Armenia: GrCF2 W2 - Yerevan Bus Project (Phase I)

NON-TECHNICAL SUMMARY

Rev01

Consultancy Contract №
C44610/12951/87449

November 2020

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Prepared for:

European Bank for Reconstruction and Development

Prepared by:

ATMS Solutions Ltd.

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In cooperation with Ecoline International

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List of Abbreviations

ADB - Asian Development Bank
AMD - Armenian Dram
BOD - Biochemical Oxygen Demand
CJSC - Close Joint Stock Company
CNG - Compressed Natural Gas
DD - Due Diligence
EBRD - European Bank for Reconstruction and Development
EEA - European Economic Area
EHS - Environmental, Health and Safety
EIA - Environmental Impact Assessment
EMEP - European Monitoring and Evaluation Programme
E&S - Environmental and Social
ESAP - Environmental and Social Action Plan
ESDD - Environmental and Social Due Diligence
ESHS - Environmental, Social and Health Safety
ESIA - Environmental and Social Impact Assessment
ESP - Environmental and Social Policy
EU - European Union
FS - Feasibility Study
GET - Green Economy Transition
GHG - Greenhouse Gases
GDP - Gross Domestic Product
HPF - Hazardous Production Facility
HR - Human Resources
MASL - Meter Above Sea Level
ME - Ministry of Environment
MPC - Maximum Permissible Concentrations
NSS - National Statistical Service
NTS - Non-Technical Summary
OHS - Occupational Health and Safety
PM - Particulate Matter
PPE - Personal Protective Equipment
PR - Performance Requirements
RA - Republic of Armenia
SEP - Stakeholder Engagement Plan
SNCO - State Non-Commercial Organization
ToR - Terms of Reference
TLV - Threshold Limit Value

Table of Content

0. Introduction

The present Non-Technical Summary ("NTS") is a part of the EBRD[1] supported Project "Armenia. Yerevan Bus Project - Environmental and Social Due Diligence" documentation package and overviews the Environmental and Social ("E&S") assessment study, risks / impacts and benefits, mitigation, management and monitoring measures as well as Green Economy Transition ("GET") potential. The Environmental and Social Due Diligence ("ESDD") documentation package also includes ESDD report, Environmental and Social Action Plan ("ESAP"), Stakeholder Engagement Plan ("SEP") and Gender Impact Assessment report.

The Project is classified as belonging to Category "B" according to the EBRD Environmental and Social Policy, 2019 ("ESP") and requires an E&S assessment to be carried out against EBRD Performance Requirements ("PR").

1. Background

1.1 Rationale of the Project's Phase 1

Public transportation services are provided to the population of Yerevan by buses, trolleybuses, minibuses and the underground / Metro. Taking into account the recent tendency of growing number of vehicles in the capital, the City authorities adopted the policy of increasing the volume of big capacity rolling stocks (buses and trolleybuses) and ceasing operation of minibuses.

In 2016, Yerevan municipality initiated the "New Bus Network and Integrated Tariff and Ticketing System" Project ("Project") and commissioned WYG International (UK) to undertake the assignment divided into two main tasks; firstly, designing a new public transport network for the City, and secondly developing a new integrated tariff and ticketing system. The New Bus Network and Integrated Tariff and Ticketing System was finalised in January 2019 and provides the cornerstone for the Yerevan new bus network.

EBRD (also the "Bank") is considering provision of a sovereign loan of up to EUR 25 million to Armenia to be on lent for the benefit of "Yerevan Bus" Close Joint Stock Company ("CJSC"), which will operate bus network. The Bank will finance immediate purchase of up to 100 CNG low-floor buses (standard 12 m). The construction of a new bus depot, the upgrade of the currently operated Nor Nork (Jrvej) bus depot, and CNG refuelling station is envisioned by the Project and will be co-funded by Asian Development Bank ("ADB"). These activities are incorporated into Phase 1 of the Project and classified as belonging to Category "B" according to the EBRD ESP.

Yerevan Municipality has invited technical consultant to deliver the detailed design for the brand-new bus depot at Arshakunyats Avenue together with the major upgrade of the Nor Nork (Jrvej) bus depot currently operated by "Yerevan Bus" CJSC. The design works for both locations shall start in September 2020 and will need 6 months to deliver the drawings and supply requirements for the tender on construction works. The entire investment package is co-funded by ADB. For details see section 2.4.3.

In total, there are 39 bus lines in the city, where 400 diesel/CNG, 7.5-8.5 m buses operate on a daily basis. The operating companies are 17; out of which one is the municipal owned company "Yerevan Bus" CJSC and the 16 are private operators. As per the 2018 data, the buses carried 82.9 million passengers, which is 42.5% of the total passenger traffic for that year. There are 66

[1]European Bank for Reconstruction and Development

minibus routes in the city, where the total fleet is equal to 1,150 units, mainly running on diesel and CNG fuel. 35 private companies provide minibus transportation services in the city; over 2018, the passenger flow of minibuses was 88.8 million, which is 45.4% of the total passenger traffic for that year.

It is envisaged that Phase 2 of the Project will be implemented later on. It will include: the purchase of up to 250 electric buses, trolleybus (including battery trolleybus, in motion charging, street charging and/or hybrid CNG, comprising articulated 18 m, standard 12 m and/or midi 9 m buses), with the related bus depots' construction/ renewal[2] and integrated ticketing system, relevant details of which (project components, including fleet composition) to be defined in this study. The pre-Feasibility Study for Phase 2 will be launched soon.

1.2 Environmental and social compliance

The E&S compliance of the Project and "Yerevan Bus" CJSC current activities and operations as per the EBRD performance requirements is summiarized below:

PR1 - Assessment and Management of Environmental and Social Risks and Impacts

According to the RA legislation the Project is classified as "C" category activities and is subject to national environmental impact assessment and expert examination. The construction and upgrade works can be started only after obtaining a positive EIA conclusion. The ESHS management practices of the Company does not comply with the provisions of internationally recongized EHS management system. The organizational structure of "Yerevan Bus" CJSC does not envisage staff positions for managing day-to-day environmental and OHS activities. The ESHS monitoring and/or audits (internal and external) are not performed.

PR2 - Labour and Working Conditions

Labour and working conditions at the Company are generally in line with the provisions of the national legislation. Meanwhile, to comply with the best international labour practices, the Human Resources (HR) policy of "Yerevan Bus" CJSC should be updated and the worker grievance mechanism procedure should be elaborated and adopted.

PR3 - Resource Efficiency and Pollution Prevention and Control

The Project implementation, i.e. the introduction of 100 new CNG buses into the City public network instead of the existing old buses and minibuses will contribute to the improvement of the Company's resource efficiency performance as well as reduction of GHG and exhaust emissions. However, the current environmental practices applied at both depots are not satisfactory. The principles of waste management and good housekeeping are not applied by the Company. The territories of both Charbakh and Nor Nork (Jrvej) bus depots are piled with hazardous wastes, and it is only household waste that is periodically removed from the sites. The permits required by the national legislation are not obtained.

PR4 - Health, Safety and Security

The requirements of the national legislation related to the OHS and fire safety are partly implemented at both depots of the Company. OHS and fire safety procedures are documented and OHS trainings are conducted. Medical examination of personnel is regularly performed. However, there are several domains where significant mitigation actions/measures are recommended and should be implemented. The facilities of depots should be equpped with proper sanitary-hygienic conditions, fire-extinguishing means / tools, medical kits. The working personnel

[2]ADB is planning to finance depot reconstruction of four main bus/trolleybus depots, the scope of which shall be determined during this study, and with which the scope of the EBRD supported project shall be fully integrated.

shall be secured with certified PPE, etc. The dangerous industrial objects should be annually examined and hazardous works shall be performed under the managed conditions. Internal OHS and fire safety audits are not practiced in "Yerevan Bus" CJSC.

PR5 - Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

According to the provided information, the land-plots to be allocated for the construction of the new depot belong to Yerevan community. So, most probably, the allocation of these land-plots to the Project needs will not trigger physical or economic displacement or involuntary land acquisition.

PR6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources

The site selected for the construction of Arshakunyats depot is an abandoned area within the City boundaries surrounded by the residential blocks and commercial facilities. In the south and east, the site borders on Shirak street and Arshakunyats avenue, respectively ,and is exposed to human impacts. It is unlikely that endangered flora and/or fauna species will be found there; however, a biodiversity survey in and around the selected site is proposed to be conducted.

PR8 - Cultural Heritage

Although, the territory envisioned for the construction of new Arshakunyats new depot is not recognized as an area with the potential for cultural heritage finds, it is proposed to have a Chance Finds Procedure in place during any earth/excavations work and to have this fully understood by the Construction Contractor staff.

PR10 - Information Disclosure and Stakeholder Engagement

Neither the mechanism of disclosing and/or communicating information to the potential stakeholders or the wider public, nor the procedure to address external stakeholders' grievances is developed and implemented by the Company / Yerevan municipality. The latter should implement meaures to establish communication channels/tools with the Project stakeholders, i.e.: affected groups and interested parties.

1.3 National EIA and expert examination procedure

According to Article 14 of the Law on Environmental Impact Assessment and Expert Examination ("EIA law"), the the construction and upgrade of bus depots is considered urban development activities with construction area of 1,500 m^2 and more, classified as "C" category intended activity and therefore is subject of one (preliminary) stage EIA and expert examination. Duration of preliminary expert examination is 30 working days starting from the date of EIA preliminary application submission to the State authorized body (State Environmental Impact Examination Center under the Ministry of Environment (ME)).

When the design documents for the construction of Arshakunyats new bus depot and for the upgrade of Nor Nork (Jrvej) depot will be approved, the national EIA and expert examination process should be initiated by Municipality of Yerevan / "Yerevan Bus" CJSC.

As per the Article 16 of EIA law, EIA preliminary application to be submitted to the State authorized body should contain at least the following issues:

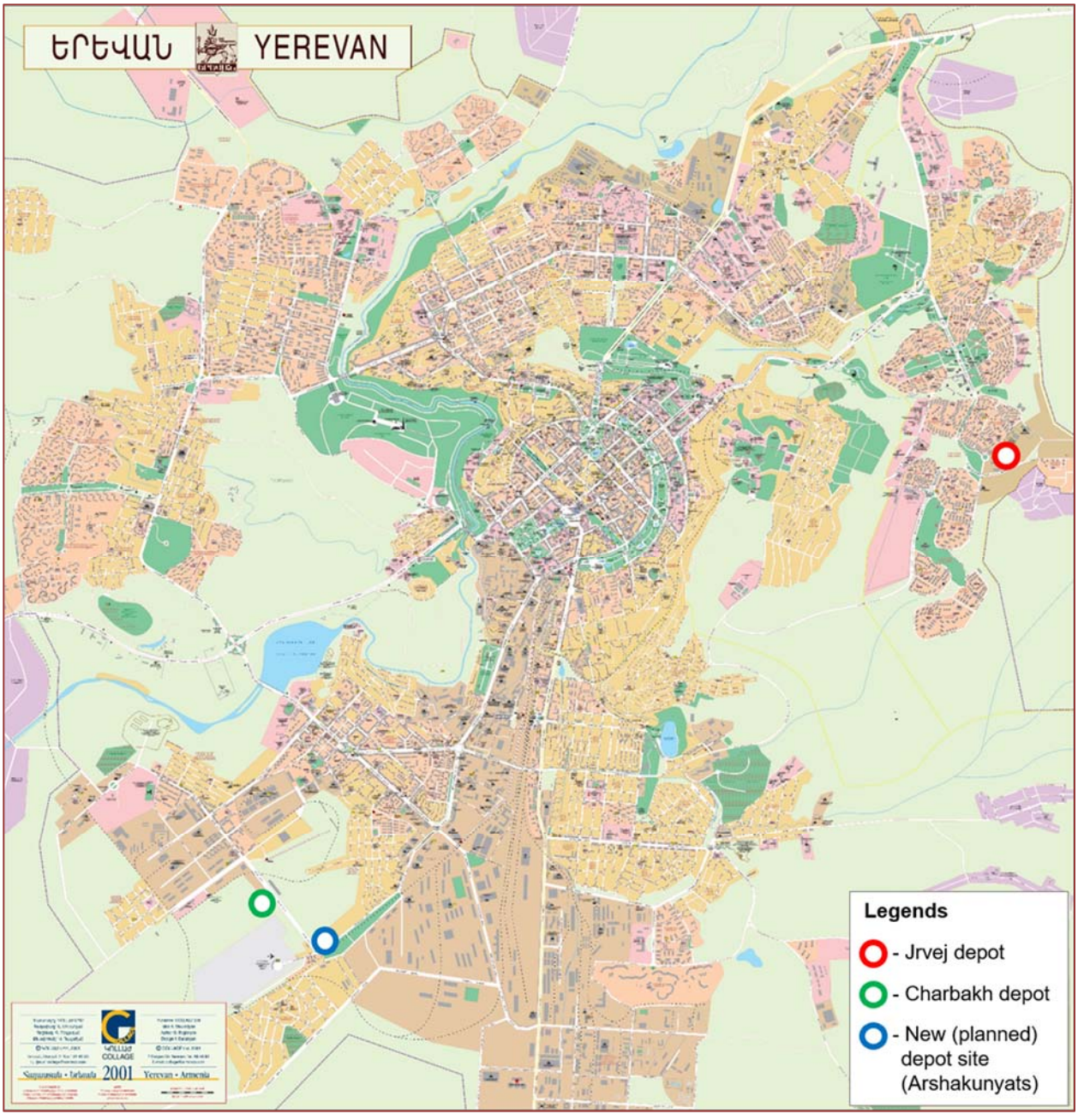
- Name and address of Initiator (Municipality of Yerevan or "Yerevan Bus" CJSC),
- Name, objectives and scope of Framework or Design Document,
- Area of activity as well as description of environment and lay-outs,
- Project characteristics (capacities, used materials and resources, technical and technological solutions),

- Environmental negative impacts elimination, reduction, mitigation program,
- Initial "no objection" decision on Project implementation from the affected community (should be attached to the EIA initial application),
- The protocol of public discussions conducted in affected community[3].

2. Project Description

The Project area and facilities are confined to the area of Yerevan city and Zvartnots airport, which is geographically located in Armavir region, however administratively is within the boundaries of Yerevan. The map of the Project area and facilities is presented below in **Figure 1**.

Figure 1. Map of Yerevan and location of the Project facilities (existing and planned)



[3]The procedure for public notification and discussions is given in the RA Government Decree №1325-N dated 19.11.2014

2.1 Current public transport system of Yerevan[4]

Public transportation services in Yerevan are provided by buses, minibuses, trolleybuses and the underground ("Metropolitan" or "Metro"). The trolleybuses and metro are serviced by "Electric Transport of Yerevan" "CJSC" and "Yerevan Metro after Karen Demirchyan" CJSC municipal companies. There are 51 trolleybuses on the balance of the "Electric Transport of Yerevan" CJSC, including 5 "Renault", 12 "Skoda" and 34 "LIAZ" models. The company operates five trolleybus routes, 40-42 units run on routes daily. In 2019, the number of passengers transported by trolleybuses decreased.

The Yerevan Metro has 10 stations, the length of the line is 12.1 km, the rolling stock includes 45 wagons. 26 wagons are operated on weekdays (13 rolling stocks), and at weekends the number is less - 24 wagons (12 rolling stocks). A significant growth in the number of passengers using the Metro has been noticed recently, largely due to improved quality of transportation.

The buses and minibuses are operated by the private and public operators. Currently, there are 562 buses ("Higer", "Hyundai", "Bogdan" and "PAZ") actually operated on 39 routes in Yerevan. About 400 buses come out on route daily. The bus routes are maintained by "Yerevan Bus" CJSC and 16 private companies. From the 562 buses 372 ("Higer", "Hyundai", "Bogdan" and "PAZ") belong to "Yerevan Bus" CJSC. The average age of used buses is 9.2 year.

64 minibus routes operate in Yerevan. The routes are served by 1,120 minibuses of different types. The mentioned routes are served on a contractual basis by 36 private operators. The volume of bus transportation in total transportation volumes is 43.2%. However, this number is still lower than desirable: the efficiency of bus itinerary operation remains low. To ensure regular transportation services to the population, it is necessary to continue increasing the number of buses and exclude the minibuses.

The fare for a single journey on all modes of transport is currently 100 AMD, with the exception of trolleybuses, where the fare is 50 AMD. There is also a new service to the "Zvartnots" International Airport organised by the RA Government, with a fare of 300 AMD.

856 public transport stops are operated in Yerevan, and bus-stop cabins and signs are installed at 352 of them. 504 stops are equipped only with signs. The arrangement of the new itinerary network provides for both, the renovation of old bus-stops and construction of new ones. In 2019, four bus-stops were furnished with modern, wrought iron cabins.

To ensure the access of people with locomotor disabilities to city buses, 25 "Higer" buses equipped with special wheel-chair elevators (**Figure 2**) were imported from China in 2014-2017.

The buses are owned by "Yerevan Bus" CJSC and are operated on 4 routes (№№ 14, 20, 22, and 28). There are special signs on the front and side parts of the buses with the phone numbers by which one can get informed about the time when the buses will approach the bus-stop. Within the framework of the programme providing availability of parking areas for people using wheelchairs, special areas were separated for them in 101 paid parking areas. In accordance with Decision №182-N of the Municipality's Council of Elders, dated December 25, 2019, the process of providing free tickets for parking spaces to the people with wheelchairs started and 102 tickets were given out for 2020.

[4]https://www.yerevan.am/en/transport-department/

Figure 2. Buses equipped with special wheel-chair elevators

2.2 New bus network and Integrated tariff and ticketing system

Within the scope of public transport system reformation in Yerevan and considering the vital need of forming a new and efficient itinerary transport network, the municipality of Yerevan has initiated the "New Bus Network and Integrated Tariff and Ticketing System" Project and commissioned "WYG International" consulting company to undertake the assignment[5] made of two main tasks:

(i) Design a new public transport network for the City, and
(ii) Develop a new integrated tariff and ticketing system.

After these two tasks are implemented, the final outcome will be a new public transport system for the City. The final report was submitted to the Municipality in January 2019.

The proposed new transport network of Yerevan comprises 47 routes (hereafter referred as "New Network"):

- **11 core routes** - typically served by articulated buses with peak frequency 5-10 minutes,
- **30 feeder routes** - targeted for current midibuses with peak frequency 4-10 minutes,
- **5 trolleybus routes** - preserving the current routing and vehicle sizes, but frequency increased, and
- **Airport Shuttle** - with flat frequency of one bus per hour during the day.

The New Network concept represents roughly a 2/3 reduction in the current number of routes in operation. This reduction meets the outlined objective of simplifying the network to make it easier for users to understand. To satisfy the demand of the New Network routes, 820 units would be needed in the peak operation:

- 488 midibuses (8 m long),
- 29 buses (12 m long),
- 216 articulated buses (18 m long), and
- 87 trolleybuses (12 m long).

[5]financed by Asian Development Bank

2.3 Overview of Phase 1 of the Project (subject of this study)[6]

Proposed and terminated bus routes within Phase 1

The 100 CNG[7] low-floor buses to be purchased within Phase 1 of the Project are recommended[8] to be introduced into the five bus routes, from which three routes have been selected from the New Network (№№ 3, 5 and 7) and the rest two are current routes №28 and №33 (**Table 1**). The daily peak vehicle requirement equals to 87 vehicles, with 13 spare buses left in the depot.

Table 1. Bus routes overview

Name	Route description	Route length, km	Duration, min	Speed, km/h
Route 3	South West Block B2 - Nor-Nork Block 9	43.1	144	18
Route 5	South West Block A1 - Zeytun	37.8	133	17
Route 7	Raffi str. × Babajanyan str. junction - Jrvej	39.4	118	20
Route 28	Huysi Block - Nor-Nork Block 8	40.7	136	18
Route 33	Davitashen 4th Block - Kharberd village	48.6	146	20

The implementation of Phase 1 requires reducing the parallel and overlapping services together with the introduction of the new Project routes. This approach ensures that the Project routes will satisfy the passenger demand in line with the proposed frequency and capacity.

In total, there were 17 bus and minibus routes identified to have a significant overlap with the proposed Project routes. However, this figure also includes the current bus routes 3, 5, 28 and 33, operated by "Yerevan Bus" CJSC and planned to be replaced by the Project routes with almost identical routing. If these four routes are omitted, the list of routes to be terminated includes 1 bus and 12 minibus routes. The overview of routes to be terminated, including the number of round trips per weekday that has been observed in the latest survey is given in **Table 2**.

Table 2. Overview of terminated routes[9]

Route category	Route number	Route length, km	Weekday vehicle, km	Comments
Bus	3	42.3	2,456	100% of this route overlaps with Route 3
Bus	5	27.7	1,831	88% of this route overlaps with Route 7
Bus	28	40.7	2,444	100% of this route overlaps with Route 28
Bus	33	48.6	2,430	100% of this route overlaps with Route 33
Bus	55	18.4	184	73% of this route overlaps with Route 33
Minibus	3	16.3	2,208	69% of this route overlaps with Route 28
Minibus	6	38.9	3,060	92% of this route overlaps with Route 3
Minibus	12	21.2	2,772	87% of this route overlaps with Route 28
Minibus	16		1,860	66% of this route overlaps with Route 3
Minibus	34	31.7	3,373	80% of this route overlaps with Route 3

[6]Description of Phase 1 and Phase 2 is presented in Chapter 0
[7]Compressed Natural Gas
[8]Draft Due Diligence Report, Yerevan Bus Renewal Project - Phase 1, August 2020
[9]These figures need to be checked with the up-to-date records of Yerevan Trans as soon as the sample data is provided and analyzed (currently in process)

Route category	Route number	Route length, km	Weekday vehicle, km	Comments
Minibus	43	20.3	3,394	80% of this route overlaps with Route 5
Minibus	55	13.9	1,503	77% of this route overlaps with Route 7
Minibus	58	26.6	4,691	85% of this route overlaps with Route 28 81% of this route overlaps with Route 3
Minibus	63	36.0	3,634	71% of this route overlaps with Route 3
Minibus	66	27.2	3,078	98% of this route overlaps with Route 3
Minibus	70	24.7	2,765	74% of this route overlaps with Route 5
Minibus	71	25.0	3,829	79% of this route overlaps with Route 3

Arshakunyats new bus depot

The brand-new bus depot will be located on the currently unused plot of land at the intersection of Arshakunyats Avenue and Shirak Street in the southwestern part of the city. It is expected that the capacity of the depot will be between 350 and 400 buses in the long-term perspective. Based on field surveys, investigations and design review of the sketch design prepared previously, the main output of the detailed design will be the layout and sizing of the depot facilities, layout and sizing of parking area, circulation plan, locations for entrances and exits (with respect to traffic flow), accessibility for persons with disabilities or other special needs, environmental safeguards, equipment and also design for the bus stop adjacent to the depot. The layout of new Arshakunyats depot is given in **Figure 3**.

Figure 3. Layout of Arshakunyats depot at conceptual design stage[10]

[10]Draft Due Diligence Report, Yerevan Bus Renewal Project - Phase 1, August 2020

The new depot will be equipped with maintenance areas, workshops, store-shops, CNG refueling and bus washing stations, drainage and sub-drainage systems, sewage and sanitation network, administrative offices, sanitary-hygienic facilities for drivers (male and female water closets, cafeteria and kitchen, rest and recreational facilities, laundry room), etc.

The design of the depot will be also sustainable and environmental-friendly in terms of choice of construction materials. The whole complex will be barrier-free and accessible to all, including persons with disabilities.

Nor Nork (Jrvej) bus depot

The detailed design of depot investment programme also includes the design of the refuelling facility for the CNG buses at the existing "Yerevan Bus" CJSC Nor Nork (Jrvej) depot located in the eastern part of the city. Nor Nork (Jrvej) bus depot will house the new fleet of 100 CNG buses in the initial period when the Arshakunyats depot will be under construction. This will allow the new buses to begin operation when they arrive in Yerevan, until the Arshakunyats site is completed and the fleet can then be moved there. The design of CNG filling stations will cover on the portion of the depot to include CNG filling dispensers as well as on a new entrance for the buses to access and egress from the facility. The design of updated Nor Nork (Jrvej) depot is presented in **Figure 4**.

Figure 4. Layout of Nor Nork (Jrvej) depot conceptual design[11]

Both conventional and mobile filling stations should be considered and costed in the design stage. For conventional stations, compressor units will need to be installed and connected into the

[11]Draft Due Diligence Report, Yerevan Bus Renewal Project - Phase 1, August 2020

pipeline, which is available at the depot. For this depot site, only fast-fill dispensers shall be utilized, given the limited spatial arrangements.

Key findings of Phase 1 of the Project

- The 100 CNG low-floor buses to be purchased within Phase 1 of the Project will be introduced into the five bus routes, from which three routes have been selected from the New Network (№№ 3, 5, and 7) and the remaining two are current routes №28 and №33. The daily peak vehicle requirement equals to 87 vehicles, with 13 spare buses left in the depot.
- The annual vehicle kilometres of the new fleet are 6,098,271 km for the bus routes №№ 3, 5, 7, 28 and 33, while the annual vehicle kilometres of the existing routes that will be replaced by the new routes equal to 20,267,858 km, of which 5,625,541 km refer to buses (28%) and 14,642,317 km refer to minibuses (72%).
- 17 routes are to be terminated (12 of them are minibus) to support the operational plan for Phase 1.
- The terminated routes are served by 50 buses and 139 minibuses. The withdrawn 50 buses will be reused on other minibus routes to replace the obsolete minibus fleet.
- The Arshakunyats bus depot will constructed southwestern part of Yerevan with the expected capacity of 350-400 buses.
- Nor Nork (Jrvej) bus depot will be upgraded to house the new fleet of 100 CNG buses in the initial period when the Arshakunyats depot will be under construction. This will allow the new buses to begin operation when they arrive in Yerevan, until the Arshakunyats site is completed and the fleet can then be moved there.
- Both bus depots will be equipped with CNG gas refueling stations.

2.4 Project alternatives

The zero or "do nothing" option is not considered a potential alternative to the Project as the latter was initiated by Yerevan municipality in 2016 in order to renew the public transport system in the City, including new bus network and Integrated tariff and ticketing components. Therefore, the main alternative options to the Project discussed during the Feasibility Study are based on:

1) Improvement/optimization of the bus routes, including adjustment of overlapping routes and termination of duplicating routes,
2) Variations (in number) among the midibuses (8m long), buses (12m long), articulated buses (18m long) and trolleybuses (12m long) within the City public transport system,
3) Feasibility of routes to be operated by microbuses,
4) Locations, equipment and capacities of bus depots (rehabilitation of operating "Charbakh" bust depot instead of construction of new Arshakunyats one).

The mentioned alternative options and their economic, environmental and technical feasibility are detailed by the Technical consultant within the Feasibility Study. The final option for public transport system was presented by the Technical consultant (WYG International Limited) and approved by Yerevan municipality in 2019. Phase 1 of the Project, i.e. purchasing of 100 CNG low-floor buses, construction of new Arshakunyats and update of operating Nor Nork (Jrvej) bus depots, is a part of Yerevan new public transport network system and is not considered as a separate component that can have alternatives.

3. Summary of Environmental and Social Baseline

3.1 Physical environment

Project location and geography

Yerevan is the capital of the RA and the largest city of the country. The City is located at the meeting point of the Hrazdan River and the Ararat valley, a high altitude plateau of semi-dessert character that requires irrigation most of the year. Covering 210 km of space, the City borders on Ararat (in the south and south-west), Armavir (in the west), Aragatsotn (in the north-west) and Kotayk (in the north and east) regions. The average altitude of Yerevan is 990 m above sea level ("MASL"), with a minimum of 865 m (Malatia-Sebastia, Shengavit, Erebuni, and Nubarashen districts) and maximum of 1,390 m (Arabkir, Nor-Nork, Davitashen, and Kanaqer-Zeytun districts). The upper part of the City is surrounded with mountains on three sides while it descends to the banks of the Hrazdan River to the south. The Hrazdan River divides Yerevan into two parts.

Climate and meteorology

Yerevan features a steppe climate with long, hot, and dry summers and short, but cold and snowy winters. This is explained by Yerevan being located on a plain surrounded by mountains and far from the sea and its effects. Summers are usually very hot with the temperature reaching up to 40°C, and winters generally carry snowfall and freezing temperatures with January often being as cold as -15°C and lower. The amount of precipitation is relatively low and ranges between 290 and 350 mm annually. Yerevan experiences an average of 2,700 sunlight hours per year.

Landscape, geology and soil

According to the approved Yerevan City Master-plan for 2005-2020[12] (hereinafter - "the Master-plan"), the territory of the City is divided into four vertical landscape zones/types:

- dry steppe with semi-desert elements,
- semi-desert with desert elements,
- desert with semi-desert elements, and
- lowland meadow.

The consolidated sediments from the upper Pliocene to the modern age mostly represented by volcanic, volcanic-sedimentary fractions found in the geological structure of the area. Rock layers such as dolerite basalt, andesite-basalt and semirock sediments are placed on them in some places. Tuffs are characterized by great strength, but have different deployment scenarios and splitting feature.

Landscape and soil compositions in Yerevan vary and comprise volcanic mountain chain, declivities, plains, and arable land. Soil is exposed to pressure caused by both human activities and natural forces such as erosion, salinization, chemical and biological pollution, which, if left uncontrolled, can lead to loss of biological productivity, desertification and biodiversity loss.

Seismic stability and tectonics

Yerevan City and the adjacent regions are located in a seismic area and considered to have a high degree of seismic risk along existing fault lines. Earthquakes in the area can reach the magnitude of 8-9 and above on the Richter scale and maximum horizontal acceleration of 0.4 g.

[12]RA Government decree №2330-N "On approval of Yerevan city Master-plan (2005-2020)"

There was a serious earthquake in 1988 in the northern regions of Armenia, measuring 6.9 on the Richter scale. That earthquake caused many deaths and was sensated in Yerevan.

Surface water

The main water artery of Yerevan is the Hrazdan River, the left tributary of the Arax River. It devides the City into two parts and feeds Yerevan Lake (an artificial lake on the Hrazdan River). The river starts from Sevan Lake and flows from the north-east to the south-west of the country. Its length is 141 km, and the water catchment basin is around 2,560 km^2 (without Sevan Lake). It falls into the Arax at 820 MASL.

Water quality data provided by Ecomonitoring Center[13] show that the Hrazdan already enters Yerevan with noticeable pollutant concentrations from anthropogenic activities upstream, and the pollution levels increase significantly as the river flows through Yerevan, mainly due to insufficient treatment of wastewater discharged into river.

Groundwater

Groundwater is the only source of industrial and drinking water supply in Armenia[14]. The drinking water system of Yerevan is fed from the Aparan aquifer[15]. There are sedimentary and volcanic rocks with both fracture and intergranular types of pores available in the territory of Yerevan. The quality and quantity of drinking water resources for Yerevan is subject to the regular monitoring by the "Hydrogeological Monitoring Centre" SNCO under the ME, as since 1994 there has been no long-term systematic monitoring of the overall groundwater quality and quantity in Yerevan region.

Air quality

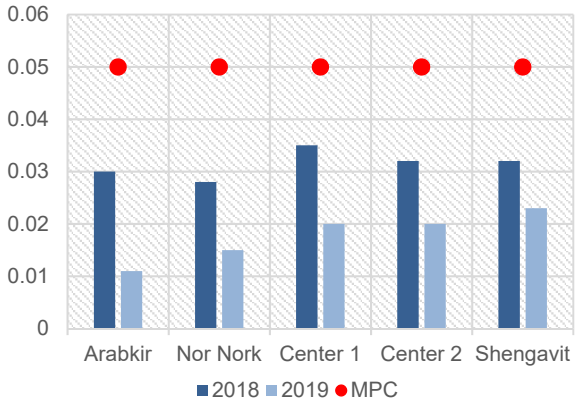
Air quality in Yerevan is significantly worse than in European cities of comparable size[16]. High concentrations of dust particles, due mainly to erosion caused by deforestation, is the leading cause of low air quality in the City. Furthermore, SO_2 and NOx emissions occur in significant concentrations. Emissions of NOx are mostly related to the transport sector. Concentration levels of pollutants and the number of days on which limits have been exceeded are above the standards set by WHO and the EU.

Air quality monitoring in Armenia is performed by the Ecomonitoring Center[17]. The concentrations of dust, CO, NOx, SO_2 and O_3 (ozone) are generally measured in the City atmosphere at five air quality monitoring stations[18]. In 2019, the concentration of air pollutants (except dust) in the atmosphere were below the 2018 average level at all five monitoring stations (**Figure 5**). During the last five years, the background concentrations of SO_2, NO_2, and surface layer of ozone have decreased, while the concentration of dust has trended to increase.

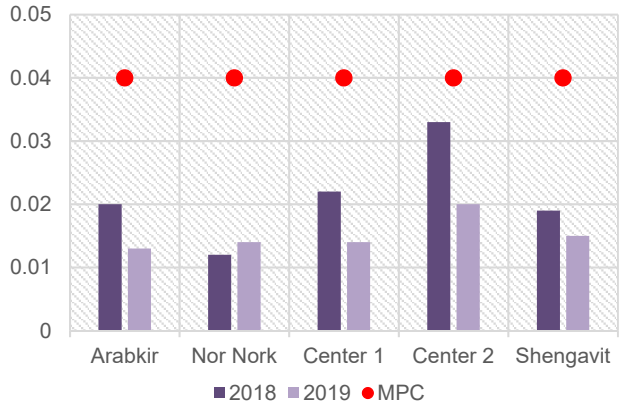
[13]"Hydrometeorology and Monitoring Center" SNCO under the ME.
[14]Aghinian A. (2009) Ground Water Vulnerability Assessment of the Aparan Aquifer, Republic of Armenia, and Its Representation in A 3-D Model. In: Jones J.A.A., Vardanian T.G., Hakopian C. (Eds) Threats to Global Water Security. NATO Science for Peace and Security Series C: Environmental Security. Springer, Dordrecht.
[15]Ibid.
[16]Yerevan's Green City Action Plan 2017.
[17]Hydrometeorology and Monitoring Center" SNCO under the ME.
[18]Report on atmospheric air pollutions in territory of the Republic of Armenia in 2019.

Figure 5. Annual average concentrations of atmospheric air pollutants (SO_2, NO_2, O_3 and dust) measured in the City's five monitoring points in 2018-2019 (mg/m^3)

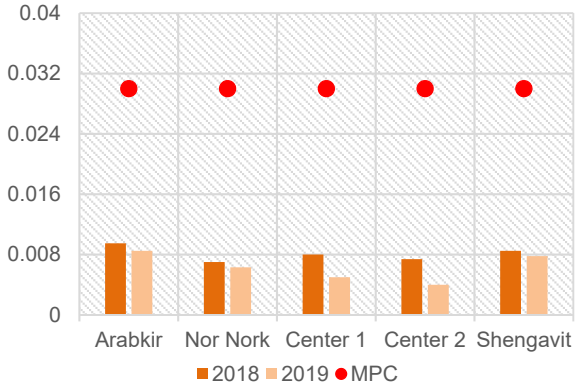
SO_2 average concentrations



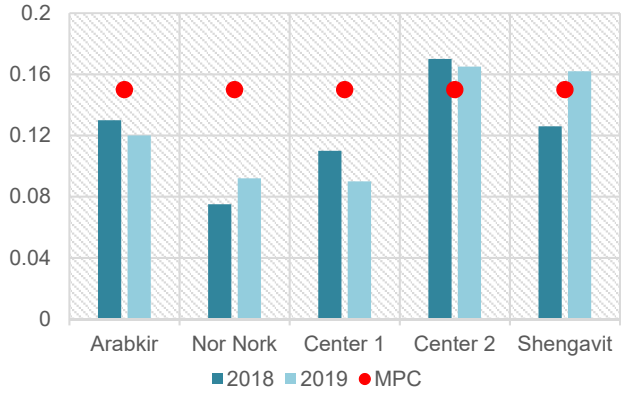
NO_2 average concentrations



O_3 average concentrations



Dust average concentrations



Noise and vibration

Currently, the dominant noise source in Yerevan is associated with the operation of urban transport (approx. 90%). The highest noise levels are generating in the center of Yerevan, where due to the high traffic density the national noise threshold limit values ("TLV") are violated even at nighttime. The TLVs set in national and WHO noise standards are summarized in **Table 3**.

Table 3. Threshold limit values for noise

№	Premises and territories		Threshold limit values (TLV), dBA		
			National[19]		WHO[20]
			Equivalent to sound level	Maximum sound level	One hour equivalent to sound level
1	Workplace		80	-	85
2	Shops, trading halls, airport and railway stations waiting rooms, drop-off points of public service providers		60	75	70
3	Territories adjacent to residential buildings, clinics, ambulatories, rest houses, care homes, disabled persons homes, libraries, kinder gardens, schools and other educational facilities	6^{00}-22^{00}	55	70	70
		22^{00}-6^{00}	45	60	

[19]Sanitary Norms № 2-III-11.3 "Noise in the workplaces, in residential and public buildings and in residential construction areas"
[20]Guidelines for Community Noise, World Health Organization (WHO), 1999

The main sources of vibration in the City are the construction and road asphalt pavement activities, operation of industrial and manufacturing facilities, etc. The vibration generated from the transport sector is low (beside the vicinities of metro network that is laid quite away from the project sites) and can be neglected.

Waste management

Generally, waste management and recycling activities are not well developed in Armenia. Neither organized waste sorting, recycling, nor reuse activities take place. The generated household waste is disposed of into the Nubarashen, Ajapnyak and Jrvej landfills City has three main landfills.

Armenia has no landfills for the disposal of industrial and hazardous wastes. However, some companies specialized in recycling and treatment of hazardous wastes, such as used tyres, lead accumulators, oil, ferrous and non-ferrous scrap, were established and operate.

3.2 Biological environment

Biodiversity

The flora and fauna of the Yerevan area are typical to the Yerevan floristic region. Mainly the petrophilvariants of the semi-desert flora are prevailing here with ephemeral and halophyte, psammophyte desert plant species. The fauna in the region is represented mostly by species, typical for desert and semi-desert landscapes. Amphibians (suchaslakefrogs, Syrianspadefoots, greentoads), lizards (round-headed, snake-headed ones and long-legged skinks) and snakes (blindsnakes, rhinosnakes) are common in the area. Birds and insects are diverse. Satyrs and big swallotails are typical butterflies.The Project area lies within the urban environment and no wild plants or animals inhabit it. No specially protected nature areas, endangered and other vulnerable ecosystems are available there.

Specially protected areas

The RA Government Decree №1059-N "On Approval of strategy, State program and measures regarding the specially protected areas ("SPA") of nature in the Republic of Armenia", specifies 34 sites, including 4 national parks, 3 reserves and 27 sanctuaries, as protected areas. The desktop study conducted by the Consultant reveals several protected areas of regional level, out of which the closest ones are:

- Erebuni Reserve (89 ha) located 6-7 km far from the City boundary, and
- Khosrov Forest Reserve (29,000 ha), Sands of Goravan (200 ha) and Vordan Karmir (200 ha) sanctuaries situated at the distance of 15-25 km from the Yerevan boundary.

3.3 Socio-economic baseline

Yerevan community is divided into 12 administrative districts: Ajapnyak, Avan, Arabkir, Davtashen, Erebuni, Kentron (City Center), Malatia-Sebastia, Nor Nork, Nork-Marash, Nubarashen, Shengavit and Kanaker-Zeytun. The population of Yerevan is equal to 1,084,0 thousand residents and the total area of the City is 22,328 ha.

Yerevan is the largest economic, educational, scientific and cultural center of Armenia. Yerevan is a major transport and transit hub. Yerevan represents 42.4% of industrial output, 53.9% of construction, 82.6% of retail trade and 85.5% of services sectors of Armenia. Around 86% of multi apartment residential buildings and around 30% of hotels are located in Yerevan.

The main trends of City's industry are food industry (including alcoholic beverages), chemical industry as well as metallurgy.

Demography

Yerevan, the capital of Armenia, has the largest share of urban population in the country. Yerevan's population had drastically increased in the Soviet period, especially in the 1950s-1980s. The historical maximum of the Yerevan population was registered in 1990 (1,218,000 residents). In the first years of independence, there was a population decline due to migration. Then, in the early 2000s, the population number dynamics stabilized at the level of around 1.1 million residents.

De facto, the population of Yerevan is higher than the "so called" permanent or de jure population. According to some studies, the population of Yerevan, including residents not officially registered in the City, is around 1,200-1,250 thousand people.

Minorities

Yerevan is a largely mono-ethnic city, with the majority of population being Armenians (98.9%). The major ethnic minorities are Yazidis (0.3%) and Russians (0.5%). Among other ethnic minorities are Assyrians, Greeks, Ukrainians, Georgians and Iranians.

The minority people are generally well integrated within Armenian society and they are not classified as indigenous people. Basically, the minority people do not have difficulty in communicating in the Armenian language. The minority people (citizens) have all the rights and obligations of the Armenians (for example voting right, property purchase right etc.).

Religious groups are Christians of Armenian Apostolic Church (94.9%), Catholic, Orthodox, as well as Protestants, Jehovah's Witnesses, Molokans. Other religious minorities are followers of Yazdanism and Paganism.

Socio-economic indicators

As stated in the "Program for Perspective Strategic Development of the Republic of Armenia for 2014-2025", the GDP per capita in Yerevan represents around 150% of the country's average (3,863.7 USD in 2014). According to the mentioned Program, the average GDP growth is assumed 4% per year towards 2025.

As of January 2020 the nominal monthly wages in Armenia amount to 183,030 AMD (around 313 EUR[21]) and increased to 5.3% compared with the 2019. In public sector the average wages has 8.6% increase up to 155,407 AMD (266 EUR), while in private sector it is equal to 196,503 AMD (336 EUR) and increased to 3.8%[22].

As per the 2011 population census (last census), the main sources of livelihood in Yerevan for the whole population in every age group are: employment (25.9%), retirement benefits (14.2%), self-employment (2.5%), public social allowances (1.1%), and remittances (1.1%). The rest comprise other sources of income generation (property, agriculture, financial services - 1.0%), by public and non-public institutions (1.7%), and other livelihood income sources (6.9%). Around 45% of Yerevan's populations (50% of women and 39% of men) have no income source; they are under the tutelage of their family members.

The overall Gini coefficient for Armenia[23] is 0.05, suggesting a relatively equal distribution of wealth at the national level. The lowest Gini coefficient is seen in Yerevan (0.02), where nearly half of the

[21] 1EUR=585AMD
[22] https://b24.am/economy/80541.html
[23] The Gini coefficient of wealth indicates the concentration of wealth, with 0 representing an exactly equal distribution (everyone having the same amount of wealth) and 1 representing a totally unequal distribution (one person having all the wealth).

population (47%) is in the highest wealth quintile. The highest Gini coefficients - that is, the least equitable distributions of wealth - are observed in Armavir (0.19) and Vayots Dzor (0.12)[24].

40.5% of women in Yerevan decide on how their earnings are used within the family, the joint (husband and wife) decision-making is 57.2% and solely husband's is 2.3%. Overall women earn less remuneration than men (68.5%). The decision on husbands' earnings are mostly managed jointly (79.9%). Around 46% of women in Yerevan do not own a housing, the same data for men is lower - 33.2%.

Poverty and social allowances

As per the "Report on poverty profile in Armenia in 2008-2018" published in 2019 by the RA National Statistical Service ("NSS"), the people are defined as poor if their monthly per capita income is less than 42,621 AMD (around 73 EUR), very poor if their monthly per capita income is less than 35,071 AMD (around 60 EUR) and extremely poor if their monthly per capita income is less than 24,827 AMD (43 EUR). This means that the criteria for extreme poverty is survival for 1.43 EUR per day.

Official unemployment rate in Yerevan is 10.6%; however, the actual unemployment rate might be higher. Among the population of Yerevan, around 15.6% receive retirement benefits and 1.6% receive social and other allowances.

4. Environmental and Social Benefits, Adverse Impacts and Mitigation Measures

Phase 1 of the Project consists of the following three components:

Component 1: Purchase of 100 CNG low floor buses (standard 12 m) to be in line with EURO V or higher standards,

Component 2: Construction of new Arshakunyats bus depot, including refueling and car washing stations,

Component 3: Upgrade/rehabilitation of Nor Nork (Jrvej) depot.

100 new low-floor CNG buses will be introduced into the five bus routes. As a result, 17 routes (5 bus and 12 minibus routes) will be terminated meaning that 50 old buses and 139 minibuses will be taken out of service. The annual vehicle kilometres / mileage of new fleet will be more than 3 times lower than that of the current 17 routes. Accoridng to the Project ToR, the buses to be purchased should comply with EURO V or higher standards as well as with high noise, safety and comfort criteria.

The elaboration of the detailed design documents for Components 2 and 3 of the Project Phase 1 is ongoing. The layouts of Arshakunyats and Nor Nork (Jrvej) bus depots as well as the lists of facilities to be constructed/upgraded in both depots are the only documents available for the E&S evaluation at the moment. Therefore, the Consultant has performed only a preliminary E&S assessment of the mentioned components based on the available E&S baseline data and walk-over surveys that provided the understanding of the sensibility of the depots' sites and surroundings, as well as the Consultant's local knowledge, expertize and practice.

[24]Armenia Demographic and Health Survey 2015-16. National Statistical Service, Ministry of Health, The DHS Program ICF available through https://dhsprogram.com/pubs/pdf/FR325/FR325.pdf

4.1 E&S assessment of Component 1: impacts and benefits

GHG assessment and air emissions

The environmental analysis of Component 1 related to the introduction of new bus fleet was performed by the Project Phase 1 Technical consultant[25]. This analysis contains the assessment/ calculations of an expected drop in GHG and exhaust emissions associated with the operation of new 100 buses instead of the 50 old buses and 139 minibuses to be withdrawn (see **Section 2.3**).

The GHG and exhaust emissions calculation was performed based on "EMEP/EEA air pollutant emission inventory guidebook, 2019" ("Guidebook") and EBRD protocol for assessment of GHG emissions, while the monetization of the calculated emissions was conducted using "Methodology for the economic assessment of EBRD projects with high greenhouse gas emissions". According to the Guidebook, the GHG and exhaust emissions calculation were conducted based on three parameters: emission factor for each type of vehicle / bus, fuel consumption, and annual mileage.

The emission factors of the considered vehicles / buses were taken and calculated as per the methods in the Guidebook for the following pollutants (**Table 4**):

- GHG emissions:
  1. Carbon dioxide (CO_2),
  2. Methane (CH_4).
- Air pollution emissions[26]:
  1. Particulate matter (PM),
  2. Nitrogen Oxide (NOx).

Table 4. Emission factors for CO_2, CH_4, PM and NOx

Parameter	Unit	EURO III Bus	EURO III Minibus	CNG bus EURO VI
CO_2 emission factor	g CO_2 per g of CNG	1.280	1.280	0.980
CH_4 emission factor	g CH_4 per g of CNG	0.003	0.003	0.002
GHG emission factor[27]	g CO_2eq per g of CNG	2.822	2.822	2.803
$PM_{2.5=10=tsp}$ emission factor	g $PM_{2.5=10=tsp}$ per g of CNG	0.000022	0.000022	0.000011
	g $PM_{2.5=10=tsp}$ per km	0.01	0.01	0.005
NO_X emission factor	g NO_X per g of CNG	0.0220	0.0220	0.0055
	g NO_X per km	10	10	2.5
For reference: fuel consumption	*g per km*	*455*		

The annual vehicle kilometres / mileage of the new fleet are 6,098,271 km (Project scenario), while the same value for the terminated routes (buses and minibuses to be replaced by new buses) are 20,267,858 km, of which 5,625,541 km refer to buses and 14,642,317 km refer to minibuses (Baseline scenario).

[25]Draft (Technical) Due Diligence Report, Yerevan Bus Renewal Project - Phase 1, August 2020
[26]The environmental analysis did not include Sulphur dioxide (SO_2) and Nitrogen dioxide (N_2O) emissions as only CNG vehicles / buses were considered.
[27]Calculated based on the Global Warming Potential (GWP) parameters.

Baseline scenario

The total amount of GHG and exhaust emissions calculated based on the annual mileage of the minibuses and urban buses currently operated in Yerevan are summarized in **Tables 5-7**.

Table 5. Summary of GHG emissions

GHG	Unit	EURO III Bus	EURO III Minibus	Total
Emission factor	g CO_2eq per g of CNG	2.822	2.822	-
Fuel consumption	g CNG per km	283.1	120	-
Annual mileage	km	5,625,541	14,642,317	20,267,858
Total annual emissions	**tonne CO_2eq**	**4,494**	**4,958**	**9,452**

Table 6. Summary of particulate matter emissions

PM	Unit	EURO III Bus	EURO III Minibus	Total
Emission factor	g $PM_{2.5=10=tsp}$ per g of CNG	0.000022	0.000022	-
Fuel consumption	g CNG per km	283.1	120	-
Annual mileage	km	5,625,541	14,642,317	20,422,947
Total annual emissions	**tonne $PM_{2.5=10=tsp}$**	**0.035**	**0.039**	**0.074**

Table 7. Summary of nitrogen oxides emissions

NOx	Unit	EURO III Bus	EURO III Minibus	Total
Emission factor	g NO_X per g of CNG	0.022	0.022	-
Fuel consumption	g CNG per km	283.1	120	-
Annual mileage	km	5,625,541	14,642,317	20,422,947
Total annual emissions	**tonne NO_X**	**35.0**	**38.62**	**73.62**

Project scenario

The Project scenario (Phase 1) assumes that the currently operated buses and minibuses will be replaced with new CNG buses of emission standard EURO VI. The summaries of total annual GHG and exhaust emissions associated with this Project scenario are given in **Tables 8-10**.

Table 8. Summary of GHG emissions

GHG	Unit	EURO VI Bus
Emission factor	g CO_2eq per g of CNG	2.803
Fuel consumption	g CNG per km	381
Annual mileage	km	6,098,272
Total annual emissions	**tonne CO_2eq**	**6,513**

Table 9. Summary of particulate matter emissions

PM	Unit	EURO VI Bus
Emission factor	g $PM_{2.5=10=tsp}$ per g of CNG	0.000011
Fuel consumption	g CNG per km	381
Annual mileage	km	6,098,272
Total annual emissions	**tonne $PM_{2.5=10=tsp}$**	**0.026**

Table 10. Summary of nitrogen oxides emissions

NOx	Unit	EURO VI Bus
Emission factor	g NO_X per g of CNG	0.0055
Fuel consumption	g CNG per km	381
Annual mileage	km	6,098,272
Total annual emissions	**tonne NO_X**	**12.766**

The calcculated annual GHG and exhaust emissions for the Baseline and Project scenarios as well as their expected reduction as a result of Component 1 implementation are summarized in Table 11.

Table 11. Estimated annual reduction in GHG and exgaust emissions

Emissions	Baseline scenario, tonne	Project scenario, tonne	Reduction	
			in tonne	in %
GHG (CO_2 eq)	9,452	6,513	-2,939	≈30
PM	0.074	0.026	-0.048	≈65
NOx	73.62	12.766	-60.854	≈83

Resource efficiency and waste generation

To evaluate the resource efficiency of Project Component 1, i.e. the use of 100 new CNG buses versus the operation of the existing fleet (buses and minibuses), the calculations of main maintenance items / expendables (oil, filters, tyres, accumulators, etc.) were conducted based on the document "Calculation of expenses for the passenger transportation by buses and microbuses", prepared by Yerevan municipality. This document sets norms / limits for buses and minibuses related to the consumption of motor oil, tyres and accumulators. Additinally, the E&S Consultant calculated the annual consumption of oil filters considering that they are replaced every time when motor oil is refilled. The consumption norms / limits of maintenance items, alongside their weights and required quanitites that were used for resource efficiency determination, are given in Table 12.

Table 12. Consumption norms for motor oil, oil filters, tyres and accumulators

№	Item	Bus	Minibus
1. Motor oil			
1.1	Consumption norm (replacement frequency)	11000 km	10000 km
1.2	Required quanity (per replacement)	12.34 liter	5.5 liter
2. Oil filters			
2.1	Consumption norm (replacement frequency)	11000 km	10000 km
2.2	Weight[28]	0.6 kg	0.4 kg
3. Tyres			
3.1	Consumption norm (replacement frequency)	80000 km	60000 km
3.2	Weight[29]	4 x 65 kg	4 x 16 kg
4. Accumulators			

[28]Web-sites of oil filter producers
[29]MPO-8-99. Methodology for calculation of generated wastes' quanitites: used tyres, 2004

№	Item	Bus	Minibus
4.1	Consumption norm (replacement frequency)	2 year	2 year
4.2	Weight[30]	46 kg	17 kg

The annual consumptions of motor oil, oil filters and tyres for the Project and Baseline scenarios were calculated based on the annual mileage of the new and existing bus / minibus fleets, respectively (see **Section 2.3**). The annual consumption of accumulators was determined considering that 5 new bus routes (100 new CNG buses) will replace the 17 terminated routes (50 old buses and 139 minibuses).

The annual consumption of maintenance items for the Baseline and Project scenarios and evaluation of resource efficiency for the Project Component 1 is summarized in **Table 13**.

Table 13. Annual consumption of maintenance items calculated for the Baseline and Project scenarios and resource efficiency values

Maintenance item	Baseline scenario			Project scenario	Resource efficiency
	Bus	Minibus	Total		
Motor oil	6,310 liters	8,053 liters	14,363 liters	6,841 liters	7522 liters
Oil filter	307 kg	586 kg	893 kg	333 kg	560 kg
Tyres	18.278 tonne	15.618 tonne	33.896 tonne	19.819 tonne	14.077 tonne
Accumulators	1.15 tonne	1.19 tonne	2.34 tonne	2.3 tonne	0.04 tonne
For references:					
Average mileage	*5,625,541 km*	*14,642,317 km*	*20,267,858 km*	*6,098,271 km*	
Bus fleet	*50*	*139*	*189*	*100*	

To summarize, due to the implementation of Project Component 1, 7,522 liters of motor oil, 560 kg (1421 pcs) of oil filters, 14.077 tonnes of tyres and 0.04 tonnes of accumulators will be saved annualy. This means that the quantities of generated waste, such as used motor oil (3rd class of hazard), used oil filters (4th class of hazard), used tyres (4th class of hazard) and used lead accumulators (2nd class of hazard) will be reduced correspondingly.

Community health and safety

The impacts of Project Component 1 on community health and safety are associated with noise and air emissions as well as traffic collisions and accidents. As stated above, 100 new CNG buses to be purchased shall comply with the EURO V or higher air emission standards. It is obvious, that the level of noise generated during the operation of new buses will be lower than from the existing ones. In general, the reduction in air emissions and noise level that will be attained as a result of Component 1 implementation can have a positive impact on community health and safety. However, the share of new bus fleet in the total City traffic is very low, if not negligable.

It is assumed that the operation of new up-to-date CNG buses will reduce the number and severity of traffic collisions and accidents as they will be in "good" working conditions (at least during the first three years of operation) and will be equipped with advanced safety alarm devices and systems. Therefore, the impact of Component 1 on community health and safety is considered positive.

[30]MPO-4-99. Methodology for calculation of generated wastes' quanitites: used accumulators, 2004

Drivers' health and safety

It is assumed that 100 new up-to-date buses to be purchased will ensure healtier and safer conditions for drivers compared with the existing bus fleet. These conditions include orthopedic seats for drivers, bus operation and control advanced system, etc.

In addition, the operation of the public transport ticketing system will release the drivers from dealing with the cash payments and, as a result, the drivers will be able to fully can concentrate on their key function, i.e. safe steering of buses.

Comfort conditions

The introduction of 100 new up-to-date buses will improve the comfort conditions of the City's public transport system. This will be accompanied with the implementation of tariff and ticketing system for the public transport network as well as of the Project Phase 2.

There is no information about whether 100 new buses with be equipped with special devices for people with disabilities, such as wheel-chairs or else.

4.2 Preliminary E&S assessment of Components 2 and 3, impacts and benefits

The results of the preliminary E&S assessment of new Arshakunyats depot (to be constructed) and existing Nor Nork (Jrvej) depot (to be upgraded) are summarized in **Table 13**.

Table 13. Summary of the preliminary E&S assessment and mitigation for Arshakunyats new bus depot construction and existing Nor-Nork (Jrvej) bus depot upgrade

(AR - Arshakunyats new bus depot, NN - Nor Nork (Jrvej) bus depot)

№	Impacts	E&S receptors	Summary of preliminary assessment	Management / Mitigation
I	**Construction / Upgrade stage**			
I-1	Noise and vibration	Working personal Neighboring community	(AR) - The site selected for the construction of Arshakunyats bus depot is located in close vicinity to residential area. The distance between the boundary of the new depot and the nearest residential house is 25-30 m. Thus, the residents of neighbouring houses can be disturbed by the noise from the construction equipment. The seismic stability of the residential houses and the restaurant (see picture below) located within 40 m from the vibration source also can be impacted. 	1. Perform regular technical maintenance of used construction equipment and heavy vehicles, 2. Inform the residents of nearby houses at least two days before about high noise evolving activities, 3. Limit truck routes and speed (keep the recommended speed) where trucks may pass close to the sensitive receptors / houses, 4. Keep restrictions on working hours, weekends or public holidays, stop operation of construction equipment at night time (20:00-08:00), 5. Enforce the use of ear protective PPE among workers, 6. Perform mapping and pre-construction inventory of sensitive buildings located within the 40 m zone from the vibration sources, 7. While starting vibration-causing works monitor the vibration impact on the cracks formation and development. If the vibration level is above the TLV, stop the works and undertake alternative mitigation measures.
			(NN) - Although the Nor Nork (Jrvej) bus depot is surrounded by the commercial facilities, there is a Jrvej residential area that is located to the south of the depot (see picture below). The distance between the depot boundary and the nearest residential area is 120-130 m. It is unlikely that the vibration from the construction works can affect thenearest houses and buildings, but the emitted noise can have some influence on the living quality of the neighbouring population.	1. Perform regular technical maintenance of used construction equipment and heavy vehicles, 2. Limit truck routes and speed (keep the recommended speed) where trucks may pass close to the sensitive receptors / houses,

№	Impacts	E&S receptors	Summary of preliminary assessment	Management / Mitigation
				3. Keep restrictions on working hours, weekends or public holidays, stop operation of construction equipment at night time (20:00-08:00), 4. Enforce the use of ear protective PPE among workers.
I-2	Air emissions	Air quality Community health and safety Neighboring community Working personal	(AR) - The construction of new Arshakunyats bus depot will be accompanied with the earthworks and operation of construction equipment and vehicles. Therefore, dust emissions as well as gaseous emissions will be released and affect the neighbouring population (see picture above). (NN) - The construction of new facilities and rehabilitation / reconstruction of the existing facilities within Nor Nork (Jrvej) bus depot will generate gaseos emissions to the atmosphere and will impact the neighbouring population (see picture above).	1. Use modern construction machinery equipped with engines compliant with at least Euro III standards, with emission control and minimal noise characteristics, 2. Perform regular technical maintenance of used construction equipment and heavy vehicles, 3. While transporting friable materials keep the body of heavy vehicles covered, 4. Store friable materials at the construction site under the waterproof tent, 5. Restrict excavation and earthworks during the periods of strong winds, 6. Apply regular watering to on-site and off-site dirt roads, especially during the excavation and other earthworks, 7. Prohibit construction materials and waste burning.
I-3	Wastewater generation	Water resources	(AR) - Wastewater can be generated as a result of site watering during the excavation and other earthworks. There are no surface water resources in the vicinities, so the wastewater as well as stormwater will penetrate the ground or	1. Prohibit excavation and other earthworks during the unfavorable weather conditions (rain, snow), 2. Construct wastewater and stormwater diversion network (culvert) around the Project site to avoid

№	Impacts	E&S receptors	Summary of preliminary assessment	Management / Mitigation
			will discharge into the nearest municipal stormwater sewage network.	wastewater penetration into the ground and soil pollution.
			(NN) The area of Nor Nork (Jrvej) depot is connected with the municipal sewage system; hence, the wastewater and stormwater to be generated in the course of reconstruction works will be discharged into the municipal sewage network.	-
I-4	Waste generation	Soil	(AR and NN) - During the construction and rehabilitation activites in both depots, the construction and household wastes as well as ferrous and non-ferrous metal scrap, oiled soil and rags and used oil will be generated. They should be stored separately in special containers and specially allocated areas and periodically disposed of to the authorized landfills or passed to the licensed companies. The earthworks in Arshakunyats depot will be accompanied with the generation of top-soil and excavated ground materials.	1. Manage the top-soil stripped before the excavation works at Arshakunyats site according to the RA Government decree №1396-N (Procedure for top-soil use), 2. Store top-soil separately in a designated place, covered by waterproof tent, uncompressed and in such a manner that it is does not lose its fertile characteristics, 3. Dispose the excavated ground materials in landfill / area recommended by Yerevan municipality, 4. Equip the construction site with household collection bins, 5. Equip the construction site and associated facilities with the waste separated collection / storage containers and locations, 6. Sign contracts with the licensed waste treatment / utilization and disposal companies.
I-5	Leakages and spills	Soil and groundwater	(AR and NN) - During the construction / rehabilitation activities, the soil / topsoil can be contaminated as a result of accidental leakages of fuel, other oil products from the vehicles and construction equipment. The spillages of chemicals, like paints and solvents are also possible. The spill of friable materials may occur due to the improper operations/activities and/or unfavorable weather conditions.	1. Refuel the vehicles at the outside refueling stations, 2. Use spill catching protective trays when refueling the construction equipment on site, 3. Place the fuel and oil tanks in covered areas with berms or dikes installed to intercept spills. Where possible, the secondary containment trays for the fuel tanks should be applied,

№	Impacts	E&S receptors	Summary of preliminary assessment	Management / Mitigation
				4. Equip vehicles (transporting liquid materials) and liquid materials storage areas with absorbent materials and emergency spill-kits, 5. Store the contaminated soil in special containers and periodically pass it to the specialized waste treatment / utilization companies.
I-6	Traffic density	Neighboring community Road infrastructure	(AR and NN) - During the construction / rehabilitation works some slight increase in traffic density along the Arshakunyats avenue - Shirak street (for Arshakunyats bus depot) and Tevosyan street - Hovhannisyan street (for Nor Nork (Jrvej) depot) can be expected. However, within the total traffic load in Yerevan, these impacts are seen as very low and can be neglected.	-
I-7	Biodiversity impact	Flora and fauna	(AR) - The selected site for Arshakunyats new bus depot is an abandoned semi-dessert / semi-steppe area with rather poor biodiversity. However, before the start of construction activities the selected site and its surroundings shall be investigated, endangered species, if any, should be identified and relevant protective measures should be undertaken.	Before the start of construction works invite a specialized company or expert to perform a biodiversity survey in and around the Project site, identify the endangered species, if any, and propose relevant mitigation meaures.
			(NN) - The area of Nor Nork (Jrvej) bus depot has been under the human impact for many years. So, no impacts on flora and fauna during the depot rehabilitatation / upgrade is expected.	-
I-7	Physical displacement and land acquisition	Land-plots Area of site selected for Arshakunyats new bus depot	(AR) - It is envisioned to allocate land-plots located in the City's Shengavit district (at the crossing point of Arshakunyats avenue and Shirak street) for the construction of Arshakunyats new bus depot. According to the provided information, the land-plots to be allocated for the construction of depot belong to Yerevan community. So, most probably, the allocation of these land-plots to the Project needs will not trigger physical displacement or involuntary land acquisition.	1. Conduct land acquisition for the purposes of Arshakunyats new bus depot construction based on the provisions of the RA Government decree №286 "On approval of procedure for the public and community owned land allocation and use as well as issuance of construction certificate". 2. If any impacts on land use / risks of economic displacement are identified for the local

№	Impacts	E&S receptors	Summary of preliminary assessment	Management / Mitigation
				population, comply with the requirements of EBRD PR5.
			(NN) - The reconstruction / rehabilitaion activities will be performed within the territory of Nor Nork (Jrvej) bus depot. No land acquisition will be required.	-
I-8	Impact on infrastructure	Infrastructure and facilities	(AR) - It is obvious that construction and operation of new Arshakunyats bus depot will require connection of internal communications and infrastructure with water, gas and power energy supply public utilities and wastewater sewage network. Therefore, the approvals of the relevant public service operators shall be obtained during the Project detailed design stage (before the start of construction).	Before the start of construction works, obtain approvals of the following public service operators: • Potable and technical / irrigation water supply (Veolia Jur CJSC), • Wastewater discharge and treatment (Veolia Jur CJSC), • Power energy supply (Electric Networks of Armenia CJSC) • Gas supply (Gazprom Armenia CJSC) • Telecommunication service providers (Ucom, Beeline/Telecom Armenia, MTS-Armenia, etc.).
			(NN) - It is not expected that the upgrade / rehabilitation of Nor Nork (Jrvej) bus depot will have a significant impact on the public service infrastructure.	-
I-9	Socio-economic impact	Working personal Population Subcontractors State budget (social payments from new jobs/salaries)	(AR and NN) - In general, the construction / rehabilitation works will have a positive impact on the economic development of Yerevan City, as well as the socio-economic profile of the region. Local/regional sub-constructors can be engaged to undertake some construction works. The Project is also important from the viewpoint of new jobs creation. Temporary workplaces will be created for the residents of the City and the neighbouring regions during the construction / rehabilitation activities, especially for the positions requiring low and medium qualifications.	-
I-10	Health and safety	Working personal	(AR and NN) - Construction and rehabilitation of the depots will be accompanied by simultaneous exploitation of vehicles and construction equipment at the construction sites as well	1. Ensure appropriate visual safety signs and posters within the site and near the entrances,

№	Impacts	E&S receptors	Summary of preliminary assessment	Management / Mitigation
			as various hazardous works, namely fire works and works at heights, which may cause the following emergency situations: • Fire and ignitions, • Liquid leakages, • Injuries of workers, • Unproper sanitary-higienic conditions, • Accidents with operating equipment.	2. Secure working personnel with certified PPE and first-aid means, 3. Conduct trainings on compliance with prescribed routes and speed for drivers of construction vehicles, 4. Ensure initial and periodical health examination of working personnel, 5. Ensure proper management of sanitary conditions for temporary (construction) workers, including hand-washing facilities, rest and lunch rooms, 6. Prepare a detailed emergency plan to reduce/eliminate accidents and other OHS risks, 7. Ensure the availability of fire-fighting means at workplaces and working zones.
I-11	Impact of cultural heritage	Cultural and historical monuments	(AR) - The area envisioned for the construction of Arshakunyats bus depot site is not identified as a sensitive / valuable in terms of cultural heritage. However, the construction contractor should be aware of the measures to be undertaken when the chance artifacts are found.	1. Elaborate a Chance Find Procedure (CFP), 2. Train staff engaged in excavation and earthwork on the application of the CFP.
II	**Operation stage**			
II-1	Noise and vibration	Working personal Neighboring community	(AR) - During the operation stage, the noise emission from the operation of CNG refueling and washing stations, bus repaire and maintenance shops, etc. as well as movement of buses within the depot's parking area may disturb the population of the neighbouring houses and commercial units. (NN) - It is unlikely that any additional noise sources (beside CNG refueling station) can appear as a result of Nor Nork (Jrvej) depot rehabilitation. Meanwhile, the operation of new modern equipment and buses within the upgraded depot site even will reduce the level of emitted noise and vibration.	1. Limit the speed of buses (keep the recommended speed) where they may pass close to the sensitive receptors / houses, 2. Limit the operation of CNG refueling and washing stations at night time (20:00-08:00), 3. Enforce the use of ear protective PPE among workers.

№	Impacts	E&S receptors	Summary of preliminary assessment	Management / Mitigation
II-2	Air emissions	Air quality Community health and safety Neighboring community	(AR and NN) - The main air pollution sources in both depots will be the CNG refueling stations. They will replace the existing petroleum fueling stations in Nor Nork (Jrvej) and Charbakh bus depots (Charbakh bus depot is located 2 km away from the planned Arshakunyats bus depot site and will be closed once Arshakunyats depot is commissioned). Hydrocarbones are emitted from both types (CNG and petroleum) of refueling stations. Another air emissions' source will be the movement of buses within the parking areas of both depots. The existing bus fleet complies to EURO III, while new buses should be in line with EURO V and high standards; this will result in reduction in air emissions.	-
II-3	Wastewater generation	Water resources	(AR and NN) - Wastewater (mainly from the bus washing stations) generated at both depots will be connected to the municipal sewage network via the site drainage systems. Stormwater will be discharged into the stormwater sewage system. According to the provided layouts of Arshakunyats and Nor Nork (Krvej) bus depots, wastewater treatment stations are not envisioned.	Consider a possibility to include the wastewater treatment stations at least for washing stations into the detailed designs of both depots.
II-4	Waste generation	Soil	(AR and NN) - Waste management at both depots shall be performed according to the requiements of national waste management legislation and international best practices. The concept of waste management hierarchy, i.e. waste avoidance ahead of recycling and disposal, should be applied, where possible.	1. Ensure compliance with the requirements of the RA waste management legislation, including: a) Register the wastes generated by "Yerevan Trans" CJSC in waste registration log-books as required by the RA Government Decree №1343-N, b) Elaborate the hazardous waste passports and submit them to the Ministry of Environment for approval as required by the RA Government Decree №47-N, c) Prepare the report on registration of waste generation facilities and submit it to the Ministry of Environment for approval as

№	Impacts	E&S receptors	Summary of preliminary assessment	Management / Mitigation
				required by the RA Government Decree №500-N, d) Elaborate waste generation norms and their disposal limits document and submit it to the Ministry of Environment for approval as required by the RA Government Decree №2291-N. 2. Ensure separate collection of generated wastes in special containers and equip relevant facilities/sites for safe waste storage. 3. Sign contracts with the specialized waste management companies to periodically hand the generated wastes over to them for utilization, treatment or disposal purposes.
II-5	Leakages and spills	Soil and groundwater Flora and fauna	(AR and NN) - Bus repair and technical maintenance works at both depots may be accompanied with the accidental leakages of oil and other chemicals (antifreeze, brake fluid, solvets, paints, etc.). The leakages may also happen in storage areas/shops. The areas where accidental leakages can take place should be equipped with oil and chemical spill-kits.	1. Secure the areas, where fuel/oil/chemicals leakages potentially can take place, with fuel / oil spill-kits and secondary containments and trays, 2. Perform technical examination and testing of fuel storage tanks/reservoirs in both depots and assess their integrity and validity, 3. Elaborate a spill prevention and respond procedure and conduct practical drills with workers engaged in fuel filling operations on the risks of oil/chemicals leakages and on how to respond to them
II-6	Biodiversity impact	Flora and fauna	(AR and NN) - During the operation stage, the areas of Arshakunyats and Nor Nork (Jrvej) bus depots will be under the human impact, so no effect on flora, fauna and wildlife will be expected.	-
II-7	Physical displacement	Community Individuals and legal entities	(AR and NN) - No physical displacement and involuntary land acquisition is expected during the operation stage of Arshakunyats and Nor Nork (Jrvej) bus depots.	-

№	Impacts	E&S receptors	Summary of preliminary assessment	Management / Mitigation
	and land acquisition			
II-8	Socio-economic impact	Working personal Population	(AR) - After constructing and commissioning Arshakunyats bus depot, Charbakh existing bus depot will be closed. It is expected that most of the personnel from Charbakh depot will re-employed in Arshakunyats depot. Moreover, some additional workplaces will be created in CNG refueling station.	-
			(NN) - It is unlikely that additional workplaces will be created after Nor Nork (Jrvej) bus depot's rehabilitation / upgrade.	-
II-9	Health and safety	Working personal	(AR and NN) - The requirements of the RA on fire safety, as well as OHS legislation, shall be implemented at both depots. The CNG refueling stations are considered as dangerous industrial objects ("DIO") according to the RA Law on State Regulation of Technical Safety. Therefore, before commissioning, design documents of CNG refueing stations should undergo expert examination of technical safety. During the operation stage, the CNG refueling stations should be registered in the DIO State Registration Log-book and annually examined/checked.	1. Before commissioning, ensure the design documents of CNG refueling stations at both depots undergo a technical safety examination. 2. Register the CNG refueling stations in the DIO State Registration Log-book. 3. Sign contract(s) with an accredited company to conduct annual technical safety examinations of both CNG refueling stations.

Mitigation and management

The management and mitigation of the Project's risks and impacts will be performed jointly by Yerevan municipality and "Yerevan Bus" CJSC in line with the latter's current ESHS management procedures and practices that are expected to be supplemented by the Project-specific mitigation measures, as well as actions needed to bring the ESHS management practices, as relevant, in compliance with the EBRD requirements.

5. Monitoring actions

The main objective of the monitoring is to measure and control the changes or modifications of the E&S / OHS factors that are affected by the proposed Project activities. Any variations of the E&S media have to be monitored to determine the degree to which the environment and population are affected and to establish corrective E&S measures. ESHS monitoring refers to the periodic inspections and testings to be performed to assess the impacts caused by Arshakunyats new bus depot (during the construction and operations stages) and Nor Nork (Jrvej) bus depot (during the rehabilitation and operation stages) on the surrounding environment and communities. At the same time, the environmental conditions impacting the Project should be monitored as well in order to adjust the Project works accordingly.

The proposed ESHS monitoring works during the construction / upgrade and operation stages are as follows:

1. Meteorological data monitoring (construction stage): The meteorological - climatic data should be monitored during the construction stage to identify windy and rainy days and stop the excavation and other earthworks, if necessary.

2. Air quality (construction stage): The air quality measurements and monitoring at the nearest residential areas and other sensitive receiptors should be regularly conducted. The instrumental measurements should be done before (baseline data) and during the construction activities and compared with the permissible concentrations approved for the residential areas (approved by the RA Government Decree №160-N dated 02.02.2006). The following parameters should be monitored: dust (PM2.5, PM10), NOx, SO2, CO.

3. Noise measurements (construction stage): The noise equivalent and maximum levels at the nearest residential areas and oher sensitive receiptors should be regularly measured. The instrumental measurements should be done before (baseline data) and during the construction activities and compared with the noise threshold limit values (the RA Sanitary Norms №2-III-11.3 "Noise in the workplaces, in residential and public buildings and housing in construction areas" and WHO's Guidelines for community noise).

4. Seismic stability / vibration monitoring (construction stage): The buildings and houses located within 40 m from the vibration sources shall be identified and their mapping and pre-construction inventory should be done. While starting vibration-causing works monitor the vibration impact on the cracks formation and development. If the vibration level is above the TLV, stop the works and undertake alternative mitigation measures.

5. Periodic inspection of preventive contamination actions (construction and operation stages): The water spray, waste, ground, top-soil and other materials covering and storage activities, working personnel instructions, equipment maintenance operations, etc. should be periodically inspected.

6. Health and safety audits and inspections (construction and operation stages).
7. Fire security audits and inspections (construction and operation stages).
8. Ongoing monitoring of compliance with the EBRD's EHSS requirements and preparation of annual monitoring reports for the EBRD to inform on the Project's EHSS performance and the progress with the ESAP implementation.