the project, location and construction methodology

- a The project includes the construction of a new 6-lane divided road over a length of approximately 1.2km, plus 0.3km of ramps. This includes 1.5km of road linking Argavand Highway to Shirak Street. The design includes an interchange at Aragvand Highway and a round-about at Shirak Street.
- b A bridge will be constructed over the Hrazdan River. The bridge design includes three spans at 42m allowing the piers to be located outside the 1 in 100 year (1%) flood level which has a 36m width at this point. The bridge elements will be made of pre-cast concrete and will be incrementally installed from the northern side.
- c The approach viaduct on the southern side of the main bridge will comprise viaduct spans and will be constructed of pre-cast beams. The abutment walls on both sides of the river will be constructed of reinforced concrete and will be filled with clean material. All piers will be supported by flat foundations.
- d The new road will comprise of a concrete asphalt layer laid over the road and shoulders. The design includes road-side drainage and a permanent oil/water separator beneath the bridge to collect oils and prevent them from entering the river.
- e A permanent separation wall will be constructed to protect the cemetery.
- f Other activities associated with construction include:
 - (ix) Identification and protection or relocation of existing utilities including water and gas mains, sewers, and electricity and communication lines;
 - (x) Measures to protect the cemetery; Karmir Blur; and caves on the north of the river by creating fenced 'no-go' areas;
 - (xi) Establishing secure construction compounds for worker facilities and offices; and storage of materials and machinery;
 - (xii) Removal of existing waste material dumped along the route;
 - (xiii) Excavation and leveling of the alignment;
 - (xiv) Installing measures to protect the Hrazdan River during construction; and
 - (xv) Landscaping of the shoulders and median following construction.
- g It is expected that construction will be undertaken over a period of up to three years.

3. Desktop investigation

RARE AND ENDANGERED ANIMAL AND PLANT SPECIES THAT NEED PROTECTION

Argavand Highway -Shirak Street road link

#	Common Name	Scientific Name	ARDB	IUCN	Endemic to Armenia	Note	It is assumed that could be affected	Influence is doubtful
Animals								
Mammals								
1	Long-Eared Hedgehog	<i>Hemiechinus auritus</i>	+				X	
2	Schreiber's Long-Fingered Bat	<i>Miniopterus schreibersi</i>	+, U	LR/NT		Wintering	X	
3	Mehely's Horseshoe Bat	<i>Rhinolophus mehelyi</i>	+	VU		Wintering	X	
4	Greater Horseshoe Bat	<i>Rhinolophus ferrumequinum</i>		LR/CD			X	
5	Lesser Horseshoe Bat	<i>Rhinolophus hipposideros</i>		VU			X	
Birds								
1	Lammergeier	<i>Gypaetus barbatus</i>	+, U			Migration, feeding	X	
2	Eurasian Griffon Vulture	<i>Gyps fulvus</i>	+			Migration, feeding	X	
3	Black (Monk) Vulture	<i>Aegypius monachus</i>	+	LR/NT		Migration, feeding	X	
4	Merlin	<i>Falco columbaris</i>	+			Wintering		X
5	White-throated Robin	<i>Irania gutturalis</i>	+			Nesting		X
6	Rock Thrush	<i>Monticola saxatilis</i>	+			Nesting		X
7	Blue Rock Thrush	<i>Monticola solitarius</i>	+			Nesting		X
8	Penduline Tit	<i>Remiz pendulinus</i>	+			Nesting		X
Reptiles								
1	Transcaucasian Ratsnake	<i>Elaphe hohenackeri</i>	+	U			X	
Amphibia								
1	Syrian spadefooted Toad	<i>Pelobates syriacus</i>	+, U	+, U		Probably disappeared	X	
Insects								
1	weevil	<i>Epiphanops dohrni</i>			+		X	
Plants								
1	Persian goatgrass	<i>Aegilops crassa</i>	+					X
2	Sweetsultan	<i>Amberboa moschata</i>	+					X
3	Large field beet	<i>Beta macrorhiza</i>	+					X

#	Common Name	Scientific Name	ARDB	IUCN	Endemic to Armenia	Note	It is assumed that could be affected	Influence is doubtful
4	Dusty miller	<i>Centraerea erivaensis</i>	+					X
5	Oriental virginsbower	<i>Clematis orientalis</i>	+					X
6	Wild spinach	<i>Spinacia tetrandra</i>	+					X
7	Adam Saffron	<i>Crocus adami</i>	+					X
8	Caucasian Persimmon	<i>Diospyros lotus</i>	+			Probably disappeared		X
9		<i>Halanthium kulpianum</i>	+					X
10	Wild barley	<i>Hardeum spontaneum</i>	+					X
11	Rhizocephalus orientalis	<i>Rhizocephalus orientalis</i>	+					X
12	Persian walnut	<i>Juglans regia</i>	+					X
13	Caucasus Red Elder	<i>Sambucus tigranii</i>	+	+	+			X
14	Oriental poppy	<i>Papaver orientale</i>	+					X

Notes:

ARDB – Armenian Red Data Book (1985). An updated version of this book is due to be released by the end of 2010.

U – Red Data Book of USSR. The USSR Red Book has no current legal standing; however it is still referred to today as an additional source of information to understand migrating species from neighbouring countries and forms a basis for the evaluation of the ecological significance.

IUCN - IUCN Red List

IUCN Red List Categories

EX - Extinct

EW - Extinct in the Wild

CE - Critically Endangered

CD - conservation dependent

EN - Endangered

NT - Near Threatened

VU - Vulnerable

LR - Low Risk

LC - Least Concern

DD - Data Deficient

NE - Not Evaluated

Endemic – Species endemic to Yerevan. The Armenian Red Data Book is currently being updated and is due to be released towards the end of spring 2010. It is envisaged that the new species added to the book will include endemic species to ensure their protection. Future investigation will require consideration of endemic species.

4. Environmental situation

3.1. The environmental situation of the project site based on the Yerevan City Master Plan includes:

- No dangerous geological phenomena recorded in the project area.
- The project crosses the Hrazdan River.
- Ground water is deep.
- The area is neighboring “Karmir Blur” ancient settlement.
- Approximately 100 m North from the project area are colonies of Schreiber’s Long-Fingered Bat (*Miniopterus schreibersi*) and Mehely’s Horseshoe Bat (*Rhinolophus mehelyi*) that are included in the Armenian Red Book and IUCN Red List.
- **Soil pollution:** mild pollution field recorded.
- **Air pollution:** zone of moderate and acceptable pollution zone.
- **Noise:** recorded noise fluctuated from 65 to 75 dB at the extents of the alignment where it meets with Shirak Street and Argavand Bridge.
- **Biodiversity:** The area has types of flora and fauna specific of landscape with the elements of the semi-desert and desert zones.
- **Waste:** there are piles of soil, construction and industrial garbage within and around the alignment.

3.2. Description of the current environmental situation of the project site from biodiversity point of view based on the site visit results:

- The project area is under strong anthropogenic influence. The alignment mainly runs through an unsettled area, which is covered with construction and industrial garbage.
- The project alignment is located adjacent to the “Karmir Blur” ancient settlement.
- There are several protected zoological and biological species registered in the area of the project.

Fish types registered in Hrazdan River are not included in the National Red Book, but still it is important taking into consideration actions targeted at the protection and preservation of those types while preparing and then implementing the construction activities, as well as during the operation of the road and the bridge, especially the latter.

Construction activities will bring about landscape alterations and anthropogenic impact, which will definitely have unfavorable impact on the biodiversity of the area. Firstly, part of the project is planned to build a bridge over the river Hrazdan which is situated in the immediate neighborhood of about 100 m from the caves, where colonies of rare and endangered bat species can be found (Yavruyan and Barsegyan, 1975). This will need to be confirmed through further investigation.

5. Conclusion and recommendations

Based on preliminary investigation, it is likely that the protected species listed in the table may be present at the site, however this will need to be confirmed through further investigation prior to construction during the vegetation season. For the development of mitigation measures, firstly, it is necessary to clearly define the species composition and abundance of specific types per season.

The most suitable timing for construction is outlined as follows:

- The most favourable time for construction on that location with the least impact on the mammals are the summer, late autumn and winter. It is necessary to prohibit any construction and clearing activities in spring and early autumn.
- For the least impact on the birds the most favourable time for construction and clearing would be the whole year, with the exception of the spring and early summer.
- For the reptiles and amphibian the construction could be implemented with the least impact in late autumn, winter and extremely hot summer days.
- For insects this would be late autumn and winter. It is again extremely important to exclude any construction and clearing activities in spring, early summer and early autumn.
- For the least impact on the flora the best time for construction activities would be late autumn and winter. Again it is necessary to prohibit any construction and clearing activities in spring.
- For the least impact on bats, noisier activities should be avoided during the hibernation period over winter.

There are 10 types of fish found in Hrazdan River (*Salmo trutta fario*, *S.t. trutta*, *Alburnus flippi*, *A.a. hohenackeri*, *Barbus capita*, *Carassius sibelia* and *Leuciscus cephalus*, *Sabanejewia aurata*, *Nemacheilus angorae* and *Barbatula barbatula*). However, none of the piscifauna type found in the Hrazdan is included in the Red book or considered rare or endemic.

In the last two years new species - Insectivore – White-breasted water shrew and Amphibian – Tree frog, were found in this location. This species is not included in the Red Book, however, they may be included in the new edition.

Nonetheless, during the construction activities it is important to follow certain norms providing free movement/migration of the fish in the river and excluding reduction of the populations (prohibit demolition works, water pollution, water damming, etc).

Beside the already existing and described types of the bats in this region in the recent years in the caves of Karmir Blur two new bat types have been found: Asian Barbastelle and Pipistrelle pigmy bat.

The design should be reviewed by a bat specialist and further research undertaken to identify potential impact and appropriate mitigation.

It is critically important to remember that the noise, made by people and machinery during the construction and other disturbances may force the bats to leave this unique habitat. Furthermore, the project site is within the geographical range of feeding by bats (up to 2km for some species) which occurs in the evening, so construction activities should be restricted to daylight hours to avoid the impact of noise and light pollution which would disturb foraging activities. Construction documents should clearly require that there should be no construction sites, parking, and shelters for workers, store houses and any other facilities on the north side of the Hrazdan river within 50m of the caves. Limited activities should be undertaken from the south, where practicable and limited facilities on this side should only be provided on the western side of the alignment. Restricted access areas must be clearly defined by fencing, communicated to all workers and enforced. The main worker facilities should be situated on the south side of the river towards the Shirak Street end and worker facilities on the north should be nearer to the Argavand Bridge end.

To investigate certain species it is recommended to establish a team of botanists and zoologist, (at least three specialists in each group) that have the appropriate education and at least 5 years of experience of field work. The team leaders should have a scientific title and relevant experience for this kind of assessment, as well as experience with relevant reporting. To collect reliable data each specialist should spend in the field at least 8 weeks.

The work of these groups should result in a site biodiversity and protected species database, as well as detailed descriptions of possible environmental impact and recommendations for the relevant mitigation measures. The data collected should be summarized in the Environmental Assessment and Environmental Management Plan.

The project should undergo environmental expertise. To protect any identified protected species it is necessary to follow the environmental legislation of Republic of Armenia and ensure the implementation of those mitigation measures that are based on the recommendations of specific specialists. It is essential to consult the relevant experts while developing the project and to implement constant environmental monitoring/investigation during the project implementation.

Image 1 The Argavand bridge end of the alignment



Image 2 Caves neighboring the planned bridge construction site



Image 3 Location of bridge construction



Image 4 Part neighboring the bridge construction site



Annex 1

Laws and Legislations passed by the Government of RA

- RA Law on Flora.
- RA Law on Fauna.
- RA Law on Payments against the Damage to the Flora and Fauna as a Result of Environmental Violations (03.05.2005).
- RA Law on Environmental Impact Expertise
- RA Law on Local Self-Governance, adopted on May 7, 2002 envisages the authority of the head of the local community in the areas of land usage, as well as the liabilities of the head of the community in the area of the nature and environment protection.
- RA Criminal Code, adopted on April 18, 2003 envisages criminal liabilities for the violation of environmental protection rules.
- RA Law on Environmental Monitoring (11.04.2005), that approved of the liabilities of the environmental monitoring department and defined the function of the given department in different sectors, including the land protection/preservation.

Currently there have been developed and are in different stages of discussions the Draft Laws on Environmental Fund, on Natural Areas under Special Protection, on Major Provisions of National Water Policy and Environmental Expertise, as well as on Rules of State Monitoring of the Land Utilization and Protection.

Annex 2

RA Government Decrees

- The Rule of Usage of the Fertile Layer of Land (19.09.2002, RA Government Decree 1622-N), which regulates the activities related to preservation and rehabilitation of land after mining of natural construction materials and minerals, like the removal and appropriate use of the fertile layer of the soil during the mining (removal, preservation and registration of the removed soil); this decree also defines the liabilities of state and local self-governance bodies.
- RA Government Decree on the Marginal Rates on Activities Planned Subject to Environmental Impact expertise (25.04.1999, RA Government Decree N193)
- On Approving the Rules for Construction/Urban Development Activities in the Special Protected Nature Areas and Forest Fund Lands (08.05.200, Decree 613-N) regulates the relevant procedures for the urban construction activities and the liabilities of different bodies.
- On Defining the Rule of Totally or Partially, Permanently or Temporarily Exclusion of the Special Protected Water Systems out of Economic Activity Field” (10.07.2003. RA Government Decree 888-N).
- On Approving the Procedures of Use and Protection of the Specially Protected Areas of International Value (15.09.2005. RA Government Decree 1628-N).
- On the Report/land Balance of the RA Land Fund Availability and Distribution (22.12.2005. RA Government Decree 2243-N), which noted the introduced balance and appointed to introduce the final balance of RA lands in 2006.

- In accordance with the RA Government Decree 125 On the Organization of Land Construction Procedures it is planned to implement land use and protection monitoring activities.

Annex 3

Participation of Armenia in the International Environmental Conventions

NAME PLACE AND DATE	In force	Signed	Ratified
Convention on Biological Diversity (Rio-de-Janeiro, 1992)	21.03.1994	1992	14.05.1993
UN Framework Convention on Climate Change (Rio-de-Janeiro, 1992)	21.03.1994	1992	14.05.1993
Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991)	10.09 1997		21.02.1997
Convention on Combat Desertification (Paris, 1994)	27.09.1996	1994	02.07.1997

Annex 4

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APPENDIX 3

ARCHAEOLOGICAL INVESTIGATION

Preparing the Yerevan Sustainable Urban Transport Investment Program. Archaeological impact of Project 1 – Shirak Street – Argavand Highway (Preliminary report)

The studied area, named access to the Argavand Highway or the western “gateways” of Yerevan, includes around 1300 m of distance, located in the western part of the city, lying in the limits of Shengavit and Malatia-Sebastia communities of the city (Map 1 of the General report). The planned section of the road (upgraded existing road and new 6 lane divided road) is starting from the end of the Shirak street, through the southern side of the Karmir Blur (Red Hill) archaeological site, across the Hrazdan River Gorge, and to the intersection of the Admiral Isakov Avenue (Argavand Highway) and Arno Babajanyan street. It is essentially the continuation of Project 2 (Map 3). West of the alignment are Karmir Blur modern cemetery and the area of the Argavand village of the Ararat Province of the Republic of Armenia.

The archaeological investigations of the area took three days. First two days of work were spent mapping the structures of the Pre Urartian settlement by putting together the plans from 1947-1950 excavations in agreement with used coordinate system and fixing their relationship with the citadel and planned road route, determining the buffer zone influence on the future destiny of the structures and the area of distribution of the cultural layers. Third day activities were oriented to the study of the right side of the Hrazdan River Gorge and the surface of the lowest – Argavand terrace of the river, lying between the Argavand village and the buildings of the Police High School (Map 3).

The most significant part in the limits of Project 2 is the archaeological site of Karmir Blur (Red Hill, the reason of such coloration of the local sediments is related to the reddish mud brick structures, used for the constructions from the Urartian period, Images 1-4). The archaeological complex of the site is located near the lower stream of the Hrazdan River, occupying an area of more than 50 hectares, and consisting of the XII-VII centuries BC Pre Urartian settlement, Urartian⁶ city with the citadel and urban quarter, functioning during VII-VI

⁶ Urartu is a name of the state, existing on the territory of the Armenian Highlands during IX-VI centuries BC, mentioned in the Assyrian cuneiform inscriptions with this variation. The center of the kingdom was city Van (Tushpa in Urartian), that's why often it's named Van kingdom. The self identification of the kingdom in the Urartian inscriptions was the Country of Biaynili.

centuries BC, VI century BC through I century AD tomb field (cemetery), Umeshin channel and cave sites on the opposite side of the Hrazdan River (Map 3). The site was discovered in 1936 with a find of a basalt structure, preserving five lines of cuneiform inscription, commemorating the name of Urartian king Rusa the II. The systematic excavations of the citadel and the living quarter started from 1939 with a joint expedition of the Leningrad state Hermitage and the Armenian Commission of Antiquities and Armenian filial of the Academy of Sciences of USSR, and were finished at 1968. The citadel, opened by the excavations is a monumental construction and one of the outstanding monuments of the Late Urartian architecture. Its was a two stored building, occupying an area of more then 4 hectares (Images 7 and 8). The first store, consisting of around 150 rooms, was comprised cellars and workshops. The second store, which was a living space for the Urartian elite and for temple buildings, is fully destroyed. Powerful defensive walls, towers strengthening the existing two entrances or gateways (southern and north-eastern) were made from mud-bricks and huge, accurately shaped basalt blocks in the foundations (Images 9 and 10). Forming the defensive system of the citadel, the walls were occupying it in one line from three sides. From the side of the plateau they were forming two defensive lines. Traces of this fortification system are still visible around the hill (Images 5 and 6). The first year of excavations brought to the light the name of the site; it was mentioned in the inscriptions as the Citadel of the city Teyshebaini (Teysheba is the name of the Urartian God of War and Storm). During the excavations of the Teyshebaini Karmir Blur many art objects and high quality cultural remains were discovered, including metal objects (ritual implements, represented by bronze shields, helmets, quivers, belts, bowls inscribed with names of Menua, Arghishti and Sarduri kings, silver and golden bracelets, medallions, ear-rings, pendants, pins, etc., Images 11-13, 25), pottery (represented by shoe-shaped drinking bowls, Image 24). Those artifacts are representing the high status of the Urartian elite, ruling the area of the citadel and attached territories, as well the role of the Teyshebaini-Karmir Blur as an administrative center.

Urartians were masters of organizing economic activity and the flourishing of life. They had fully cultivated the landscape around Karmir Blur and adjunct territories through building of water channels, roads and fixing the agriculture and trade activities. The Umeshin channel, built by the order of king Rusa II in VII century BC, started from the Hrazdan River east of the site and continued west, reaching Zvartnots area. The inscription about the building of the channel is discovered during the excavations of Zvartnots (Image 14). In this way they were regulating the amounts of water supplies and controlling the portions of paid taxes. The wine cellars opened in the first floor of the citadel indicate the volume of the agricultural activity of that time and

showing the development of such a branch of agriculture as wine making. The total amount of the earthenware pots or karases for keeping wine, opened in the cellars by the excavations, is around 400, with total volume of 400 000 liters. Volume of each karas was calculated and written on its surface by hieroglyphic, cuneiform inscription or both together (Images 17-20). Together with the karases excavated in the houses of the city (this wine was for everyday use of the citizens) the total amount of the wine kept in Teyshebaini-Karmir Blur was up to one million liters. An approximate calculation for preparation of such amount of wine indicates that around 1, 5 million kilograms of grapes would have been produced, on around 300 hectares of vineyards, with a help of 2500 workers. In addition to karases, oil lamps for working in the area of dark cellars, and clay funnels for transporting the wine, pitchers, askoses, and glasses, and different kinds of bowls for wine serving and drinking were found. The censers (fumigation vessels) found near empty karases are indicate the process of fumigation of the clay volumes for wine preservation with sulfur (Image 21). Large amount of grape seeds found in and around the wine making units are showing that local varieties of grapes were cultivated by the Urartians (Image 16).

One of the other important branches of agriculture was wheat growing. The excavated agricultural tools made from iron were in everyday use (Image 15), making the Urartian argoeconomy very productive. The cellars adopted under wheat storage are showing 1500 tones of volume of crops, preserved in Karmir Blur, and grown on around 2000-3000 hectares of fields. In total the land cultivated by Urartians was 4000-5000 hectares, without calculating the area of pastures and meadows for cattle breeding. The production of a large amount of beer here is proved by the existence of cigar-shaped vessels for beer production (Image 22).

The city of Teyshebaini was occupying around 50 hectares of area. The city, like the citadel was surrounded by fortification walls. Inside of the city walls the living quarters were settled by craftsman, field workers and the soldiers. In the flat area of the city the excavations opened two streets, straight and parallel to each other, 5,57 m wide. They were intersected with one, wider street (9, 46 m) (Map 3). The central living quarter consists of well built stone houses. The walls of those structures were missing windows and doors and were opening directly to the streets from the side of the facade and forming stone corridors with backyards. Some of the inhabitants were fully depending on the state service and provision (their houses were missing any proof of economic activity) and the others were running their own small economy (those houses preserve bread baking structures, areas for keeping cattle, storages and cellars).

The life in Urartian Teyshebaini-Karmir blur was flourishing till the beginning of the VI century BC, when the Van Kingdom or the Urartu failed under the attacks of Median-Scythian and local Armenian joint military forces. In 590 BC the citadel of Teyshebaini was fully destroyed and abandoned, as the last enclave of the Urartian Kingdom. The life hasn't continued here even in later periods. The area of the city became a cemetery in V century BC through I century AD time period.

The Pre Urartian settlement of Karmir Blur spreads on the western side of the citadel, under the living quarters of the city. The excavations here began in 1947 and finished in 1958, showing that it was also occupying around 40-50 hectares of area. Huge dwelling complexes were excavated on the site, consisting from rectangular and rounded (circular) constructions with around 120 square meters in plan together with the attached secondary buildings (Images 26-29). The walls of the constructions were preserved up to 1 m of height. Inside of the small rooms stoves and baking areas, product and food storages with stone idols nearby, fragments of common pottery, concentration of faunal remains, inventory for metalwork, agricultural tools, grinding stones were discovered. The circular sections were for living and the rectangular ones, for the economic activity. Such complexes were serving as houses for large patronymic families. The cultural remains allow the dating of the Pre Urartian settlement in the time limits of XII-XI and X-VIII centuries BC. Settled from the XII century BC, the area was occupied until the VII century BC, before the arrival of the troops of Rusa the II. By the order of the Urartian king the settlement was burnt and destroyed and the Urartian city of Teyshebaini was built.

The last complex of the site consists of 5 caves (Karmir Blur-1 to 5) on the right bank of the Hrazdan River, located in the basalt formations. Those formations have significant columnar structures and are among the unrecorded natural monuments of Armenia (Images 32-34). The caves were studied by me in 1992. The test trenches in the caves are showing some medieval period cattle keeping activity and cultural remains from the XI-XIII centuries (not published materials). However, the excavator of the Pre Urartian settlement professor H. Martirosyan suggested that those could serve as mausoleums for the Urartian elite persons due to their suitable shape and convenient location. Organization of the burials in the caves was a strong Urartian tradition. Probably, those rich burials were robbed by the inhabitants of the Medieval Argavand settlement (see below), located above the plateau. The only cave that is located closer to the constructional area is Karmir Blur-1 (Image 35). The constructional activities must be realized with consideration that the cave must not to be covered by garbage or destroyed, because it's still under the scientific interest and is recorded in the Yerevan list of

protected sites (Inventory number 1.11.27). The access to the cave must not be blocked by constructions⁷.

The same questioning is related with the Umeshin or Ejmiatsin irrigation channel of the VII century BC (Inventory number 1.7.7), which was rebuilt several times (end of the 17th century, 1815 and 1922) and is acting nowadays (Image 36). There is a memorial dedicated to the construction of the channel, standing on Isakov Avenue, raised in 1968. The constructional activities must be designed in the way not to harm the functioning channel and not to close the access to it.

Coming back again to the Teyshebaini-Karmir Blur archaeological site (Inventory number 1.11.22), where the remnants and constructions of the citadel (Inventory number 1.11.22.2), living quarters of the city (Inventory number 1.11.22.1) and the dwellings of Pre Urartian settlement (1.11.22.1.1-1, 1-2, 1-3) are still visible on the ground, it was planned to develop here a National park here for tourism industry. The structures of the Pre Urartian site were strengthened with cement, reconstructed and left in the regime of open-air preservation and the cellars and rooms in the citadel were covered by sediment for conservation. Unfortunately, after the collapse of the Soviet Union the site slowly turned into a garbage area (Images 30-32). Luck of findings was not able to keep the corresponding regime of its preservation, to provide the completeness of the site itself, surrounding historical and landscape environment. Survival of the site is threatened by the rapid widening of the actual cemetery area, the construction activities around the site and in the Hrazdan River gorge, the garbage deposited on the site and into the gorge, and the growing agricultural activities. A fully cultivated and flourishing area, regulated by the Urartians some 3000 years ago was transformed into an unattractive, abandoned area without any significance. By looking at the site in nowadays, it is hard to believe and imagine that the old fixed scenes, showing the situations opened by the excavations, belong to the same site.

Another risk for the site is the new road construction project. Our detailed mapping of the area shows that the structures of the Pre Urartian settlement dwelling complexes fit directly into the road line (Map 3). The road is passing directly over the cultural layer, which is continuing even in the area of the cemetery (in the soil of fresh burials fragments of pottery and other artifacts are visible). The excavations conducted at the site, never reached the level of the

⁷ The law on preservation and utilization of Immovable Monuments of History and Culture and of the Historic Environment (adopted on the 11 of November 1989) – **LPUMHCHE LAW. Chapter 13.** The recorded list of the monuments has a power of law and is a basis for giving an official status to the monument. **Chapter 21.** Destruction of the archaeological sites during constructional activities is forbidden. **Chapter 22.** Constructional activities in or around the areas of the sites must run without causing any damage and destruction to the site and its environment.

bedrock. Due to our preliminary investigations, the depth of the cultural layer can be at least 2 m and more.

The third day of the survey activities were carried out on the right side of the Hrazdan River Gorge, in the area between the Police High School and Argavand village (Map 3). The mentioned area is occupying the surface of the last and lowest, so called Argavand terrace of the river. After the terrace the river is flowing outside of the canyon into the fertile Ararat valley. “Aragavand” means fertile in Armenian (Image 37). Those areas are supposedly part of the land cultivated by the Urartians. The surface of the Argavand terrace is fully destroyed by construction activity and mostly occupied by houses and other buildings (Images 32, 34, 38). Especially the contact area of the future road is occupied by a factory building from the west, at the very end of the terrace. The eastern side is destroyed by the constructions of high voltage electric lines and then after cleaned by mechanisms and covered by deposited waste (soil and basalt blocks). This made the systematic surveying of the area impossible. First checking of the “islands” on the rims of the terrace, escaped from destruction and garbage accumulation, indicated existence of artifacts (Images 38-41). The future investigations on the central part of the terrace deeply cut by mechanisms for pipelines resulted in no findings. The artificial deep sections didn’t indicate existence of any cultural layers or structures preserved in the sediments (Images 42 and 43). Next collections of the artifacts were made on the western side of the terrace, between the factory and the area of the existing houses. The soil in the gardens and cultivated areas contained pottery fragments and other artifacts. At some parts, survived from destructions, traces of walls and other constructions were visible (Images 44-47). The study of the constructions and the finds indicated that the hill, based on the terrace of the river, is associated with a settlement which was fully destructed by modern activities. The analyses of the collected artifacts are showing that they belong at least to two different time periods – Late Bronze through Early Iron Age (XII-X centuries BC) and to High Medieval Period (XIII-XIV centuries AD, Images 48 and 49). It means that the Pre Urartian settlement of Karmir Blur was occupying a wider area and spreading to the other side of Hrazdan River Gorge. The medieval occupation indicated on the hill must be related with the old Aragavand village. Not far from the area of the hill, on the western side, in the limits of the Argavand cemetery church foundations exist and, in practice, all those finds and structures together are part of the ancient Argavand village (Map 3).

Putting together the collected archaeological data from the studied area, we can say, that along Project 1, two archaeological sites or settlements are present. First is the Karmir Blur and the second is Old Argavand. The last one is destroyed and has lost its scientific value.

There is no need for any special operation to protect it or to organize rescue excavations before the construction activities. It should be possible to recommend to the authorized body (the Ministry of Culture) to allow the construction operations in the area of the Argavand settlement with a condition, that the construction contract should include provision of suitably qualified staff, such as an archaeologist, to ensure, that proper chance-find procedures are implemented during those activities along the cleaned and opened sections⁸.

In spite of this, the situation with Karmir Blur is the most problematic in comparison with the all parts of the Yerevan Sustainable Urban Transport Investment Program. In the case of the future road construction activities, the only possible recommendation is:

1. To remove the garbage from the surface of the site under archaeological observation (must be considered as an absolutely separated activity from the excavation process);
2. To organize full archaeological excavations along the whole area of the road and the buffer zone, for opening the bedrock, which will bring to full understanding of the archaeological situation and figure out the future solutions about the road design and limits;
3. To design the road constructions in harmony and agreement with the overview of the site, taking into consideration its future potential for becoming a tourist destination and an important cultural site.

Armenian legislation states that destruction of historical monuments is forbidden and that full investigation is required prior to construction⁹. Karmir Blur is a serious “barrier” from the point of view of the archaeological impact and not only for Project 1, but for the whole Yerevan Program.

Boris Gasparyan
Archeologist consultant
01.05.2010

⁸ **LPUIMHCHE LAW. Chapter 19.** Any type of the construction activity in the areas containing historical monuments or archaeological sites must be realized in agreement with the authorized body (Ministry of Culture). **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.

⁹ **LPUIMHCHE LAW. Chapter 19.** Any type of construction activity in the areas containing historical monuments or archaeological sites must be realized in agreement with the authorized body (Ministry of Culture). **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. If the activities may cause any damage to the site, the initiator must pay for study, excavations, reconstruction and in separate case the removal of the structures, and for other activities suggested by the authorized body.

ARM Yerevan SUTP Tranche 1 Project. P2: Argavand Highway – Shirak Street

Map 3

0 105 210 420 Meters

Scale 1:3000 (WGS 84 coordinate system)



- Legend**
- | | | | | | |
|------------------------|--------------|---|---|------------------------------------|------------------|
| Road construction area | New cemetery | Survey area | Points of surface collections | Umeshin channel | Modern buildings |
| Buffer zone | Old cemetery | Outlines of the archaeological sites protection zones | Cave sites | Citadel of Teyshabaini-Karmir Blur | Streets |
| | | Church | Constructions of the Preurartian settlement | Elevation | Hrazdan River |



View of the Hrazdan River Gorge in the 50-ies of the 20th century,
with Karmir Blur in the background



View of the Hrazdan River Gorge in nowadays,
with Karmir Blur in the background



Teyshebaini-Karmir Blur in 2001 (main view of citadel from the south-west)



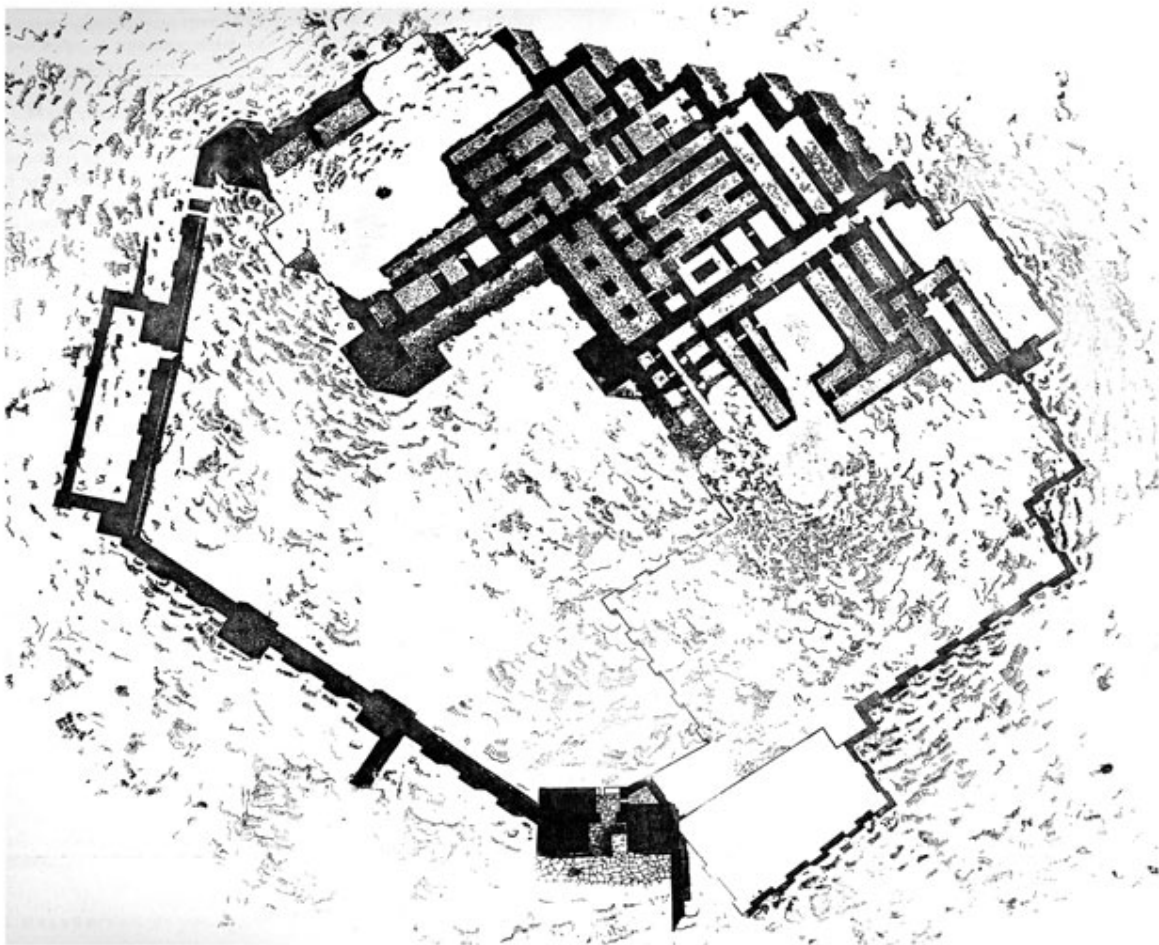
Teyshebaini-Karmir Blur in nowadays (main view of citadel from the west)



Citadel of Teyshebaini-Karmir Blur with visible traces of the fortification system
(view from the south-west)



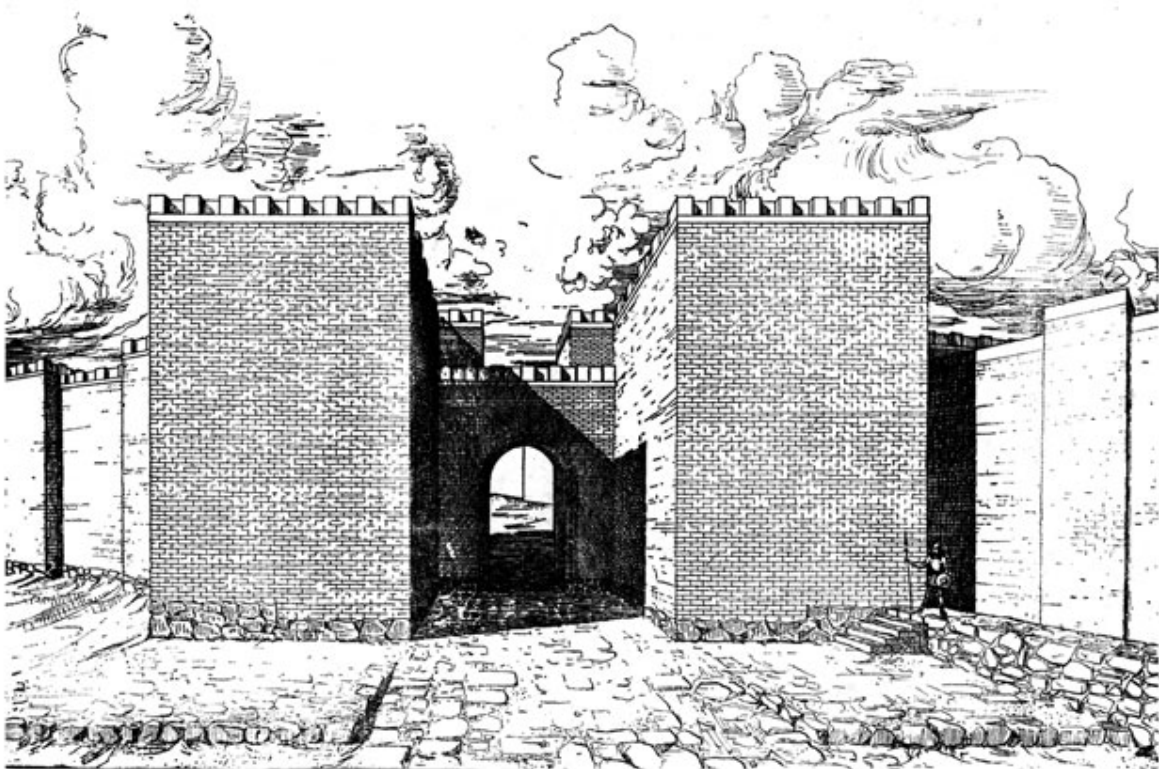
Citadel of Teyshebaini-Karmir Blur with visible traces of the fortification system
(view from the north-east - from the right bank of Hrazdan River)



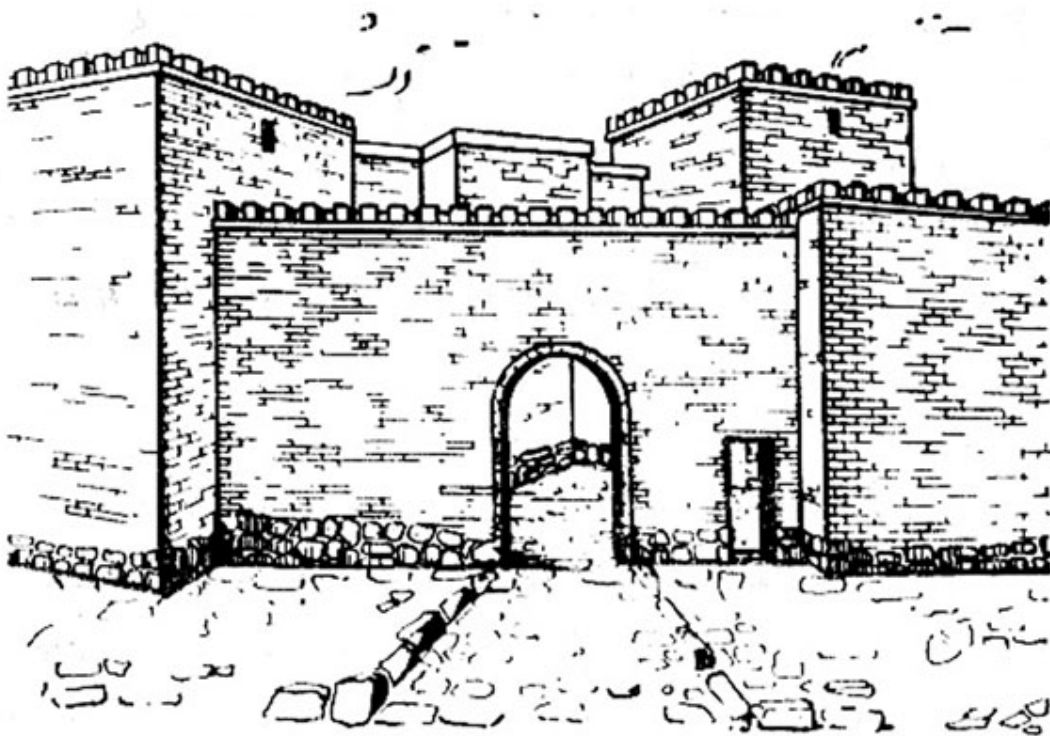
Citadel of Teyshebaini-Karmir Blur. Plan



Citadel of Teyshebaini-Karmir Blur. Plan



Reconstruction of the main (southern) gateway of the citadel of Teyshabaini-Karmir Blur



Reconstruction of the north-eastern gateway of the citadel of Teyshabaini-Karmir Blur



Bronze shield, helmet and quiver from Teyshabaini-Karmir Blur (VIII century BC)



1. Golden bracelet; 2. Silver medalyon;
3. Lid with cuneiform inscription of Argishti I.
Teyshebaini-Karmir Blur (VIII-VII centuries BC)



Uartian cuneiform inscription
of King Rusa II
about the construction of
irrigation channel from
the Ildarouni (Hrazdan) River.
Zvartnots (VII century BC).



Section of the Uartian channel,
passing north from Teyshabaini-Karmir Blur,
in the Hrazdan (Ildarouni) River Gorge,
constructed by King Rusa II
(VII century BC).



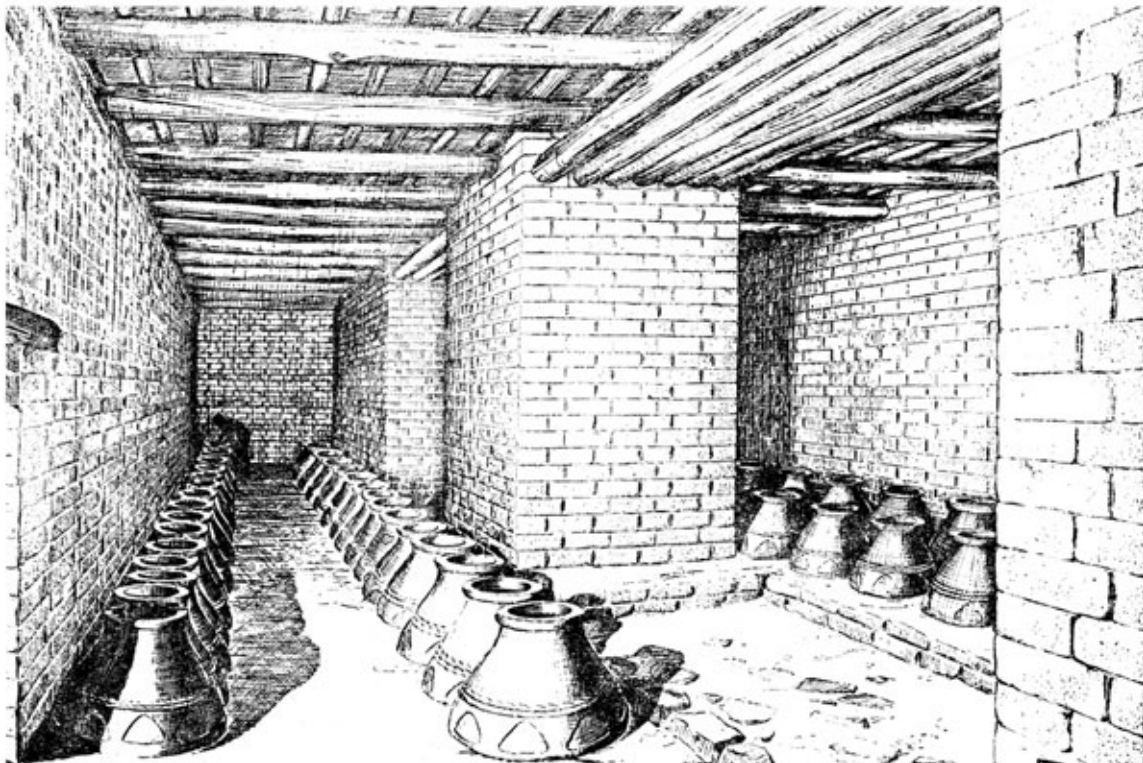
Iron shawls from the citadel of Teyshebaini-Karmir Blur (VII century BC)



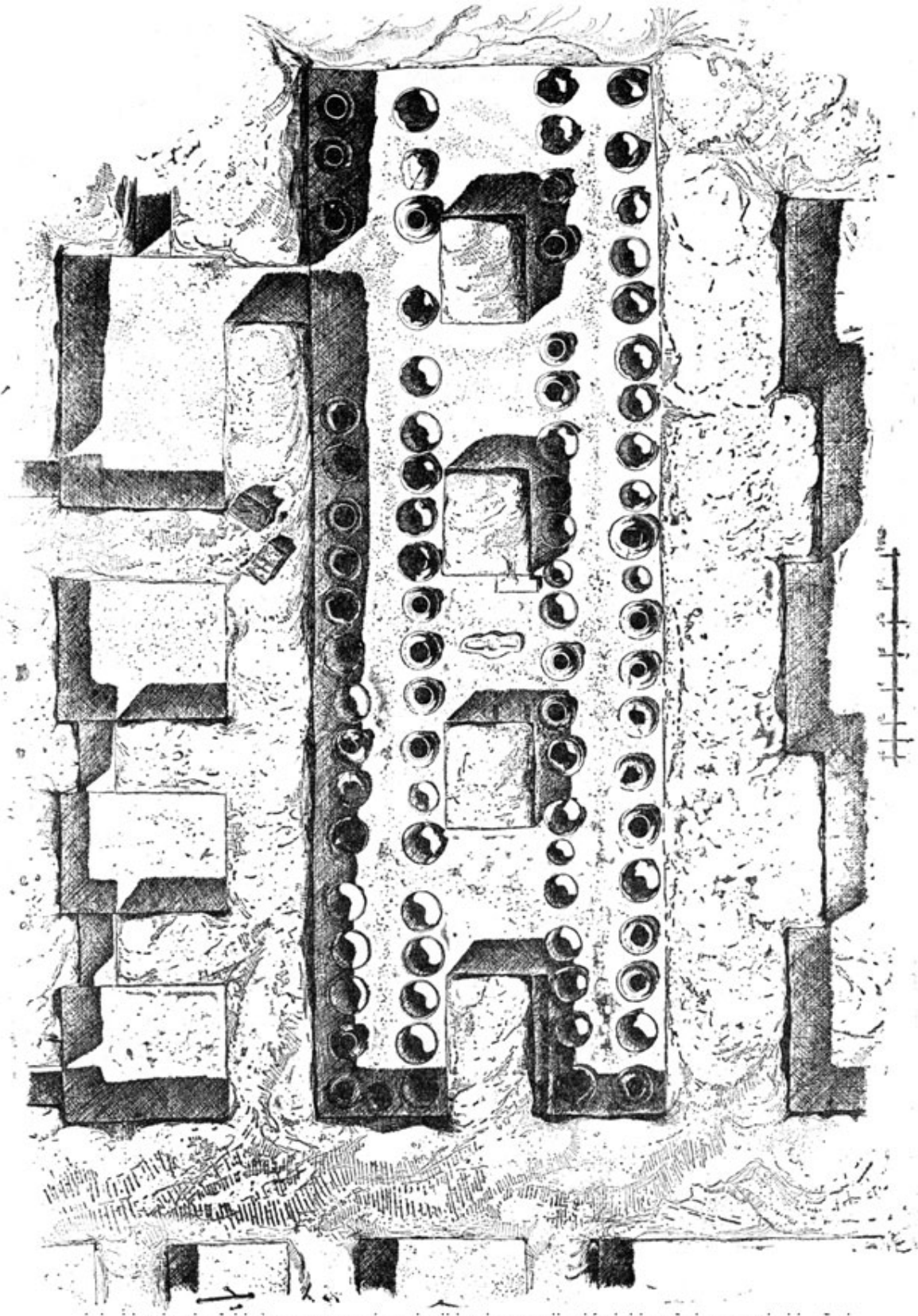
Charred pits of grape from Teyshébaini-Karmir Blur (VII century BC).



Wine cellar N 28 with karases. Teyshebaini-Karmir Blur (VII century BC)



Reconstruction of wine cellar N 28 with karases



Plan of wine cellar N 25 with karases. Teyshebaini-Karmir Blur (VII century BC)



1-2. Karases from Teyshebaini-Karmir Blur (VII century BC)



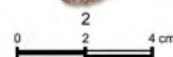
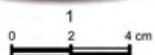
Cuneiform and hieroglyphic inscriptions telling the volumes of karas



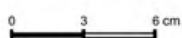
1.Funnel; 2.Censer (fumigation) vessel; 3-6.Oil lamps.
Teyshebaini-Karmir Blur (VII century BC)



1-4. Vessels for making beer. Teyshebaini-Karmir Blur (VII century BC)



3

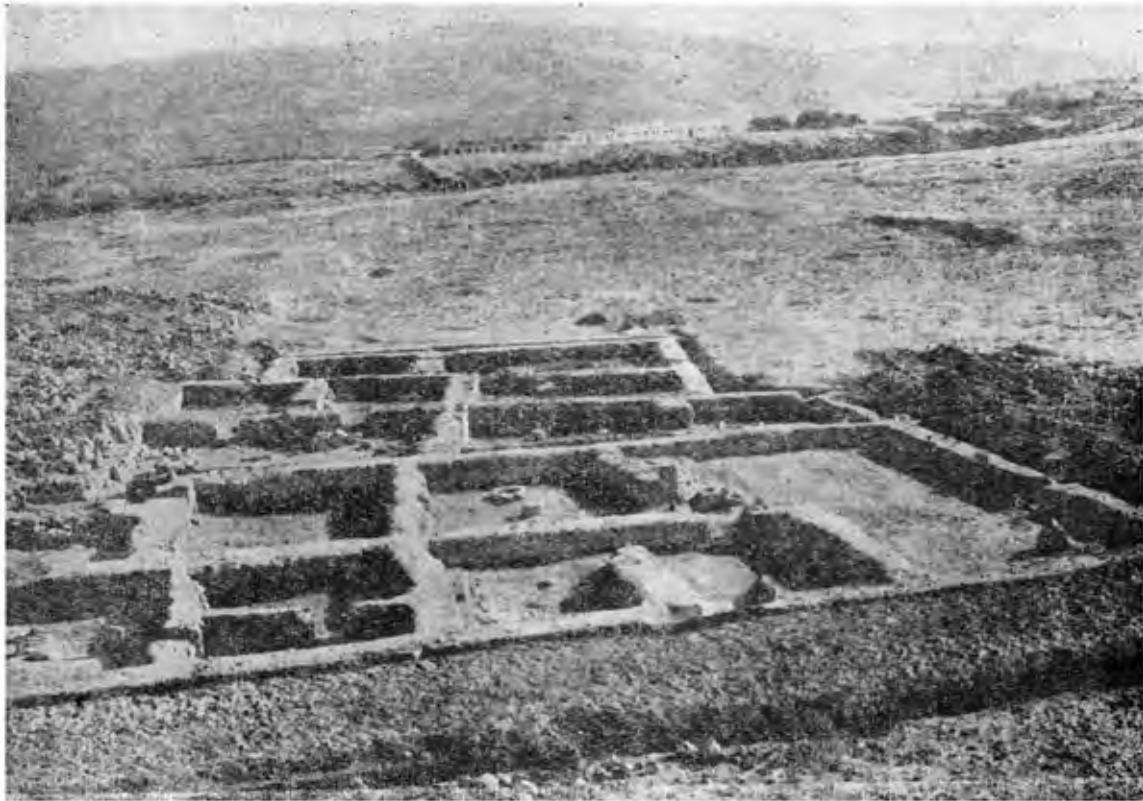


4

1-4. Wine cerving facilities. Teyshebaini-Karmir Blur (VII - VI centuries BC).
1.Askos; 2.Glass; 3-4.Pitchers



1-3. Shoe-shaped vases. Teyshebaini-Karmir Blur (VII century BC)



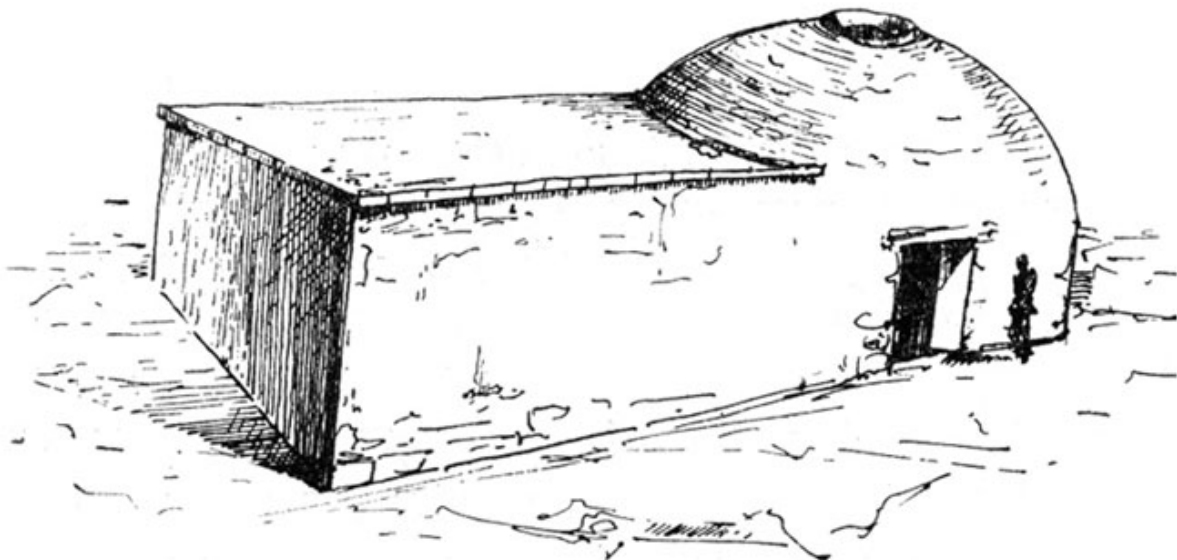
Pre Urartian (Late Bronze-Early Iron Age) settlement during the 1958 excavations



Pre Urartian (Late Bronze-Early Iron Age) settlement in nowadays



Plan of a room from the dwelling complex N1 in the Pre Urartian settlement



Reconstruction of the dwelling complex N1 in the Pre Urartian settlement



Construction waste, deposited on the structures of the Pre Urartian settlement



Construction waste, deposited on the structures of the Pre Urartian settlement



Right bank of the Hrazdan River Gorge, north-west from Karmir Blur, with a destroyed Argavand settlement, Umeshin channel and cave sites



Columnar basalt structures at the right bank of the Hrazdan River Gorge, near Karmir Blur



Karmir Blur caves 3-5, situated in the basaltic structures of the right bank of the Hrazdan River Gorge, in front of Karmir Blur



Karmir Blur-1 cave, situated under the Argavand settlement, right from the future passage above the Hrazdan River Gorge



Fragment of the Umeshin Urartian channel, running till nowadays on the right side of the Hrazdan River Gorge



End of the Hrazdan River Gorge, turning into a fertile valley near Argavand



Southern boundary of the destroyed Argavand settlement, located on the right side of the Hrazdan River Gorge, north-west from Karmir Blur



Preserved "island" of the Argavand settlement on its southern ending, where part of the surface finds were collected



Totally destroyed middle part of the Argavand settlement



Checking the sections of the middle - fully destroyed part of the Argavand settlement



Totally destroyed western part of the Argavand settlement



Checking the sections of the western part of the Argavand settlement,
where some surface finds were present



Preserved "island" of the Arghavand settlement on its western ending, closer to the acting factory and private houses



Area at the western part of the Argavand settlement, between the acting factory and the private houses, where some surface finds were present



Artifacts found from surface and destructed areas of the Argavand settlement. Artificially modified bone with cut-marks, obsidian implements, fragment of a metal implement, ceramic fragment (XII-X centuries BC)



Artifacts found from surface and destructed areas of the Argavand settlement.
Ceramic fragments (XIII-XIV centuries AD)

APPENDIX 4

PUBLIC CONSULTATION EVENT - 19 MARCH 2010

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ՀԱՆՐԱՅԻՆ, ԽՈՐՀՐԱՏՎՈՒԹՅՈՒՆ՝ ՇՐՋԱԿԱՍ ՄԻՏԱԿԱՅԻՐԻ ՊԱՐԴԱՆՈՒԹՅԱՆ ՎԵՐԱԲԵՐՅԱԼ

Երեւանի կայուն բաղաքային տրանսպորտի ծրագիր

ՀՀ Կառավարությունը և Երեւանի բաղաքապետարանը տված որոշումն են իրականացնել բաղաքային տրանս-
պորտի ծրագրեր՝ Երեւան բաղաքի երթեւեկության շարժունակությունը բարելավելու և տրանսպորտային համա-
կարգի ծանրաբեռնվածությունը նվազեցնելու նպատակով:
Ասիական զարգացման բանկը Ֆինանսական աջակցություն է ցուցաբերում Երեւանի բաղաքապետարանին՝
հետևյալ աշխատանքներն իրականացնելու համար:

Ստույգ ժամանակներում առաջարկվում է իրականացնել հետևյալ չորս նախագծերը՝




- Նախագիծ 1 - Դավիթաշենի կամուրջ - «Աշտարակի մայրուղի» ճանապարհի արդիականացում
- Նախագիծ 2 - Արզականցի մայրուղի - «Շիրակի փողոց» ճանապարհի արդիականացում
- Նախագիծ 3 - Շիրակի փողոց - «Արտաշատի մայրուղի» ճանապարհի արդիականացում
- Նախագիծ 4 - «Երիտասարդական» մետրոյի մեր մուտքի կառուցում (Արևմտյան փողոց - Սայաթ-Նո-
վա դղճուտա խաչմերուկ)

Դուք իրավիճակ ենք մասնակցելու համայնի խորհրդակցության, որտեղ կարող եք առավել մանրամասն տե-
ղեկություններ ստանալ մշված նախագծերի վերաբերյալ և հնարավորություն կունենաք փոխանակել Ձեր կար-
ծիքները և քննարկել Ձեզ հուզող հարցերը տեխնիկական թիմի հետ, մասնավորապես՝ խնդիրը վերաբերում է
շրջակա միջավայրի տաշտոյանությանը:

Ժամը՝ 11.00-ին
Ուրբաթ՝ 19 մարտի, 2010թ.
Վայրը՝ Երեւանի բաղաքապետարան, առաջին հարկ

Հասցե՝	ԱԶԲ - Հայաստանյան մետավայր
Երեւանի բաղաքապետարան	Վազգեն Սարգսյան փ. 26/1
Արզիշտի փ. 1	«Երեւանի Պլազա», Բիզնես կենտրոն
Երեւան 0015	Երեւան 0010
Հեռ. (+374) 10 514187	Հեռ. (+374) 10 546371, 546373
Էլ. փոստ՝ contacts@yerevan.am	Էլ. փոստ՝ acbarrm@adb.org

Տեխնիկական աջակցության համարը՝ TA: 7340
Ծրագրի համարը՝ 42417-01

Attendance list - translated

Note that the actual attendance lists contain repeat names and does not include several attendees.

No.	Name	Position	Address/organization
1.	Karen Avetisyan	Coordinator	Association for Sustainable Human Development, NGO forum on ADB
2.	Karine Danielyan	President of NGO, Representative of environmental ADB Armenian Office Public Alliance	Association for Sustainable Human Development NGO
3.	Abrahamyan Tamara	President of NGO	"Araza" NGO
4.	Andranik Tevosyan	Citizen	
5.	Ashot Mnatsakanyan	Advisor to the Mayor	Yerevan Municipality
6.	Mushegh Burnusuzyan	Yerevan Municipality Staff Transport Department Main Specialist	Yerevan Municipality
7.	Diana Yeritspokhyan	Ecologist	Yerevan Municipality
8.	Basencyan Frunz		Yerevan Municipality
9.	Tadevosyan Rudik		Yerevan Municipality
10.	Ofelia Sivonyan		Yerevan Municipality Information Department
11.	Hayk Abelyan	Deputy of the Head of District	Ajapnyak Administrative District
12.	Gevorgyan Gagik	Land Usage Town Department Head	Davitashen Administrative Region Deputy Director
13.	Vardanyan Vardan		Shengavit Administrative District
14.	Felix Afyan	Deputy Director	PIU
15.	Ruben Srapyan	Leading specialist	PIU
16.	Levon Hakobyan	Yerevan Building Investment PIU Director	PIU
17.	Gohar Aleksanyan	Journalist	
18.	Hasmik Gregorgyan	Journalist	ArmenPress
19.	Anahit Avagyan	Journalist	Public radio
20.	Areg Barseghyan	ADB Representative	ADB Armenian office
21.	Anna Avagyan	Translator	ADB Armenian office
22.	Klaus Schonfeld	Environment Specialist	ADB
23.	Lanfranco Blanchetti	Resettlement Specialist	ADB
24.	Anjela Arakelyan		"AdInfoSys" CJSC
25.	Milena Babaeva	Translator	"AdInfoSys" CJSC
26.	Liana Mkhitarian	Social and Resettlement Specialist	"AdInfoSys" CJSC
27.	Vahe Tunyan	Transport Specialist	"AdInfoSys" CJSC
28.	Kristine Araqelyan		"AdInfoSys" CJSC
29.	Arman Vermishyan	Environment Specialist	"AdInfoSys" CJSC
30.	Paul Holmes	Project Manager	Mott MacDonald
31.	Naomi Hull	Environment Specialist	Mott MacDonald
32.	Tom Streather	Resettlement Specialist	Mott MacDonald

Attendance list – actual (1 of 3)

ՀՀ	Անուն	Հասցե/կազմակերպություն	Ստորագրություն
1.	Արթուրյան, Եսեկ Buu Tseren	"Արալյա" ՅԺԶ. 22.10.97 araz@armico.com	
2.	Բաղդասարյան Յ Բաղդասարյան	Հրշեթի ֆաբրիկայի տնօրեն	
3.	Քոչարյան Ն Քոչար	Հրեաթի փղամուկի տնօրեն	
4.	Համբարձումյան Համբարձում	Դուրյան փողակի շրջան	
5.	Հարությունյան Հարություն	ՀՀ Դատախազի օրենսդր.	
6.	Օհանյան Օհանյան	Դպրոցական կազմակերպություն	
7.	Անիկոյան Անիկոյան	"ՀՀ Դատախազի օրենսդր."	
8.	Արսենյան Արսենյան	"ՀՀ Դատախազի օրենսդր."	

Attendance list – actual (2 of 3)

ՀՀ	Անուն	Հասցե/կազմակերպություն	Ստորագրություն
1.	Դավիթ Բաղդասարյան	Արհեստագործական	
2.	Բաղդասարյան Արսենյան	ՀՀ Դատախազի օրենսդր.	
3.	Դավիթ Բաղդասարյան	ՀՀ Դատախազի օրենսդր.	
4.	Անիկոյան Արսենյան	ՀՀ Դատախազի օրենսդր.	
5.	Արսենյան Արսենյան	ՀՀ Դատախազի օրենսդր.	
6.	Դավիթ Արսենյան	ՀՀ Դատախազի օրենսդր.	
7.		ՀՀ Դատախազի օրենսդր.	
8.	Արսենյան Արսենյան	ՀՀ Դատախազի օրենսդր.	
9.	Դավիթ Բաղդասարյան	ՀՀ Դատախազի օրենսդր.	
10.	Դավիթ Բաղդասարյան	ՀՀ Դատախազի օրենսդր.	
11.	Դավիթ Բաղդասարյան	ՀՀ Դատախազի օրենսդր.	
12.	Դավիթ Բաղդասարյան	ՀՀ Դատախազի օրենսդր.	
13.	Անիկոյան Արսենյան	ՀՀ Դատախազի օրենսդր.	
14.	Anna Aragyan	ՀՀ Դատախազի օրենսդր.	
15.	Անիկոյան Արսենյան	ՀՀ Դատախազի օրենսդր.	

Attendance list – actual (3 of 3)

No	Ազգանուն	Անուն	պաշտոն	աշխատավայր
1	Սարգսյան	Եղիշ	բարձրագույն	Հասարակական կենտրոն
2	Սարգսյան	Սևակ	բարձրագույն	
3	Սարգսյան	Կարեն	Կարգ/ճակատագր	ՀՀԿԿ
4	Սարգսյան	Խաչիկ	լրագրող	Փորձագետ
5	Սարգսյան	Կարեն	դեմոստրացիոն/կենտրոն	Սարգսյանի կենտրոն
6	Սարգսյան	Գևորգ	Կարգ/ճակատագր	Հասարակական կենտրոն
7	Սարգսյան	Սևակ	լրագրող	Սարգսյանի կենտրոն
8	Սարգսյան	Սևակ	Կարգ/ճակատագր	ՀՀԿԿ
9	Սարգսյան	Կարեն	Կարգ/ճակատագր	ՀՀԿԿ
10	Սարգսյան	Կարեն	Կարգ/ճակատագր	ՀՀԿԿ
11	Սարգսյան	Կարեն	Կարգ/ճակատագր	ՀՀԿԿ
12	Սարգսյան	Կարեն	Կարգ/ճակատագր	ՀՀԿԿ
13	Սարգսյան	Կարեն	Կարգ/ճակատագր	ՀՀԿԿ
14	Սարգսյան	Կարեն	Կարգ/ճակատագր	ՀՀԿԿ

Environmental Assessment Report

Initial Environmental Examination for
Shirak Street to Artashat Highway Upgrade (Project 2)
Document Stage: Final
Project Number: 42417
September 2010

Armenia: Sustainable Urban Development Investment Program

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Fw: ARM Yerevan Sustainable Urban Transport MFF
Arnaud Dauphin to: Mary Ann Z. Vargas
(766 6496)

09/14/2010 09:07 AM

FYI

Arnaud Dauphin

Urban Development Specialist (Transport)
Urban Services Division
Central and West Asia Department
Asian Development Bank
Tel: (632) 632-6496
Fax: (632) 636-2484
adauphin@adb.org



----- Forwarded by Arnaud Dauphin/CWRD/ADB on 09/14/2010 09:07 AM -----

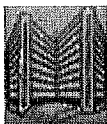
From: "Nerses Yeritsyan" <nyeritsyan@mineconomy.am>
To: <adauphin@adb.org>
Cc: "Mushegh Tumasyan" <mtumasyan@mineconomy.am>, <abarseghyan@adb.org>, <gmousaelyan@adb.org>
Date: 09/10/2010 11:53 AM
Subject: RE: ARM Yerevan Sustainable Urban Transport MFF

Dear Arno,

I would like to confirm that LARF, LARPs and EARF have been approved by the ministerial committee chaired by the PM, and will be approved next Thursday. Therefore, we are in the schedule agreed during the teleconference.


I also would like to suggest the you discuss with Mushegh Tumasyan the Municipality co financing and project governance issues via phone.

Best regards,



Nerses Yeritsyan | Minister

Ministry of Economy of RA
5 Mher Mkrtchyan str, Yerevan 0010, Armenia
T +374 (10) 52 61 34 (110) | F + 374 (10) 52 65 77
E nyeritsyan@mineconomy.am | W www.mineconomy.am

 Please consider the environment before printing this email.

ABBREVIATIONS

ADB	Asian Development Bank
EA	Executing Agency
EARF	Environmental Assessment and Review Framework
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
EMP	Environmental Management and Monitoring Plan
ERT	Emergency Response Team
IA	Implementing Agency
IEE	Initial Environmental Examination
IMF	International Monetary Fund
IFI	International financial institution
IUCN	International Union for Conservation of Nature
LARP	Land Acquisition and Resettlement Plan
Master Plan	Yerevan City Master Plan, Vol.5, 2004
MNP	Ministry of Nature Protection
MOC	Ministry of Culture
MFF	Multi-tranche Financing Facility
NO ₂	Nitrogen Dioxide
NO	Nitrogen Oxide
NPE	Nature Protection Expertise
NGO	Non-governmental organization
PIU	Project Implementation Unit
PPMU	Program Preparation and Management Unit
PPTA	Project Preparatory Technical Assistance
RAMSAR	Ramsar Convention on Wetlands
RA	Republic of Armenia
REA	Rapid Environmental Assessment
SEI	State Environmental Inspectorate
SNCO	State Non-commercial Organization
SO ₂	Sulfur Dioxide
UNESCO	United Nations Educational, Scientific and Cultural Organization

WEIGHTS AND MEASURES

dBA	decibel (A-weighted)
km	kilometer(s)
km ²	square kilometer(s)
m	meter(s)
mg/m ³	milligram(s) per cubic meter

NOTE

In this report, "\$" refers to US dollars.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

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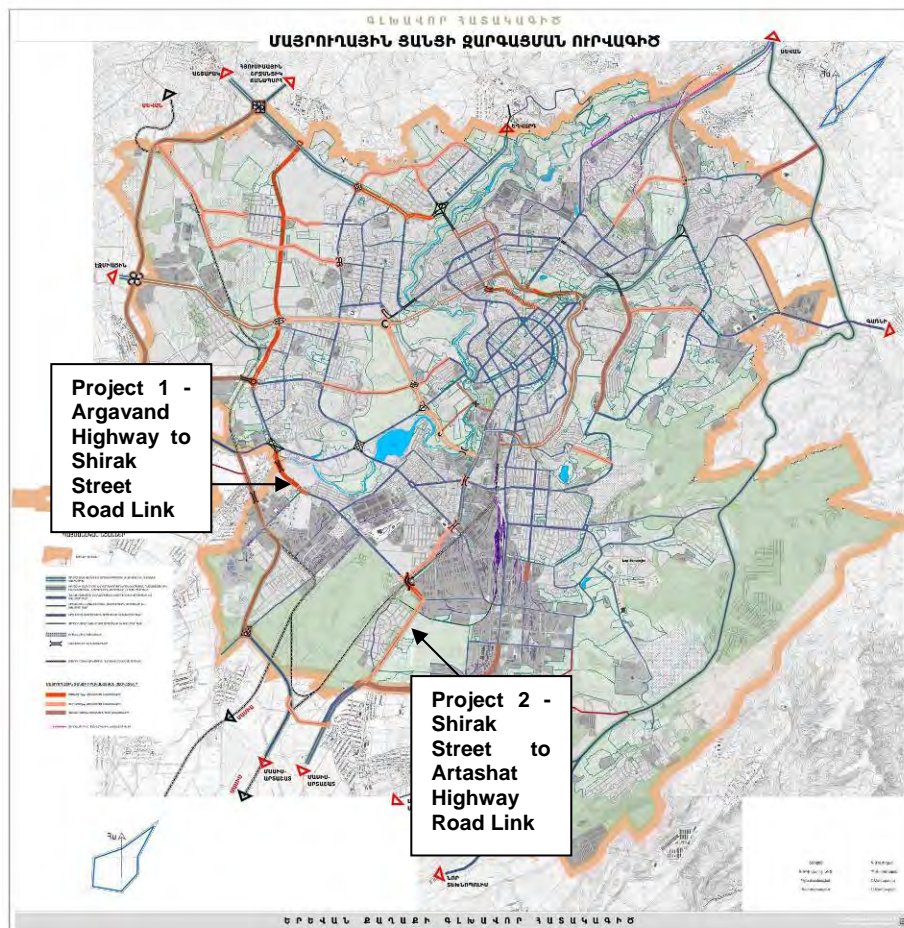
APPENDIXES

1. Rapid Environmental Assessment (REA) – Roads and Highways
2. Phase 1 contaminated land investigation
3. Ecological site investigation
4. Archaeological site investigation
5. Consultation meeting advertisement and attendance sheet

Figure 1: Armenia showing the location of Yerevan

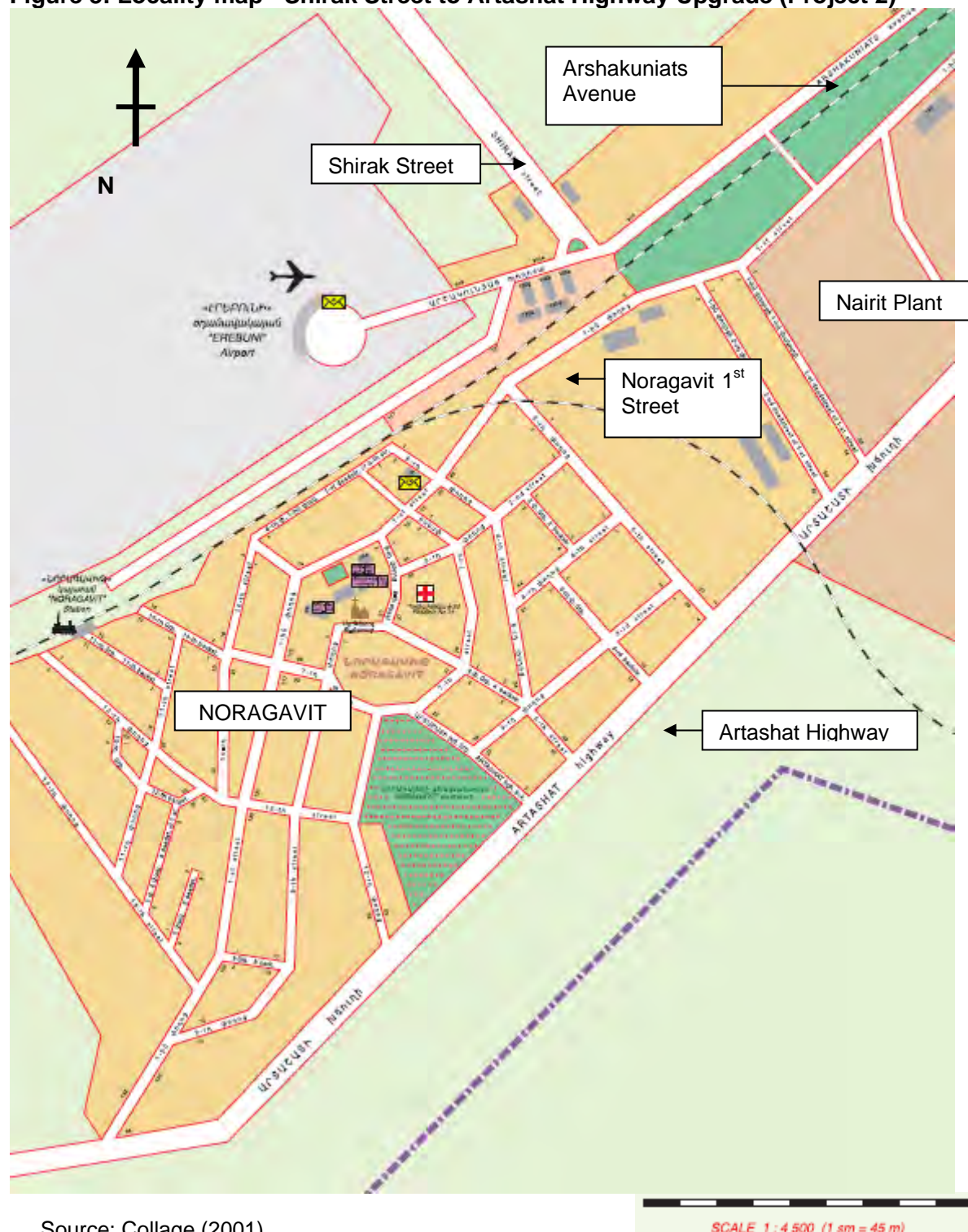


Figure 2: Map of Yerevan showing program project locations

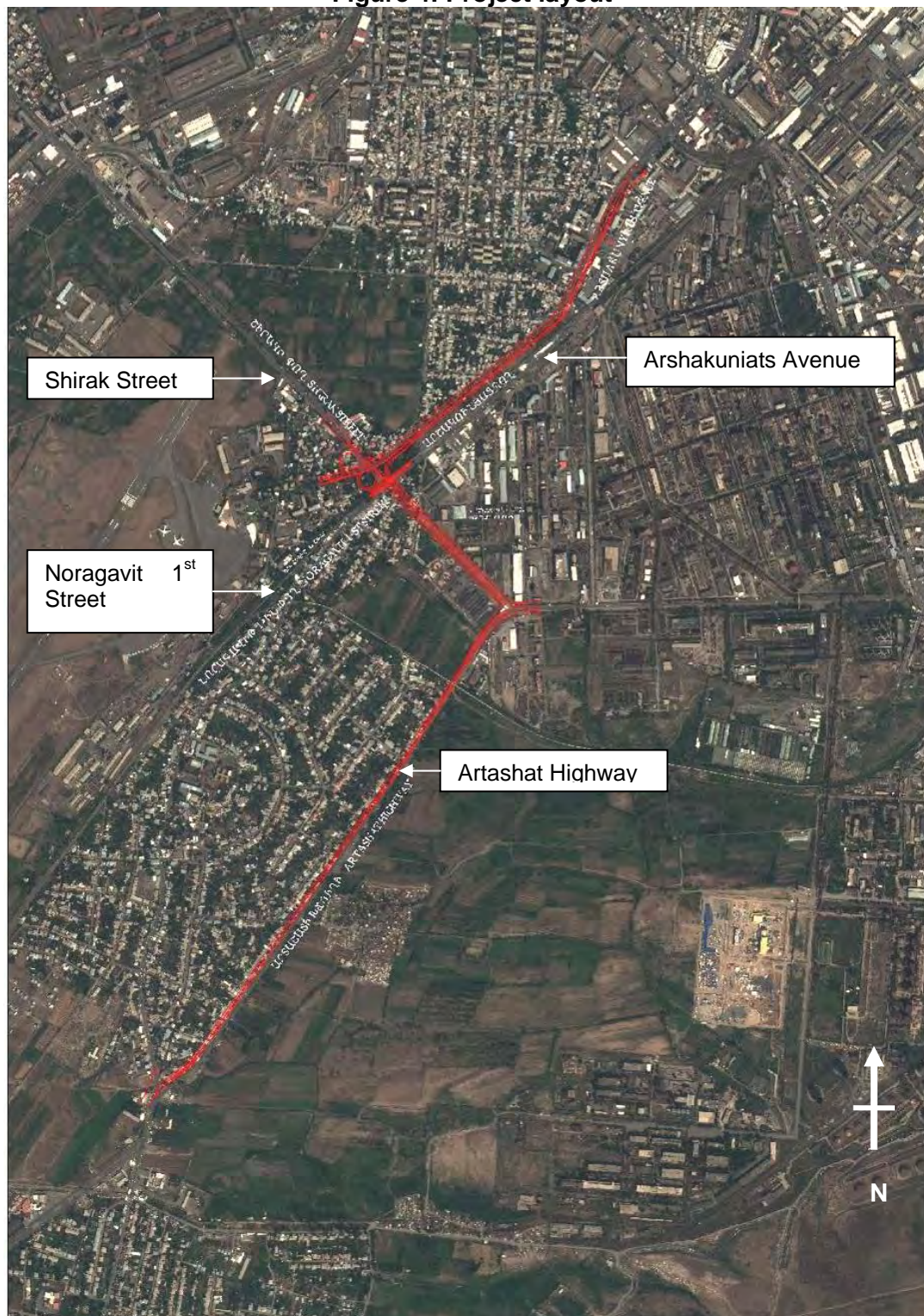


Source: Municipality of Yerevan Master Plan (2004)

Figure 3: Locality map - Shirak Street to Artashat Highway Upgrade (Project 2)



Source: Collage (2001)

Figure 4: Project layout

Source: Municipality of Yerevan (2010)

I. INTRODUCTION

A. Project Background and Purpose of Report

1. The Republic of Armenia is a landlocked country between the Black and the Caspian Seas, bordered on the north by Georgia, to the east by Azerbaijan, on the south by Iran, and to the west by Turkey as shown in Figure 1. Yerevan covers an area of 260km² extending 18km north-south and 16km east-west with the centre and the south of the City at a lower geographic level.

1. Project Background

2. Like other New Independent States of the former Soviet Union, Armenia's economy still suffers from the legacy of a centrally planned economy and the breakdown of former Soviet trading networks. Investment from these states in support of Armenian industry has virtually disappeared, and consequently few major enterprises are still able to function. The structure of Armenia's economy has changed substantially since 1991, with sectors such as construction and services replacing agriculture and industry as the main contributors to the economic growth. Other industrial sectors driving industrial growth include energy, metallurgy, and food processing.

3. Steady economic progress has earned Armenia increasing support from international institutions. The International Monetary Fund (IMF), World Bank, European Bank for Reconstruction and Development (EBRD), as well as other international financial institutions (IFIs) and foreign countries are extending considerable grants and loans. These loans are targeted at reducing the budget deficit; stabilizing the local currency; developing private businesses related to energy, agriculture, food processing, transportation, and health and education sectors. In December 2005, the U.S. Millennium Challenge Corporation approved a 5-year \$235 million contract with the Government of Armenia, which was to focus on rehabilitation of irrigation networks and upgrading of rural transport infrastructure.

4. There has been little traffic forecasting, with the last study conducted in 2007 through the Millennium Challenge Corporation, by engineering consultancy SWECO. That study used gross domestic product (GDP) per capita to forecast the future growth in car ownership. This is based on car ownership of 80 per 1,000 of population in 2007, projected to increase to 344 per 1,000 by 2026. The carbon dioxide emissions related to passenger transport are expected to increase by 160% over this period resulting in increased greenhouse gas emissions which contribute to climate change. Other adverse effects of passenger transport such as air pollution, traffic congestion, and noise are also likely to increasingly affect the environment and quality of life in a negative way. Yerevan has seen increasing and rapid economic development, resulting in:

- (i) Growing car ownership and increasing congestion;
- (ii) Outdated public transport;
- (iii) Safety issues; and
- (iv) Decreased air quality linked to vehicle emissions.

5. Yerevan has a high road traffic accident rate with the number of recorded accidents increasing 65% from 2001 to 2006, with steady increases over these years. Approximately one-fifth of these accidents are fatal.

2. The Project

6. During 2007, the Municipality of Yerevan worked with the World Bank on the public transport network, traffic management, parking and ticketing systems, and has set relevant objectives. The Asian Development Bank (ADB) is now working with Government of Armenia and the Municipality to address some of the objectives by improving municipal infrastructure and reducing road transportation constraints on economic activity. The program aims to promote efficient and effective urban transport services with incentives and capacity to improve the quality, reliability, accessibility, affordability, integration and coverage of transport services. The Yerevan Sustainable Urban Transport Program has been developed and is to be funded by the ADB under a Multi-tranche Financing Facility (MFF) Investment Program. The two proposed engineering projects under Tranche 1 of the Program, as shown in Figure 2, are:

- (i) Project 1 - Argavand Highway to Shirak Street Road Link;
- (ii) Project 2 - Shirak Street to Artashat Highway Road Link; and

7. The three road projects will complete the missing road links of the Yerevan west bypass to divert through-traffic around the City centre. This report presents the findings of an Initial Environmental Examination (IEE) of Project 2- Shirak Street to Artashat Highway.

B. IEE Report Outline and Methodology

8. This Initial Environmental Examination (IEE) report comprises the following key components:

- (i) Description of the project;
- (ii) Description of the environment;
- (iii) Screening of the potential environmental impacts and mitigation;
- (iv) Environmental Management and Monitoring Plan (EMP);
- (v) Public consultation and information disclosure; and
- (vi) Findings, recommendation, and conclusion on whether there is a need for a full EIA.

9. The study has been undertaken in accordance with the ADB's *Safeguard Policy Statement* (2009), *Environmental Assessment Guidelines* (2003) and *Armenia: Yerevan Sustainable Urban Transport Program Environmental Assessment and Review Framework* (March 2010). Internationally recognized standards and guidelines have provided guidance where local standards are not available and/or where referred to by the ADB on particular environmental aspects. This includes World Bank's *Pollution Prevention and Abatement Handbook* (1998) and *Environment, Health, and Safety General Guidelines* (2007).

10. 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. The Yerevan City Master Plan Vol.5, (2004) (Master Plan) is a primary source of baseline data, and has been supplemented by other information sources and specialist studies.

11. Site inspections were conducted by the International Environment Specialist and National Environment Specialist during January, February, and March 2010. The site inspections included driving the route of existing roads and walking sections of the route, including areas of potential environmental significance or likely impact.

12. Meetings were held with stakeholder authorities to discuss the relevant environmental aspects of the project, obtain information and gauge any specific environmental concerns. A consultation event was held to present the project to the public and allow opportunity for comment. Refer to Section VI of this report for further detail on consultation activities.

C. Armenian and ADB Environmental Assessment Requirements

13. This environmental assessment has been undertaken to satisfy both the ADB and Republic of Armenia requirements with regard to environmental protection and management. This IEE has been prepared in English as a safeguard requirement of ADB and a separate EIA report in has been prepared in Armenian language.

1. Armenian Laws Governing Environmental Management and Assessment

14. After Armenia gained its independence in 1991, the deteriorating environmental condition of the country became more apparent and, as environmental concerns became high priority political issues, the process of development of environmental legislation was initiated. The 10th Article of the Constitution of the Republic of Armenia (passed in 1995) outlines the State responsibility for environmental protection, reproduction, and use of natural resources. Some 33 relevant national laws have been promulgated to protect the environment. There are two main laws administered by the Ministry of Nature Protection (MNP):

- (i) Law on the Principles of Environmental Protection (1991); and
- (ii) Law on Environmental Impact Assessment (EIA) (1995).

Law on the Principles of Environmental Protection (1991)

15. The Law on the Principles of Environmental Protection (1991) outlines the environmental protection policy of the Republic of Armenia. Its purpose is to ensure state regulation of environmental protection and use within the territory of the Republic. It provides a legal basis for the development of environmental legislation regulating the protection and use of forest, water, flora and fauna, and the atmosphere. This law also grants every citizen the right to obtain reliable information on environmental conditions.

Law on Environmental Impact Assessment (EIA) (1995)

16. The Law on Environmental Impact Assessment (EIA) (1995) contains the standard steps of the EIA process for various projects and activities in Armenia. It establishes, in Articles 2-5, the general legal, economic, and organizational principles for conducting mandatory state EIA of various types of projects and “concepts” of sectoral development, which includes construction and infrastructure. The law forbids any economic unit to operate or any concept, program, plan or master plan to be implemented without a positive conclusion of an EIA. This right was given to local authorities, ministries, local communities, and non-governmental organizations (NGOs) in Article 4. The MNP can initiate a review of environmental impact when it deems it to be necessary. The EIA Law specifies notification, documentation, public consultations, and appeal procedures and requirements (Articles 6-11).

17. The key departments within the MNP that have administrative authority over EIA and the project approval process are two State Non-commercial Organizations (SNCOs):

- (i) The SNCO Nature Protection Expertise (NPE) is responsible for reviewing and approving EIA reports and projects for implementation and adding conditions when necessary to protect the environment; and
- (ii) The SNCO State Environmental Inspectorate (SEI) is responsible for inspecting projects to ensure compliance with conditions imposed by the NPE and with the project EMP.

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

19. To satisfy relevant regulations and to gain project approval of the MNP, an EIA, in accordance with the Law on Environmental Impact Assessment (EIA) (1995), has been prepared. The MNP EIA will have similar, if not identical, requirements as the ADB IEE.

Other Relevant Environmental Legislation

20. Other pieces of pertinent environmental legislation have also been considered during the assessment, which include specially protected natural areas, air protection, cultural and historical monuments, flora, fauna, water use, seismic defense, waste, hygiene, and workers' protection.

21. The Republic of Armenia has also signed and ratified International Conventions and Protocols on environmental protection.

2. ADB Environmental Assessment Requirements

22. ADB's *Safeguard Policy Statement* (2009) sets the requirements of environmental assessment for all projects supported by the ADB. At an early stage of project preparation, the policy requires that the project's potential risks and their significance be identified and in consultation with stakeholders. 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.

23. Under the ADB's *Environmental Assessment Guidelines* (2003), preliminary assessment of Project 2 was undertaken through a Rapid Environmental Assessment (REA) checklist for road improvements (see Appendix 1). The assessment indicates an environment category 'B' which means that impacts that may arise from the implementation of all the components will generally be minor and measures to mitigate them will be provided and instituted without difficulty. The Safeguard Policy requires that risks and potential impacts be identified and reported in an IEE report.

D. Extent of the IEE Study

24. The IEE study for the sub-project was carried out by the Project Preparatory Technical Assistance (PPTA) consultants, in accordance with ADB guidance, and where relevant environmental policies and guidelines of the Government of Armenia were not available, international guidance. Environment Specialists of the PPTA consultants visited the sub-project site and also carried out public consultation prior to preparation of this report. The IEE involved the following activities:

- (i) Gathering of baseline information on the physical, biological, and socio-economic environment of the project area and understanding the technical, social, and institutional aspects;
- (ii) Field visits;
- (iii) Discussions with officers of the relevant agencies;
- (iv) Public consultation;
- (v) Screening of potential issues, concerns, and impacts relative to location, design, construction, and operation to distinguish those that are likely to be significant and warrant further study;
- (vi) Preparing an EMP indicating impact areas, recommended mitigation measures, method of monitoring the impacts, responsible agencies/persons, and associated costs; and
- (vii) Proposing the institutional set-up for implementation of the EMP.

25. Findings of site reconnaissance, technical descriptions based on the engineering designs, and outcomes of discussions with officers of the relevant agencies and the general public are integrated into this IEE report.

II. DESCRIPTION OF THE PROJECT

A. Type of Project

26. This is a Multi-tranche Financing Facility (MFF) Investment Program. This IEE assesses Project 2 of the first tranche of the MFF.

B. Project Location

27. The project site is located in Yerevan's Shengavit district, approximately 6km south-west of the City centre of Armenia's capital (refer to Figure 2). The 3.7km alignment includes widening of Arshakuniats Avenue, connecting Artashat Highway (M-2) to Shirak Street and widening Artashat Highway to Noragavit 1st Street.

28. Except for the new service road along the southern part of Artashat Highway (adjacent to Noragavit neighborhood where an additional service road design accompanied with main horizontal alignment shift away from the buildings) the alignment follows a previously established right-of-way ('red lines') and previously established alignment, as indicated in the Master Plan.

C. Magnitude of Operation

29. This section of road is part of a program of road section upgrades to complete the Yerevan western bypass, aiming to divert through-traffic around Yerevan's City centre, which will improve traffic flow and reduce congestion on local roads. As identified under Section I, there are two other road section upgrades in this tranche. Further upgrades have been defined conceptually under Tranches 2 and 3 to the north of Yerevan and these projects are likely to be constructed following those within Tranche 1.

D. Project Description

30. Over a length of approximately 3.7km, the project comprises 4.8km of new road construction, sections of widening of existing road, ramps and an interchange, to connect

Artashat Highway and Arshakuniats Avenue via Shirak Street as illustrated in Figure 3 and Figure 4. The project comprises:

- (i) Widening along the east of Arshakuniats Avenue from a 2 to 4-lane road divided with a central reservation for 1.5km to where the road meets Shirak Street;
- (ii) New half-clover leaf interchange at Shirak Street/Arshakuniats Avenue;
- (iii) New overpass of the railway line to adjoin Shirak Street and providing a connection with Noragavit 1st Street;
- (iv) New section of 4-lane road divided with a central reservation to extend Shirak Street by 1km along an existing right-of-way to meet with Artashat Highway. Sections of corridor walls will be removed and replaced to accommodate the new road;
- (v) New T-shaped intersection at the Shirak Road extension onto Artashat Highway. Depending on traffic volumes, consideration will be given to either a roundabout or traffic lights at this intersection;
- (vi) Widening 2.3km of Artashat Highway between the end of the Shirak Street extension and Noragavit 1st Street from 4 to 6-lanes divided with a central reservation. Consideration is being given to an additional service road parallel to the main alignment to provide safe access and egress for the Noragavit neighborhood;
- (vii) New overpass of the railway line that crosses Artashat Highway; and
- (viii) Possible new ground level intersection, possibly with traffic lights at Artashat Highway and Noragavit 1st Street.

31. The roads and bridges have been designed in accordance with:

- (i) Road Design Building Code SNIP 2.07.01-89;
- (ii) Bridge Design Building Code SNIP 2.05.03.84; and
- (iii) Construction Norm of Republic of Armenia IV11.05.02-99.

32. Widening of existing roads will involve removal of existing asphalt layer (and grinding and re-using it as much as possible). The below-standard top and sub-base will be removed as required and replaced with material meeting accepted quality standards. A new concrete asphalt layer will be laid over the road and shoulders. The design includes 3m wide pedestrian paths along both sides of the road. Road traffic safety measures will be installed including signage and traffic markings.

33. The interchange at Shirak Street/Arshakuniats Street; overpass of the railway line and Noragavit 1st Street; and railway overpass along Artashat Highway will comprise reinforced concrete foundations to support the piers, impact protection measures on the piers, pre-cast concrete beams to form the deck, and concrete barriers along the sides of the overpass. Mainline railway operations will be maintained during construction of the rail overpasses with works to be undertaken at night where required.

34. Other activities associated with construction include:

- (i) Identification and protection or relocation of existing utilities including water mains, gas mains, sewers, electricity and communication lines;
- (ii) Selection of suitable locations for construction camps; facilities and offices; and storage of materials and machinery. Installed gated security fences around the camps;

- (iii) Removal of existing waste material dumped along the route;
- (iv) Excavation and leveling of the alignment;
- (v) Establishing wheel-wash facilities for vehicles leaving the site;
- (vi) Testing of and, if necessary, excavation, transportation and disposal of contaminated soil; and
- (vii) Landscaping of the shoulders and median following construction.

35. Detailed design has been completed for this project and it is expected that construction will begin in 2011 and will be undertaken over a period of up to three years.

E. Alternatives to the Proposed Project

36. The ADB's *Environmental Assessment Guidelines* (2003) require 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.

37. The City of Yerevan has been planned with the central area connected by radial roads to the suburbs. This directs through-traffic into the City centre as there is currently no complete link directing through-traffic around the City centre. The heavy congestion along the existing sections of road contributes to high noise, vehicle emissions and traffic incidents. A complex transport development scheme for Yerevan was originally included in the Yerevan Master Plan in 1981 and construction of some sections of the scheme began in the 1980's but never completed. The current 2004 Master Plan began to be developed in 2000, at which time the transport development scheme was reviewed, and the proposed scheme essentially remains similar to the original design. Construction of this new section of road will complete a section of the Yerevan west bypass to divert through traffic off local roads. This will ease congestion, improve traffic conditions and contribute to improving economic factors, and improve regional air quality.

36. The new road alignment will pass over the existing main railway line. An option to construct a road bridge beneath the railway line was considered, but was discounted due to greater disruption to rail services and due to technical reasons.

37. There are no practicable alternatives in terms of location, design, construction methodology, and social and environmental impacts. The no-go option is not considered viable as the conditions will worsen as traffic congestion increases over time.

III. DESCRIPTION OF THE ENVIRONMENT – BASELINE

A. Physical Resources

1. Air Quality and Climate

38. Yerevan experiences a continental climate¹, with hot and dry summers and moderately cold winters with unstable snow coverage. The average annual air temperature is 12°C, whilst the average low is -3.5°C in January, and the average high of 25.7°C is in July. Humidity is generally low with 45%-49% in summer and 75%-79% in winter. Average annual precipitation is 391mm with the highest level in May at 45mm and the lowest in August at only 8mm. The prevailing wind direction is north-east.

39. Yerevan is surrounded by mountains on three sides which does not allow for natural dispersion of pollutants in the atmosphere, thereby resulting in high concentrations in the air. The main source of air pollutants are emissions arising from automobiles which is exacerbated by a congested road network. It is estimated in the Master Plan that approximately 95% of the pollutants in the air are the result of transport emissions.

40. According to the Master Plan, the Arshakuniats Avenue and Shirak Street sections of the project are designated a 'permissible pollution zone' with respect to air quality; whilst Noragavit 1st Street and Artashat Highway are in a 'moderate air pollution zone'².

41. In addition to pollution caused by vehicle emissions, a significant proportion of dust is present in the atmosphere. This is largely due to extensive deforestation which has occurred in the region in close proximity to the City borders. These large areas of arid landscape produce significant dust during the dry summer months.

42. Table III.1 shows the measured concentrations from a monitoring station located at the Erebuni airport, approximately 300m west of the closest point to the site on Shirak Street. The table compares the maximum permissible concentration (MPC) of air pollutants (dust, sulfur dioxide, nitrogen dioxide, nitrogen oxide) based on the Armenian standard *Maximum Permissible Concentration (MPC) for Ambient Air in Human Settlements*. Based on the annual average measured, the table indicates that pollutants sometimes exceed the respective MPC. The average dust recorded in Yerevan between March to May over 2007 and 2008 was recorded as considerably higher than other months. The average annual measured nitrogen dioxide consistently exceeds the daily medium MPC. The table shows overall improvements between 2007 and 2009.

¹ Weather results from the Erebuni monitoring station, north of the site.

² According to the Master Plan, the City is separated to two air quality zones, 'moderate air pollution' and 'permissible air pollution'. The zone classification is based on a pollution index calculation of parameters including nitrogen oxide, carbon oxide and dust, and takes into account of exceedance of MPCs, harmfulness, and other aspects. The methodology is based on 'Methodical guidelines of sanitary supervision in the regional planning' (USSR, 1990).

Table III.1: Measured Concentrations and Maximum Permissible Concentration of Air Pollutants

Pollutant	Annual average measured at monitoring station N7 – Erebuni airport (mg/m ³) ¹				Maximum permissible concentration (mg/m ³) ²	
	2007	2008	2009	TOTAL AVERAGE 2007 - 2009	Maximum single event	Daily medium
Dust	0.16	0.15	0.07	0.13	0.5	0.15
Sulfur Dioxide (SO ₂)	0.07	0.05	0.04	0.05	0.5	0.05
Nitrogen Dioxide (NO ₂)	0.085	0.052	0.061	0.066	0.085	0.04
Nitrogen Oxide (NO)	0.04	0.02	0.02	0.03	0.4	0.06

¹ Data supplied by L Margaryan of the Ministry of Nature Protection's Environmental Impact Monitoring Centre, dated 24/03/10.

² *Maximum Permissible Concentration (MPC) for Ambient Air in Human Settlements*, Republic of Armenia government decision N160-N, 02.02.2006.

43. Yerevan also experiences a high concentration of ground ozone, especially in summer, which results in the development of a photochemical smog due to Yerevan's geographical location of restricted natural dispersion and emissions from transport.

2. Surface and Groundwater

44. There are no surface water bodies close to the alignment. The closest point of the Hrazdan River is approximately 2.5km north of the northern extent of the alignment where it then flows into the Yerevan Lake approximately 400m further north.

45. The Master Plan indicates that there is a low risk of flooding in the vicinity of the project site, probably because the Hrazdan River is highly regulated to control flood risk.

46. Groundwater beneath the majority of the Artashat Highway is at depth of 5-10m; however, the direction of flow is not known but may reasonably be expected to flow towards the Hrazdan River to the north. There is no other information available about groundwater.

3. Topography, Soils, Geology, and Seismology

47. The project site is located in the southern part of Yerevan within the Ararat valley, the area being relatively flat. The altitude of project site is approximately 900-950m above the sea level.

48. Yerevan City and the adjacent regions are located in a seismic area and are considered to have a high degree of seismic risk along existing fault lines. Earthquakes in the area can reach up to the magnitude of 9 and above on the Richter scale. There was a serious earthquake in 1988 in the north of the country, measuring 6.9 on the Richter scale, which led to a large loss of life.

49. The geology is based on an intrusive ground investigation, believed to have been undertaken in the 1980's; and the Master Plan. The shallow geology of the project site consists

of late-quaternary lake and alluvial sediments. The solid geology comprises interbedded clay and sand with a variable proportion of gravel (approximately 20-30%). The clay content of the soils recorded by the investigation is considered to limit the downwards migration of contaminants into groundwater. The geology has limited filtration potential due to dry climates and poor vegetation coverage (humus cover of less than 1%).

50. The Master Plan indicates that soils along the alignment contain concentrations of heavy metals (including chromium, nickel, zinc, copper, cobalt, molybdenum and silver) which are elevated when compared to background concentrations. Significant concentrations of metals have been recorded in areas which have been occupied by industrial land uses and information in the Master Plan suggests that such contamination is localized to these industrial areas.

51. The Shirak Street extension road section is located in a corridor which is adjoined by Nairit Plant on both sides. The factory manufactures rubber (locally known as 'caoutchouc') products. Potential sources of contamination observed within and/or likely to be associated with Nairit factory include:

- (i) Above-ground liquid storage tanks;
- (ii) Liquid treatment plant;
- (iii) Chimneys;
- (iv) Gas pipes and liquid pipes;
- (v) Derelict buildings that may contain asbestos material in the building fabric.
- (vi) Chemical use areas including process areas and laboratories;
- (vii) Chemical waste store;
- (viii) Underground fuel storage;
- (ix) Uncontrolled waste/equipment dumping and burning;
- (x) Automotive workshops/garage;
- (xi) Electrical transformers.

52. Other potential sources of contamination within or in the vicinity of the road alignment are associated with:

- (i) Dumped waste along the route;
- (ii) Fuel filling station on Artashat Highway;
- (iii) Railway line across the Shirak Street extension alignment and across Artashat Highway;
- (iv) Small orchard which may have been sprayed with pesticides; and
- (v) Residential and other buildings which may not be connected to the Municipal sewer system.

53. A phase 1 contaminated land investigation was undertaken to identify the potential for contaminated soils and groundwater near the site, and need for further investigation. The investigation is based on a source, path, and receptor methodology and includes a qualitative risk assessment and recommendations.

54. The investigation concludes that it is likely that the soil is contaminated with oils, heavy metals, PCBs, asbestos, pathogens, metals, inorganic compounds, and chemicals from the rubber production activities. Based on the high clay content, contamination is likely to be mostly limited to the upper layers of the soil. The clay content would limit filtration into the groundwater; however, there still potential for contamination of groundwater by one or more of the mentioned

contaminants beneath or around the investigation area. The overall risk associated with this section of the alignment is concluded as high potential.

55. The investigation recommends that a phase 2 contaminated land investigation be undertaken prior to construction to verify the findings which will allow for mitigation to be designed and spoil disposal requirements to be identified. Refer to Appendix 2 for the full phase 1 investigation.

B. Ecological Resources

56. In Armenia the Law on Flora and the Law on Fauna set out 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. The Armenian Red Book has been developed which lists all rare and vanishing species that need to be protected. The International Union for Conservation of Nature (IUCN) has developed an IUCN Red Data Book and the IUCN Red List of Threatened Species, which highlights those plants and animals that are facing a higher risk of global extinction and are therefore listed as critically endangered, endangered or vulnerable). Species endemic to Yerevan have been identified; however, they are expected to be commonly found within the Yerevan and surrounding regions.

57. The project site is located in a semi-desert landscape zone with elements of desert. In this landscape are different types of flora and fauna species which are typical of Yerevan. In general, Yerevan contains the following flora and fauna types (Yavruyan, 2010):

- (i) **Plants** - 900 types of vascular plants, 15 are included in the Armenian Red Book, among them one endemic species is included on the IUCN Red List.
- (ii) **Mammals** - 25 species, three are included in the Armenian Red Book, 5 are on the IUCN Red List. The City area is widely populated by undesirable species, such as grey rats and the house mouse.
- (iii) **Birds** – about 170 species, 29 are registered in the Armenian Red Book. At least 100 types, of which 15 are included in the Armenian Red Book, build nests. Birds are also regularly present during seasonal migration, wintering and feeding time. The most numerous are synanthropic types, such as the sparrow, grey crow, magpie, rock pigeon (including feral pigeon) and Eurasian Collared Dove.
- (iv) **Reptiles** - 25 species, five are included in the Armenian Red Book.
- (v) **Amphibians** - the Syrian spadefooted Toad (*Pelobates syriacus*), listed in the Armenian Red Book, is likely to have disappeared due to landscape alteration and alterations to water reservoir flows.
- (vi) **Invertebrates** – there are many throughout Yerevan. The most investigated are beetles: about 700 known species, most of which are endemic to Armenia and some endemic to Yerevan. Known insect species include 60 fly species (dipterans); 40 wasp, bee and ant species (hymenopterans); 130 butterfly species; between 10 to 20 types of grasshopper, cricket and locust species (orthoptera); spiders; snails (molluscs); and about 30 types of gnawing beetle and tick species.
- (vii) **Fish** – ten species are registered in the rivers Hrazdan and Getar.

58. Notwithstanding the above, the project site is within a highly-modified urban and industrial area. Sections of the alignment contain dumped domestic and construction waste and are void of vegetation. Some fruit and decorative trees have been planted at the residential properties within the Shirak Street extension section of the alignment and a nursery is located

towards the north of the Artahsat Highway. Planted trees line Arshakuniats Avenue and the eastern edge of Artashat Highway.

59. According to the Master Plan there are no natural biodiversity sites in the vicinity of the project site which contain registered species that need special protection (registered in Armenian Red Book, Armenian endemic, original ecosystems).

60. A preliminary investigation was undertaken by an ecologist in March and April 2010 to verify the Master Plan or identify the protected species and the potential impact from the project on them (see Appendix 3). The season over which the study was undertaken was not favorable from the vegetation, migration, wintering, ovipositing (egg-laying) and other biological perspectives. Based on the preliminary investigation, it was determined that it is likely that protected species are not present at the site, however the investigation recommends that this will need to be confirmed through further investigation prior to construction.

C. Economic Development

61. Nerkin Shengavit and Noragavit comprise mixed pockets of industrial, commercial, and residential areas. Erebuni airport, a facility predominantly used by the military, is located just west of the alignment on the northern side of Noragavit.

62. Nairit Plant is a large industrial factory bordered by Arshakuniats Avenue to the west; Tamantsiner Street in the north; beyond Artashat Highway in the east; and just beyond the alignment of the Shirak Street extension and into the Noragavit neighborhood to the south. Parts of the factory are derelict and no longer in operation.

63. Above ground gas pipes are located within the alignment. Other utilities, including electricity and communications lines, water mains, and sewers, within or near the alignment, will be confirmed through a survey by the Contractor prior to construction.

D. Social and Cultural Resources

64. In 2001-2006 34.3% of the Armenian population lived within Yerevan's 12 districts. 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; which has since led to a static population in Yerevan. Statistically 28% of the population in Yerevan is categorized as below the UNDP poverty line. Poverty reduction targets aim to decrease the percentage of classified poor in Yerevan to a target figure of 2.6% by 2021.

65. Overall employment has stagnated although the economic recovery has led to an increase in employment sectors benefiting from foreign investment. The unemployment rate has fallen from 10.1% in 2003 to 6.5% in 2008 in Yerevan, but this rate remains high and official figures may underestimate the true situation. According to household surveys carried out by the National Statistical Service of the Republic of Armenia (NSS, dated 2001), the unemployment rate exceeds 30%.

66. The medium-density areas Nerkin Shengavit and Noragavit are located along the alignment. This includes pockets of residential areas and businesses, a large manufacturing/industrial area, and open land. Within the right-of-way of the Shirak Street extension are approximately ten affected private residences, reportedly built without Municipality approval. On the north-western side of Artashat Highway is the area of Noragavit including

residences and businesses next to the road, some also reportedly built without Municipality approval.

67. An archaeological investigation was undertaken to identify any archaeological sites and items of interest and that may be impacted by the project (see Appendix 4 for the full report). The southern extent of Artashat highway is adjacent to the Medieval village which was a wealthy urban area surrounded by fertile valleys, gardens and vineyards. The foundations of the 4th to 7th century Saint Grigor Lusavorich (Gregory the Illuminator) church are located in the middle of the village which is located to the south of Noragavit. Chance finds of Urartian tombs and mausoleums are known to have been discovered in the area. The earthquake of 1679 fully destroyed the early Noragavit village, after which it was revived and rebuilt, continuing to play a central role in the agriculture and trade of the Yerevan district.

68. Fieldwork was undertaken over two days as part of the archaeological investigation. The full results of the investigation are contained within Appendix 4, however in summary traces of medieval activity have been identified which are associated with early farming practices. A well preserved and possibly man-made hill, which is probably an ancient settlement or structure, is located towards the southern extent of the project alignment. There are no published and archival records about these archaeological finds, nor are they on the list of the protected sites adopted by the MOC or designated by UNESCO. A small cemetery is located approximately 60m from the existing eastern edge of Artashat Highway. This cemetery is designated as a 'special protected area' on the Master Plan. Pottery fragments were found at the cemetery; however the area is highly modified. There were no visible constructions identified and there is no direct evidence of ancient occupational activity, as such there is no need for any special action to protect the sites or to organize recovery excavations before construction begins.

69. Currently, the dominant noise source in Yerevan is associated with transportation (approximately 90%). The project site is exposed to noise from road traffic; rail movements; nearby industrial operations; and the Erebuni airport. The Master Plan records that baseline noise level along the existing section of Arshakuniats Avenue to Shirak Street varies between 65-70dBA; and along Artahsat Highway levels are 70-75dBA. This is compared to Armenian standards that limit maximum permissible noise to 55dBA during the day (7 a.m. to 10p.m.) and 45dBA during the night (from 10 p.m. to 7 a.m.) (see Table III.2). This indicates that baseline noise levels near the project site are already near or above maximum permissible levels.

Table III.2 Maximum Permissible Noise Levels¹

Receptor	Time (hours)	Level of noise LA and level of equivalent noise L _{Aeq} dBA	Maximum level of noise L _{AMax} dBA
Close territories of apartment buildings, polyclinics, dispensaries, rest homes, boarding houses, home for senior or disabled citizens, preschools, schools and other educational institutions, libraries	06.00 – 22.00	55	70
	22.00 – 06.00	45	60

¹ Source: Ministry of Health, Republic of Armenia, Order N138, 6 March, 2002, Order on adoption of N2-III-11.3 sanitary norms "Noise in workplaces, apartment and public buildings, territories of urban construction"

IV. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION

A. Environmental Parameters that may be Impacted

70. There are likely to be both beneficial and adverse impacts associated with Project 2 to construct and widen the road, including on:

- (i) Physical environment – air quality, water and soil;
- (ii) Ecological resources – vegetation;
- (iii) Economic development – industry and commerce, local and regional roads and public transport;
- (iv) Social and cultural – noise; human health and safety; income and employment; cultural sites.

71. The potential issues, concerns and/or impacts relative to location, design, construction and operation phases of the project are outlined below. The significance of any impact and need for mitigation or opportunity for enhancement are also discussed below. Detailed mitigation measures are included in Section V.

B. Impacts Due to Location

72. The purpose of constructing the new section of road is to provide a link between Artashat Highway and Shirak Street which will form part of the Yerevan west bypass. Completion of this bypass will divert through traffic around the City centre and is expected to improve regional air quality due to a reduction in congestion.

73. The majority of the project alignment is located within a right-of-way that was established during the 1980's and is owned by the Municipality of Yerevan. However, there are several private residential and other buildings within the right-of-way, reportedly without Municipal approval. The new service road along western side of Artashat Highway will be partly constructed on private land. Buildings will be demolished and occupants resettled to accommodate the project. Businesses operating from these buildings will be required to relocate. Resettlement and compensation are detailed in the Land Acquisition and Resettlement Plan (LARP) for Project 2.

74. All trees removed from publicly owned land will be replaced by native trees to a ratio of 10:1, of which the majority will be in the vicinity of the site.

75. Widening of Artashat Highway will bring the road closer to a cemetery on the south-eastern side of the road. A suitable barrier will be constructed to mitigate noise and dust impacts on the cemetery and trees may be planted to provide additional screening. No part of the project passes through or near any ecologically sensitive areas, designated wildlife or other sanctuary, national park, botanical garden, nor area of international significance (e.g., IUCN, RAMSAR site). Notwithstanding that the cemetery is designated as a 'special protected area' on the Master Plan, the alignment does not pass through or near any cultural heritage or archaeological sites designated by UNESCO or the MOC, however the archaeological investigation in Appendix 4 identified finds of archaeological interest which will be managed through chance-find provisions.

C. Impacts Related to Design

76. The new road section is anticipated to improve road safety and Yerevan's regional air quality by removing through-traffic from the City and congested local roads. The road will be designed and constructed to current high standards, thereby facilitating driver safety.

77. The design includes landscaping on the median and along the shoulders. Benefits of landscaping include enhancing ecological value, facilitating infiltration of run-off, enhancing visual aesthetics of the locality, and providing some noise reduction.

78. The structural elements of the project have been designed with consideration to the high risk of seismic activity of the region. This will enhance the sustainability of the project.

D. Impacts During Construction

79. Activities during the pre-construction, site preparation and construction phases are outlined below and the potential impacts assessed and mitigation measures recommended. Section V outlines more detailed mitigation measures including the requirement to prepare detailed operating plans for specific aspects for inclusion in the EMP. Regulations on environmental protection, safety of the public, and safety and hygiene of workers should be fully complied with in all phases of constructing the project.

80. There is potential for the project to generate employment opportunities for locals. It is recommended that recruitment be offered in the local community as it is likely to promote good community relations and encourage good work practices. Procurement of local workers will also minimize social problems otherwise caused by non-local workers attracting camp followers.

81. On-site workers should be made aware of, and trained in, standard environmental protection requirements and the IEE recommendations. Contractors will be contractually required to include environmental training and monitoring as part of their management of the project.

82. 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.

1. Site Preparation Activities

83. Locations for the construction camps will be selected by the Contractor in consultation with the PPMU (Program Preparation and Management Unit) Environment Specialist.

84. Prior to the start of construction, the occupants of the buildings within the right-of-way will need to be resettled and the buildings demolished. The full social impact of this is being assessed through a social analysis report, and resettlement will be undertaken in accordance with the LARP.

85. Waste that has been dumped along the alignment (the Shirak Street extension and along Argavand Highway) will need to be moved prior to excavations and leveling activities. The source of the waste is unknown; however, based on site visits, the material is a combination of

domestic and construction waste. The waste should not be used as fill material on the project and will be transported and disposed in accordance with MNP requirements.

86. There is potential for disruption to both above and below-ground utilities during construction. This might include above-ground gas mains, water mains, sewers and, electricity and communications lines. Surveys will be undertaken by the Contractor prior to construction to identify operational and redundant utilities. Plans will be prepared to set out temporary or permanent relocation and/or protection measures prior to construction. Any disruption to services would be short-term and localized. Consideration will need to be given to the time of year and time of day for any disruption and those potentially affected should be notified prior to the works.

87. Construction site safety for workers and residents of the nearby communities is of concern to the ADB. The construction site layout should be planned and areas and machinery secured as required prior to and during construction to ensure safety. First aid facilities will be provided and safety and environmental emergency response plans prepared prior to the start of construction. This is particularly important due to the potential contamination of the soil along sections of the alignment.

2. Vehicle Movements, Machinery Operation, Excavation and Leveling

88. The small hill towards the south of Artashat Highway is of potential archaeological interest. The alignment lies partially across the hill and any archaeological potential is likely to be impacted by excavation and earthmoving activities. To ensure that any chance-finds are identified during excavation activities, a qualified and experienced archaeologist will supervise excavation activities. Where items of cultural heritage or archaeological interest are uncovered during excavation activities, works must stop, the item recovered, and the MOC notified. Unless otherwise agreed by the MOC, construction activities cannot commence until the chance-find has been investigated by the archaeologist and written permission given by the MOC. Contractors will be obliged to familiarize themselves with the chance-find procedure of the MOC and will be contractually required to implement them strictly.

89. Prior to construction, trees and other vegetation within the alignment will be removed. Based on the ecological investigation (Appendix 3), none of the trees are protected. Clearing of vegetation, earthmoving activities and other construction activities have the potential to impact on other flora and fauna. The preliminary ecological investigation identified that it is likely that protected species are not present at the site. However this will need to be confirmed through further investigation prior to construction. The listed species that, if present on the site, may potentially be impacted by construction activities associated with the project, are listed in Table IV.1. There are no plant species considered at risk of being potentially affected by the project so plants are not listed in Table IV.1.

Table IV.1 Protected Species that would Potentially be Impacted

Common name	Scientific name	ARDB ¹	IUCN ²	Note
Birds				
Pallid Harrier	<i>Circus macrourus</i>	✓	LR/NT	Migration
Montagu's Harrier	<i>Circus pygargus</i>	✓		Migration
Reptiles				
Transcaucasian Ratsnake	<i>Elaphe hohenackeri</i>	✓		
Amphibians				
Syrian spadefooted Toad	<i>Pelobates syriacus</i>	✓	✓	Possibly disappeared
Insects				
Willowherb Hawkmoth	<i>Proserpinus Proserpina</i>		✓	
Seathorn Hawk-moth	<i>Hyles hippophaes</i>		✓	

¹ ARDB – Armenian Red Data Book

² IUCN - International Union for Conservation of Nature Red List of Threatened Species.

IUCN Red List Categories: NT - Near Threatened, LR - Low Risk

90. Vegetation removal and site clearing will be undertaken during late autumn and/or winter which are seasons most favorable to avoid impact on flora and protected fauna species.

91. As ground cover is removed, exposed soils of the site will provide a dust source potentially causing nuisance to nearby receptors and a reduction in local air quality. The generation of dust should be mitigated primarily through maintaining vegetation cover as long as practicable, and surfacing internal haul roads with gravel. Other measures include spraying the internal haul roads with water.

92. Particulate matter and nitrogen dioxide (NO₂) 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. Exhaust attenuation such as scrubbers or diesel particulate filters, will still be applied to vehicles.

93. The alignment does not pass through or near any cultural heritage or archaeological sites designated by UNESCO or the MOC. If any item of cultural heritage or archaeological interest is uncovered during excavation activities, works must stop and the MOC notified. Construction activities cannot commence until the chance-find has been investigated and written permission given by the MOC. Contractors will be obliged to familiarize themselves with the chance-find procedure of the MOC and will be contractually required to implement them strictly.

94. Noise will be generated from the operation of vehicles and machinery (including excavators, compactors, jackhammers, vehicle reversing alarms, etc), verbal communications and other construction-related activities. The most sensitive receptors are occupants of residential properties and other buildings that are close to the site boundary. Although there is

already high background noise levels in the vicinity of sections of the site, and the noise would be temporary and localized, noise levels could result in impact without mitigation. Attenuation measures in the EMP include scheduling of noisy activities towards the middle of the day, distancing noisier activities away from receptors where practicable, installation of temporary hoarding, and mechanical attenuation on vehicles and equipment. After applying mitigation, residual noise will not result in significant impact.

95. Construction equipment may generate vibration at the properties immediately adjacent to the alignment on Artashat Highway. Any vibration would be localized, temporary, may result in minor nuisance effects, and will unlikely result in structural damage to buildings or walls of the adjacent private properties.

96. Construction of the road involves removal of wastes from along the alignment, excavating the upper layers of the soil and earthmoving activities. Constructing the two rail overpasses includes constructing piers. The phase 1 contaminated land investigation (Appendix 2) identified the high potential for contaminated soil and groundwater in this area. Any dermal contact with the soil/materials or accidental ingestion could harm workers during construction. Disturbed and exposed contaminated soils and materials may also become airborne through windblown dust which may affect workers and nearby residents. Certain contaminants, including sulfates, have the potential to attack concrete used in road construction and high concentrations of petroleum hydrocarbons result in deterioration of concrete strength.

97. The phase 1 contaminated land investigation report includes a brief for a comprehensive ground investigation that will be undertaken by the Contractor prior to construction, in order to:

- (i) Gather general information on the distribution of common soil and groundwater contaminants across the site and develop a conceptual site model. This will reduce the uncertainty in the risks to human health and the environment and to develop mitigation measures. Additionally the investigation will identify appropriate disposal or re-use options of spoil associated with the construction activities; and
- (ii) Obtain information on the geotechnical properties of the soils to allow for the design of structures/highway.

98. Based on the outcome of the ground investigation, a management plan will be prepared and implemented by the Contractor.

99. There is potential for spill or leak of fuels and oils from inappropriately stored material or when refueling which could contaminate the soil and could infiltrate into the groundwater. Mitigation in the EMP sets out recommendations for avoiding on-site maintenance and refueling where practicable, providing bunded areas for fuel storage and maintenance where on-site maintenance activities cannot be avoided, clean-up of any spill/leak, and reporting to the MNP in case of spills and leaks.

3. Traffic Movements on Local Roads, Altered Access, and Rail Disruption

100. 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, and increased road traffic conflict. A Traffic and Transport Management Plan will be prepared by the Contractor to set out safe entry and exit points, enforce strict safety on public roads in conjunction with Yerevan

police force, specify timing for deliveries, and, in conjunction with Municipality of Yerevan, determine routes on local roads to manage traffic and minimize potential conflict.

101. Dirt and mud carried onto public roads from construction vehicles exiting the site has the potential to cause safety hazard. Graveled site exits and wheel wash facilities will mitigate this potential impact.

102. The haul roads to the project site are in poor condition, some of which are minor local unsealed roads. Heavy vehicle movements on these roads during construction have the potential to result in further dilapidation. A dilapidation survey will be undertaken by the Contractor prior to and following construction and maintenance undertaken during and following construction if road conditions become damaged and unsafe. Inspections should be undertaken in coordination with the Armenian Roads Directorate.

103. There are no planned disruptions to railway operations during construction of the railway overpass on Shirak Street and Artashat Highway.

4. Solid and Liquid Waste Generation

104. There is rubble and dumped domestic waste within this alignment and along Artashat Highway which will need to be cleared prior to construction and disposed of it in suitable locations approved by the Municipality of Yerevan and MNP, another task that may be included in the construction contract.

105. Solid waste that may be generated during construction includes redundant road surface, 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 MNP and Municipality requirements.

5. Site Reinstatement

106. Following construction, and prior to handover of the site by the Contractor to the Municipality, the Contractor should reinstate the site which will include clearing the site of all construction-related material and waste, and landscaping. The landscaping activities should include grass-seeding and planting trees within the median and along the shoulder. All trees removed from publicly owned land will be replaced by native trees at a ratio of 10:1, of which the majority will be in the vicinity of the site. The landscaping activities will enhance the ecological value of the area. Trees will also be planted along the cemetery barrier to provide additional screening. Roads will be inspected for dilapidation and the approach to repair agreed with the Municipality.

6. Summary of Construction Impact

107. In summary, adverse impacts due to the construction of the project will be temporary and short-term and can be mitigated in accordance with the EMP to insignificant levels. Low to moderate positive impacts include short-term employment of local population in construction.

E. Impacts related to Operations

108. There is potential for human receptors to be exposed to contaminants in the soil that may become airborne through inhalation of windblown dust. The receptors include both

pedestrians along the roadside footpaths and occupants of the nearby residential area. Workers along the road may also be exposed to contaminants through dermal contact, ingestion, and inhalation of windblown dust. The potential risk will be confirmed through a phase 2 intrusive investigation to be undertaken by the Contractor, and appropriate mitigation developed. Maintaining adequate vegetation cover will manage windblown dust.

109. It is envisaged that the resulting effect along nearby local roads will be reduced congestion and therefore an enhancement of the amenity, thereby attracting new business and customers with positive socio-economic effects. The improved road link, along with completion of the other Yerevan west bypass sections, will induce regional economic growth by enhancing accessibility between the north and south of Yerevan. Regional air quality is expected to improve.

F. Cumulative Environmental Effects

110. 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.

111. Project 2 is one of two projects within Tranche 1. Based on the close proximity of Project 1 to construct a new link between Shirak Street and Argavand Bridge, it is likely that the road traffic disruption and increased construction vehicle movements on surrounding roads will result in cumulative effects which will need to be coordinated and addressed in the Traffic Management Plan. Due to other minor potential impacts associated with the other three projects and their distance from each other, there will be no adverse combined impacts during construction.

112. Combined with the other two road upgrade projects and possible future tranche projects to upgrade road sections, Project 2 will improve the links within the regional through-traffic road network. This will contribute to economic benefits as well as reducing air quality impacts associated with the currently congested road network.

113. There are no other known current or planned construction projects in the vicinity of the project area. As such, there will be no cumulative impacts in this respect.

V. ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

114. Environmental management involves the implementation of environmental protection and mitigation measures and monitoring for environmental impacts. The purpose of the EMP document is to set the framework for ensuring compliance with the ADB's environmental requirements and all applicable Government of Armenia environmental laws, regulations and standards for environmental protection.

115. Environmental protection measures are taken to:

- (i) Mitigate environmental impacts,
- (ii) Provide in-kind compensation for lost environmental resources, or
- (iii) Enhance environmental resources.

116. The plan covers all phases of the project which includes pre-construction, construction, and operation. Provisions set out in the Environmental Management Plan of the EMP will be implemented by the Contractor and monitored by the PIU Environment Specialist.

A. Environmental Management Plan

117. The EMP in Table V.1 summarizes the anticipated environmental impacts as identified in Section IV, mitigation measures, required environmental monitoring activities, and the entities responsible for carrying out those activities together with estimated costs of implementation.

118. The purpose of the EMP is to guide engineers and contractors in the prevention and mitigation of environmental impacts related to construction activities, to guide monitoring by the relevant authorities including the SEI, and to guide the Municipality in the subsequent operation of the road. The EMP:

- (i) Links road works activities, their potential impacts and their prevention or mitigation;
- (ii) Provides the basis for updating by the Contractor prior to commencement of specific identified activities; and
- (iii) Forms the basis for preparing a program of monitoring for checking on compliance with impact prevention and mitigation measures.

119. The Environmental Management Plan and the Environmental Monitoring Plan will be updated during detailed engineering design when more information is available, and will be reviewed and approved by ADB before included in the bid and contract documents. They will then be further refined by the contractor based on the construction contract and thereafter as required by changing conditions.

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
<p style="text-align: center;">Detail Design Phase (To be updated as required by Detail Design Consultant and PPMU & PIU Environment Specialists)</p>				
Fauna investigation	Degradation of flora and fauna species, including protected fauna	<ul style="list-style-type: none"> • Undertake fauna surveys to confirm findings of the preliminary ecological investigation. The investigation is to be first agreed with the MNP and shall be guided by the following: <ul style="list-style-type: none"> ○ Establish a team of qualified and experienced botanists and zoologist. ○ Program fieldwork to collect reliable data. (The timing of the fauna investigation is dependant on the species status; i.e., migrating, nesting, stable habitat, etc. ○ Include in the outputs a site biodiversity and protected species database, detailed descriptions of possible environmental impact, and recommendations for the relevant mitigation measures for inclusion in the Flora and Fauna Management Plan, which includes protected fauna. ○ Develop protection measures and/or a relocation program in consultation with the MNP if the specialist identifies protected species on the site that would be affected. 	<u>PIU</u> Hire specialists	PPMU \$10,000+ for specialist investigation
Hiring of Contractor's labor force	Social impacts from non-local workers	<ul style="list-style-type: none"> • Maximize employment opportunities for local people by employing them as part of the project labor force. 	<u>PPMU</u> Ensure provision is included in bid and contract documents and review bids	Cost savings envisaged
Land acquisition and resettlement	Social impacts associated with land acquisition and resettlement	<ul style="list-style-type: none"> • Implement LARP and social assessment. 	<u>PIU</u> Implement LARP <u>ADB</u> Review	Costed under LARP
Environment protection and preservation of	Protection and preservation requirements do not reflect detail design	<ul style="list-style-type: none"> • Update EMP to reflect detail design and incorporate in bid and contract documents • Include specific requirement in bid and contract documents: <ul style="list-style-type: none"> ○ withholding of payment or penalty clauses, to ensure contractor's 	<u>Detail Design Consultant</u> Update EMP and include appropriate	Detail Design Consultant included in contract

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
archaeology		implementation of environmental and archeological mitigation measures; <ul style="list-style-type: none"> employment of a designated Environmental Specialist and a designated Archeologist to oversee environmental and archeological issues and mitigation; and provision of environmental and archaeological awareness training to all staff and periodic reinforcement training and effectiveness monitoring. 	clauses in bid and contract documents <u>PIU</u> Review updated EMP and bid and contract documents <u>ADB</u> Review updated EMP and bid and contract documents and provide non-objections	PIU included in environmental due diligence budget ADB included in corporate environmental due diligence budget
Construction Phase (To be updated by the Contractor together with the PIU Environment Specialist prior to beginning construction and thereafter, as required)				
		<ul style="list-style-type: none"> Update EMP to reflect contract documents Update EMP to reflect changed conditions 	<u>Contractor</u> Update EMP <u>PIU</u> Review updated EMP <u>ADB</u> Review updated EMP and provide non-objection	Contractor <ul style="list-style-type: none"> included in construction contract PIU included in environmental due diligence budget ADB included in corporate environmental due diligence budget
Construction planning	Damage to utilities and interruption of services	<ul style="list-style-type: none"> Undertake prior to construction a utilities survey for protection and/or relocation of water mains, gas mains, sewers, electricity, and communication lines 	<u>Contractor</u>	Contractor <ul style="list-style-type: none"> included in construction contract
Construction transport planning	Damage to public roads and property	<ul style="list-style-type: none"> Obtain necessary approvals from the Armenian Roads Directorate and Municipality for occupation of roads. Undertake a Pre-Construction Road and Property Dilapidation Survey to document the condition of the road. 	<u>Contractor</u>	Contractor <ul style="list-style-type: none"> Included in construction contract
Construction planning for	Impact to archaeological	<ul style="list-style-type: none"> Obtain necessary approvals from MOC for construction in areas where 	<u>Contractor</u> Hire an archaeologist	Contractor <ul style="list-style-type: none"> \$2,000+ for

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
archaeology	find	archaeological finds have been identified.		archaeologist
Contaminated land investigation	<p>Safety of workers and public</p> <p>Pollution of soil, water, and air</p>	<ul style="list-style-type: none"> • Hire specialists to undertake an investigation on radioactivity in soils at the Davitashen Bridge end of the project. This investigation shall set out requirements for working near these soils and management of contaminated material. • Hire, depending on the outcome of the investigation, specialists to develop a plan, TOR, and outline contract for safe disposal of the soil. • Review the requirements of the investigation and amend other plans as appropriate to reflect the findings – Waste Management and Disposal Plan, Traffic and Access Plan, Emergency Plan for Hazardous Materials, Health, Safety, and Environment Emergency Response Plan. 	<p>Contractor Hire specialist</p> <p>PIU Approve plans</p>	<p>Contractor</p> <ul style="list-style-type: none"> • \$10,000 for Contractor services
Contractor or workers not following environmental requirements	Insufficient environmental controls implemented	<ul style="list-style-type: none"> • Contract to include specific contractual requirement; e.g., withholding of payment or penalty clauses, to ensure contractor's implementation of environmental mitigation measures. • Contract to include the requirement that the contractor has on staff a designated Environmental Specialist to oversee environmental issues and mitigation. • Contract to include the requirement for the contractor to provide environmental induction training to all staff. 	<p>Contractor Monitor environmental parameters and report to PIU.</p> <p>PIU Monitor the Contractor and representative environmental parameters and reports to MNP and ADB through EA.</p> <p>MNP's State Expertise Department³ Monitor the Contractor.</p> <p>ADB Monitor EA/IA based on reports and through periodic missions</p>	<p>Contractor</p> <ul style="list-style-type: none"> • \$5,000 per year Env. Protection team <p>IA/EA monitoring and reporting included in environmental due diligence budget</p> <p>MNP State budget</p> <p>ADB included in corporate environmental due diligence budget</p>
All site activities	Degradation of environment	<ul style="list-style-type: none"> • Prepare and submit, within 30 days of contract effectiveness, the following environmental management sub-plans: 	<p>Contractor Update and implement</p>	<p>Contractor</p> <ul style="list-style-type: none"> • included in

³ Yerevan Municipality is the Implementing Agency (IA) and MNP's State Expertise Department will provide an Environment Specialist to participate in a Program Preparation and Management Unit (PPMU).

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
	<p>Degradation of archaeological, historical, and cultural sites and monuments</p> <p>Deleterious effects on nearby residents from air and noise pollution</p> <p>Health hazards to workers and nearby residents</p>	<ol style="list-style-type: none"> 1. Health, Safety, and Environment Emergency Response Plan 2. Public Relations and Communications Plan 3. Flora and Fauna Plan 4. Physical Cultural Resources Plan 5. Utility Protection and Relocation Plan 6. Drainage, Slope Stability, Erosion, and Sediment Control Plan 7. Construction Work Camps Plan 8. Traffic and Access Plan 9. Spoil Disposal Planning and Management Plan 10. Emergency Plan For Hazardous Materials 11. Vegetation Clearing Plan 12. Dust and Emissions Control Plan 13. Noise Control Plan 14. Waste Management and Disposal Plan 15. Site Reinstatement, Landscaping, and Revegetation Plan <ul style="list-style-type: none"> • Base the sub-plans on the EIA report, bid and contract documents, best international environmental management practices, and as briefly outlined below. 	<p>PIU Review and monitor implementation</p> <p>ADB Review and issue non-objection prior to construction</p>	<p>construction contract</p> <p>PIU included in environmental due diligence budget</p> <p>ADB included in corporate environmental due diligence budget</p>
<p>All site activities</p> <p>Worksite safety</p>	<p>Workers damage environment and archaeological, historical, and cultural sites and</p>	<p>1. Health, Safety, and Environment Emergency Response Plan</p> <ul style="list-style-type: none"> • The purpose of this sub-plan is to document the approach of the general contractor⁴ (GC), subcontractors (SCs), and their workers in the implementation of a training program for construction workers in relation to environmental, archaeological, and occupational health and safety issues. • Training rationale. The implementation of the EMP will require the involvement of all construction personnel. The nature of the EMP is such that 	<p>Contractor Hire training specialist to devise plan and implement training program Record and report environment and safety</p>	<p>Contractor</p> <ul style="list-style-type: none"> • Personal protective equipment – \$5,000 (at \$40/worker) • Security fencing purchased: Metal wire and concrete

⁴ The general contractor is the entity who enters into a contract for the works with the IA and who is responsible, by contract, for the work and conduct of its subcontractors.

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
	<p>monuments.</p> <p>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>	<p>personnel at all levels have a degree of responsibility in relation to environmental, archaeological, and occupational health and safety issues and the implementation of measures contained in the EMP. As such, training for all personnel in relation to environmental issues and the implementation of the EMP will be critical to ensuring the effectiveness of the EMP.</p> <ul style="list-style-type: none"> Training objective. The objective of the training program is to raise the awareness and enhance the skills of the construction workforce in relation to relevant legislation and the four following issues: <ul style="list-style-type: none"> general environmental awareness, including rules and regulations to be followed on the construction site and in the construction camps; general health and safety awareness, including an AIDS/HIV and STD awareness program; job-specific training for workers with responsibility for activities that could have adverse impacts on the environment or humans (e.g., PAH); and requirements for worker personal protective equipment including hard hats, safety boots, high-visibility vests, gloves, eye-glasses and ear defenders, and PAH masks or equivalent, as required. The training should include posters in work camps that illustrate the Red Book species likely to be found in various areas of the project. Contractor should post a progressive penalty plan to discourage the hunting and consuming of wildlife. Blasting. Training should include a module on the safety aspects of blasting (if blasting is contemplated). Topics should include: <ul style="list-style-type: none"> public meetings to introduce the concept of blasting, signs posted that contain times of blasting, alarms prior to blasting, the use of blasting mattresses, and proper handling and storage of explosives. Health risks and prevention. Training should include information and education on sexually transmitted diseases and HIV/AIDS for construction workers as part of the health and safety program at campsites during the construction period. 	<p>incidents to relevant authorities.</p> <p>PIU Review plan and monitor implementation Review incident logs ADB Review and issue non-objection prior to construction</p>	<p>supports - \$36,000 (at 2.2m high - \$36/m). Plus plastic fencing –\$4,000 (\$2-4/m)</p> <ul style="list-style-type: none"> Alternative option is metallic hoarding with concrete supports (at 2m height - \$220-250/m) Other costs covered by labor cost of the construction budget <p>PPMU & PIU included in environmental due diligence budget ADB included in corporate environmental due diligence budget</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<ul style="list-style-type: none"> • 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.. 		
Public consultation and awareness building	Lack of information and understanding by communities and affected parties about the planned works activities and schedule of implementation can lead to frustration and complaints, which could result in delays.	<p>2. Public Relations and Communications Plan</p> <ul style="list-style-type: none"> • The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of a plan to relate to the general public and nearby residents prior to commencing site preparation and construction activities and during construction. • This plan should be consistent with the LARP and social assessment, and should include the following: <ul style="list-style-type: none"> ○ Procedures for communicating with local residents and other nearby receptors developed in advance of activities, particularly when noise, vibration, utility service disturbance, or other nuisances may be generated. ○ Details on the dedicated project phone line. ○ Complaints process developed whereby the public and other stakeholders may make complaints and be assured of receiving responses within a reasonable period, consistent with the requirements of the Grievance Redress Mechanism in ADB's <i>Safeguard Policy Statement</i> (2009). . • Maintain a register of complaints received (name, issue, date, response, date of response, further follow-up action, date closed out). • Hold meetings with community representatives to discuss the project, its impacts, etc. • Provide community leaders and local newspapers with notices on project progress and anticipated issues. • Post clear signs and notices around construction sites to provide project information, including the Contractor's environmental "hot line" number. 	<p>Contractor Hire public liaison and awareness specialist to devise plan and implement awareness and grievance redress program</p> <p>PIU Review plan and monitor the implementation</p> <p>ADB Review and issue non-objection prior to construction Review consultation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> • \$2,000 for advertising and dedicated project phone line • Other costs covered by labor cost of the construction budget <p>PIU included in environmental due diligence budget</p> <p>ADB included in corporate environmental due diligence budget</p>
Construction	Unabated damage to flora and fauna, especially Red Book flora	<p>3. Flora and Fauna Plan</p> <ul style="list-style-type: none"> • The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers to minimize the impact on flora and fauna and to protect areas that contain known Red Book species and Red Book species that are encountered 	<p>Contractor Hire botanist and zoologist to report on extent of Red Book flora and Red Book</p>	<p>Contractor</p> <ul style="list-style-type: none"> • Cost covered by labor cost of the construction budget

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
	species	<p>during construction.</p> <ul style="list-style-type: none"> The plan should comply with MNP policy and the RA laws on flora and fauna and include the following provisions: <ul style="list-style-type: none"> Vegetation removal and site clearing should be undertaken during late autumn and/or winter which are seasons most favorable to avoid impact to protected flora and fauna species. No clearance of vegetation other than that outlined within the plan. If Red Book plant and/or nesting places, burrows, and holes of animals discovered, inform to PIU environmental specialist and MNP for future actions. Reporting any observation of animals on site to the MNP. Contacting an animal rescue centre in the case of an injured animal being found. See also Vegetation Clearing Plan 	<p>fauna respectively and provide recommendations to minimize impact on each.</p> <p>PIU Review plans and monitor the implementation</p> <p>ADB Review implementation reports</p>	<p>PIU included in environmental due diligence budget</p> <p>ADB included in corporate environmental due diligence budget</p>
All site activities	Unabated damage to archaeological, historical, and cultural sites and monuments	<p>4. Physical Cultural Resources (PCR) Plan</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC and SCs 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. The plan should comply with procedures set by MOC. The plan should delineate clearance boundaries to avoid impact on areas of known archaeological and cultural interest. In the event of an archaeological find: <ul style="list-style-type: none"> stop work immediately; notify the PIU; isolate the site; inform the MOC's Department for Protection of Historical and Cultural Monuments and hire an experienced and qualified archaeologist to determine whether and how the chance-find should be preserved; document and photograph the find and area immediately around it; 	<p>Contractor Hire archaeologist to report on extent of archaeological impacts, provide recommendations to minimize impact on each, and supervise excavations, if any. Hire sub-contractors to excavate any chance finds.</p> <p>PIU Review plan and monitor implementation. Provide liaison with MOC</p> <p>ADB Review implementation</p>	<p>Contractor</p> <ul style="list-style-type: none"> \$20,000+ for archaeology specialist supervision and chance-find investigation <p>PIU included in environmental due diligence budget</p> <p>ADB included in corporate environmental due diligence budget</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<ul style="list-style-type: none"> when advised and as directed by the MOC, excavate and remove the find; and resume construction only following clearance from the MOC. 	reports	
Utilities protection and relocation	Disruption to services impacting on end users	<p>5. Utility Protection and Relocation Plan</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC to protect or relocate identified utilities and to manage the protection or relocation of any utilities that are encountered during the construction works. Undertake a utilities survey and prepare a Utility Protection and Relocation Plan in consultation with relevant government agencies, user groups, and service providers. If there is potential for disturbance to services (i.e. cut off for periods), schedule the disturbances to take account of the time of year, week, and day to minimize the disturbance. Notify the potentially affected receptors well in advance of the works. 	<p>Contractor Survey utilities and prepare plan Liaise with local representatives, especially for irrigation facilities, and service providers</p> <p>PIU Review plan and monitor implementation. Assist with liaison with local representatives and service providers</p> <p>ADB Review implementation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> Cost will be determined following completion of survey and development of plan Majority of costs covered by labor cost of the construction budget and service provider <p>PIU included in environmental due diligence budget</p> <p>ADB included in corporate environmental due diligence budget</p>
Earthworks	Erosion of soil and material piles, and discharge of sediment and pollutants into water courses and/or aquifers	<p>6. Drainage, SLOPE STABILITY, EROSION AND SEDIMENT CONTROL PLAN</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of measures to manage erosion and sedimentation caused as a result of the construction activities. One of the main risks to water quality during construction arises from the erosion of soils and the resulting effects of sediment-laden pollutants entering watercourses. Several elements of the construction activities have the potential to cause erosion and generate sediment that can have adverse effects on the surrounding environment in terms of water quality. However, the implementation of the following erosion and sediment control measures should reduce the risk 	<p>Contractor Prepare plan</p> <p>PIU Review plan and monitor implementation.</p> <p>ADB Review implementation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> Plastic sediment fencing— \$3,000 (at \$2-4/m) Grass seeding for temporary ground cover —\$3,000 (at \$0.8/m²) <p>PIU included in environmental due</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<p>of any impacts to an acceptable level:</p> <ul style="list-style-type: none"> ○ Preserve existing ground cover where practicable. ○ Where ground cover is removed and if ground is to be exposed for long periods, provide temporary cover such as fast-growing grass species. ○ Avoid erosion and therefore, generation of sediment-laden runoff, through appropriate siting of works and minimization of exposed areas. ○ Ensure clean runoff is diverted around the construction site where possible. ○ Treat sediment-laden runoff generated by construction activities prior to it entering watercourses. ○ Regularly monitor operation and effectiveness of mitigation measures, record the results, and submit to PIU on a monthly basis. ○ Regularly maintain drains, runoff, erosion and sedimentation protective measures to ensure effectiveness. ○ Inspect and repair or modify drainage structures and erosion controls as soon as practicable after rain events. 		<p>diligence budget</p> <p>ADB</p> <p>included in corporate environmental due diligence budget</p>
Accommodation of workers and equipment and materials storage	Adverse health and aesthetic effects on work force and nearby residents	<p>7. Construction Work Camps Plan</p> <ul style="list-style-type: none"> • The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of measures to manage construction work camps that will be part of the project. • 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 and maximize worker health, safety, and amenity. The following aspects of camp development should be addressed in this sub-plan: <ul style="list-style-type: none"> ○ Definition of elements to be included in construction work camps. ○ Criteria/principles for the location of components of the work camps to minimize soil and water pollution, diseases and possible outbreaks, and conflict situation with villagers, local/central authorities and/or the contractor. ○ Specific management requirements for construction of components of the work camps. ○ Management of camp operation. 	<p>Contractor</p> <p>Prepare plan</p> <p>PIU</p> <p>Review plan and monitor implementation.</p> <p>ADB</p> <p>Review implementation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> • included in construction contract <p>PIU</p> <p>included in environmental due diligence budget</p> <p>ADB</p> <p>included in corporate environmental due diligence budget</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<ul style="list-style-type: none"> See also Emergency Plan for Hazardous Materials. 		
Vehicle movements on and off-site	Dust and emissions Noise and vibration Traffic hazards and safety Dirt and mud carried onto public roads causing traffic hazard and sediment in drainage system Damage to roads from heavy vehicles	<p>8. Traffic and Access Plan</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of measures to manage traffic and access on the construction site during the construction works. The sub-plan will cover vehicle management on and off-site and will include: <ul style="list-style-type: none"> Driver requirements (license, training) and safety requirements. Carefully selected construction vehicle routes including safe entry and exit points. Clear route directions. Designated parking areas. Appropriate signage. Established speed limits. Scheduling of vehicle movements to avoid peak periods where practicable. Traffic diversions on public roads including direction signs, markings, traffic signals, lighting, clearly visible solid barriers to channel traffic, flagmen employed as needed, and maintenance of diversions. Vehicles requirements including covering loads (when carrying sand, soil, spoil and waste material), exhaust attenuators, silencers, regular maintenance of vehicles to prevent fuel and oil leaks to meet national standards requirements and to ensure compliance. Provision for graveled surfaces and vehicle wash facilities at site exits with suitable runoff protection. Inspecting dirt and mud on roads from the construction site and sweeping as needed and when safe. Provisions to use and using water spray of road surfaces to control dust. Undertake a Post-Construction Road Dilapidation Survey and agree the repair or restoration of any roads with Armenian Roads Directorate and the Municipality. Maintain communication with the railway operator and discuss scheduling of construction, risks of work overruns, management and communications. Obtain relevant notification/approvals from the appropriate authorities on construction 	<p>Contractor Prepare plan PIU Review plan and monitor implementation. ADB Review implementation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> Repair and/or restoration of roads to be agreed with the Armenian Roads Directorate and the Municipality Traffic management measures not in environmental budget Road and property dilapidation survey, provisionally \$10,000, however not in environmental budget The road and property dilapidation survey and other costs covered by labor cost in the construction budget <p>PIU included in environmental due diligence budget</p> <p>ADB included in corporate environmental due diligence budget</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		over the railway line.		
Earthworks	<p>Spoil is disposed in inappropriate locations.</p> <p>Topsoil is wasted</p>	<p>9. Spoil Disposal Planning and Management Plan</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of measures to manage spoil generated by the construction of the project. Spoil should be disposed of in locations approved by MNP and local government. Topsoil should be stored for site restoration and in medians. Surplus top soil should be distributed in the area based on recommendations by the local government. 	<p>Contractor Prepare plan Coordinate disposal of surplus soil and excess topsoil with heads of local communities</p> <p>PIU Review plan and monitor implementation. Provide liaison with local communities</p> <p>ADB Review implementation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> included in construction contract <p>PIU included in environmental due diligence budget</p> <p>ADB included in corporate environmental due diligence budget</p>
Handling hazardous substances	<p>Leakage or spillage of diesel or oil may result in the substance to enter the soil, surface water and/or groundwater. These substances are toxic to living organisms.</p>	<p>10. Emergency Plan For Hazardous Materials</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers for the handling, storage, use, and disposal of chemicals and in the implementation of measures in the event of spills or accidental releases of hazardous materials during the construction works. The implementation of the following measures should reduce the risk of any impacts to an acceptable level: <ul style="list-style-type: none"> Develop and implement procedures to ensure safe handling and storage of hazardous substances, e.g., diesel, waste oil. Material safety data sheets, emergency response procedures, and clean-up materials should be readily available on site and their proper use should be part of the workers' training. Spill clean-up materials should be appropriately located and stored to ensure availability. An Emergency Response Team (ERT) that is part of the Environment Protection team should be identified, include an organizational diagram, work and out of hours phone numbers, and reporting lines. Ensure that the ERT receives emergency response training. 	<p>Contractor Prepare plan Dispose of hazardous materials per MNP directive</p> <p>PIU Review plan and monitor implementation. Provide liaison with MNP</p> <p>ADB Review implementation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> \$5,000 – 10,000 for designated materials storage area Spill clean-up material - \$1,245 (at \$83/spill kit) \$1,000 for specialist trainer Other labor costs covered by the construction budget <p>PIU included in environmental due diligence budget</p> <p>ADB included in corporate</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<ul style="list-style-type: none"> ○ Ensure that the ERT and all personnel handling chemicals and hazardous substances receive hazard and risk management training. ○ The area of spill should be cleaned in a timely manner to prevent potential contamination of surface and groundwater and soil and the spilled material, together with contaminated soil and and absorbent materials should be disposed of in a site approved by MNP. ● Only necessary chemicals, hazardous substances, and fuel should be stored on site, within a covered, secure and naturally ventilated area that has an impervious floor and impervious bund around it. The bund should have a capacity of at least 150% of the capacity of the largest tank. ● The storage area should be located away from drainage lines and danger areas. 		environmental due diligence budget
Site clearing	Overclearing of vegetation Clearing of vegetation at times detrimental to fauna habitat	11. Vegetation Clearing Plan <ul style="list-style-type: none"> ● The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers to vegetation clearing activities during construction. The plan should comply with MNP policy and the RA Law on Flora and include the following provisions: <ul style="list-style-type: none"> ○ Guidance on mulching removed vegetation, storage, and use. ○ Storing and managing removed topsoil (graded, stabilized and drained) for re-use for landscaping activities. ○ Vegetation removal and site clearing should be undertaken during late autumn and/or winter which are seasons most favorable to avoid impact to protected flora and fauna species. ○ No clearance of vegetation other than that outlined within the plan. ● See also Flora and Fauna Plan 	<u>Contractor</u> Prepare plan Hire arborist to devise dendro design for tree replanting or replacement Report results monthly <u>PIU</u> Review plan and monitor implementation. Provide liaison with MNP <u>ADB</u> Review implementation reports	Contractor <ul style="list-style-type: none"> ● included in construction contract PIU included in environmental due diligence budget ADB included in corporate environmental due diligence budget
Materials hauling	Excessive dust and air pollution due to vehicle emissions	12. Dust and Emissions Control Plan <ul style="list-style-type: none"> ● The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of measures to control gaseous emissions and dust resulting from the construction activities, including quarry sites, crushing plants, road construction, haulage of materials, and establishment of construction work camps. The management measures in this sub-plan have been developed to minimize potential health and nuisance impacts by 	<u>Contractor</u> Prepare plan Hire local water trucks for dust control Report results monthly	Contractor <ul style="list-style-type: none"> ● included in construction contract

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		incorporating the following principles: <ul style="list-style-type: none"> ○ Preserve existing ground cover where practicable. ○ Provisions to use and using water spray of road surfaces to control dust. ○ Minimize the amount of excavated material held on site and cover all materials wherever possible to prevent generation of dust. ○ Avoid double handling of material. ○ Ensure that vehicles used should be at their maximum load capacity to minimize the number of vehicles and journeys to and from the site. ○ Do not leave construction equipment idling when not in use. ○ Use mains electricity or battery power where possible (or practical for hand tools) rather than diesel. ○ Avoid the use of diesel or petrol powered generators where practicable. ○ Spray aggregate loading point at quarries and crusher plants 	PIU Review plan and monitor implementation. ADB Review implementation reports	PIU included in environmental due diligence budget ADB included in corporate environmental due diligence budget
All site activities	Excessive noise resulting from construction activities	13. Noise Control Plan <ul style="list-style-type: none"> • The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of measures to minimize and manage the impacts of noise generated during construction. • A number of elements of the construction activities have the potential to cause noise impacts. The health effects of noise range from annoyance to hearing impairment and can impact both construction workers and nearby villages or settlements. The management measures in this sub-plan have been developed to minimize potential health and nuisance impacts by incorporating the following principles: <ul style="list-style-type: none"> ○ minimization of noise generation at source; ○ reduction of the transmission of noise from the source to sensitive receivers including nearby villages and settlements and construction workers on the construction site; ○ schedule noisier activities towards the middle of the day where practicable; 	Contractor Prepare plan Report results monthly PIU Review plan and monitor implementation. ADB Review implementation reports	Contractor <ul style="list-style-type: none"> • Noise wall (concrete) \$45,000 (at \$150m²) PIU included in environmental due diligence budget ADB included in corporate environmental due diligence budget

⁵ This time requirement is more stringent than the Armenian standard which sets out a day-time limit of 6am to 10pm and night-time limit of 10pm to 6am, respectively. The standard is Order N138, 6 March, 2002, Order on adoption of N2-III-11.3 sanitary norms "Noise in workplaces, apartment and public buildings, territories of urban construction".

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<ul style="list-style-type: none"> locate noisier activities away from sensitive receptors where practicable; fit vehicles and equipment with silencers to meet national noise standards and regularly check to ensure compliance; install noise control barriers (e.g. solid walls, earth barriers, noise-reflective panels, double-glazed windows) when necessary and practicable to shield houses and other sensitive receptors; construct permanent noise barriers along the site early in construction where indicated in final design and agreed by local village heads; unless agreed with the relevant authorities, noise levels at receptors shall not exceed: <p style="text-align: center;">8am to 8pm (day) – 55dBA L_{Aeq}, 70dBA L_{Amax}</p> <p style="text-align: center;">8pm to 8am (night) – 45dBA L_{Aeq}, 60dBA L_{Amax}^{5}; and</p> provide response mechanism for noise-related complaints. <p>Note: This time requirement is more stringent than the Armenian standard which sets out a day-time limit of 6am to 10pm and night-time limit of 10pm to 6am, respectively. The standard is Order N138, 6 March, 2002, Order on adoption of N2-III-11.3 sanitary norms "Noise in workplaces, apartment and public buildings, territories of urban construction".</p>		
Generating and handling hazardous and non-hazardous substances from all activities - solid waste streams - removed vegetation - spoil - contaminate	Waste and pollutants entering drainage system and/or infiltrating into groundwater Litter in public places Worker and public safety hazard	14. Waste Management and Disposal Plan <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of measures for the management of wastes produced during construction. Several elements of the construction activities have the potential to generate waste that can have adverse effects on the surrounding environment in terms of water quality, soil quality, air quality (odor and pollutants) and human health: Non-hazardous solid waste includes construction waste and domestic refuse. Improper storage, handling, and disposal may cause adverse effects via spills or being carried away by wind or vectors, may affect health and be unsightly. Non-hazardous solid waste can be further divided into putrescible and non-putrescible waste streams. Hazardous solid wastes can have the most severe impacts. A material is hazardous if it is ignitable; corrosive; reactive; or toxic (causing bodily damage, 	Contractor Prepare plan Hire sub-contractors to load and haul wastes to sites approved by MNP PIU Review plan and monitor implementation. Provide liaison with MNP ADB Review implementation reports	Contractor Environmental charge \$150,000 (according to waste categorization under the Armenian Law on Rates of Environmental Charges (2006), Article 3: <ul style="list-style-type: none"> Category 1 – \$133/t Category 2 – \$72/t Category 3 – \$13/t Category 4 – \$4/t Non hazardous – \$2/t) Non-hazardous

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
d spoil liquid wastes		<p>sickness, or death). The following categories of hazardous wastes will potentially be generated by the project:</p> <ul style="list-style-type: none"> ○ Chemical wastes ○ Medical wastes ○ Batteries, paint, and solvents ○ Used oil and grease <ul style="list-style-type: none"> • Wastewater includes wastewater from construction activities (e.g. sediment pond outlets, crushing plant operation), domestic wastewater from activities such as from kitchens or showers (grey water) and may contain pollutants such as grease, soap and mild detergents, and liquid sanitary waste (black water) that contains nutrients, organic substances, and pathogens. • The key waste management philosophy that is applied in this sub-plan is based on the following hierarchy of waste management approaches (highest to lowest priority) <ol style="list-style-type: none"> 1. Avoid waste generation 2. Minimize waste generation 3. Reuse as much waste as practical 4. Recycle as much waste as practical 5. Dispose of any remaining waste in an environmentally suitable manner in locations approved by the MNP • Implementation of this hierarchy, together with the use of appropriate collection, segregation, storage, disposal and education/training methods will ensure that the level of risk associated with waste management is low. <ul style="list-style-type: none"> ○ Maintain the site clear of litter. ○ Hold sewage in sealed tanks for proper disposal. ○ Categorize spoil and other construction wastes in terms of hazard level. ○ Manage hazardous wastes in accordance with the Health, Safety, and Environment Emergency Response Plan and the Emergency Plan For Hazardous Materials ○ Remove wastes from the site regularly to avoid dust and litter generation, attracting pests, and reducing visual amenity. ○ Transport waste in accordance with the Traffic and Access Plan. 		<p>produced during land excavation and construction - \$0.2/t</p> <p>PIU</p> <p>included in environmental due diligence budget</p> <p>ADB</p> <p>included in corporate environmental due diligence budget</p>

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
Site re-instatement of all areas Re-vegetation, landscaping	Construction materials that are not cleared from the site are potential safety hazards Localized flooding from impermeable surfaces if inadequate drainage Sediment and erosion of uncovered areas	<p>15. Site Reinstatement, Landscaping, and Revegetation Plan</p> <ul style="list-style-type: none"> The purpose of this sub-plan is to document the approach of the GC, SCs, and their workers in the implementation of site clearance and restoration, landscaping, and revegetation measures as part of the construction works. The sub-plan should include the following: Clear all construction-related materials and equipment from the site including waste, unused materials, fencing etc. Reinstate natural drainage lines. Landscape site following a plan approved by PIU. Implement check-list to be prepared for final sign-off by PIU. Procedures for planting, maintenance and monitoring to ensure stable growth of trees and groundcover. <ul style="list-style-type: none"> (i) Species MUST be <ul style="list-style-type: none"> endemic to entire site or specific area, readily available (commercially or from seed collection), and relatively easy to propagate. Species should ideally be <ul style="list-style-type: none"> easily seeded (manual or mechanical methods), and relatively easy to maintain. Replant trees and bushes according to dendro design and agreements with heads of affected communities. Plant new trees at a ratio of 10 new trees per 1 tree cut. Maintain new trees until viable or 3 years, whichever comes first as certified by qualified arborist (Note: 80% survival is considered excellent). See also Waste Management and Disposal Plan 	<p><u>Contractor</u> Prepare plan Hire arborist to prepare dendro design Hire landscape contractor to implement plan <u>PIU</u> Review plan and monitor implementation. Monitor tree survival <u>ADB</u> Review implementation reports</p>	<p>Contractor</p> <ul style="list-style-type: none"> Tree planting – \$30,000+ (at \$14/tree) Landscaping with grass – \$3,000 (at \$0.8/m²) Arborist - \$2,000 <p>PIU included in environmental due diligence budget</p> <p>ADB included in corporate environmental due diligence budget</p>

Operation and Maintenance Phase

(If required, to be updated by the PIU Environment Specialist prior to operation of the road)

Table V.1: Summary of Impacts and Proposed Mitigation Measures (Environmental Management Plan)

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
Traffic movements	Noise impacts Air pollutants from vehicle emissions	<ul style="list-style-type: none"> Hire an acoustic specialist to monitor noise on a periodic basis and in response to any complaints. Hire a specialist to monitor air quality associated with vehicle emissions on a periodic basis and in response to any complaints. Identify the need for further investigation or mitigation. 	PPMU Hire acoustic and air quality monitoring specialists	PPMU <ul style="list-style-type: none"> \$5,000 for purchase of air quality monitoring equipment Labor within Municipality budget
Vegetation	Vegetation does not establish	<ul style="list-style-type: none"> Include project area in Municipality of Yerevan vegetation maintenance operations. Monitor the health of vegetation and trees and replace as required. 	Contractor Maintain trees for 3 years after planting Municipality of Yerevan Maintain trees thereafter	Contractor <ul style="list-style-type: none"> As required – part of Site Reinstatement, Landscaping, and Revegetation Plan budget Municipality <ul style="list-style-type: none"> Within Municipality budget

B. Environmental Monitoring Plan

120. The environmental monitoring plan within the EMP is primarily the framework within which environmental monitoring will be conducted. It will guide the PIU in determining if the recommended mitigation measures during the pre-construction, construction and operation phases are being implemented effectively. The basic framework for EMP monitoring is provided in Table V.2. In addition to the responsible entities below, each item will be monitored by the PIU Environment Specialist monthly, or at a frequency deemed appropriate. Quarterly reviews will also be undertaken of Contractor records to satisfy that monitoring has been undertaken, as appropriate.

121. Environmental monitoring results will be documented to record that signs of adverse impacts are detected at the earliest time practicable. Where monitoring results do not meet the environmental performance indicator, action taken will also be recorded. Monitoring results will be reported monthly by the PIU Environment Specialist to the Municipality of Yerevan (as the IA), who will compile the monthly reports into semi-annual reports to the ADB. Annual reporting and end of phase reporting will be undertaken for submission to the PPMU head, who will in turn submit to MNP for endorsement and to the ADB.

122. The format for the monthly and annual environmental monitoring report will be developed during project implementation by the PIU Environment Specialist.

Table V.2: Monitoring Requirements – Site Preparation and Construction

Location / Activity / Phase (as relevant)	Parameters to be monitored	Monitoring location/s	Method of monitoring	Environmental performance indicator	Responsible entities	Frequency (formal monitoring)
Construction Phase (To be updated by the Contractor together with the Environment Specialist prior to beginning construction and thereafter, as required)						
Construction of rail overpasses and all works within 50m of a sensitive receptor	Noise	To be agreed by the Contractor and PIU Environment Specialist as identified in the Noise and Vibration Management Plan	Noise meter	Maximum at monitoring location: - 8am to 8pm (day) – 55dBA L_{Aeq} , 70dBA L_{Amax} - 8pm to 8am (night) – 45dBA L_{Aeq} , 60dBA L_{Amax} Or as agreed with the relevant authority ⁶	Contractor Hire specialist to monitor PIU Review complaints and monitoring records	To be developed in the Noise and Vibration Management Plan
All areas	Noise	To be agreed by the complainant, contractor and PIU Environment Specialist	Noise meter Review complaints records, monitoring records			If complaint received Monthly review
Waste management and disposal	Solid waste (general domestic, construction, hazardous)	Designated waste receptacles All site areas	Visual inspection	No litter No waste outside designated areas	Contractor Spot-check PIU Monitor results	Ongoing Formally weekly
Material stockpiles	Stockpiled material	Stockpile locations	Visual	Within designated area Stockpiled correctly Topsoil stockpiled correctly and not within drainage line	Contractor Spot-check PIU Environment Specialist	Weekly Monthly
All areas	Slope protection and drainage Run-off control	Site boundary and downhill	Visual and by sample, if required	Water released is clear and does not exceed USSR standard <i>Integrated list of MPCs and nearly safe levels of influence of pollutants on water in fishing reservoirs</i> for Total suspended solids (TSS) being < 30mg/l	Contractor PIU Review records	Weekly Monthly Following a rain event

⁶ This time requirement is more stringent than the Armenian standard which sets out the day-time limit of 6am to 10pm and night-time limit of 10pm to 6am, respectively. The standard is Order N138, 6 March, 2002, Order on adoption of N2-III-11.3 sanitary norms "Noise in workplaces, apartment and public buildings, territories of urban construction".

Table V.2: Monitoring Requirements – Site Preparation and Construction

Location / Activity / Phase (as relevant)	Parameters to be monitored	Monitoring location/s	Method of monitoring	Environmental performance indicator	Responsible entities	Frequency (formal monitoring)
				No evidence of erosion Drainage control measures in place		
Secured construction sites/camps	Security fence	Boundary	Visual	Security fence maintains integrity	<u>Contractor</u> Check entire length PIU Environment Specialist	Weekly Monthly
Transportation	Dust Vehicles covered if transporting domestic wastes, soil, spoil, sand and other materials	All site areas	Visual	No visible suspended dust Vehicles covered	<u>Contractor</u> Check PIU Environment Specialist	Ongoing and weekly inspection Daily during earthmoving activities Monthly
All site areas	Air pollution – dust	Representative boundary between road and adjacent residence/s	Dust deposition gauge or other method approved by PPMU (e.g., sticky pad, gravimetric)	Dust deposited below 0.15 mg/m ³ daily average in accordance with standard <i>Maximum Permissible Concentration (MPC)</i> for Ambient Air in Human Settlements, Republic of Armenia government decision N160-N, 02/02/2006.	<u>Contractor</u> Monitor and report PIU Review report records	Samples analyzed monthly Monthly
Traffic and road safety	Mud and dirt on public roads	Site exits	Visual inspection	No mud and dirt on public roads Vehicles leaving site: (i) loads covered (ii) tires do not contain excessive mud/dirt	<u>Contractor</u> Check PMU Spot check	Daily Monthly
Traffic and	Traffic diversion measures and	Public roads	Visual and records	Measures in place in accordance with the Traffic	<u>Contractor</u>	When measures/signage is

Table V.2: Monitoring Requirements – Site Preparation and Construction

Location / Activity / Phase (as relevant)	Parameters to be monitored	Monitoring location/s	Method of monitoring	Environmental performance indicator	Responsible entities	Frequency (formal monitoring)
road safety	signage			and Transport Management Plan No accidents	Check facilities PMU Spot check	installed Monthly
Work site safety	Personal protective equipment Knowledge of procedures, points of contact	All workers	Visual Question a sample of workers as specified in Health, Safety and Environment Emergency Response Plan	Personal protective equipment worn Demonstrated knowledge of workers Safety signage appropriately displayed	Contractor Conduct awareness testing and report results PIU Review results	Ongoing and weekly Monthly report Monthly
Public relations	Public notices around the site Complaints register	At gates	Visual	Notices in place Complaints documented per requirements of the Grievance Redress Mechanism in ADB's <i>Safeguard Policy Statement</i> (2009) Complaints resolved and resolutions recorded	Contractor Keep log and report PMU Review reports	Monthly If complaint received
Handling hazardous materials	Hazardous materials	Designated hazardous material storage area All site areas	Visual	Appropriately stored and in designated areas	Contractor Keep inventory current PMU Check inventory	Weekly Monthly
Revegetation	Vegetation cover	All soil exposed surfaces	Visual	Exposed soils for extended periods	Contractor PMU Spot check	Monthly
Revegetation	Vegetation	All soil exposed	Visual	Revegetation as per Landscaping and Site	Contractor	As required at the end

Table V.2: Monitoring Requirements – Site Preparation and Construction

Location / Activity / Phase (as relevant)	Parameters to be monitored	Monitoring location/s	Method of monitoring	Environmental performance indicator	Responsible entities	Frequency (formal monitoring)
for site re-instatement		surfaces		Reinstatement Plan	PMU Check compliance with Sub-plan	of works until signed off as acceptable
Site rehabilitation	Waste Drainage lines	All sites as construction is completed	Visual	Waste, materials and equipment removed Drainage lines reinstated	Contractor PIU Ensure compliance with check-list	As required at the end of works until signed off as acceptable
Records and reporting	Inspection checklist Complaints log Consultation record Training records Licenses, approvals, permits	Recorded information	Visual review	All available, recorded correctly, any follow-up has been carried out as required	Contractor PIU Environment Specialist to EA via PIU head and PPMU director. EA Report to ADB	Monthly Bi-annually

Operation and Maintenance Phase

(To be updated by the PIU Environment Specialist prior to operation of the road if required)

Location / Activity	Parameters to be monitored	Monitoring location/s	Method of monitoring	Environmental performance indicator	Responsible entities	Frequency
Landscape d areas	Landscaping	Landscaped areas	Visual	No dead trees No exposed soils	Contractor for period specified in contract Municipality of Yerevan thereafter	Quarterly over the first 2 years then bi-annually for the next 2 years

123. Although monitoring will be formally undertaken at a frequency specified in Table V.2, visual observation should be undertaken by all workers (especially supervisors and other trained personnel) on a daily basis and during key activities, and any potential or actual issues reported to PIU's Environment Specialist.

C. Institutional Arrangements and Responsibilities

1. Institutional Arrangements

124. The Ministry of Economy is the Executing Agency (EA) of Project 2 and the Municipality of Yerevan is the Implementing Agency (IA) for the other projects within Tranche 1 of this MFF. The Municipality will establish a Program Preparation and Management Unit (PPMU) to manage and monitor all implementation activities of the program and the projects with the assistance of the Project Management Facility and the Yerevan Development Project Implementation Unit (Yerevan PIU). The role of Yerevan PIU is to manage day-to-day coordination, implementation, monitoring, and administration activities of individual projects through a Program Implementation Team including expertise in social and environmental safeguards and whose Environment and Resettlement Specialists are to provide immediate oversight for environmental and social safeguards.

2. Responsibilities

125. The Program Preparation and Management Unit (PPMU) of the Implementing Agency's (IA's):

- (i) Establish a safeguard unit that includes a PPMU Environment Specialist for at least the duration of Tranche 1, preferably for the duration of the Program, and ideally as the core for future projects that involve environment safeguards;
- (ii) Manage and monitor the Yerevan PIU safeguard unit; and
- (iii) Report regularly to the ADB.

126. The Yerevan Development Project Implementation Unit (Yerevan PIU):

- (i) Establish a safeguard unit that includes a PIU Environment Specialist for at least the duration of Tranche 1, preferably for the duration of the Program, and ideally as the core for future projects that involve environment safeguards; and
- (ii) Report regularly to the IA.

127. The IA's Environment Specialist (PIU Environment Specialist):

- (i) Assist the Yerevan PIU in procuring the Contractor, in particular, ensure that bid and contract documents include specific environmental safeguard provisions that reflect the IEE EMP;
- (ii) Work with the Contractor in further developing an EMP based on the IEE EMP;
- (iii) Assist the Contractor to provide environmental awareness training to site supervisors and workers;
- (iv) Support the PPMU Environment Specialist in implementing mitigation measures as specified in the EMP;
- (v) Undertake monitoring activities as specified in the IEE EMP;
- (vi) Report on compliance with ADB and Government of Armenia requirements;
- (vii) Be a point of public contact for any complaints or concerns;

- (viii) Respond to emergencies and notify the relevant authorities within reasonable times; and
- (ix) Keep updated with changes in authority requirements and legislation and respond as appropriate.

128. *The Contractor:*

- (i) Hire the services of a Contractor Environment Specialist;
- (ii) Update the IEE EMP based on the actual contract and thereafter based on actual conditions prevailing on site;
- (iii) Implement the construction phase components of the EMP;
- (iv) Support the PPMU/PIU Environment Specialist in implementing various components of the EMP including the provision of training and monitoring; and
- (v) Respond to emergencies and notify the PPMU/PIU Environment Specialist and emergency authorities.

129. *Independent Environment Specialist:*

- (i) Monitor compliance of the project with the EMP and any other authority requirements.

3. **Recommended Environmental Safeguard Clauses for Civil Works Contracts**

Clause 1 – Environmental Safeguards

130. The Contractor shall:

- (i) Provide facilities for the on-site Environment Specialist;
- (ii) Allow access to the site for environmental inspection at any time requested, pending completion of appropriate safety training;
- (iii) Undertake the following investigations prior to construction:
 - a. Utilities survey for protection and/or relocation of water mains, gas mains, sewers, electricity and communication lines;
 - b. Road dilapidation survey; and
 - c. Comprehensive ground investigation including a phase 2 contaminated land investigation.
- (iv) Prepare a detailed EMP based on the measures outlined in the IEE report and incorporating the following operating plans:
 - 1. Health, Safety, and Environment Emergency Response Plan
 - 2. Public Relations and Communications Plan
 - 3. Flora and Fauna Plan
 - 4. Physical Cultural Resources Plan
 - 5. Utility Protection and Relocation Plan
 - 6. Drainage, Slope Stability, Erosion and Sediment Control Plan
 - 7. Construction Work Camps Plan
 - 8. Traffic and Access Plan
 - 9. Spoil Disposal Planning and Management Plan
 - 10. Emergency Plan For Hazardous Materials
 - 11. Vegetation Clearing Plan
 - 12. Dust and Emissions Control Plan
 - 13. Noise Control Plan

14. Waste Management and Disposal Plan
 15. Site Reinstatement, Landscaping, and Revegetation Plan
- (v) Implement the EMP and operating plans, including undertaking monitoring, maintenance, reporting etc. Any departure from the EMP must first be agreed in writing with the PPMU Environment Specialist and be approved by relevant authorities and ADB;
 - (vi) Execute, upon work completion, all work necessary to reinstate all unconstructed areas of the site as near to its original condition. This work will be complete when the PPMU Environment Specialist provides written certification of reinstatement to a reasonable level.

D. Cost of Implementation

131. The cost of environmental monitoring will be that required for the remuneration of staff involved in EMP activities and their traveling expenses as well as any direct cost for monitoring activities.

132. The monitoring plan does not include periodic monitoring to obtain specific measurements, such as noise level and, air quality or water quality. However, if any unexpected impact or complaint arises it is recommended that the Environment Specialist take the necessary action in coordination with the PIU. It is recommended that the PIU set up a working arrangement with the relevant Government agency to use its facilities and/or equipment in taking samples for analyses and/or in the analyses, whichever is/are applicable.

VI. CONSULTATION AND INFORMATION DISCLOSURE

A. Stakeholder Meetings

133. Meetings were held with representatives of a number of stakeholder groups and will be ongoing with the same and different stakeholder groups during the preparation of other projects planned to be funded under the MFF.

134. Stakeholder meetings as at the date of this report include:

- (i) Ministry of Economy – the Executing Agency
- (ii) Municipality of Yerevan - the Implementing Agency
- (iii) Yerevan Development Project Implementation Unit (Yerevan PIU)
- (iv) Ministry of Nature Protection
 - o Department of Economics
 - o Environmental Protection Department
- (v) Ministry of Culture
 - o Agency for Protection of Historical and Cultural Monuments
 - o Department of Cultural Heritage
- (vi) Non-government organizations (NGOs)
 - o Public Environmental Alliance (an alliance of NGOs)
 - o Association for Sustainable Human Development.

B. Public Consultation

135. An advertisement (see Appendix 5) was placed in The Armenian Times newspaper and on the Municipality of Yerevan website and sent directly to key authority stakeholders inviting interested persons to a formal public consultation event on Friday 19 March 2010 at Yerevan Municipality. Amongst the attendees were fifteen recorded representatives of relevant government agencies and NGOs; and members of the general public (see Appendix 5). The following summarizes issues raised and discussed:

- (i) Trees that will be cut down;
- (ii) Uncovering new historical monuments during excavation; and
- (iii) Sustainability of the projects and greater program.

136. ADB's Social Safeguards Specialist generally addressed resettlement and compensation questions.

C. Information Disclosed

137. The IEE will be made publicly available on the ADB website (in English only) and an EIA in the Armenian language will be submitted to the MNP and made publicly available on the MNP and the Municipality of Yerevan websites. This will ensure the disclosure of environmental concerns and proposed mitigation measures to the relevant authorities and other interested parties.

D. Future Consultation

138. A workshop will be held in early May 2010 and will provide a platform to discuss the projects with key stakeholders. The four projects will be assessed during this workshop by participating stakeholders with concerns and issues captured and where appropriate further actions taken to alleviate concerns raised at the event. The display material from the workshop will remain within the foyer of the Municipality building for public viewing.

139. Under Armenia's EIA legislation, the EIA will be subject to public hearings conducted by the MNP '... for the public opinion, the opinions of affected community leaders, the opinions of affected communities, and relevant state bodies.'

VII. FINDINGS AND RECOMMENDATIONS

140. Based on the environmental screening carried out for the IEE study, the proposed project is unlikely to cause significant, irreversible adverse impacts on the environment.

141. The benefits of the project will include:

- (i) Reduced traffic congestion, thereby reducing air pollution, and improved safety once operational;
- (ii) Economic benefits by generating employment opportunities during construction;
- (iii) Long-term regional improvements in air quality;
- (iv) Landscaping on the shoulders and median to improve ecological value and amenity;
- (v) Dumped waste removed from the area; and
- (vi) Removal of trees from publicly owned land will be replaced by a ratio of 10:1.

142. The potential adverse impacts that are associated with location, design, construction, and operation of the project will be of low magnitude and localized, and can be mitigated to acceptable levels without difficulty. The impacts during constructions will be temporary and can be minimized by following the construction management and supervision outlined in the EMP.

143. It is recommended that:

- (i) The clauses set out in the EMP be included in the Bid Documents and Contract Documents;
- (ii) The Contractor prepare a detailed EMP based on the EMP contained in this IEE;
- (iii) The IA, the PPMU, and the PIU ensure that the impact prevention and mitigation measures specified in the IEE and EMP be implemented; and
- (iv) Environmental monitoring be carried out as specified in the monitoring plan within the EMP.

144. All project activities prior to construction, during construction, and during operation will be monitored in accordance with relevant Government of Armenia regulations and ADB policy.

VIII. CONCLUSIONS

145. Based on the indication of the Rapid Environmental Assessment in Appendix 1 and the findings of the IEE, the classification of the subproject as Category “B” is confirmed, and no detailed EIA will be needed to comply with the environmental policies of the ADB. Any additional studies proposed or deemed necessary based on site conditions not yet known are expected to result in mitigation measures that are routine and can be easily incorporated within the construction schedule. Accordingly, the IEE with the recommended institutional arrangements and monitoring program given in the EMP will become the completed Environmental Assessment.

Nuisance impacts, including noise, dust, traffic and access changes, are likely to be experienced by nearby receptors during construction. Key benefits of this project include a reduction in traffic congestion; economic benefits; and improvements to air quality once operational.

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APPENDIX 1

Rapid Environmental Assessment (REA) Checklist Roads and Highways

Instructions: <ul style="list-style-type: none"> ❑ This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional and Sustainable Development Department. ❑ This checklist is to be completed with the assistance of an Environment Specialist in a Regional Department. ❑ This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on (i) involuntary resettlement, (ii) indigenous peoples planning, (iii) poverty reduction, (iv) participation, and (v) gender and development. ❑ 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 / Yerevan Sustainable Urban Transport Project

Shirak Street - Artashat highway

Sector Division: Roads and Highways

Conducted by / date: Arman Vermishyan and Klaus Schonfeld, 26 Jan 2010

Naomi Hull and Klaus Schonfeld, 10 Feb 2010

Naomi Hull, Davit Yavruyan, and Klaus Schonfeld, 17 Mar 2010

SCREENING QUESTIONS	Yes	No	REMARKS
A. PROJECT SITING			
Is the Project area adjacent to or within any of the following environmentally sensitive areas?			
1. Cultural heritage site	X		A suitable separation wall will be constructed to shield the cemetery from the noise and dust of the near-by road.
2. Protected area		X	
3. Wetland		X	
4. Mangrove		X	
5. Estuarine		X	
6. Buffer zone of protected area		X	
7. Special area for protecting biodiversity		X	
B. POTENTIAL ENVIRONMENTAL			

SCREENING QUESTIONS	Yes	No	REMARKS
IMPACTS			
Will the Project cause...			
1. Encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?		X	
2. Encroachment on precious ecology (e.g. Sensitive or protected areas)?		X	
3. Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?		X	
4. Deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?		X	No surface water bodies. Discharges onto surrounding land that may affect groundwater will be minimized through routine mitigation measures during construction as set out in EMP.
5. Increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	X		Routine mitigation during construction as set out in EMP.
6. Noise and vibration due to blasting and other civil works?	X		Routine mitigation during construction as set out in EMP.
7. Dislocation or involuntary resettlement of people	X		Land Acquisition and Resettlement Plan (LARP) refers.
8. Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?		X	Generation of dust, which is a normal occurrence during this kind of construction, will be minimized through routine mitigation measures as set out in EMP
9. Hazardous driving conditions where construction interferes with pre-existing roads?	X		Routine mitigation during construction as set out in EMP.
10. Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations?	X		Routine mitigation during construction as set out in EMP.
11. Creation of temporary breeding habitats for mosquito vectors of disease?		X	

SCREENING QUESTIONS	Yes	No	REMARKS
12. Dislocation and compulsory resettlement of people living in right-of-way?	X		LARP refers.
13. Accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials and loss of life?		X	While improved roads are expected to result in increased traffic volumes, better alignment, surfacing, signage, and controls (traffic lights) are expected to result in overall decrease of accident risks.
14. Increased noise and air pollution resulting from traffic volume?	X		Routine mitigation during construction as set out in EMP.
15. Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?		X	No surface water bodies. B.13 also refers.

APPENDIX 2

PHASE 1 CONTAMINATED LAND INVESTIGATION

Project 2 - Shirak Street to Artashat Highway

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X. INTRODUCTION

A. Background

This Phase 1 contamination investigation has been undertaken for Project 2, the Shirak Street to Artashat Highway Road Link as part of Tranche 1 of the Yerevan Sustainable Urban Transport Program. This is a program being implemented by the Government and the Municipality of Yerevan in conjunction with the Asian Development Bank (ADB).

This investigation's focus is on the Shirak Street extension section of the project which is a new section of road along an existing right-of-way through a predominantly industrial area, including Nairit Plant (a rubber product manufacturing facility); and a 400m section along Artashat Highway to the crossing railway line. Constructing the road would require excavation. The key components of this extension include:

- New half-clover interchange at Shirak Street/Arshakuniats Avenue;
- New overpass of the railway line to adjoin Shirak Street;
- New section of four-lane divided road to extend Shirak Street to meet with Artashat Highway. Sections of Nairit Plant wall on both sides will be removed and replaced to accommodate the new road;
- New T-shaped intersection at the Shirak Road extension onto Artashat Highway. Depending on traffic volumes, consideration will be given to either a roundabout or traffic lights at this intersection;
- Widening of Artashat Highway between the end of the Shirak Street extension and Noragavit 1st Street from four to six-lanes and a possible service road for the Noragavit neighbourhood; and
- New overpass of the railway line that crosses Artashat Highway

B. Scope of Work

The scope of works comprised:

- Review of existing information;
- A site visit;
- Review of industry profiles guidance;
- A preliminary qualitative environmental risk assessment; and
- Providing a brief for further investigation.

C. Sources of Information

There was very little information available for this investigation. The information has been taken from the following sources:

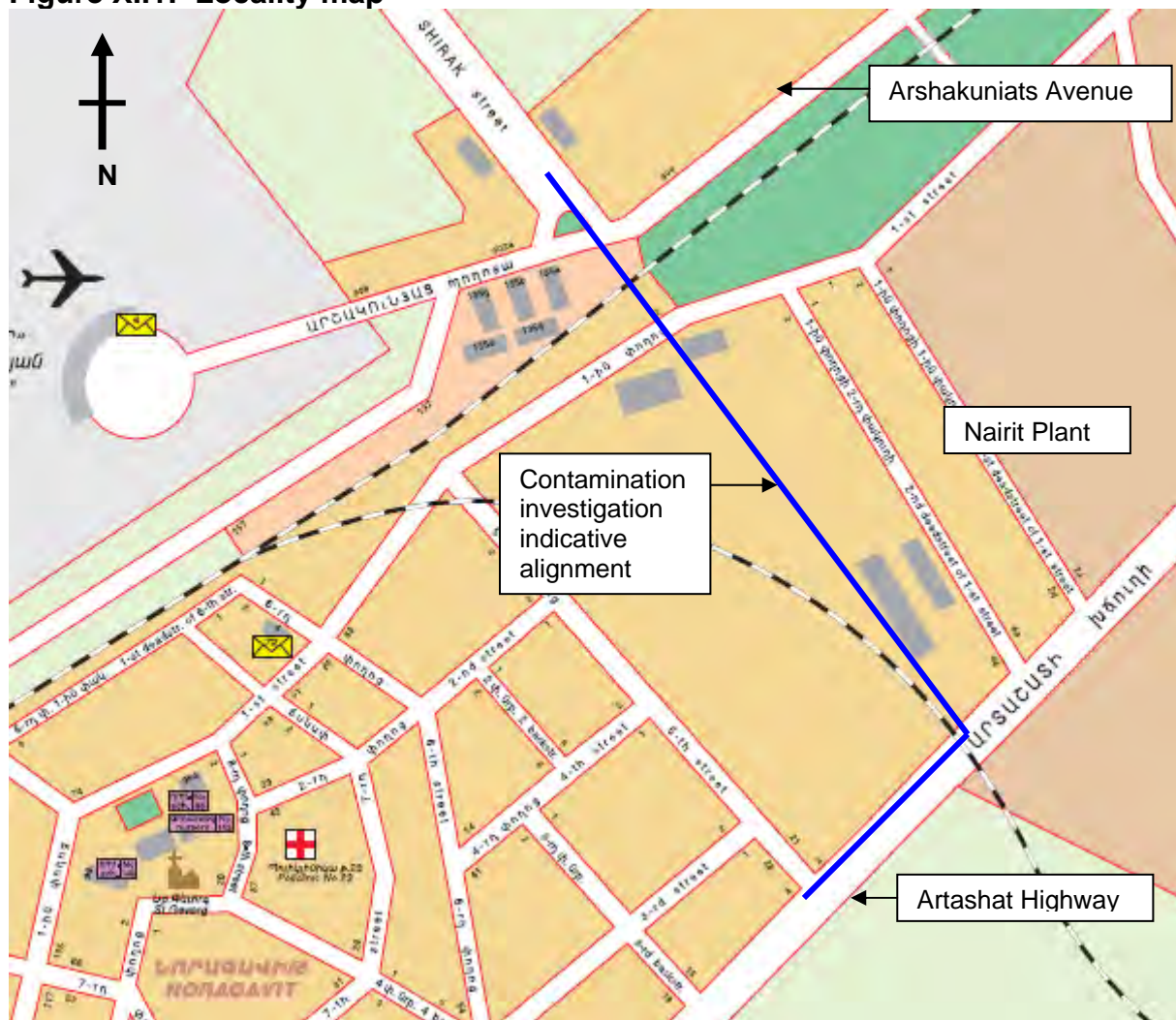
- A review of aerial photography;
- The Initial Environmental Examination report prepared for the project; and
- A site visit.

XI. ENVIRONMENTAL SETTING

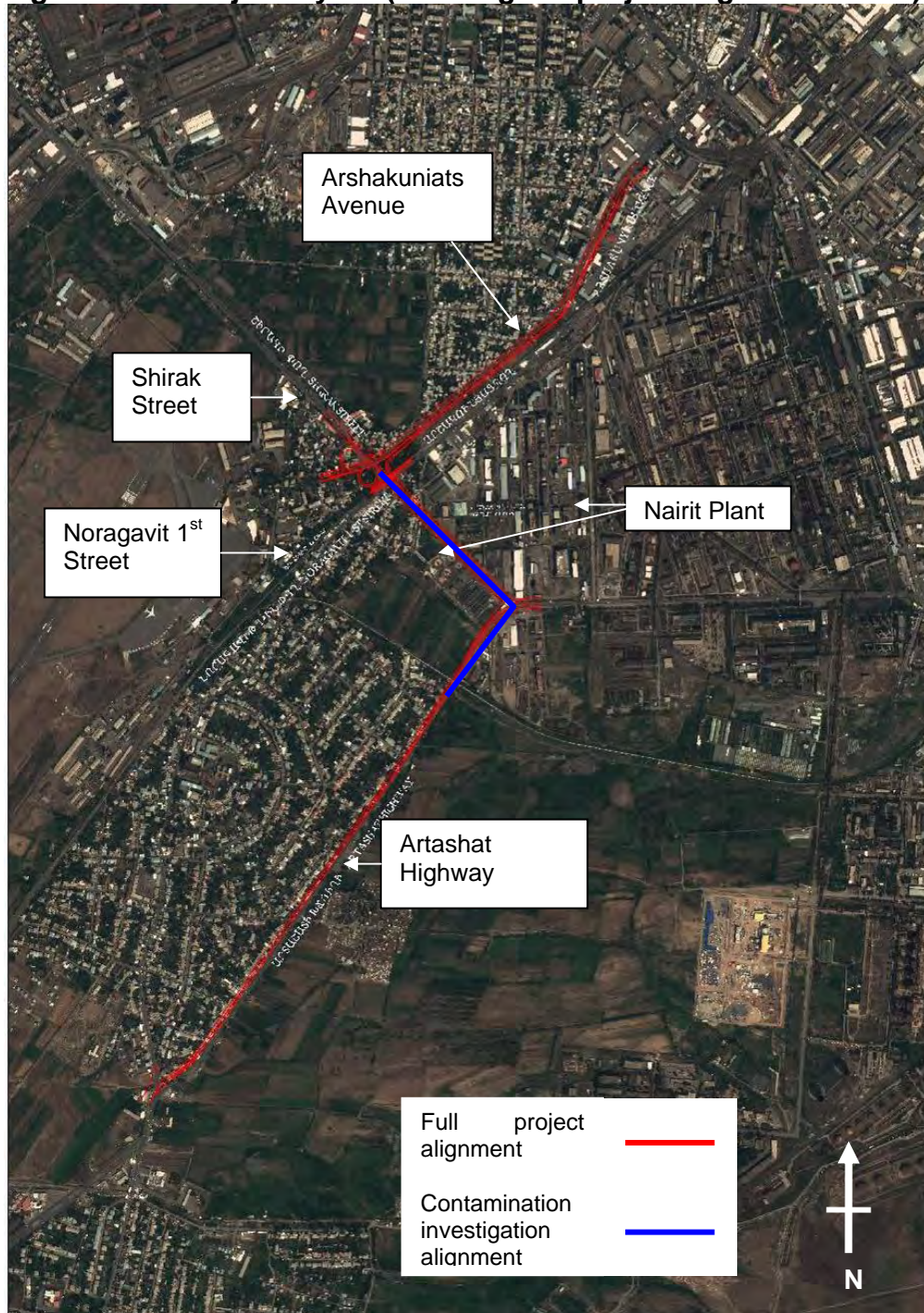
A. Site Location

The site is located in Yerevan's Shengavit district, approximately 6 km south-west of Yerevan City centre near the areas of Shengavit and Noragavit. The site location and a section of the proposed road alignment is shown in **Figure XI.1** and **Figure 2.2**.

Figure XI.1: Locality map



Source: Collage (2001)

Figure XI.2: Project layout (showing full project alignment in red)

Source: Municipality of Yerevan (2010)

B. Site Description

The site comprises a linear strip of land located within an industrial area between Shirak Street and Artashat Highway. The site also includes approximately 350m of Artashat Highway to the point at which it is crossed by the railway line. The alignment follows a previously established right-of-way ('red lines'), as indicated in the Yerevan Urban Master Plan (Yerevan Municipality, 2004). Activities both within and adjacent to the project footprint of the alignment have been investigated.

Site visits were undertaken on 10 and 24 February 2010. These site visits were undertaken from publicly accessible areas only.

The Arshakuniats Avenue end of the site comprises a small parcel of vacant land, an industrial railway line and Noragavit 1st Street. There is a pocket of residential and other associated buildings, reportedly constructed without Municipal approval, that sit within the alignment. Trees and a small orchard are associated with these residential properties. Above-ground gas pipes run across the site. The Noragavit residential area extends on either side of the site.

The remainder of the Shirak Street extension section is located within a transport corridor which walled on both sides. Sections of the walls will be shifted to accommodate the new road alignment. The corridor contains a dirt track containing dumped rubble and domestic waste. No significant vegetation is present within the dirt track or remainder of Shirak Street.

On both sides of the Shirak Street extension corridor is the Nairit Plant, an industrial factory which mainly manufactures rubber products (locally referred to as 'caoutchouc'). It was noted by visual inspection that the western side of the alignment contains a liquid treatment plant, liquid storage tanks and other infrastructure. The east contains chimneys, administration buildings, large buildings likely to be assembling plants and other infrastructure. The facility contains apparently abandoned and derelict infrastructure, however the site is still operational.

Nairit Plant is bordered by Arshakuniats Avenue to the west; Tamantsiner Street in the north; beyond Artashat Highway in the east; and just beyond the alignment of the Shirak Street extension and into the Noragavit neighborhood community to the south.

The Nairit Plant website indicates that it currently operates in the following lines:

- Production of chlorine and caustic soda;
- Production of acetylene from natural gas;
- Production of chloroprene from butadiene; and
- Rubber production.

Production lines of chloroprene and monocarboxylic acids are currently not in operation; however preparatory works for restarting these production lines are being carried out.

A small fuel filling station sits on the southern extent of the alignment of the Shirak Street extension where it meets Artashat Highway. Artashat Highway is bordered by Nairit Plant on the east and vacant land on the west until where the railway line crosses over the road approximately 350m south.

The Master Plan indicates that soils along the alignment contain concentrations of heavy metals (including chromium, nickel, zinc, copper, cobalt, molybdenum and silver) which are elevated when compared to background concentrations. Significant concentrations of metals have been recorded in areas which have been occupied by industrial land uses, although information in the Master Plan suggests that such contamination is localized.

C. Potential Contamination Sources

Potential contamination sources observed along the alignment, but not associated with Nairit Plant, include:

- Dumped waste along the route;
- Fuel station on Artashat Highway;
- Railway line across the Shirak Street extension alignment and across Artashat Highway;

- Small orchard which may have been sprayed with pesticides; and
- Residential and other buildings which may not be connected to the Municipal sewerage system.

Potential contamination sources observed within and likely to be associated with the Nairit factory, include:

- Above-ground liquid storage tanks;
- Liquid treatment plant (reportedly a sewage treatment plant but now used occasionally for treatment of other liquids). The smell of sulfur was noted during both site visits;
- Chimneys;
- Gas pipes and liquid pipes;
- Derelict buildings that may contain asbestos material in the building fabric;
- Chemical use areas including process areas and laboratories;
- Chemical waste store;
- Underground fuel storage;
- Uncontrolled waste/equipment dumping and burning;
- Automotive workshops/garage; and
- Electrical transformers.

D. Geology, Hydrogeology and Hydrology

The geology is based on a geological borehole investigation of the subject site, believed to have been undertaken in the 1980s; and the Yerevan City Master Plan Vol.5 (2004). The geology beneath the investigation site consists of late-quaternary lake/alluvial sediments. The boreholes, which measured up to 9m deep, records soils to comprise interbedded clay and sand with a variable proportion of gravel (approximately 20-30%). The clay content of the soils recorded by the investigation should limit the downwards migration of contaminants into groundwater.

Groundwater beneath the majority of the Artashat Highway is at depth of 5-10m. The direction of groundwater flow is not known but may reasonably be expected to flow towards the Hrazdan River to the north. There is no other information available about groundwater, and abstractions along or near the site are unknown.

There are no surface water bodies close to the alignment. The closest point of the Hrazdan River is approximately 2.5km north of the northern extent of the alignment where it then flows into the Yerevan Lake approximately 400m further north.

The Master Plan indicates that there is a low risk of flooding in the vicinity of the project site. The Hrazdan River is highly regulated to control flood risk.

XII. HISTORICAL LAND USE

A. Records from Historical Maps

Historical maps were not available for this review.

B. Records from Other Sources

The Nairit Plant website includes a history of activities at the site. Table XII.1 contains the history of plant operations⁷.

Table XII.1: History of the Nairit Plant operations

Year	Operations
1933	Order to start in Yerevan the construction of a plant for large-scale production of chloroprene rubbers from calcium carbide.
1936	Start-up of calcium carbide production line with the capacity 20 thousand tons/year.
1939	Start-up of workshops, producing caustic soda, chlorine and synthetic hydrochloric acid, capacity- 7 thousand tons/year.
1940	Start-up of monovinyl acetylene, chloroprene rubbers production with the initial capacity of 7 thousand tons/year (full capacity -14.0 thousand tons of "Sevanit" (rubber) a year, produced by mass polymerization).
1942	Rubber output increased 1.4 times.
1951	Instead of Sevanit production, Nairit SR line by emulsion polymerization is put into operation. The full capacity of MVA (monovinylacetylene) equal to 16 thousand tons/year is attained in 1952.
1952	Start-up of chlorobenzene production by continuous method (Bergman's method).
1958	Start-up of carbon dioxide snow plant.
1961	Increase of chloroprene rubber production capacities up to 32.5 thousand tons/year, later to 45.0 thousand tons/year. Start-up of commercial latexes production (3.2 thousand tons/year).
1962	Start-up of liquid carbon dioxide plant (7 thousand tons a year). Plant of instrument and process air with the full capacity of 8200 m ³ /hour and 4000 m ³ /hour respectively, is put into operation.
1963	Reconstruction of synthetic hydrochloric acid plant with the full capacity of 47.7 thousand tons of gas a year and 30 thousand tons of acid a year.
1964	Reconstruction of caustic soda evaporation unit with the full capacity of 66 thousand tons of 100% caustic soda a year.
1965	Start-up of natural gas-based acetylene production. Cold production (-30°C) with the full capacity of 5 x 106 kcal/hour is put into operation.
1966	Two units for methane pyrolysis with the full capacity of 15 thousand tons a year each are put into operation. Expansion of rubber production capacities to 50.5 thousand tons a year.
1966	Reconstruction of chloroprene and MVA production units with expansion of rubber production capacities from 1967 to 75 thousand tons a year. Capacity of 74 thousand tons a year is attained in 1970.
1967	Effluent homogenization and neutralization production unit is put into operation.
1967	Chemically pure hydrochloric acid production unit with the capacity of 4000 thousand tons a year is put into operation. Start-up of unit N3 in acetylene production.
1968	Caustic soda production capacity of 66 thousand tons a year is attained. Start-up of unit N4 in acetylene production.
1969	Start-up of unit N5 in acetylene production, full capacity is extended to 75 thousand tons of commercial acetylene a year.

⁷ Text has been modified from the website into table format and edited for readability (http://www.nairit.am/history.php?menu_1=&)

Year	Operations
1970	Rubber production capacities are extended to 74 thousand tons a year, inclusive of 4 thousand tons of commercial latexes a year.
1970	Start-up of acetic acid production line with the capacity of 35.5 thousand tons a year.
1971	Start-up of the first stage of the brine extraction facility with the full capacity of 450 thousand m ³ of brine at simultaneous work of 5 wells.
1972	Dismantlement of 1 carbide furnace and conservation of one limekiln.
1979	High purity nitrogen generator unit is put into production. Start-up of softened and desalted water units with the capacity of 660 and 160 m ³ /year respectively.
1980	Start-up of butadiene-based chloroprene production, closure of calcium carbide and chlorbenzene production.
1981	Start-up of the unit for incineration of liquid organochlorine wastes.
1982	Delivery of chemically polluted wastes to the Aeration station. Cyclone furnaces for incineration of pulp slurry in the production of acetylene are put into operation. Start-up of a new brine extraction facility.
1981-1984	Start-up of the first stage of the reconstructed facilities for effluent homogenization and neutralization.
1983	Overhaul reconditioning of acetylene production with 50% shrinkage in capacity.
1984	Works on stabilization of butadiene-based chloroprene production with further enlargement of capacities to 75 thousand tons a year.
1985	Start-up of the chloroprene-based butadiene production after its stabilization. Shut down of production of chloroprene from acetylene. Shut down production of acetylene from calcium carbide. Shrinkage in pyrolysis acetylene capacity to 10 thousand tons a year. Start-up of the plant for treatment of latex-containing wastewaters.
1986	Start-up of a new production line of licensed rubbers with the output of 50 thousand tons a year.
1987	75.7 thousand tons of rubbers are produced. Full capacity of chloroprene production is attained. A new cell plant with 130 electrolysis baths is put into operation.
1993	The RD department of the enterprise develops the project of acetylene-based chloroprene plant.
1994	Start-up of acetylene-based chloroprene plant with the capacity of 10-20 thousand tons a year.
2007	The program on "Nairit Plant" CJSC reconstruction and modernization is approved, rubber output is extended by 44% as compared with the previous three years.
2008	Reconstruction of butadiene-based chloroprene production line. The plant is ready to receive and store butadiene.

The United Kingdom Department of the Environment industry profile for chemical works on rubber processing (1995) outlines the likely contaminants and their probable locations. Refer to Table 3.2.

Table XII.2: Main groups of contamination for rubber works and their probable locations

Contaminant		Location					
Main group	Sub-group	Raw material delivery and storage	Process areas	Tanks, pipework and pumps	Product storage and blending	Waste storage/ on-site disposal	Wastewater treatment facilities
Metal and metalloid contaminants	activators						
	desiccants						
	colouring pigments						
Inorganic compounds	flame retardants						
Organic compounds	rubber precursors						
	rubber						
	rubber preservatives						
	vulcanising agents						
	processing aids, plasticisers and extenders						
	accelerators						
	activators						
	stain protectors						
	retarders						
	waxes						
	tackifying resins						
	hardeners						
	peptisers						
Other	vulcanising agents						
	fillers						
	anti-degradants						

Source: United Kingdom, Department of the Environment (1995).

XIII. CONCEPTUAL MODEL

A. Background

A key element of undertaking an environmental risk assessment is to develop a conceptual model of the site that describes the environmental features of the site together with the expected interaction of potential contamination sources with the environment. This is done by undertaking a Source – Pathway – Receptor analysis⁸ of the site:

- Sources (S) are potential or known contaminant sources e.g. a former fuel storage area.
- Pathways (P) are environmental systems through which a contaminant could migrate e.g. air, groundwater.
- Receptors (R) are sensitive environmental receptors that could be adversely affected by a contaminant e.g. site occupants, groundwater resources.

Where a source, relevant pathway and a target are present a pollutant linkage is considered to exist whereby there is a circumstance through which environmental harm could occur and a potential environmental liability is considered to exist.

A summary of potential sources, pathways and targets relevant to the site are described below and given alpha numeric codes for identification (e.g. S1 – Source 1).

B. Potential Sources of Contamination

1. Potential Sources of Contamination not Associated with Nairit Plant

Potential contamination sources observed along the alignment, but not associated with Nairit Plant, include:

S1: Dumped waste along the alignment

Domestic and construction-related wastes have been dumped along the Shirak Street extension section of the alignment. The actual waste streams have not been identified as part of this investigation, however potentially contaminating wastes might include biodegradable matter (producing methane) and hazardous substances (including pharmaceuticals, chemicals, batteries, asbestos, lead and others).

S2: Fuel station

The fuel station on Artashat Highway may contain fuels, oils, anti-freeze and other substances in the soil which have leaked/spilled, during transfer and storage in underground tanks. Fuel vapors are a potential airborne contamination source.

⁸ This is based on standard approach set out in Environment Agency guidance and BS 10175:2001: Investigation of potentially contaminated sites - Code of practice.

S3: Railway line

The alignment crosses the railway line at two points, Shirak Street extension and Artashat Highway. Contaminants associated with railway lines includes ash ballast (possibly containing metals, phenols, sulfates and PAHs); fuel oils, lubricating oils, greases; anti-freeze; treated wood sleepers; herbicides; semi-volatile organic compounds (SVOCs); and materials from spills/incidents.

S4: Orchard trees

Pesticides may have been sprayed on the orchard trees associated with the residential properties within the right-of-way.

S5: Domestic sewage

If the residential properties within the alignment are not connected to the sewage mains, there is potential for these properties to contain outdoor toilet facilities, therefore pathogens (such as fecal coliforms) area a potential contaminant.

S6: Erebuni airport

The Erebuni airport is located approximately 100m to the closest point of the investigation site. Contaminants associated with airports include storage, use and waste generated by aviation fuels, de-icing chemicals and chemicals associated with servicing and maintenance (including resins and solvents). As the airport is/was predominantly used for military purposes, it is likely that ammunition has been stored on site at some stage of its operations.

2. Potential Sources of Contamination Associated with Nairit Plant

Given that Nairit Plant has been operating since the 1930s, it is likely that contaminants may have leaked and/or spilled due to transportation, use and disposal practices that are not in line with current good practices and safety standards. The current condition of buildings and infrastructure also indicates a potential source of contamination where equipment, buildings and infrastructure have not been maintained and contaminants could leak.

The potential contamination sources likely associated with Nairit Plant include:

S7: Above-ground liquid storage tanks

Tanks may contain fuels or chemicals used in production. It is unknown whether the tanks are still in use; it was however observed that the tanks show signs of rust and could be in a poor condition allowing for escape of their contents.

S8: Liquid treatment plant

The liquid treatment plant observed was reportedly previously used as a sewage treatment plant, but now used occasionally for treatment of other liquids. A sulfurous odor was noted during the site visits.

S9: Chimneys

Numerous chimneys are located within the factory grounds, some of which are still operational. These may be a source of particulates, metals, dioxins and furans.

S10: Gas pipes and liquid pipes

There are numerous pipes located within Nairit Plant and crossing roads. The pipes may contain water, gas, sewage and liquids either used by, or produced at the factory.

S11: Derelict buildings that may contain asbestos material in the building fabric

Buildings constructed around the 1960s and 1970s may contain asbestos material in the building fabric which might include asbestos concrete, tiles, insulation and in numerous other forms. The derelict state of some of the buildings indicate that any asbestos within the buildings may be disturbed, therefore resulting in loose asbestos fibers which may have become airborne.

Any areas where building material has been dismantled and disposed may also contain asbestos in the material and/or fibers in the soil.

S12: Storage and use of chemicals, including chemical waste

The site is known to have been used for the manufacture of rubber and associated chemicals. Table 3.2 indicates the likely contaminants from rubber processing activities.

S13: Automotive/garage workshops

It is likely that garage workshops are/were located on the site. Such activities may involve the use of fuels, lubricants, degreasers and cutting oils as well as paints and solvents.

S14: Electrical switchgear/ transformers

It is likely that the site contains electrical power generation facilities. Electrical switchgear and sub-stations have the potential to contain polychlorinated biphenyls (PCBs) which were historically used within coolant oils in transformers and capacitors.

S15: Uncontrolled waste disposal on site

Possible burning of waste materials can give rise to the generation of polycyclic aromatic hydrocarbons (PAHs). Other possible uncontrolled waste disposal on site includes electrical transformers, chemical/fuel drums, tanks and other chemical containers.

C. Potential Contamination Transport Pathways

P1: Direct contact with contaminated soil/groundwater;

P2: Dermal contact with contaminated soils/groundwater;

P3: Inhalation of volatile compound vapors and/or windblown dust;

P4: Ingestion and uptake of contaminated soil or groundwater;

P5: Gas migration;

P6: Vertical and lateral migration of contaminants via groundwater/; and

P7: Vertical and lateral migration of liquid contaminants through soil.

P8: Migration of contaminants via drainage channels

D. Potential Human and Environmental Receptors

1. Environmental Receptors

R1: Groundwater.

2. Human Receptors

R2: Road End Users

It is proposed to construct a road within the alignment with pedestrian paths along both sides, therefore human receptors will be future road users, and particularly pedestrians, along the alignment. Given the development involves the construction of a hard-surfaced highway, which will effectively isolate contaminants at depth, the risks to the roads end users is generally considered to be very low. Risks however, will be greater wherever areas of soft landscaping (i.e. planted verges) are proposed..

R3: Construction and Maintenance Workers

Workers involved in the construction of the road are the principal human receptors, as are future maintenance workers. Both types of workers may be required to work closely with subsurface soils and may include the possible need to gain access to excavations made into contaminated materials.

R4: Nearby residents

In consideration of the potential for mobilization of volatile substances through soil and groundwater, and in particular the potential for wind blown dust, occupants of the neighboring residential may be considered to represent a specific receptor.

3. Fabric of infrastructure

R5: Infrastructure and services

Certain contaminants, including sulfates, have the potential to attack concrete used in road construction and high concentrations of petroleum hydrocarbons can result in the reduction of expected concrete strength during setting,

Additionally, certain hydrocarbons and solvents can predate plastic water supply pipes, tainting drinking water supply.

The risk of degradation to new roads and associated infrastructure is considered to be medium due to the unknown ground conditions.

E. Conceptual Model

Based upon the potentially active Sources, Pathways and Receptors defined in the previous sections, a conceptual model based upon the potential pollutant linkages can be derived as presented in Table XIII.1.

Table XIII.1: Conceptual Model

Source	Potential contaminants	Transport Pathway	Receptor
S1: Dumped waste along the alignment	Chemicals, pharmaceuticals, battery acid, asbestos, metals (lead), hydrocarbons	P1: Direct contact	R5: Construction materials
		P2: Dermal contact P3: Inhalation of vapors and/or windblown dust P4: Ingestion	R2: Future end use R3: Construction workers
		P6: Vertical and lateral migration of contaminants via groundwater P7: Vertical and lateral migration of liquid contaminant through soil P8: Migration via drainage channels	R1: Groundwater
S2: Fuel station S13: Automotive/ garage workshops	Oils, lubricants, fuels, VOCs, polycyclic aromatic hydrocarbons (PAH), metals	P1: Direct contact	R5: Construction materials
		P2: Dermal contact P3: Inhalation of vapors and/ or windblown dust P4: Ingestion P5: Gas migration	R2: Future end users R3: Construction workers R4: Residential properties
		P6: Migration of groundwater P8: Migration via drainage channels	R1: Groundwater
S3: Railway line	Metals, phenols, sulfates, PAHs, fuel oils, lubricating oils, greases, anti-freeze, sleeper wood treatments (cresols), herbicides	P1: Direct contact	R5: Construction materials
		P2: Dermal contact P3: Inhalation of windblown dust P4: Ingestion	R2: Future end use R3: Construction workers R4: Residential properties
		P6: Vertical and lateral migration of contaminants via groundwater P7: Vertical and lateral migration of liquid contaminant through soil P8: Migration via drainage channels	R1: Groundwater
S4: Orchard trees	Pesticides, SVOCs	P2: Dermal contact P4: Ingestion	R3: Construction workers
		P3: Inhalation of windblown dust	R3: Construction workers R4: Residential properties

Source	Potential contaminants	Transport Pathway	Receptor
S5: Domestic sewage S8: Liquid treatment plant	Methane, carbon dioxide, hydrogen sulfide, pathogens, metals, inorganic compounds, acids, alkalis	P2: Dermal contact P5: Gas migration	R3: Construction workers
		P3: Inhalation of windblown dust	R3: Construction workers R4: Residential properties
		P6: Vertical and lateral migration of contaminants via groundwater P7: Vertical and lateral migration of liquid contaminant through soil P8: Migration via drainage channels	R5: Construction materials R1: Groundwater
S6: Erebuni airport	Aviation fuels, de-icing chemicals, resins, solvents, ammunition	P3: Inhalation of windblown dust	R3: Construction workers
		P6: Vertical and lateral migration of contaminants via groundwater P7: Vertical and lateral migration of liquid contaminant through soil P8: Migration via drainage channels	R1: Groundwater R5: Construction materials
S7: Liquid storage tanks	Fuels, liquid latex, hydrocarbon solvents	P1: Direct contact	R5: Construction materials
		P2: Dermal contact P4: Ingestion	R2: Future end users R3: Construction workers
		P3: Inhalation of VOCs	R3: Construction workers
		P6: Vertical and lateral migration of contaminants via groundwater P7: Vertical and lateral migration of liquid contaminant through soil P8: Migration via drainage channels	R1: Groundwater R4: Residential properties
S9: Chimneys	Metals, particulates, PAHs, dioxins, furans	P1: Direct contact P2: Dermal contact	R3: Construction workers R5: Construction materials
		P3: Inhalation of windblown dust	R3: Construction workers R4: Residential properties
S10: Derelict buildings that may contain asbestos material in the building fabric	Asbestos	P3: Inhalation of windblown dust	R2: Future end users R3: Construction workers R4: Residential properties
S12: Storage and use of chemicals	Flame retardants, zinc and iron compounds aluminum bronze, PAH, hydrocarbon solvent, phenols, amines, oils,	P1: Direct contact	R5 : Construction materials
		P2: Dermal contact P3: Inhalation of vapors and/ or windblown dust P4: Ingestion P5: Gas migration	R2: Future end users R3: Construction workers R4: Residential properties
		P7: Vertical and lateral migration of groundwater P8: Vertical and lateral migration of liquid contaminant through soil P8: Migration via drainage channels	R1: Groundwater R4: Residential properties

Source	Potential contaminants	Transport Pathway	Receptor
S14: Electrical switchgear/transformers	PCBs, oils	P1: Direct contact	R5 : Construction materials
		P2: Dermal contact P3: Inhalation of vapors and/ or windblown dust P4: Ingestion P5: Gas migration	R2: Future end users R3: Construction workers R4: Residential properties
		P6: Vertical and lateral migration of groundwater/surface water P7: Vertical and lateral migration of liquid contaminant through soil P8: Migration via drainage channels	R1: Groundwater R4: Residential properties
S15: Uncontrolled waste disposal at Nairit Plant	PAHs, soot, hydrocarbon solvent, PCBs, fuels, chemicals, asbestos	P2: Dermal contact P3: Inhalation of vapors and/ or windblown dust P4: Ingestion P5: Gas migration	R2: Future end users R3: Construction workers R4: Residential properties
		P6: Vertical and lateral migration of groundwater P7: Vertical and lateral migration of liquid contaminant through soil P8: Migration via drainage channels	R1: Groundwater R4: Residential properties

XIV. RISK ASSESSMENT

The normal approach to undertake a risk assessment is to identify the overall contamination risk based on probability of the event occurring multiplied by the consequence of event occurring to give an overall risk rating. The risk identifies the worst case potential risks assuming no mitigation measures have been implemented. Based on the limited available evidence, a qualitative description of risk has been undertaken based on the conceptual model.

It is likely that the soil is contaminated with oils, heavy metals, PCBs, asbestos, pathogens and chemicals from the rubber production activities. Based on the high clay content which reduces soil permeability, contamination is likely to be mostly limited to the upper few meters of the soil. The clay content would also limit migration of contaminants to groundwater, however there is still potential for contamination of groundwater beneath or around the investigation area with one or more of the aforementioned contaminants.

Construction of the road involves removal of wastes from along the alignment, excavating the upper layers of the soil and earthmoving activities. Any dermal contact with the soil/materials or accidental ingestion, could harm workers during construction. Disturbed and exposed contaminated soils and materials may also become airborne through windblown dust and vapor release which may affect workers and nearby residents.

Road end users are likely to be at a very low risk from historical contamination as the construction of a hard-surfaced highway will isolate contaminants at depth, effectively severing potential exposure pathways. Risks however will be greater wherever areas of soft landscaping (i.e. planted verges) are proposed and contaminated soils are left exposed at the ground surface.

Contaminants in the soil and groundwater may affect road infrastructure materials. This includes the railway overpass infrastructure that requires piers and foundations which would be at a greater depth than other road infrastructure.

Overall, given the industrial legacy and significant contamination sources present, the investigation site has been given a **HIGH** risk rating.

XV. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

The following conclusions are drawn from this Phase 1 desk study regarding the likely contamination of soil and groundwater along the alignment of the investigation:

- The investigation alignment is located within an existing right-of-way that crosses two railway lines, is through a residential area and within a corridor located between two areas of Nairit Plant, an industrial factory which mainly manufactures rubber products. Nairit Plant is operational; however the site contains many derelict buildings. Erebuni airport is approximately 100m from the closest point of the investigation site.
- The underlying geology consists of late-quaternary lake and alluvial sediments. Soils comprise interbedded clay and sand with a variable proportion of gravel (approximately 20-30%). The clay content of the soils should limit the downwards migration of contaminants into groundwater. The groundwater level is to a depth of 5-10m. The groundwater flow is not known but may reasonably be expected to flow towards the Hrazdan River to the north. There are no surface water bodies within 2.5km of the alignment.
- No previous investigations on contamination were made available for this investigation. Nairit Plant has been operational since the 1930s, however earlier uses of the site and surrounding areas has not been established as part of this investigation.
- Based on the site visit and documentary research, it is likely that the soil and groundwater is contaminated with one or more of the following: asbestos, diesel oil, PCBs, pathogens, metals, inorganic compounds, and chemicals associated with rubber production activities.
- To estimate the significance of the potential contamination identified, a qualitative assessment of risk of the site was undertaken which has concluded the level risk to the environment, human receptors, and construction materials, if the road were to be constructed without implementing mitigation, is **HIGH**.

B. Recommendations

A comprehensive ground investigation will be needed at the site prior to development, in order to:

1. Gather general information on the distribution of common soil and groundwater contaminants across the site and develop a conceptual site model – this will reduce the uncertainty in the risks to human health and the environment and to develop mitigation measures. Additionally the investigation will identify appropriate disposal or re-use options of spoil associated with the construction activities.
2. Obtain information on the geotechnical properties of the soils to allow for the design of structures/highway.

It is anticipated that the investigation will comprise a series of shallow trial pits and boreholes which will collect information on ground conditions including the hydrogeology of the area..

Boreholes should be fitted with standpipe monitoring wells or piezometers which will enable monitoring of groundwater levels beneath the site and enable samples of groundwater to be obtained for laboratory and in-situ analysis. Selected boreholes should also be fitted with gas taps to enable characterization of the soil gas regime.

Boreholes should be of minimum 150mm (6 inch) diameter in soils and casing should be used for the full depth to avoid collapse. Standard penetration tests should be undertaken, alternating continuously with undisturbed samples.

The following types of soils samples should be retrieved:

- Small disturbed samples in all materials for classification and identification;
- Small disturbed samples for contamination testing;
- Bulk disturbed samples to be taken from granular strata; and
- U100 undisturbed samples in cohesive strata.

All boreholes shall be logged by an experienced engineering geologist/geotechnical engineer.

Samples of soil and groundwater should be tested by an appropriately equipped and accredited laboratory for either geotechnical or chemical (contamination) purposes.

Site investigation boreholes and trial pits should be targeted on the location of known structures and contamination sources. The exact location and depths of all boreholes and trial pits will be dependent upon access, location of buried services and the specific development proposals.

XVI. REFERENCES

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Yerevan Municipality (Undated). “Yerevan project” CJSC Complex object - Working plan.

Appendices

Appendix A.

Photographs
3

Intersection of Shirak Street and Arshukinyats Avenue (facing east)

XVII.

Photographs



Shirak Street extension alignment (from Artashat Highway facing east)



Shirak Street extension alignment (from Artashat Highway facing west)



Liquid treatment plant (facing west)



Eastern extent of the Shirak Street extension and Artashat highway (facing north west)



Example of some of the pipes throughout the factory site



Example of some of the above-ground tanks throughout the factory site



ADB	Asian Development Bank
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Glossary

PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyls
SVOC	Semi-volatile organic compounds
VOC	Volatile organic compound

APPENDIX 3

ECOLOGICAL INVESTIGATION

Yerevan Sustainable Urban Transport Program Ecological Investigation Report For Project 2: Shirak Street to Artashat Highway Road Link

This ecological study has been undertaken as part of environmental assessments for Shirak Street – Artashat Highway road link. The key purpose of the study is to identify protected flora and fauna and to develop mitigation measures for their protection.

1. Study approach and limitations

The site has been visited with the purpose of ecological survey. During the visits investigations of the current general environmental situation have been implemented and relevant professional study, as well as overview study of the zoological and biological variety has been fulfilled.

The preliminary environmental research was implemented in the period 17-26 March, 2010, the field visit on 17 March 2010. The study was undertaken within tight time limitations and over a season which did not allow full investigation of the variety and quantity composition of the flora and fauna. The season over which the study was undertaken was not a favorable season from the vegetation, migration, wintering, ovipositing (egg-laying) and other biological perspectives.

Thus, with the purpose of professional investigation aimed at the development of preliminary environmental research, results have been gathered from the field visit, as well as a number of other informational sources; the list of the latter is included in Annex 4. Meetings have been organized and discussions held with relevant professionals (zoologists and biologists) who have previously implemented research in the areas under discussion.

In general, Yerevan contains the following flora and fauna types:

- According to the expert evaluation, the natural flora of Yerevan includes about 900 types of vascular (high class) plants; 15 of them are included in Armenian Red Book, among them one endemic species included in the IUCN Red List.
- Yerevan's fauna diverse. There are 25 mammal types, among them 3 included in Armenian Red Book and 5 – in IUCN Red List.
- The City area is widely populated by undesirable mammal species, such as grey rats and house mouse.
- From about 170 bird types 29 are registered in Armenian Red Book. At least 100 types, of which 15 types included in the Armenian Red Book, build nests. The other types are regularly present at seasonal migration, wintering and feeding time. The most numerous are synanthropic types, such as sparrow, grey crow, magpie, rock pigeon (including feral pigeon), in recent years also Eurasian Collared Dove.
- There are 25 types of reptiles, of which 5 are included in Armenian Red Book.
- The Armenian Red Book includes amphibians, including Syrian spadefooted Toad (*Pelobates syriacus*), which has most likely disappeared due to the devastation of landscapes and unfavorable alterations of the water reservoir schedules.
- There are a number of invertebrates spread within the city. The most investigated ones are the beetles: there are known about 700 types of beetles; most of them are Armenian and some even Yerevan endemic. Of these insects, those known are 60 dipterans, 40 hymenopterans, 130 butterflies, from 10 to 20 types of orthopterous insects (Orthoptera), spiders, mollusks (Mollusca), about 30 types of gnawing beetles (Ostomatidae) and ticks.
- There are 10 types of fish registered in the rivers Hrazdan and Getar.

Construction works can adversely impact the flora and fauna on or near the site. In this report, the focus is only on direct impacts on vegetation removal, habitat removal and harming protected species. Other impacts on flora and fauna have been identified in the complete Initial Environmental Examination report and mitigation measures are provided. This ecological investigation focus' on the impact on flora and fauna and provides recommendations for mitigation including protection and compensation for trees removed.

2. Basic description of the project, location and construction methodology

- a Over a length of approximately 3.7km, the project comprises sections of new construction and sections of widening of existing road to connect Artashat Highway and Arshakuniats Avenue via Shirak Street. The project comprises:
 - (ix) Widening along the east of Arshakuniats Avenue from a 2 to 4-lane road divided with a central reservation for 1.5km to where the road meets Shirak Street;
 - (x) New half-clover leaf interchange at Shirak Street/Arshakuniats Avenue;
 - (xi) New overpass of the railway line to adjoin Shirak Street and providing a connection with Noragavit 1st Street;
 - (xii) New section of 4-lane road divided with a central reservation to extend Shirak Street by 1km along an existing right-of-way to meet with Artashat Highway. Sections of corridor walls will be removed and replaced to accommodate the new road;
 - (xiii) New T-intersection at the Shirak Road extension onto Artashat Highway. Depending on traffic volumes, consideration will be given to either a roundabout or traffic lights at this intersection;
 - (xiv) Widening 2.3km of Artashat Highway between the end of the Shirak Street extension and Noragavit 1st Street from 4 to 6-lanes divided with a central reservation. Consideration is being given to an additional service road parallel to the main alignment to provide safe access and egress for the Noragavit neighborhood;
 - (xv) New overpass of the railway line that crosses Artashat Highway; and
 - (xvi) Possible new ground level intersection, possibly with traffic lights at Artashat Highway and Noragavit 1st Street.
- b Widening of existing roads will involve removal of existing asphalt layer (and grinding and re-using it as much as possible). The below-standard top and sub-base will be removed as required and replaced with material meeting accepted quality standards. A new concrete asphalt layer will be laid over the road and shoulders. The design includes 3m wide pedestrian paths along both sides of the road. Road traffic safety measures will be installed including signage and traffic markings.
- c Other activities associated with construction include:
 - (i) Identification and protection or relocation of existing utilities including water mains, gas mains, sewers, and electricity and communication lines;
 - (ii) Selection of suitable locations for construction camps; facilities and offices; and storage of materials and machinery;
 - (iii) Removal of existing waste material dumped along the route;
 - (iv) Excavation and leveling of the alignment;
 - (v) Establishing wheel-wash facilities for vehicles leaving the site;
 - (vi) Excavation, transportation and disposal of contaminated soil; and
 - (vii) Landscaping of the shoulders and median following construction.
- d It is expected that construction will be undertaken over a period of up to three years.

3. Desktop investigation

RARE AND ENDANGERED ANIMALS AND PLANTS THAT NEED PROTECTION

Shirak Street – Artashat Highway road link

#	Common Name	Scientific Name	ARDB	IUCN	Endemic	Note	Could be affected	Influence is unlikely
1. Animals								
Mammals								
1	Long-Eared Hedgehog	<i>Hemiechinus auritus</i>	+					X
2	Schreiber's Long-Fingered Bat	<i>Miniopterus schreibersi</i>	+, U	LR/NT		Wintering		X
3	Mehely's Horseshoe Bat	<i>Rhinolophus mehelyi</i>	+	VU		Wintering		X
4	Greater Horseshoe Bat	<i>Rhinolophus ferrumequinum</i>		LR/CD				X
5	Lesser Horseshoe Bat	<i>Rhinolophus hipposideros</i>		VU				X
Birds								
1	Short-toed Eagle	<i>Circaetus gallicus</i>	+, U			Nesting		X
2	Pallid Harrier	<i>Circus macrourus</i>	+	LR/NT		Migration	X	
3	Montagu's Harrier	<i>Circus pygargus</i>	+			Migration	X	
4	Levant Sparrowhawk	<i>Accipiter brevipes</i>	+			Nesting		X
5	Lesser Kestrel	<i>Falco naumanni</i>		VU		Nesting		X
6	Merlin	<i>Falco columbaris</i>	+			Wintering		X
7	Woodchat Shrike	<i>Lanius senator</i>	+			Nesting		X
8	White-throated Robin	<i>Irania gutturalis</i>	+			Nesting		X
9	Orphean Warbler	<i>Sylvia hortensis</i>	+			Nesting		X
10	Penduline Tit	<i>Remiz pendulinus</i>	+			Nesting		X
11	Trumpeter Finch	<i>Rhodopechys gitadineus</i>	+			Nesting		X
Reptiles								
1	Transcaucasian Ratsnake	<i>Elaphe hohenackeri</i>	+, U				X	
Amphibians								
1	Syrian spadefoot Toad	<i>Pelobates syriacus</i>	+, U	+		Most probably disappeared	X	
Insects								
1	Willowherb Hawkmoth	<i>Proserpinus Proserpina</i>		+			X	
2	Seathorn Hawk-moth	<i>Hyles hippophaes</i>		+			X	

#	Common Name	Scientific Name	ARDB	IUCN	Endemic	Note	Could be affected	Influence is unlikely
3	Yerevan road beetle	<i>Medon erevaensis</i>			+		X	
4	Armenian road beetle	<i>Heterotops armeniacus</i>			+		X	
5	Blister beetle	<i>Lydus caucasicus</i>			+		X	
Plants								
1	Dusty miller	<i>Centrarea erivaensis</i>	+					X
2	Adam Saffron	<i>Crocus adami</i>	+					X

Notes: ARDB – Armenian Red Data Book;

U – Red Data Book of USSR. The USSR Red Book has no current legal standing, however it is still referred to today as an additional source of information to understand migrating species from neighboring countries and forms a basis for the evaluation of the ecological significance.

IUCN - IUCN Red List

+ Exists in mentioned categories

IUCN Red List Categories

EX - Extinct

EW - Extinct in the Wild

CE - Critically Endangered

CD - conservation dependent

EN - Endangered

NT - Near Threatened

VU - Vulnerable

LR - Low Risk

LC - Least Concern

DD - Data Deficient

NE - Not Evaluated

4. Environmental situation

4.1 The environmental situation of the project site based on the site visit and the Yerevan City Master Plan (citation):

- No dangerous geological phenomena recorded in the project area.
- No rivers or other waterways run through or near the project area.
- High level of ground water (5-10 m) in Artashat highway section.
- There are no specially protected areas, rare and/or endemic species.
- **Soil pollution:** pollution levels vary across the project area, mild and moderate pollution fields. The industrial area contains high levels of pollution.
- **Air pollution:** within average and acceptable air quality zone.
- **Noise:** factual recorded noise fluctuates from 65 to 75 dB.
- **Biodiversity:** Major parts of the project area are significantly changed. The area has types of flora and fauna specific to semi-desert and desert zones. In the middle part of the project area there are low-storied residential houses with fruit and decorative trees. There are trees and bushes at Arshakuniats Avenue that will be cut down.
- **Waste:** there are piles of soil, construction and industrial garbage.

4.2 Description of the current environmental situation of the project site from biodiversity point of view based on the site visit results:

- The project area is under strong anthropogenic influence. It runs through both residential area, which is rich with vegetation (mainly orchards) and unsettled area, which is also covered with orchards and nurseries.
- There are Armenian Red Book and IUCN Red List (endangered species) of flora and fauna recorded in the area.
- There are multiple types of protected zoological and biological species registered as potentially located in the area of the project; however the area is highly modified. Further investigation would be required to identify the actual presence of these species.

5. Conclusion and recommendations

Construction activities include tree cutting, which will have unfavorable impact on the biodiversity of the area. Based on preliminary investigation, it is likely that protected, rare and endangered species are not present at the site, however this will need to be confirmed through further investigation prior to construction during the vegetation season.

The most suitable timing for vegetation removal and site clearing activities is outlined as follows:

- The most favorable time for construction on that location with the least impact on the mammals is summer, late autumn and winter. It is necessary to prohibit any clearing activities in spring and early autumn.
- For the least impact on the birds the most favorable time for construction would be the whole year, with the exception of the spring and early summer.
- For the reptiles and amphibian the construction could be implemented with the least impact in late autumn, winter and extremely hot summer days.
- For insects this would be late autumn and winter. It is again extremely important to exclude any clearing activities in spring, early summer and early autumn.

- For the least impact on the flora the best time for construction activities would be late autumn and winter.

The most favorable time for further investigation of flora is the vegetation season: April – September, with June and July being the most favorable months. For the fauna the investigation time depends on the status (migrating, nesting, stable habitat, etc) and the specialist themselves should be suggesting the investigation timelines.

To investigate definite species it is recommended establishing a team of botanists and zoologist that have the appropriate education and at least 5 years of experience of field work. The team leaders should have a scientific title and relevant experience for this kind of assessment, as well as experience with relevant reporting. The program for collecting field data should be approved by the Ministry of Nature Protection.

The work of these groups should result in a site biodiversity and protected species database, as well as detailed descriptions of possible environmental impact and recommendations for the relevant mitigation measures. The data collected should be summarized in the Initial Environmental Investigation and Environmental Management Plan.

The project should undergo environmental expertise. To protect any identified protected species it is necessary to follow the environmental legislation of Republic of Armenia and ensure the implementation of those mitigation measures that are based on the recommendations of specific specialists. It is essential to consult the relevant experts while developing the project and to implement constant environmental monitoring/investigation during the project implementation.

Image 1. Arshakuniats Avenue to be widened.



Image 2. Shirak Street extension to Artashat Highway.



Image 3. Residential properties within the alignment.



Image 4. Residential area within the alignment of the Shirak Street extension



Image 5. Trees to be removed at the Arshakuniats Avenue and Shirak Street interchange.



Annex 1

Laws and Legislations passed by the Government of RA

- RA Law on Flora.
- RA Law on Fauna.
- RA Law on Payments against the Damage to the Flora and Fauna as a Result of Environmental Violations (03.05.2005).
- RA Law on Environmental Impact Expertise
- RA Law on Local Self-Governance, adopted on May 7, 2002 envisages the authority of the head of the local community in the areas of land usage, as well as the liabilities of the head of the community in the area of the nature and environment protection.
- RA Criminal Code, adopted on April 18, 2003 sets out criminal liabilities for the violation of environmental protection rules.
- RA Law on Environmental Monitoring (11.04.2005), that approved of the liabilities of the environmental monitoring department and defined the function of the given department in different sectors, including the land protection/preservation.

Currently there have been developed and are in different stages of discussions the Draft Laws on Environmental Fund, on Natural Areas under Special Protection, on Major Provisions of National Water Policy and Environmental Expertise, as well as on Rules of State Monitoring of the Land Utilization and Protection.

Annex 2

RA Government Decrees

- The Rule of Usage of the Fertile Layer of Land (19.09.2002, RA Government Decree 1622-N), which regulates the activities related to preservation and rehabilitation of land after mining of natural construction materials and minerals, like the removal and appropriate use of the fertile layer of the soil during the mining (removal, preservation and registration of the removed soil); this decree also defines the liabilities of state and local self-governance bodies.
- RA Government Decree on the Marginal Rates on Activities Planned Subject to Environmental Impact expertise (25.04.1999, RA Government Decree N193)
- On Approving the Rules for Construction/Urban Development Activities in the Special Protected Nature Areas and Forest Fund Lands (08.05.200, Decree 613-N) regulates the relevant procedures for the urban construction activities and the liabilities of different bodies.
- On Defining the Rule of Totally or Partially, Permanently or Temporarily Exclusion of the Special Protected Water Systems out of Economic Activity Field” (10.07.2003. RA Government Decree 888-N).
- On Approving the Procedures of Use and Protection of the Specially Protected Areas of International Value (15.09.2005. RA Government Decree 1628-N).
- On the Report/land Balance of the RA Land Fund Availability and Distribution (22.12.2005. RA Government Decree 2243-N), which noted the introduced balance and appointed to introduce the final balance of RA lands in 2006.

- In accordance with the RA Government Decree 125 On the Organization of Land Construction Procedures it is planned to implement land use and protection monitoring activities.

Annex 3

Participation of Armenia in the International Environmental Conventions

NAME PLACE AND DATE	In force	Signed	Ratified
Convention on Biological Diversity (Rio-de-Janeiro, 1992)	21.03.1994	1992	14.05.1993
UN Framework Convention on Climate Change (Rio-de-Janeiro, 1992)	21.03.1994	1992	14.05.1993
Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991)	10.09.1997		21.02.1997
Convention on Combat Desertification (Paris, 1994)	27.09.1996	1994	02.07.1997

Annex 4

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APPENDIX 4

ARCHAEOLOGICAL INVESTIGATION Preparing the Yerevan Sustainable Urban Transport Investment Program. **Archaeological impact of Project 2 – Arshakunyats Street – Shirak Street – Artashat Highway (Preliminary report)**

The studied area, serving as the southern “gateways” of Yerevan, is including around 4445 m of distance and is located in the south-western part of the city. It is passing through the Shengavit community of Yerevan and ending at the beginning of the Ararat province of the Republic of Armenia (Map 1 of the General report). The planned section of the road (upgraded to 4-6 lane divided roads) is starting from so called “Workers square” of the Arshakunyats street up to its intersection with the Shirak street (around 1555 m in length); south-east to extend Shirak street to Artashat Highway (around 710 m in length) then south-west along the Artashat Highway (around 2180 m in length) till its connection with the main Yerevan-Meghri or Southern Highway (Map 4).

The realization of survey activities in the limits of the Arshakunyats and Shirak streets was restrictive and of little benefit, because of fully urbanized character of the area, covered by modern buildings, private houses and gardens, railroad zone, asphalted roads and highways. The same situation was present along the western side of the Artashat highway, where the whole area is occupied by private houses and constructions. In spite of this, the eastern side of the Artashat Highway, after the buildings of the “Nairit” factory, was an open area, occupied by gardens and fields, based on small hills and mounds, visible from the highway and very convenient for surveying. The conducted systematic survey for archaeological study of the described area took two field days (Map 4). The survey activities and mapping were realized on a distance of 2050 m in length and 30 m of width, counted from the left border of the acting highway. Around 50-70 m wide additional area was included under intensive survey for understanding the logistics and intensity of spreading of the surface finds. All the studied area was rich with surface finds, especially collected from disturbed parts of sediments after agricultural and funeral activities (Map 4, Image 11). The mapping of the finds showed their most intensive concentration in the southern parts of the studied area (Map 4). The mentioned finds were represented by Developed or High Medieval Pottery fragments, including samples of glazed pottery, including jars, pitchers, bowls etc. By their typological characteristics they belong to 14-18 centuries AD (Images 12, 14 and 15). Among the finds there are two stone implements, represented by a basalt flake, and a flint end scraper (Image 13), with traces of

notching on the right edge (probably Early Upper Paleolithic). Most of the artefacts have fresh surfaces and good preservation, some are washed and rolled and carried by water activity on longer distances. No traces on any kind of constructions were recorded. For analyzing the most intensive concentration of the pottery fragments, the occupation of two hills, lying on the southern end of the Artashat Highway were studied more carefully. One of the hills, (the largest) is occupied by modern cemetery. The surface of the hill is fully destroyed and changed by funeral activity and memorial constructions. In the case of presence of some pottery fragments from the disturbed soil of fresh burials, it was impossible to make any conclusions about the distribution of pottery fragments in the area. The most interesting picture was recorded on the surface of the second hill neighboring to the cemetery from the south (Map 4). The hill has an oval shape and is around 6-8 m tall from the level of the road and its environs. It has flat surface in the middle and by its morphology could be an artificial mound (Images 4 and 5), reminding so called blurs (in Armenian), and tepes (in Turkish) and tells (in Arabic). There is an artificial irrigation structure bypassing the hill from the south-east. There are visible traces of a former large river passing through a wide valley from the area of the Yerevan heat power plant to Artashat Highway. Analyses of the pebbles accumulated in the sections of the alluvial deposits of the valley, shows that it was a left tributary of the Hrazdan River, with strong water activity in ancient past, fully disappeared now (Image 6). Even, nowadays the area is rich with water activity and there are lots of swamps and accumulated standing water sources in the vicinity. The distribution of the archaeological finds in the area of the hill is mostly associated with growing trees. Most of the pottery fragments were collected around the planted trees, when the local inhabitants were digging holes for their planting and disturbing the sediments (Images 8 and 9). Absence of the visible structures on the hill can be explained by thick humus formations or top soil covering its surface. Unfortunately, there were no deep sections for checking the layers on deeper levels. However, it is very possible, that the hill, with its convenient location, overlooking the fertile valley and water sources, is bearing traces of an old settlement with cultural remains belonging at least to Late Medieval occupation.

For more clear understanding of the recorded medieval archaeological remains we can discuss in addition the historical environment of the finds. The surveyed area is located at the south-eastern suburbs of the Noragavit district of Yerevan, which is the area of the famous Medieval Noragavit village, included in the limits of Yerevan only in 1940. The village was well known from medieval written sources as a very rich and urban area, surrounded by fertile valleys, gardens and vineyards. The foundations of 4th-7th century S. Grigor Lusavorich (Gregory the Illuminator) church are standing in the middle of the village (Map 4, Image 1). There are

wine crusher-basis from 4th-5th centuries found around the old church, talking about the importance of the area for a wine production (Image 3). For this reason the area was important even for more ancient times (around 1300 years before it). Chance finds of Urartian tombs and mausoleums discovered in yards of the private houses during the construction activities are known. The Urartian kings were paying a special attention to the wine production (see report for P2) and the area of Noragavit was among such ones. The earthquake of 1679 fully destroyed the village, but it was revived and rebuilt after, continuing to play a central role in the agriculture and trade of the Yerevan district. Two of the churches standing in the middle of the village (S. Gevorg Tsiranavor and S. Kiraki) were fully renovated in late 19th century, including the acting school (Image 2). The center of Noragavit with the described monuments is located some 350-400 meters from the surveyed area (Map 4), and it is possible that our finds belong to some parts of former Noragavit, existing before the 1679 earthquake, closer to the areas of the agricultural activity of the ancient inhabitants of this settlement. From the communications with the inhabitants of the houses on the western side of the road, it became clear, that, similar finds are often discovered in their gardens during construction or agricultural activities.

Summarizing the collected archaeological data from the surveyed area, we can say, that along the western side of the Artashat Highway of Project 2, intensive traces of medieval activity are recorded. The most interesting object is the well preserved hill on the southern extent of the investigation area, which is probably an ancient settlement or structure (Map 4). No records about those archaeological finds are present in the published and archival records and in the lists of the protected sites, adopted by the Ministry of Culture⁹.

The western end of the hill is very close to the area of future road and may be impacted by construction activity (Map 4, Image 7). This section of the road construction will be required to be under strong archaeological observation during cleaning and earthmoving activities. It would be logical to separate the modern cemetery from the road by raising a separation wall, because the entrance of the cemetery will appear exactly on the border of the new Artashat Highway (Map 4, Image 10). As there are no visible constructions recorded and the direct evidence of ancient occupational activity is missing, there is no need of any special operation to protect the areas of finds or to organize rescue excavations before the construction activities. From the point of view of the archaeological impact, there are not any “archaeological barriers” to start the constructional activities for Project 2. It should be possible to recommend to the authorized body (the Ministry of Culture) to allow the construction operations with a strong

precondition that the construction contract should include provision of suitably qualified staff, such as an archaeologist, to ensure, that proper chance-find procedures are implemented during those activities along the cleaned and opened sections¹⁰.

Boris Gasparyan

Archeologist consultant

01.05.2010

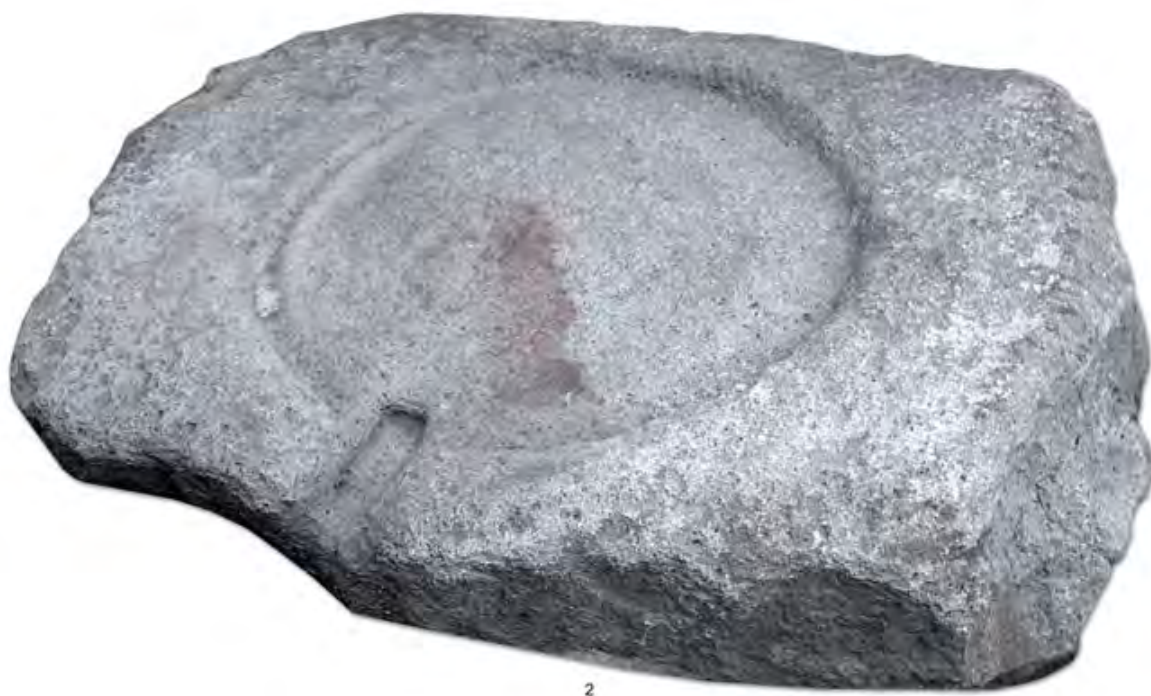
⁹ The law on preservation and utilization of Immovable Monuments of History and Culture and of the Historic Environment (adopted on the 11 of November 1989) – **LPUIMHCHE LAW. Chapter 13**. The recorded list of the monuments has a power of law and is a basis for giving an official status to the monument.

¹⁰ **LPUIMHCHE LAW. Chapter 19**. Any type of the construction activity in the areas containing historical monuments or archaeological sites must be realized in agreement with the authorized body (Ministry of Culture). **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.

ARM Yerevan SUTP Tranche 1 Project. P3: Shirak Street-Artashat Highway-Arshakuniats Street

Map 4





0 5 10 cm

1-2. Crusher bases. Noragavit (IV - V centuries)



Artificial hill in the south-eastern ending of Noragavit,
on the right side of the Artashat Highway (view from south-west)



Artificial hill in the south-eastern ending of Noragavit,
on the right side of the Artashat Highway (view from south-east)



Wide paleovalley of one of the Hrazdan River tributaries,
passing through the southern ending of the artificial hill



North-western ending of the artificial hill,
sloping to the right side of the Artashat Highway



Ceramic fragments lying on the surface of the artificial hill



Ceramic fragments lying on the surface of the artificial hill



The boundary of the modern Norgavit cemetery,
overlooking the Artashat Highway



Fragment of a surveyed area along the right side of the Artashat Highway



Artifacts found from surface of the artificial hill, on the south-eastern ending of Noragavit.
High Medieval pottery fragments (14-16 centuries)



Artifact found on the surface during the survey of the area on the right side of the Artashat Highway. Flint scraper (Upper Paleolithic)



Artifacts found on the surface during the survey of the area on the right side of the Artashat Highway. High Medieval pottery fragments (14-16 centuries)



Artifacts found on the surface during the survey of the area on the right side of the Artashat Highway. High Medieval pottery fragments (14-16 centuries)

APPENDIX 5

PUBLIC CONSULTATION EVENT - 19 MARCH 2010

Advertisement in The Armenian Times

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Երևանի կայուն բաղաքային տրանսպորտի ծրագիր

ՀՀ Կառավարությունը և Երևանի բաղաքապետարանը տված որոշումն են իրականացնել բաղաքային տրանս-
պորտի ծրագրեր՝ Երևան բաղաքի երթևեկության շարժունակությունը բարելավելու և տրանսպորտային համա-
կարգի ծանրաբեռնվածությունը նվազեցնելու նպատակով:
Ասիական զարգացման բանկը Ֆինանսական աջակցություն է ցուցաբերում Երևանի բաղաքապետարանին՝
հետևյալ աշխատանքներն իրականացնելու համար:

Մուտակյա ժամանակներում առաջարկվում է իրականացնել հետևյալ չորս նախագծերը՝




- Նախագիծ 1 - Դավիթաշենի կամուրջ - «Աշտարակի մայրուղի» ճանապարհի արդիականացում
- Նախագիծ 2 - Արզականցի մայրուղի - «Շիրակի փողոց» ճանապարհի արդիականացում
- Նախագիծ 3 - Շիրակի փողոց - «Արտաշատի մայրուղի» ճանապարհի արդիականացում
- Նախագիծ 4 - «Երիտասարդական» մետրոյի մոր մուտքի կառուցում (Աբովյան փողոց - Սայաթ-Լու-
վա դղրդուտա խաչմերուկ)

Դուք իրավիճակ ենք մասնակցելու համայնի խորհրդակցության, որտեղ կարող եք առավել մանրամասն տե-
ղեկություններ ստանալ մշակված նախագծերի վերաբերյալ և հնարավորություն կունենաք փոխանակել Ձեր կար-
ծիքները և քննարկել Ձեզ հուզող հարցերը տեխնիկական թիմի հետ, մասնավորապես՝ խնդիրը վերաբերում է
շրջակա միջավայրի տաշտոյանությանը:

**Ժամը՝ 11.00-ին
Ուրբաթ՝ 19 մարտի, 2010թ.
Վայրը՝ Երևանի բաղաքապետարան, առաջին հարկ**

Հասցե՝ Երևանի բաղաքապետարան Արզիշտի փ. 1 Երևան 0015 Հեռ. (+374) 10 514187 Էլ.փոստ՝ contacts@yerevan.am	ԱԶԲ - Հայաստանյան մետավայր Վազգեն Սարգսյան փ. 26/1 «Երեւոնի Պլազա», Բիզնես կենտրոն Երևան 0010 Հեռ. (+374) 10 546371, 546373 Էլ.փոստ՝ acbarrm@adb.org
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Տեխնիկական աջակցության համարը՝ TA: 7340
Ծրագրի համարը՝ 42417-01

Attendance list - translated

Note that the actual attendance lists contain repeat names and does not include several attendees

No.	Name	Position	Address/organization
1.	Karen Avetisyan	Coordinator	Association for Sustainable Human Development, NGO forum on ADB
2.	Karine Danielyan	President of NGO, Representative of environmental ADB Armenian Office Public Alliance	Association for Sustainable Human Development NGO
3.	Abrahamyan Tamara	President of NGO	"Araza" NGO
4.	Andranik Tevosyan	Citizen	
5.	Ashot Mnatsakanyan	Advisor to the Mayor	Yerevan Municipality
6.	Mushegh Burnusuzyan	Yerevan Municipality Staff Transport Department Main Specialist	Yerevan Municipality
7.	Diana Yeritspokhyan	Ecologist	Yerevan Municipality
8.	Basencyan Frunz		Yerevan Municipality
9.	Tadevosyan Rudik		Yerevan Municipality
10.	Ofelia Sivonyan		Yerevan Municipality Information Department
11.	Hayk Abelyan	Deputy of the Head of District	Ajapnyak Administrative District
12.	Gevorgyan Gagik	Land Usage Town Department Head	Davitashen Administrative Region Deputy Director
13.	Vardanyan Vardan		Shengavit Administrative District
14.	Felix Afyan	Deputy Director	PIU
15.	Ruben Srapyan	Leading specialist	PIU
16.	Levon Hakobyan	Yerevan Building Investment PIU Director	PIU
17.	Gohar Aleksanyan	Journalist	
18.	Hasmik Gregorgyan	Journalist	ArmenPress
19.	Anahit Avagyan	Journalist	Public radio
20.	Areg Barseghyan	ADB Representative	ADB Armenian office
21.	Anna Avagyan	Translator	ADB Armenian office
22.	Klaus Schonfeld	Environment Specialist	ADB
23.	Lanfranco Blanchetti	Resettlement Specialist	ADB
24.	Anjela Arakelyan		"AdInfoSys" CJSC
25.	Milena Babaeva	Translator	"AdInfoSys" CJSC
26.	Liana Mkhitarian	Social and Resettlement Specialist	"AdInfoSys" CJSC
27.	Vahe Tunyan	Transport Specialist	"AdInfoSys" CJSC
28.	Qristine Aragelyan		"AdInfoSys" CJSC
29.	Arman Vermishyan	Environment Specialist	"AdInfoSys" CJSC
30.	Tom Streather	Resettlement Specialist	Mott MacDonald
31.	Paul Holmes	Project Manager	Mott MacDonald
32.	Naomi Hull	Environment Specialist	Mott MacDonald

Attendance list – actual (1 of 3)

ՀՀ	Անուն	Հասցե/կազմակերպություն	Ստորագրություն
1.	Արթուրյան, Եսեկ Buu Tseren	"Արալյա" 348 22.10.97 araz@armico.com	
2.	Բաղդասարյան Ն. Բաղդ.	Հրէւ. Բաղդասարյան	
3.	Քոչարյան Ն. Քոչար	Հրէւ. Բաղդասարյան	
4.	Համբարձումյան Համբ.	Հրէւ. Բաղդասարյան	
5.	Համբարձումյան Համբ.	Հրէւ. Բաղդասարյան	
6.	Օհանյան Օհանյան	Հրէւ. Բաղդասարյան	
7.	Արմենյան Արմենյան	"Հրէւ. Բաղդասարյան"	
8.	Արմենյան Արմենյան	"Հրէւ. Բաղդասարյան"	

Attendance list – actual (2 of 3)

ՀՀ	Անուն	Հասցե/կազմակերպություն	Ստորագրություն
1.	Բաղդասարյան Բաղդ.	Հրէւ. Բաղդասարյան	
2.	Բաղդասարյան Բաղդ.	Հրէւ. Բաղդասարյան	
3.	Բաղդասարյան Բաղդ.	Հրէւ. Բաղդասարյան	
4.	Բաղդասարյան Բաղդ.	Հրէւ. Բաղդասարյան	
5.	Բաղդասարյան Բաղդ.	Հրէւ. Բաղդասարյան	
6.	Բաղդասարյան Բաղդ.	Հրէւ. Բաղդասարյան	
7.	Բաղդասարյան Բաղդ.	Հրէւ. Բաղդասարյան	
8.	Բաղդասարյան Բաղդ.	Հրէւ. Բաղդասարյան	
9.	Բաղդասարյան Բաղդ.	Հրէւ. Բաղդասարյան	
10.	Բաղդասարյան Բաղդ.	Հրէւ. Բաղդասարյան	
11.	Բաղդասարյան Բաղդ.	Հրէւ. Բաղդասարյան	
12.	Բաղդասարյան Բաղդ.	Հրէւ. Բաղդասարյան	
13.	Բաղդասարյան Բաղդ.	Հրէւ. Բաղդասարյան	
14.	Բաղդասարյան Բաղդ.	Հրէւ. Բաղդասարյան	
15.	Բաղդասարյան Բաղդ.	Հրէւ. Բաղդասարյան	

Attendance list – actual (3 of 3)

№	Ազգանուն	Անուն	պաշտոն	աշխատավայր
1	Սարգսյան	Եղիշ	բարձրագույն	Հասարակական կենտրոն
2	Սարգսյան	Սևակ	բարձրագույն	
3	Սարգսյան	Կարեն	Կարգ/ճակատագր	ՀՀԿԿ
4	Սարգսյան	Խաչիկ	լրագրող	Փորձագետ
5	Սարգսյան	Կարեն	դեկորատիվ և ներքին	Սարգսյանի թանգարան
6	Սարգսյան	Զարգի	հոր. օգն. ժող. կույր. և հիմ.	Դաս/թանգարան թանգարան
7	Սարգսյան	Սևակ	լրագրող	Սարգսյանի թանգարան
8	Սարգսյան	Սևակ	ճարտարապետ	ՀՀԿԿ
9	Սարգսյան	Կարեն	հեղինակ. և ներքին	
10	Սարգսյան	Զարգի	դեկորատիվ և ներքին	Դ.Զ.
11	Սարգսյան	Զարգի	ստանդարտ. և ներքին	Դ.Զ.
12	Սարգսյան	Զարգի		
13	Սարգսյան	Զարգի	ստանդարտ. և ներքին	McDonald's
14	Սարգսյան	Սևակ	ստանդարտ. և ներքին	Սևակ - սևակ