SEA Scoping Report

Application of SEA to the "Strategic Development Plan, Road Map and Long Term Investment Plan for the Solid Waste Management Sector in Armenia"

Yerevan, Armenia

September 2016

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1. BACKGROUND AND PURPOSE OF SEA SCOPING

1.1. Background

Strategic Environmental Assessment (SEA) effectively promotes sustainable development by mainstreaming environment into economic development at the national, regional and local levels. SEA is a well-established, practical and efficient planning and environmental governance tool/system set out in the UNECE Protocol on SEA to the Convention on Environmental Impact Assessment (EIA) in a Transboundary Context (Espoo Convention). It ensures that strategic policy and legal frameworks and development plans in key sectors, including energy, water, waste management with likely significant adverse environmental effects are developed taking into account potential environmental and health effects and considerations. SEA ensures the identification of the most sustainable and cost-effective strategic development alternatives for attracting new investments and improving its environment. SEA also helps strengthening environmental governance through fostering transparency and consultation with relevant stakeholders and the public prior to the approval of plans and programmes which significantly improves public awareness and participation to the environmental decision making at national and local levels. SEA in a transboundary context can also greatly facilitate regional cooperation on environmental matters.

UNECE provides capacity-building support that aims at ensuring the implementation of the Espoo Convention and the SEA Protocol in Eastern Europe, Caucasus and Central Asia, the compliance of the provisions of national legislation with those of the Protocol, the development of national experience, and the development of guidelines on SEA, as well as the effective implementation of SEA in the Republic of Armenia, led by the SEA Protocol.

Armenia is a Party to the Protocol on SEA since 2011 and has been developing its national environmental assessment system in line with the Espoo Convention and its Protocol on SEA, including:

(a) Improvements of its legislative and institutional framework to fully comply with the Protocol

(b) Defining roles and responsibilities of various authorities in the SEA process

(c) Building national and local capacities, developing practical experience and national guidelines in application of the SEA procedures in line with the Protocol

(d) Raising awareness and common understanding of the benefits of the SEA at national and local levels and in different sectors, including the benefits of public participation and the consultation of relevant authorities.

At the sixth Meeting of the Parties to the Espoo Convention, in June 2014 in Geneva, the Government of Armenia requested the secretariat to further assist the country developing its national environmental assessment system. Based on this request the work-plan of the two treaties for 2014–2017 foresees implementation of the large assistance programme, which in particular includes:

1. Preparation of amendments on SEA to the national legislation

2. Pilot application of the SEA procedure to a draft “Strategic Development Plan, Road Map and Long Term Investment Plan for the Solid Waste Management Sector in Armenia”,

3. Preparation of the guidance on practical application of SEA

4. Training workshop on SEA.

The funding for the activities is secured through the EU funded programme "Greening Economies in the Eastern Neighborhood" (EaP GREEN).

Armenia ratified the Protocol on SEA on 24 January 2011. However, despite its benefits, SEA is still a rarely used tool in the country, and there are a number of obstacles that hamper development of a well-functioning national system to apply SEA procedures according to the provisions of the Protocol. One of them is a weak legislative and institutional framework for application of environmental assessments, as well as lack of practical experience in SEA implementation based on the local frameworks.

In August 2014, the Government of Armenia adopted the Law "On environmental impact assessment and expertise" (hereafter – the Law) that regulates both, SEA and EIA. However, the EIA and SEA systems established by the law are not completely in line with the provisions of the UNECE Convention on the EIA in a Transboundary Context and its Protocol on SEA and therefore further revision of the Law is currently under way.

Armenia also ratified the UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention) on May 14, 2001.

1.2. Subject of the Pilot SEA and Purpose of SEA Scoping

Subject of the Pilot SEA

"SEA for Strategic Development Plan, Road Map and Long Term Investment Plan for the Solid Waste Management Sector in Armenia" /hereafter referred to as the "waste management plan" or the Plan/ was selected as a SEA pilot project in Armenia, as the Law stipulates that founding documents related to the waste management sector are subject to strategic assessment and expertise. The assessment and expertise processes should also include the organization of public discussions in the processes of SEA and expertise from the very start of the assessment process and until the decision-making stage / provision of the expertise conclusion/. The pilot SEA should be implemented in accordance with the provisions of the RA Law on "Environmental Impact Assessment and Expertise", and the Protocol on SEA.

The aim of Scoping

The Scoping (or according to the Law 'preliminary assessment') is the initial stage of the SEA process. The aim of the Scoping stage is to identify environmental and health issues related to the plan or programme, which should be further analyzed within the SEA.

The Scoping is important for the efficiency of the SEA process, since it ensures that SEA focuses only on the likely significant effects which are relevant for the proposed plan or program.

The Scoping in SEA for the Waste Management Plan shall entail the following activities and analyses. According to guidelines of the scoping report that has been provided as support within the framework of the program, the definition of the waste management plan SEA scoping implies:

- Preliminary analysis of the environmental and health baseline,
- Identification of key environmental and health issues relevant to the Waste Management Plan,
- Identification of environmental and health policy objectives relevant for the Waste Management Plan,
- Identification of stakeholders and consultations with stakeholders.

The pilot project will reveal the opportunities via the practical application of legislation, will allow proposing recommendations as to how to improve the SEA process in Armenia, and will raise the overall awareness on the benefits of SEA. It will also inform the legal recommendations that will help to bring the national SEA legislation in line with the requirements of the Protocol.

2. WASTE MANAGEMENT PLAN

2.1. Name of the initiator, location

This subsection contains the information required by Article 16.4. of the Law pertaining to the content of the Preliminary Assessment Application (i.e., Scoping Report):

(1) the name and location (registered office) of the initiator.

The Government of the Republic of Armenia and Asian Development Bank (ADB) initiated a two-phase technical assistance for project preparation / PPTA / assignment, which aimed at improving the planning of the solid waste management sector. The entity responsible for the implementation of the waste management plan is considered to be the RA Ministry of Territorial Administration and Development, based in Yerevan, Republic Square, Government Building Street 3.

2.2. Goal of the Plan

This subsection contains the information required by Article 16.4. of the Law pertaining to the content of the Preliminary Assessment Application (i.e., Scoping Report):

(2) the name and purpose of the fundamental document and/or the proposed activity.

In Armenia the delivery of solid waste management services is at a rather low level resulting in social, environmental and overall sanitary problems. At the same time, there is no national strategy or action plan in the country. To this end, the **SEA for Strategic Development Plan, Road Map and Long Term Investment Plan for the Solid Waste Management Sector in Armenia** (waste management plan) was prepared in 2013 with its ultimate goal being as follows:

> "*Armenia will have a modern SWM system covering the country as a whole and that meets international best practices, that takes into account the country's EU approximation efforts and that provides cost-effective services in a technically, financially, and environmentally sustainable manner".*

The Plan covers the period between 2017 and 2036. The activities described in the waste management plan will be implemented gradually, step-wise. Since twenty years is a long time period for planning, it is envisioned that changes will be made throughout the implementation process.

In the framework of waste management plan five sub-programs will be implemented in Kotayk, Shirak, Syunik, Lori and Yerevan, that will serve the neighbouring communities. Currently the waste management plans of Kotayk marz and Shirak marz are in the process of development. The activities of the remaining three have not started yet. All five programs shall be approved by the RA Government. The timelines for the design and approval of the mentioned programmes are not set yet.

The Plan itself has not been adopted yet and is subject to the review by the Government of Armenia.

2.3. Characteristics of the founding document/

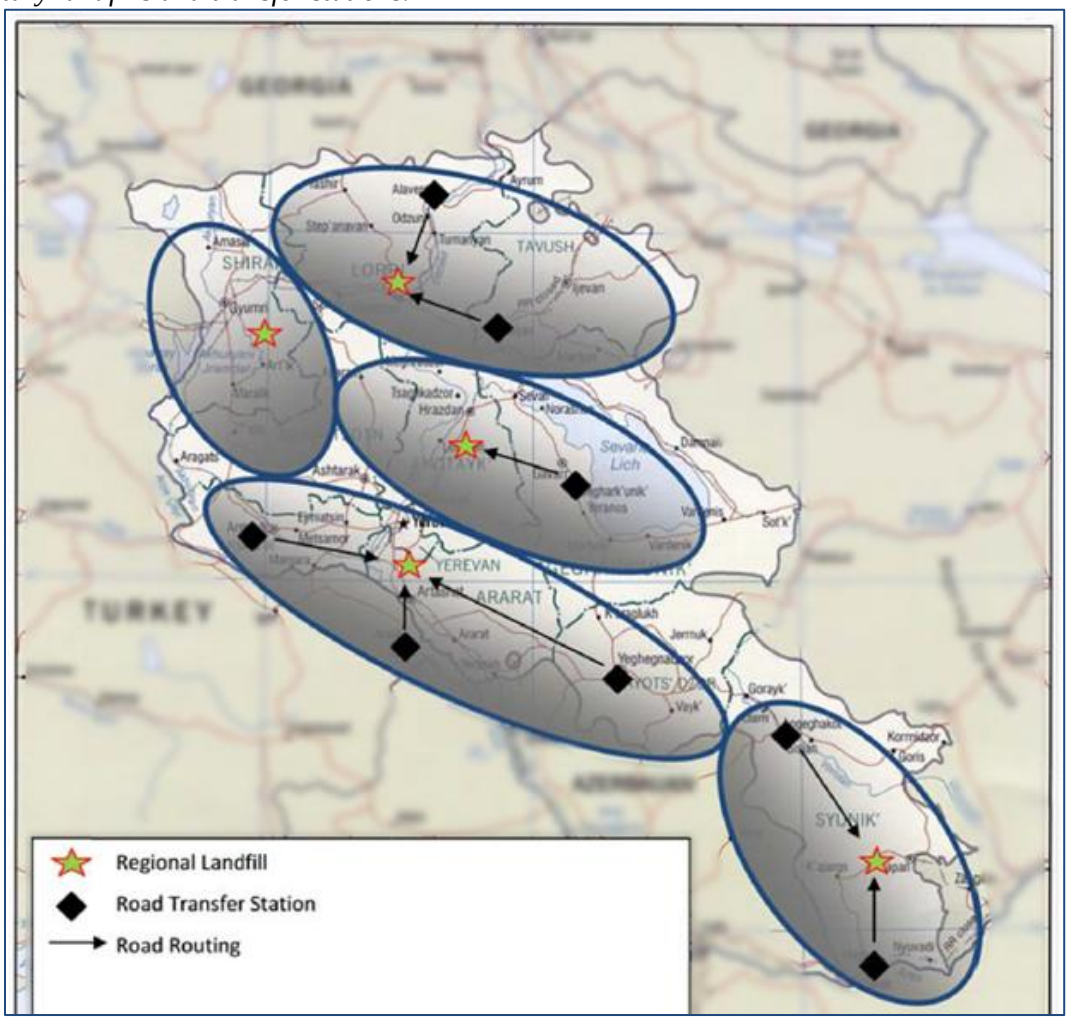
This subsection contains the information required by Article 16.4. of the Law pertaining to the content of the Preliminary Assessment Application (i.e., Scoping Report):

> *(4) the characteristics of the fundamental document and/or proposed activity (production capacities, used natural resources and materials, technical and technological solutions)*;

Conceptual approach

Figure 1 presents the proposed solid waste management regional system. It supposes five regional sanitary landfills that serve the same number of service areas. The landfills designed based on EU standards will be situated in Shirak, Lori, Kotayk, Yerevan and Syunik regions. Yerevan's landfill will be the extended version of the Nubarashen landfill that will use Nubarashen's existing lands. It will have 300 thousand annual capacity and 20 years' lifespan and it will serve Armavir, Ararat, Vayots dzor and Aragatsotn, besides Yerevan, through transfer stations. The regional landfills will cover 20 hectares and will again serve for 20 years. They will operate through the use of six other transfer stations.

Figure 1: Conceptual figure of waste management regional system with the proposed location areas of the sanitary landfills and transfer stations.



Source: ADB, 2013

Besides the transfer stations, integrated and up-to-date collection system will be developed that will include service areas for waste. In urban areas this will include one infrastructure for collection based on containers developed according to location and availability standards for the purposes of service provision in living areas. Similarly, the choice of machines will be standardized to the extent possible. In smaller rural areas there will be larger dumps from where waste can be collected and transferred to transfer stations or directly to landfills. The remote rural communities that are not linked to the national system will be served by the local services. Yerevan will develop capacity for collection, transfer and removal on its own.

All city centers will be provided with a standardized system of bins for recycling, through which bins will be installed close to the residential communal trash collection centers. Based on others' experience, the dry recyclable waste collection ratio will gradually increase due to installation of these bins. The main goal of the prospective waste collection system is to improve the existing waste collection system in towns and municipalities through the supply of sufficient amount of collection machines and the development of collection centers with containers. It is believed that waste collection in the cities will be carried out every day and seven days a week.

Transfer stations

The main purpose of establishing transfer stations is to reduce the transportation expenses / expenses, tonnes, km / of waste delivery to the regional landfill through machines with larger capacity as compared to smaller vehicles used by municipalities for waste collection. Moreover, the transfer station provides greater opportunities for those small enterprises that collect and transport their own waste, since the road leading to the transfer station is shorter.

Table 1. Transfer stations included in the planning model

District	Area of service	Location	Volume (tones, annual)	Distance to the regional landfill (km)
Shirak marz	No transfer station	-	-	-
Lori marz	Berd, Tavush region, Dilijan and Ijevan	Dilijan	22,000	36
	Alaverdi	Alaverdi	12,000	50
Kotayk marz	Gavar, Martuni and Vardenis of Gegharkunik region	Gavar, Martuni	38,000	52
South region /close to Yerevan	Aragatsotn marz	Ashtarak	24.000	43
	Armavir marz	Vagharshapat	53,000	21
	Ararat Marz, Ararat, Artashat and Vedi	Artashat	36,000	32
	Vayots Dzor marz	Yeghegnadzor	11,000	124
Syunik marz	Dastakert Goris and Sisian of Syunik marz	Goris	14,000	66
	Agarak and Meghri of Syunik marz	Meghri	4,000	101

Source: ADB, 2013

Sanitary landfills

The collected solid waste will be located in a variety of modern sanitary landfills. It is assumed that the landfills are located, designed and operated according to the EU Directive on waste landfills (1999/31 / EC). The regional landfills included in the planning model are presented in Table 2 below. The exact location of the landfills shall be defined through a detailed feasibility study. Some initial feasibility studies have been carried out by EBRD and KFW for Kotayk and Lori regions respectively. The landfill space in the table is indicative and the definition of the real area will depend on the precise definition of the landfill site and the final service area. Landfills should be planned as part of the regional waste management center with the possibility of including extra spaces in the future.

Table 2. Regional sanitary landfills presumed in the planning model

Service area	**Location of the landfills**	**Capacity for 20 years (mln tons)**	**Necessary total area (ha)**
Shirak marz	Gyumri	1.1	17
Lori marz, Tavush marz	Vanadzor of Lori marz	1.3	20
Kotayk marz, Gegharkunik marz	Hrazdan of Kotayk marz	1.5	23
Artagatsotn, Armavir marz, Ararat marz, Vayots Dzor marz	Nubarashen's landfill / Yerevan	8.0 /including waste from Yerevan /	Extended and updated landfill existing in Nubarashen
Syunik marz	Kapan region	0.5	10

Source: ADB, 2013

In the future, until the end of the planning period, landfills for solid waste will be established, with three years' capacity each. In those rural areas, where villages are available for vehicles with great capacity, waste collection will be carried out as that in urban areas, using the standard 700-liter containers and trucks placed in the streets. However, the collection frequency will be lower in rural areas than that in urban areas/ presumably, once a week /.

For those rural areas where big trucks cannot reach or where roads are in bad conditions, the "collection centres in rural areas" approach is suggested to gradually reduce dumps and other inappropriate practices in rural areas, such as open incineration or irregular waste disposal.

The collection centre will be composed of a fenced area on the verge of the road where 5 cubic meters' containers will be displaced, disposed through trucks with great capacity to transport the waste to the sanitary landfill or transfer stations. In the villages the collection centres shall be located in areas suitable for the trucks, close to the main road. Collection machines / small trucks and / or tractors/ can collect the waste in the villages and transport it to the collection centres.

The containers shall be displaced in such a way so that the truck is able to move back and dispose them one after another. The same truck will be used for waste disposal as a collection machine in the village, usually by hand.

Each collection centre will require a design that will fit the location and the number of containers to be included. A typical collection centre will be composed of six containers within approximately 200sq m area.

It is supposed that waste collection and transfer from rural areas to collection centres will be organised on a community level, meanwhile inter-city organization or agreement will be reached based on which waste will be transported from collection centres, transfer stations and sanitary landfills.

Activities will be carried out to reduce the amount of transported waste to the minimum level through reprocessing programs. There can also be local communities or groups of communities where one landfill is recovered and satisfies the maintenance requirements, although not fully meeting the sanitary standards. This is an alternative solution to the transfer from rural collection centres particularly where there are obstacles related to distance, road conditions and weather. It is recommended to develop a national funding mechanism to fund such initiatives through grants. Resources allocated for the development of this system shall be disbursed also for the coordinated closure of the existing official and non-official landfills that predominantly includes one-off cleaning / removal of waste, upon which inspection and drainage control will be carried out.

In villages the necessity for collection centres will vary from one area to the other, depending on the size of the village and road conditions. The implementation shall be coordinated based on the waste collection in communities and, among other things, the planned improvement of the roads shall be taken into consideration.

Waste from rural areas is collected and immediately sent to the regional sanitary landfill or transfer station and, from there, to the regional landfill.

Due to the small amount of waste accumulated in rural areas and greater costs related to the recycled materials as compared to those of the cities, it is assumed that collection system for the recycled materials will not be developed in rural areas within the planning period.

3. LEGAL AND INSTITUTIONAL ANALYSIS

3.1. Legislation regulating the SEA process in Armenia

As said, SEA in Armenia is regulated by the RA Law on "Environmental Impact Expert Assessment" /hereafter referred to as Law/ adopted by the RA national Assembly on June 21, 2014. The SEA process is also regulated by the legislative acts stemming from the Law.

- RA Government decision N 399-N, April 9, 2015, on "Procedure of the Environmental impact assessment expertise of the founding documents and the planned activities." [1]

- RA Government decision N 1325-N, November 19, 2014 on "Defining the procedure for public notification and the conduct of public discussions."

- RA Government decision 428-N, April 22, 2015, on "setting the order of revocation of the expert conclusion."

The law presents the fundamentals, principles, objective and goals of the assessment and expertise and sets out the powers of the state agencies, regional government bodies and local self-government bodies in

[1] This relates to the implementation of expertise and not purely to the SEA.

the assessment and expertise processes. The main goal of the environmental assessment is to predict, prevent or reduce to the minimum the hazardous impact of an activity or procedure on human health, the environment, regular economic and social development.

According to the Law, the strategic assessment is the complete assessment process of the possible impact resulting from the activities of the founding documents.

The founding documents include the 'strategic' documents that can possibly have effects on the environment (such as a policy, strategy, concept, outline, natural resource use scheme, program, plan, and urban development plan document). According to the Law, the founding documents that are subject to assessment concern the development of the following spheres: social and economic; energy; municipal construction; transportation; communications; agriculture; fish farming; mining; industrial branches; health; social; environmental protection, recreation, tourism and services. Thus, "Strategic Development Plan, Road Map and Long Term Investment Plan for the Solid Waste Management Sector in Armenia" is subject to strategic assessment.

The state management of the assessment and expertise is conducted by the RA Government, RA Ministry of Nature Protection and the "Centre of Expertise for Environmental Impact Assessment" state non-commercial organization.

Public is notified and public discussions are held in all stages of the assessment and expertise process from the earliest stage up to the decision-making stage. According to the legislation, the regional government and local self-government bodies are responsible for the public notification and discussions with the assistance of the Centre of expertise and the initiator.

The implementation of the activities set by the founding document is prohibited without the positive conclusion of the state expertise body (the Centre). This means that SEA's execution is obligatory.

3.2. Legislation regulating the waste management sector

The RA Law on Waste (24.11.2004) defines the state policy in the field of waste management, aimed at preventing the harmful impact of waste on the environment and human health and maximize its use as a secondary raw material.

The following laws are also related to the field concerned:

- The RA Law on "Provision of sanitary-epidemiological security of the population," 1992 /12.12.1992t. HO -43 /,
- The RA Law on "Garbage Disposal and Sanitation" /23.06.2011t. HO-237-N /,
- RA Law on "Local Self-Government" /07.05.2002t. HO -337 /,
- RA Law on "Licensing" /30.05.2001t. HO -193 /,
- RA Law on "Environmental and Natural Resource Payments," /28.12.1998t. HO -270 /,
- RA Law on "Rates of Environmental Payments" /20.12.2006t. HO-245-N /,
- RA Law on "Targeted use of environmental fees paid by organizations "/15.05.2001t. HO -188 /.

- The manual for design and maintenance of existing and operating landfills, order No. 321-A of December 29, 2009, issued by the Ministry of Urban Development, which contains specific requirements for deployment, design and use of landfills.

The specific laws define the powers of state bodies, local self-government representatives and territorial governance bodies in the field of waste management.

Table 3. Legislative and strategic acts related to waste management program

Law/ Strategy	**The main scope of legislative regulation**	**Linkage with the Waste management plan**
RA Land Code, 2001	This Code defines the basic directions of State regulatory system improvement concerning land relations, development of various organizational and legal forms of land economy, fertility of land, improvement of land use efficiency, protection and improvement of the environment – favourable for human life and health, and the legal framework concerning the protection of the land rights.	++
RA Water Code, 2002	This Code regulates for the most part relations connected to the use of water. It stipulates that the State "ensures the protection of water systems, protection from harmful impact and use for the benefit of the public – towards the safety of all human beings."	++
RA Law On Protection of Atmospheric Air, 1994	The aim of the Law is to prevent and eliminate the contamination of atmospheric air and engage in international cooperation in the field of protection of atmospheric air.	++
RA Law on Nature Protection and Nature Utilization Payments, 1999	The Law defines concepts of nature protection and nature utilization payments in the Republic of Armenia, payers, types of payments, procedure of calculation and payment, liability for violation of this law and other relations related to payments.	+
RA Law on Flora, 1999	The law on Flora defines the State policy of the Republic of Armenia on scientifically motivated protection, maintenance, reproduction and use of natural flora.	+
RA Law on Fauna, 1999	The goal of the RA Law on Fauna is the provision of protection, maintenance and natural reproduction of the gene pool and species diversity, prevention of violations of the integrity of animal vitality environment, protection of animal migration ways and regulates the use of animal species.	+
RA Law on the Alienation of Property for the needs of the society and state, 2006	It defines that the constitutional basis for the alienation of property for the needs of the society and state is exclusively the prevailing interest of the public.	+
RA Code on Mineral Resources, 2002	This regulates the main functions of the use and maintenance of mineral resources.	++
RA Law on the protection of immovable monuments of history and culture and historical environment, 1998	This regulates the preservation of the monuments of history and culture.	+
Master plans of the communities	Performs space planning and zoning, sets garbage disposal areas, sizes and conditions.	++

- ++ indicates a strong connection of the legislative act to the waste management plan
- + indicates a weak connection.

Furthermore, Article 16 of the RA Law on "Environmental Impact Assessment and expertise" outlines a number of environmental measures directed at the elimination, reduction and compensation for the harmful impact on environment:

- Deploy the landfill at least 500 meters far from the residential areas and define it as a sanitary zone.
- Agricultural lands and forests cannot be used as landfills.
- Preference is given to the areas where the ground waters are 2 meters over the surface level.
- Waste dumps shall be located 15 km away from the airport.
- The landfill space can be used for 25 years.
- The lower liner shall be not less than 0.5 m, deep water norm shall be no more than 105 cm / s. (0.0086 m / day) / as defined in the natural state of the alumina /. If the water exceeds the norm of 105 cm / s., an artificial membrane shall be posted.
- There is no need to install a water penetrable layer in such climatic zones where the humidity does not exceed 52% and the annual rainfall is less than 100 mm.

3.3. Current challenges of the legal and institutional setup of the SEA system and of the waste management sector of Armenia

The key challenges of the legal and institutional setup of the SEA system and of the waste management sector of Armenia are as follows:

- There is no waste sorting system in Armenia, and currently waste of almost all types is disposed to domestic waste landfill without being sorted.

- The existing landfills do not correspond to the nationally established criteria.

- The legislative field regulating SEA does not fully reflect the requirements of the SEA Protocol, especially in the healthcare field.

- There are no methodological manuals regulating the field in the Republic, which will help the participants implement SEA.

- There is no unified system for data and information collection related to the SEA sector in Armenia, which would simplify and facilitate the process of implementation in terms of time management.

Preliminary recommendations regarding the improvements needed to the RA legislation on SEA and waste management are presented in Chapter 7.

4. STAKEHOLDER ANALYSIS

The table below contains the list of relevant stakeholders to be involved in SEA process and consultations, including agencies which can provide comments and views on the Plan within their competence. The listed stakeholders will be approached and invited to participate in stakeholder consultation activities and to comment on outputs presented in the SEA scoping report and SEA report. The table also presents the areas of interest and potential concerns of the identified key stakeholders.

Table 4. Main stakeholders of the waste management plan

Stakeholder (Institution)	Interest / Concern
RA Government	Administration of the waste management policy
RA Ministry of Natural Protection	1. Expertise of the preliminary assessment (that is SEA scoping) of the Waste management plan and development of the TOR within 30 working days of receiving the preliminary assessment application. 2. Provision of conclusion on SEA on the Waste management plan within 60 working days of receiving the SEA report. 3. Participation in public discussions during the stages of expertise.
RA Ministry of Healthcare	Development of requirements for human health safety measures related to the waste management sector. Conclusion and opinion sharing related to the plan when it comes to human health related pollutants / air, water, land / in terms of sanitary protection of residential areas.
RA Ministry of Territorial Administration and Emergency Situations	Responsibility towards the implementation of the plan. Amendments and changes to the Waste management plan based on SEA recommendations.
RA Regional Government Bodies that are responsible for the discussions: 1. Governor of Shirak region / marzpetarans/ 2. Governor of Lori region 3. Governor of Syunik region 4. Governor of Kotayk region 5. Mayor of Yerevan	Participation in the implementation of the plan in the regions. Responsibility for public awareness-raising and organization of discussions according to the Decision of RA Government 1325-N on "Public notification and organization of discussions.
Self-Government Bodies The names of the communities will be decided upon the selection of the areas. In this stage it is impossible to clarify the beneficiary communities, they will be determined in separate stages within EIA.	Participation in the implementation of the plan in the regions. Responsibility for public awareness-raising and organization of discussions in further stages / EIA/.
NGO, the public According to the Decision of RA Government 1325-N "Public notification and organization of public discussions," the initiator, marzpetaran, notifies the public through the RA official newspaper, e-mails, announcements in beneficiary communities / marzpetarans /. Separate invitations are not sent, all those who wish, do participate on free basis, in the abovementioned decision timelines are set for written recommendations.	Participation in public discussions related to the plan, presentation of opinions and recommendations.

It should be noted that the following information required by Article 16.4. of the Law pertaining to the content of the Preliminary Assessment Application (i.e., Scoping Report):

(6) information regarding notification of the public, public hearings and preliminary agreement of the local self government bodies, unless otherwise provided for by the legislation.

will be provided in separate documents by the Plan proponent to the Centre of Expertise.

5. PRELIMINARY BASELINE ANALYSIS

This Chapter contains the information required by Article 16.4. of the Law pertaining to the content of the Preliminary Assessment Application (i.e., Scoping Report):

(3) the brief description and situation scheme of the area, including the environment falling under the application of the fundamental document and/or proposed activity.

Although not required by the Law, the public health and socio-economic baseline is also described following the Protocol on SEA and best international practice.

Baseline section of the current scoping report presents the results of the preliminary analysis related to the environmental and public health related to the Waste Management Plan. Baseline analysis covers threats and risks within the field of environment and health related to the water/groundwater, land, biodiversity, climate change, emissions/air pollution, health hazards and diseases identified in relation to the Waste Management Plan or playing a crucial role and impact in relation to implementation of the Waste Management Plan. Baseline outlines the background for the assessment of potential environmental and health hazards and targets challenges, which should be considered within the Waste Management Plan.

5.1. Water

Surface water resources

Taking into account all available water resources in the country, Armenia has sufficient resources to supply approximately 3,100 cubic meters per capita per year. All the rivers in Armenia are tributaries of the Araks and Kura Rivers. Most rivers are small, rapid, and fed by melting snow, springs, and groundwater. The overall river flow (originating within the country) has been estimated at 6.8 billion cubic meters. These water resources are not evenly distributed in space and time with significant seasonal and annual variability in river runoff. Water resources are stressed, particularly in the densely populated Hrazdan River basin in the central part of the country. Map (Appendix 1) and Table 5 below illustrate six river Basin Management Areas (BMAs) incorporating 14 major river basins and operated by respective Basin Management Organizations (BMOs) (see Table 5).

Table 5. Basin Management Organizations (BMOs) and River Basins in Armenia

BMO	River basin	Area (km^2)	River flow (MCM/yr)[2]
Northern BMO	Debed	3,895	1,203
	Aghstev	2,480	445
	Kura tributaries	810	199
Hrazdan BMO	Kasakh	1,480	329
	Hrazdan	2,565	733
Sevan BMO	Lake Sevan	4,750	265
Ararat BMO	Azat	952	232
	Vedi	998	110
	Arpa	2,301	764
Akhuryan BMO	Akhuryan	2,784	391

[2] MCM = million cubic meters.

	Metsamor (Sevjur)	2,240	711
Southern BMO	Vorotan	2,476	725
	Voghji	1,341	502
	Meghriget	664	166
Total			**5572**

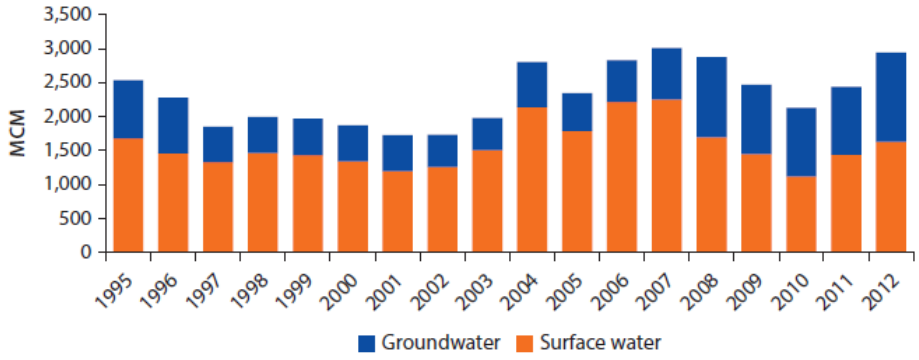
Source: USAID, 2008.

There is also significant seasonal and annual variability in river runoff, including frequent droughts and risk of flooding in the spring, when about 55 percent of total annual runoff occurs during the peak snow melting period. The ratio of maximum to minimum flow can reach 10:1 (Ministry of Nature Protection 2010). Lake Sevan, the largest freshwater body in Armenia (almost 35 billion cubic meters), is important multipurpose water reservoir for irrigation, hydropower, and recreational uses, one of the largest high-altitude lakes in the world. The lake is fed by 28 rivers and streams and is drained by the Hrazdan River. The lake outflow has been artificially regulated for irrigation and the Sevan-Hrazdan hydropower cascade since the 1930s. The level of Lake Sevan fell dramatically due to excessive use during the period from 1930 to the 1980s, resulting in serious environmental and ecological problems, including deterioration of water quality, destruction of natural habitats, and loss of biodiversity. Starting in the 1980s, programs to stabilize and raise the lake level were initiated. This includes the construction of the Arpa-Sevan and Vorotan-Arpa tunnels, transferring up to 250 and 165 million cubic meters (MCM), respectively, and outflow limits up to 170 MCM per year. As a result, the level of Lake Sevan has been steadily rising since 2001. However, overfishing continues to be a major problem in the lake.

Groundwater resources

Armenia has considerable groundwater resources, which play an important role in the overall water balance. About 96 percent of the water used for drinking purposes and about 40 percent of water abstracted in the country comes from groundwater (Figure 2) (ADB 2011).

Figure 2. Water abstraction by source, 1995-2012

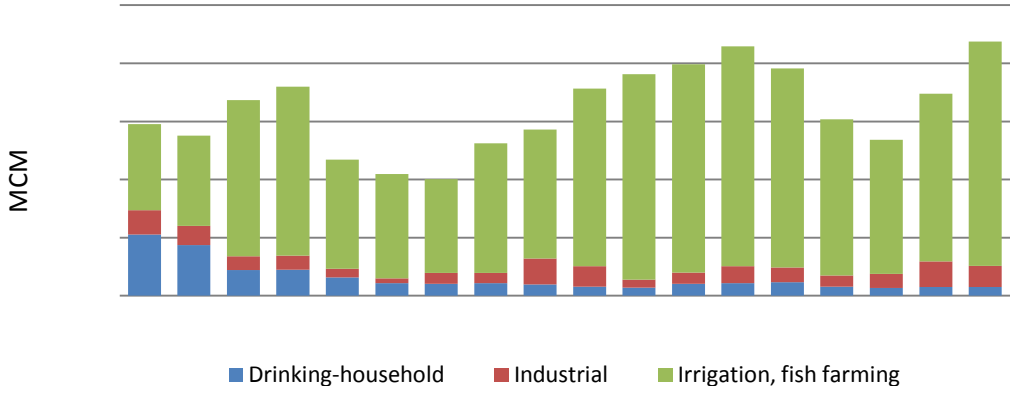


Source: National Statistical Service of RA.

At present, the knowledge on availability and quality of groundwater resources in the country is limited due to the lack of monitoring. After the collapse of the Soviet Union, groundwater monitoring stopped for over 20 years and has only restarted in the last 4–5 years. In the last nationwide assessment of groundwater resources in the 1980s, total groundwater resources were estimated to be 4.0 billion cubic meters per year, which included 1.6 billion cubic meters of spring flow, 1.4 billion cubic meters of drainage flow, and 1.0 billion cubic meters of deep flow.

Figure 3 shows consumption by different water-using sectors, excluding consumption of recycled water or reuse of waste and sewage water. Water consumption has fluctuated over time, however, irrigation remains the largest consumptive user.

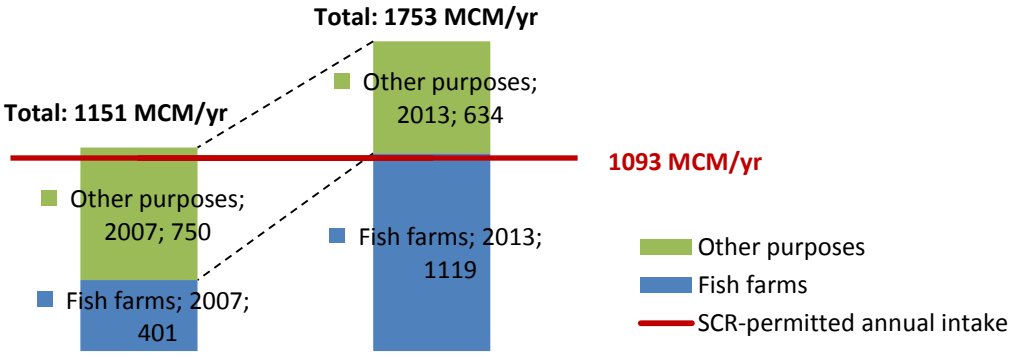
Figure 3. Water Consumption by Sector



Source: National Statistical Service of RA.

The Ararat valley is rich with high-quality artesian groundwater, which is suitable for drinking purposes without additional treatment and comprises a strategic reserve of drinking water for the country. This resource has historically been used for drinking and irrigation purposes. Since 2006, a large number of fish farms have been established in the Ararat valley due to the rich supply of artesian groundwater of high quality and low cost, and have become one of the major water users. Fish production was included in the list of priority development programs in 2008, and thus more water use permits were issued for fish farms, exceeding the renewable level of groundwater resources in Ararat Valley established by the Article 6 of the RA Law on the National Water Program (2006). In 2013, groundwater use by fish farms alone exceeded the sustainable level (Figure 3). In some cases, fish farms are abstracting more water than allowed in their Water Use Permits (WUP). Also, there are illegal wells operating without WUPs. As a result of over-abstraction of groundwater resources, artesian groundwater resources have sharply declined and the artesian groundwater zone has decreased.

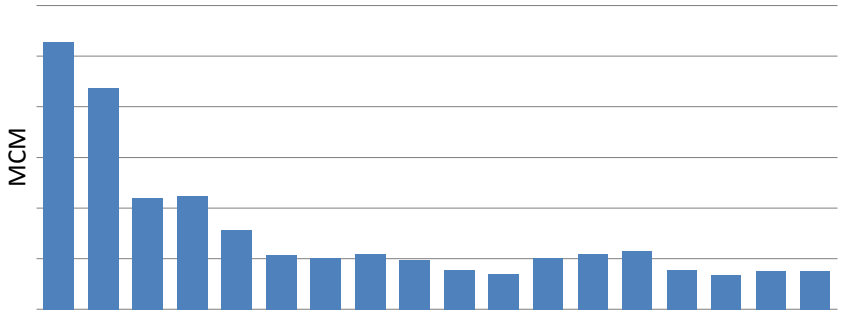
Figure 4. Discharge of Operating Wells in Ararat Valley in 2007 and 2013



Source: USAID 2014.
Note: "Other purposes" include irrigation, drinking, and industrial water uses.

Domestic water consumption, which used to be the second-largest water user after irrigation, sharply decreased in the 1990s (Figure 5). This dramatic drop is attributed to the introduction of water metering and a volumetric billing system.

Figure 5. Water consumption for domestic sector



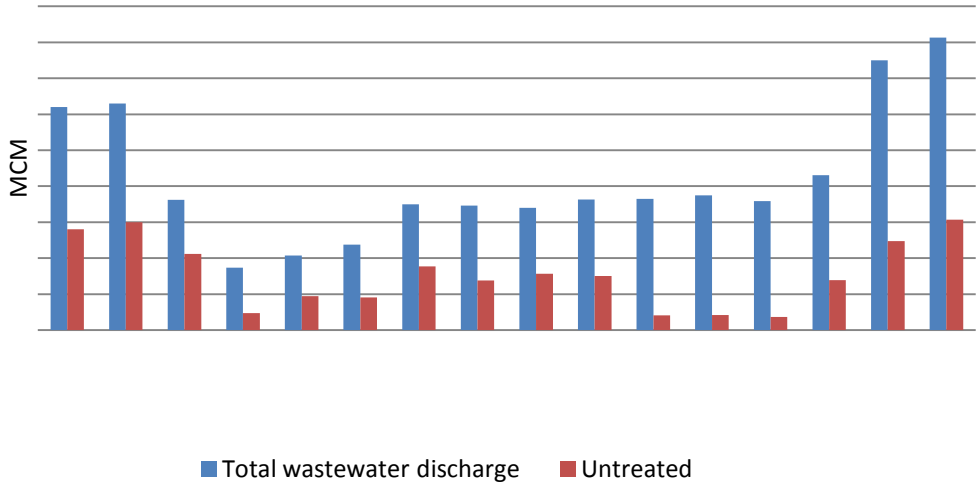
Water supply and discharge systems

Over the past decade, water supply in Armenia has greatly improved with the increased use of public-private partnerships. This has shown success, particularly with improving water supply duration, water meter instalment, and collection efficiency. Although the collection rate is high, the tariff is still currently too low to provide sufficient funding to cover even routine operation and maintenance and investment costs.

Moreover, while water supply has greatly progressed, sanitation has fallen behind. Wastewater collection and treatment systems are not sufficiently provided and operational, and wastewater is often discharged directly to water bodies or land, causing unhygienic conditions and water quality issues. Currently, 68 percent of the population (2 million, mostly urban) is connected to the sewerage network.

There are growing concerns with respect to the declining quality of water in the country. Polluting substances enter the water from various land-based sources, including industrial and mining enterprises, agricultural lands, houses and farms in rural areas, and especially from municipal sewer systems in urban areas. From 2008 to 2012, the total wastewater volume doubled (from 375 million to 813 MCM per year), and untreated discharge increased seven times (from 42 million to 307 MCM per year) (Figure 6). Some of this increase can be attributed to improved measurement and the increase in discharge from fish farming. There are 20 wastewater treatment plants, all built before the 1990s and inadequately maintained – either not operational or partially operational with mechanical treatment only, while biological and chemical wastewater treatment is not provided. There is a need for major investment to rehabilitate and modernize wastewater treatment facilities and expand their coverage to rural areas (ADB 2011; World Bank 2011).

Figure 6. Wastewater discharge.



Source: National Statistical Service of RA.

Water-related strategic documents

Reforms in the water resources management sector in the Republic of Armenia were initiated in 1999-2000 through the World Bank supported project "Integrated Water Resources Management". As a result of implementation of this project, the Government of Armenia initiated a targeted program for improving water sector in the country, as well as revised legal and institutional framework in the field.

The new Water Code adopted on June 4, 2002, was one of the most important steps directed at the improvement of water sector. The main purpose of this Code is the conservation of the national water reserve, the satisfaction of water needs of citizens and economy through effective management of usable water resources, securing ecological sustainability of the environment, as well as the provision of a legal basis to achieve the objectives of this Code:

- Establishment of appropriate water resources management mechanisms;
- Conservation and protection of water resources, including mitigation of pollution, maintenance and supervision of water standards and water level of the national water reserve;
- Prevention of water's harmful impact;
- Ensuring water resources assessment;
- Ensuring water supply to population and economy in necessary quantity and quality by regulated tariffs;
- Safe and smooth working of water supply and wastewater systems, and provision of normal conditions for their use, maintenance, and supervision;
- Provision of conditions for hydro technical structures, and safe and smooth use, maintenance, and supervision;
- Organization of management, protection, and development of water systems.

Following the Water Code, in 2005 the *Law on the Fundamental Provisions of the National Water Policy* was adopted. This law provides greater definition and clarity on key aspects, including setting water resource use and protection priorities, establishing a broad procedure for demand estimation and water resources assessment, outlining additional water policy principles (not covered in the Water Code), and highlighting the centrality of the water basin management plan. The purpose of this law is to assure that water resources of adequate quantity and quality are available at the moment and in the future to meet living standards, country's socio-economic development, ecological and economic needs.

In 2006 Law on the National Water Program (NWP) of Armenia was adopted. This law provides further clarity on various issues, including definition of the various types of "reserves", classification of water systems and identification of those of State significance, assessment of water demand and supply, development of a strategy for storage, distribution, and use of water resources, delineation of the issues in various water subsectors (for example, water supply and wastewater collection, irrigation, hydropower), development of water standard norms, and improvement of water resources monitoring. The overall goal of the law is development of measures aimed at satisfying the needs of the population and economy, ensuring of ecological sustainability, formation and use of strategic water reserve and protection of National Water Reserve. Short-term (until 2010), medium-term (2010–15), and long-term (2015–21) measures for implementation of the National Water Program were also identified.

During the past decade Armenia has made significant progress in establishing institutional and legislative framework for improved water management system. The second generation of water reforms in Armenia is targeted at harmonization with the EU water legislation and application of the EU Water Framework Directive approaches in particular. The EU Water Framework Directive and its methodologies for water management and river basin planning are adopted as guidance for water resources management in the country.

The National Water Program (Article 24) refers to norms for limiting the impact on water resources and quality assurance. According to this article, water standards shall be based on health requirements, as well as the needs for preventing the degradation, aggravation and pollution of water resources and ensuring minimal ecological flow. To meet the international norms, water standards shall include the permissible quantities of all possible pollutants and their reduction indicators by years.

A driving force in introducing standards and protocols for monitoring is the European Union Water Framework Directive. The RA Government Decree No. 743-A (29.04.2004) on "Organization of the activities for elaboration of a National Program for implementation of the Partnership and Cooperation Agreement signed between the RA and the EC and its member states" is the basis for harmonization of the national and the EU legislation.

Chapter 8 of the Water Code requires that the WRMA establish water resource quality standards to preserve the quality of surface and ground waters. According to the Code, these standards must be reviewed regularly and included in the National Water Program. The WRMA may specify wastewater discharge limits to be met by a permit holder. If achieving such standards is not reasonable by the permit holders, a legally binding five-year plan must be prepared and implemented by the permit holder to improve compliance and meet the standards.

One of the major issues included in the Phased Program of Measures of the NWP is the "elaboration and enforcement of water quality standards". As a short-term measure the PPM envisions: "adjustment and introduction of internationally accepted methodology for determination of norms for limitation of impact on water resources and standards for ensuring water quality, taking into consideration the best international practices." As a medium-term measure the PPM targets at development and adoption of norms for limitation of impact on water resources and standards for ensuring water quality. It also

includes the study of possibilities for localization of water quality standards on the level of basin management areas. Long-term measures include: i) enforcement of norms for limitation of impact on water resources and standards for ensuring water quality; ii) adoption of water quality standards on the level of basin management areas.

In order to insure the proper application of the new Water Code of Armenia, since 2002, number of new laws over 120 regulations by-laws, which relate to the procedures of issuing water use permits, river basin management, transparency and public participation in the decision-making process, information accessibility, establishment of the state water cadastre, formation of water resources monitoring, management of transboundary water resources and others were adopted in Armenia.

Key regulatory documents include:

- Decree No.4 of Feb 3, 2011 of the Protocol Session of the Government of Armenia "On approving the contents of water basin management model plan", which formalized the outline and technical characteristics for the development of standardized River Basin Management Plans (RBMP) to be developed for the 14 River Basins identified.
- Decree No.75-N of January 27, 2011 "On Defining water quality norms for each water basin management area taking into consideration the peculiarities of the localities". The Decree adopted river basin specific surface water quality standards and water quality classification, taking into account the background concentrations and the specific features of each river basin. The decree defined 5 classes of chemical surface water quality: high, good, moderate, poor and bad. Specific quality norms for each class are defined in total for 117 parameters.

The RA signed the Protocol on Water and Health to the 1992 UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) on 17 June 1999 in London. The process of ratification has been initiated.

Key issues related to water relevant for the SEA of the WMP

Table.6. Key issues to be addressed by the SEA for the WMP

	Specific concerns and problems		**Likely linkages to the Waste Management Plan**
Water & groun dwater	**Wastewater treatment is applied in limited areas, only mechanical treatment is available** **Pollution of surface water with chemicals from households and industry** **Microbiological pollution of surface water** **In some cities only partial sewerage is available: (Yerevan-96%, Gyumri -50%, Vanadzor-70%, Sisian-41%, Alaverdi – 37%, Ararat – 38%, Artashat-55%, Ejmiatsin-62%, Gavar-49%, Vardenis-48%, Sevan-58%)**	**Nationwide, but closer attention to Ararat Basin and Lake Sevan**	**Absence of proper landfills compliant to international and/or EU standards** **Water control and leachate management** **The location of a landfill must take into consideration:** **-the distances from the boundary of the site to residential and recreation areas, waterways, water bodies and other agricultural or urban sites;** **-the existence of groundwater in the area** **Criteria for acceptance at a specific class of landfill must be derived from considerations pertaining to protection of the surrounding environment (in particular groundwater and surface water);**

	Due to missing landfills domestic waste occurs on river banks causing surface water pollution	**Due to the absence of waste separation chemicals, such as paints and other construction materials, as well as medicament etc pollute surface water and/or leaks into the ground)**

5.2. Land and mining

Description of the land resources of Armenia (their distribution and dynamics of change)

640 sections of total 7530 hectares of degraded land have been recorded in Armenia, of which 3780 hectares used to serve as agricultural lands before the degradation [7]. Overall, 81.9% or 24.353 km^2 of the republic is subjected to varying degrees of desertification. It should be noted that 50% of the area is subject to erosion, 60% of the land surface are vulnerable to landslide and mudflow phenomena, 40% are rocky areas, saline soils constitute about 30.0 thousand hectares, polluted soils constitute more than 90 thousand hectares.

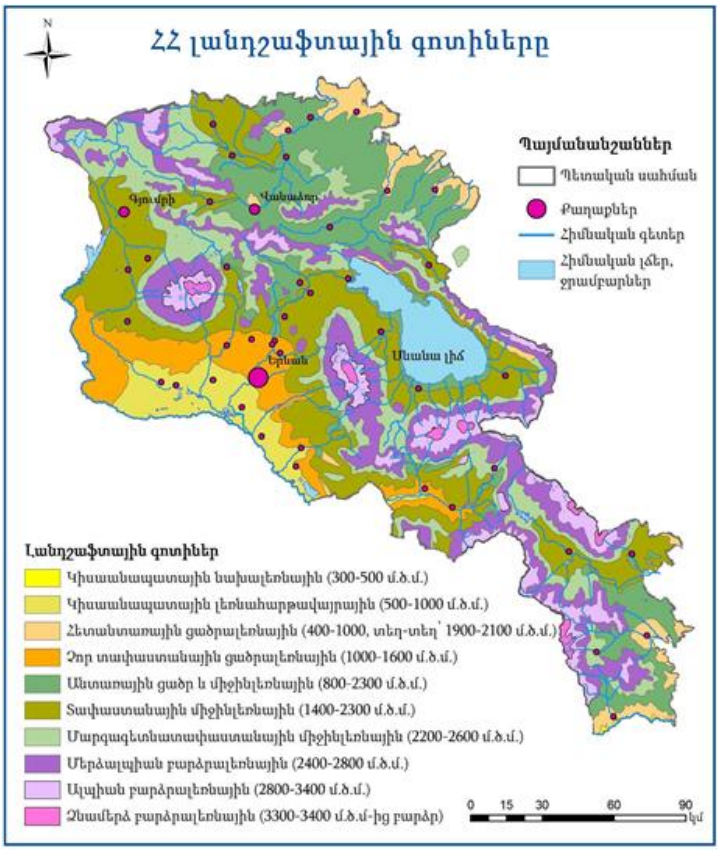
Armenia is characterized by scarcity of land resources: the total land area is only 2,974,259 hectares. Armenia has one of the lowest scores in the world in the land area per capita index (0.4 hectares). Due to the rich diversity of vegetation, landscape and climatic conditions of the country there are 14 genetic types of land, 7 of which are zonal types, and it is dominated by the black ridge soils as well as brown and grey semi-desert soils (42.5% of the area). The other 7 types are inter-zonal types, dominated by black meadow soils, soils of river valleys, soils of wetlands, soils of meadows, saline and irrigated meadow soils (6% of the territory) (Table 7). Forest soils occupy 697 thousand hectares (22.4% of the territory), forested areas occupy 334.2 thousand hectares (11.7%).

Table 7. Zones and Types of Soils[9]*

Zones	Marzes	Types of lands	Area		The height above sea level (M)
			Thousand ha.	**%**	
Semi-desert	Aragatsotn, Ararat, Armavir, Kotayk, Yerevan	1.Semi-desert grey 2.Irrigable meadow grey 3.Paleohydromorph, salinized 4. Saltwater	152 53 2 29	5.8 2.0 0.1 1.1	850-1250
		Total	236	9.0	
Dry steppe	Aragatsotn, Ararat, Kotayk, Syunik Vayots_Dzor	Brown	242	9.2	**1250-1900**
Steppe	Aragatsotn, Ararat, Gegharkunik, Lori, Kotayk, Syunik, Vayots_Dzor, Shirak	Black Soils Meadow-black Valley-terrace Ground soils	718 13 48 18	27.4 0.5 1.8 0.7	**1300-2450**
		Total	797	30.4	

Forest	Aragatsotn, Ararat, Gegharkunik, Lori, Kotayk, Syunik, Vayots_Dzor, Tavush	Forest grey	133	5.2	**500-2400**
		Carbonated	15	0.6	
		Sepia	564	21.6	
		Total	712	27.4	
Ridge - meadow	Aragatsotn, Ararat, Gegharkunik, Lori, Kotayk, Syunik, Vayots_Dzor, Tavush	Mountain meadow	346	13.2	2200-4000
		Meadow steppe	283	10.8	
		Total	629	24.0	
Total			**2616**	**100**	

*358.3 thousand hectares of radical rock outlets, sands, waters, roads and buildings



Map 1: Landscape zones of the Republic of Armenia

The majority of land resources of Armenia are agricultural lands. The latter are followed by forest lands of special protected areas and settlements. Reserve lands form only the negligible part of the available lands (Table 8).

*Table 8. Land Resources of the Republic of Armenia, thousand ha. *

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	%
The total land area, including	2974.3	2974.3	2974.3	2974.3	2974.3	2974.3	2974.3	2974.3	2974.3	2974.3	2974.3	100
Lands with agricultural value	2135.3	2129.6	2122.1	2121.2	2120.3	2100.9	2076.9	2052.4	2051.0	2049.4	2045.7	68.8
Residential lands	133.9	150.5	151.0	151.2	151.6	152.0	152.2	151.6	151.7	151.8	151.8	5.1
Lands with manufacturing, mining and other industrial value	20.9	28.1	28.2	29.2	29.4	31.8	33.0	33.6	34.9	36.4	36.5	1.2
Lands of energy, communication, transport and utility infrastructure facilities	9.1	11.9	12.1	12.2	12.4	12.5	12.8	12.5	12.6	12.6	12.6	0.4
Lands of specially protected areas	187.8	220.6	229.3	229.7	229.9	249.4	298.0	331.9	331.7	331.7	335.4	11.3
Lands of special significance	29.5	31.6	31.7	31.7	31.7	31.6	31.7	31.6	31.6	31.6	31.6	1.1
Forest lands	398.0	373.0	370.6	369.8	369.8	369.1	343.1	334.2	334.3	334.3	334.2	11.2
Water lands	22.1	28.3	28.6	28.6	28.6	26.4	26.0	25.9	25.9	25.9	25.9	0.9
Reserve lands	37.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.0

For the last 10 years, the agricultural land of the country were reduced by about 4.2% (grassland decreased by 5.8 thousand hectares, arable land - by 4.6 thousand hectares, pastures - by 64.1 thousand hectares), while the reduction of the forest land surfaces during the same period amounted to more than 16.0%.

The land of the protected areas increased significantly – by 78.6% or 102.4 thousand hectares, perennial plantations increased by about 4500 hectares during 7 years.

Currently 3 state reserves operate in Armenia ("Khosrov Forest," "Shikahogh" and "Erebuni"), occupying an area of 35439.6 hectares or 1.19% of Armenia's total area, there are 4 national parks ("Sevan," "Dilijan," "Lake Arpi" and "Arevik"), occupying an area of 236802.1 ha or 7.96% of the total territory of Armenia, as well as 27 state sanctuaries.

Pollution of soils in the Republic of Armenia

Soil pollution is one of the important anthropogenic factors causing land degradation in the Republic of Armenia that stems from nearly all sectors of economic activity. From the perspective of man-made hazards, mining, energy, chemicalization of agriculture, chemical industry and transportation serve as sources of pollution for soil, vegetation and water basin. In the 1990s, more than 300 industrial enterprises operated in the country, whose emissions, without being cleaned, have been released to the environment, causing pollution of the natural environment. The emissions of a number of polluting sources (more than 50 in Yerevan, 7 - in the Vana valley, 12 - in Alaverdi, 3 – in Kapan, Kajaran, Agarak each, 4 - in Hrazdan and 4 – in Ararat) and dozens of tailings have generated 90 thousand hectares of contaminated soil with various degrees of contamination. In the industrial land and suburban areas the content of heavy metals in general and active forms exceeded the norms by the following values, respectively: copper - by 5.3-39.3 and 14.0-69.2 times, lead - by 15.5-54.4 and 14.3-36.9 times, molybdenum - by 12.0- 49.2 and 11.8-42.4 times, zinc by 3.7-17.8 and 8.7-17.8 times, cobalt by 3.6-6.9 and 4.1- 7.4 times, Cadmium - by 6.5-17.8 and 4.0-10.5 times, iron - by 4.8-26.0 and 3.4-15.4 times, mercury - by 3.8-4.9 and 7.5-2.8 times and 7.8-9.4 and nickel - by 5.2-12.0 times. Increase in heavy metals is observed throughout the year (Table 9). (Guide to reduce harmful natural and man-made disasters in agriculture of the Republic of Armenia, Yerevan 2015).

Table 9. The content of heavy metals and accumulation dynamics in anthropogenically polluted soils (0-20 sm)

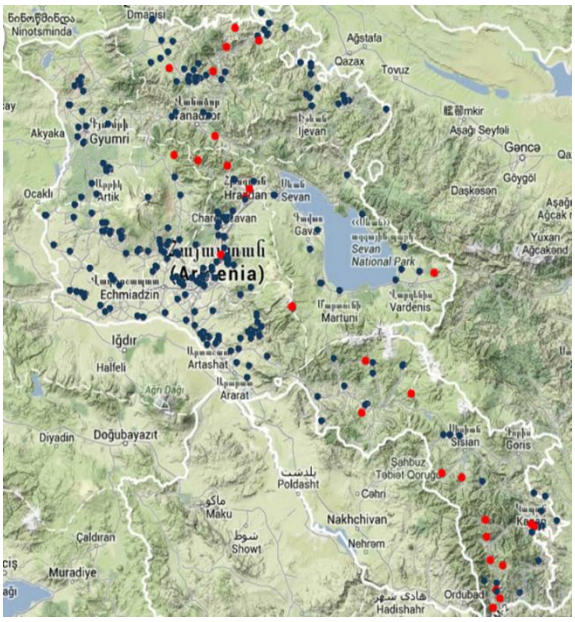
Level of pollution	1980				1985				2005				2015			
	Cu	Pb	Mo	Zn	Cu	Pb	Mo	Zn	Cu	Pb	Mo	Zn	Cu	Pb	Mo	Zn
Strong	2436	1094	80	1216	2465	1108	86	1398	2497	1130	89	1400	2411	1143.2	93.2	1436
Average	213	179.8	5.7	728	217	184	6.4	765	221.6	187	7.2	724	224.5	190	7.7	796
Weak	90.4	31.8	2.3	96.2	92	33.5	2.4	96.4	93	34.5	2.4	90	93.8	32.6	2.6	94
Not polluted	72	30.5	2.4	65.1	67.2	27.9	2.1	66.3	65.1	316	2.2	70	72.4	31	2.1	72

Use of natural resources

Use of natural resources is one of the main sources of pollution and land degradation in the country.

Overall, 670 mines with solid minerals are registered in the RA state reserve of mineral resources, including 7 copper-molybdenum, 4 copper, 14 gold and gold-polymetallic, 2 polymetallic, 2 iron and 1 aluminum mines. Besides the basic metals there exist also rare and scattered elements - rhenium, selenium, tellurium, cadmium, indium, helium, thallium, bismuth, etc.

In addition to the mines assessed and registered in State balance, 115 manifestations of various metals are found in the RA area. Armenia has significant reserves of non-metallic minerals, in particular, tuff, travertine, basalt, granite, perlite, pemza, zeolite, bentonite, and other colorful building blocks and mineral absorbers. The main mining regions of the country are Syunik and Lori.



Metallic mines are marked in red, others are marked in blue

Map 2: Map of mining regions of the Republic of Armenia

Particular attention should be given to the industrial, mining and other lands used for production purposes the observed increase of which is triggered by the greater market demand for natural resources. The forest, as well as reserve and agricultural lands (about 7000.0 hectares of only agricultural lands) have been allocated for the purposes of mining (?) production. Overall, the land area for the use of resources in the country amounted to 13532.7 hectares or 37.0 of lands for industrial, mining and other manufacturing purposes and 0.45% of the lands of the Republic of Armenia.

As shown in Table 10, the land designated for industrial, mining and other manufacturing purposes increased by 15.6 thousand hectares or 74.6 % between 2005 and 2015. According to the RA Land balance the lands for industrial, mining and other manufacturing purposes amounted to 36.6 thousand ha, among which mining land constituted 11.6 thousand ha in 2015 (the breakdown of land of this type is presented in Table 10).

Between 2013 and 2015 alone the mining land areas increased by 17%.

*Table 10. The presence and distribution of the lands for industrial, mining and other manufacturing purposes **

	Total lands	the lands for industrial, mining and other manufacturing purposes	Mining lands
2013			
Aragatsotn	275632.1	2444.7	849.1
Ararat	209003.2	2999.6	303.8
Armavir	124210.9	2879.7	656.6
Gegharkunik	148581.3	3670.1	776.2
Lori	379864.5	3706.3	668.8
Kotayk	208552.9	3419.3	681.9
Shirak	268027.0	3880.3	1675.8
Syunik	450541.8	5666.3	3836.4
Vayots Dzor	230783.0	1998.3	1635.0
Tavush	270399.0	1154.2	347.3
Yerevan	22328.0	3116.2	135.6
Total	**2974259.4**	**34935.0**	**11566.4**
2014			
Aragatsotn	275632.1	2444.7	849.1
Ararat	209003.0	3037.6	305.8
Armavir	124210.9	2874.9	656.5
Gegharkunik	534916.8	3670.1	1271.3
Lori	379864.5	3718.9	677.2
Kotayk	208552.9	3423.2	681.9
Shirak	268027.0	3894.6	1690.1
Syunik	450541.8	7053.5	5220.6
Vayots Dzor	230783.0	1998.3	1635.0
Tavush	270399.0	1153.5	347.3
Yerevan	22328.0	3114.1	132.2
Total	**2974259.4**	**36383.3**	**13466.9**
2015			
Aragatsotn	275632.1	2444.6	849.1
Ararat	209003.2	3037.5	305.8
Armavir	124211.4	2877.8	656.5
Gegharkunik	534916.8	3675.0	1271.3
Lori	379864.5	3937.9	739.7
Kotayk	208553.2	3426.1	684.2
Shirak	268027.0	3889.4	1691.1
Syunik	450541.8	7059.0	5220.6
Vayots Dzor	230783.0	2000.8	1635.0
Tavush	270399.0	1154.2	347.2
Yerevan	22328.1	3114.2	132.2
Total	**2974259.4**	**36616.6**	**13532.7**

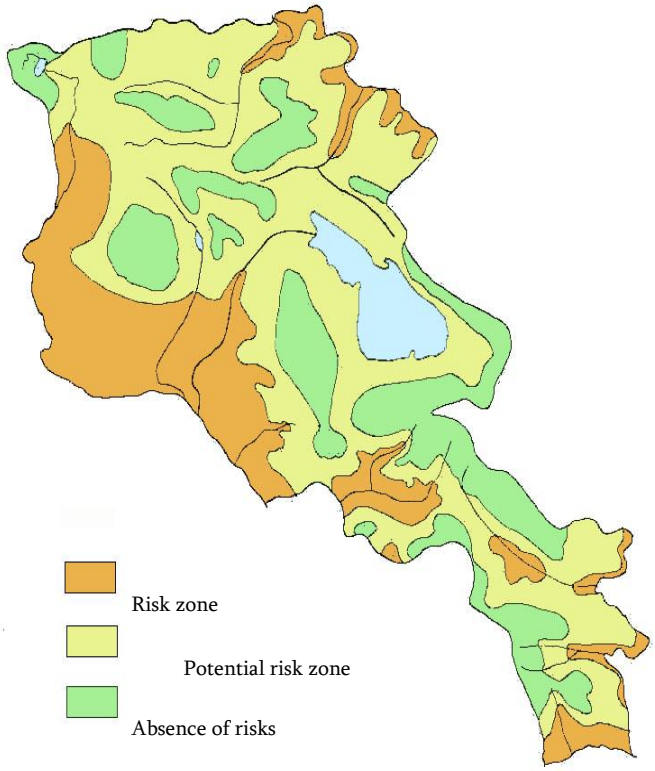
*** Report of the State Committee of Real Estate Cadastre adjunct to the RA Government, on the presence and distribution of land**

The surface of metal mines only being operated in the country is about 4700 hectares. Land area of more than 250 thousand hectares is allocated for the purposes of geological exploratory activities.

There are 22 operating and conserved tailings in the country, whose total volume capacity is about 600 million. m^3, while their surface area is over 700 hectares (including the tailing of the Teghut mine). All the tails of tailings are wet, and the majority of tailings were designed and built in Soviet times, not

having closed circulation of water and not using the latest technologies for safe storage of the tails (water-repellent membranating, extraction of gas, etc.).

For the most part, the aerials of mining (including enrichment of ore and metal processing), man-made emissions, including aerials of metal distribution, are observed at the distance of 15 – 25 km away from the source.



Map 3. Desertification risk zone in Armenia

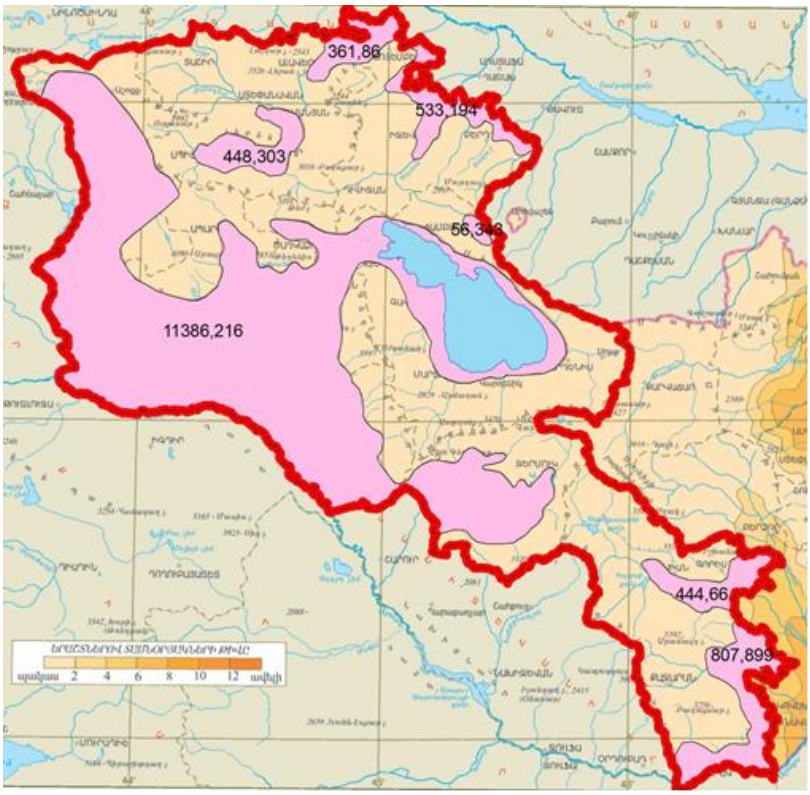
Man-made deserts (with a total area of 200-250 hectares) have been formed in the areas adjacent to man-made sources (Alaverdi mining plant, processing plant of Agarak). Man-made pollutants emitted into the environment negatively impact on the agrochemical, physical-chemical and physical indicators of the soil. In the technologically contaminated soil the composition of humus in the upper layer of the soil (0-20 layer) has decreased by 2.5-3.8, calcium - by 2.8-2.3, magnesium – by 2.0-2.8, natrium - by 1.3-1.5 times. The general and active nitrogen decreased by 1.6-1.9 and 2.8-2.4, phosphorus - by 1.6-2.7 և 1.4-3.2, and calium – by 1.4-1.2 and 1.5-1.9 times.[3]

Droughts [4]

7233 km^2 of Armenia's territory (24.3%) is at risk of desertification, 14519 km^2 (48.8%) of the area (in Lori and Tavush marzes) are being subject to desertification: this desertification processes are not expressed only on an area of 6742 km^2 (22.6%).

In the area of the country droughts are among the natural factors of desertification. The low and foothill zones of the Ararat Valley, as well as several regions of the Vayots Dzor and Syunik marzes are distinguished with high frequency of droughts.

[3] Guide to reduce harmful natural and man-made disasters in agriculture of the Republic of Armenia, Yerevan 2015
[4] Strategy and National Action Plan on the fight against Desertification in the Republic of Armenia, Yerevan, 2015



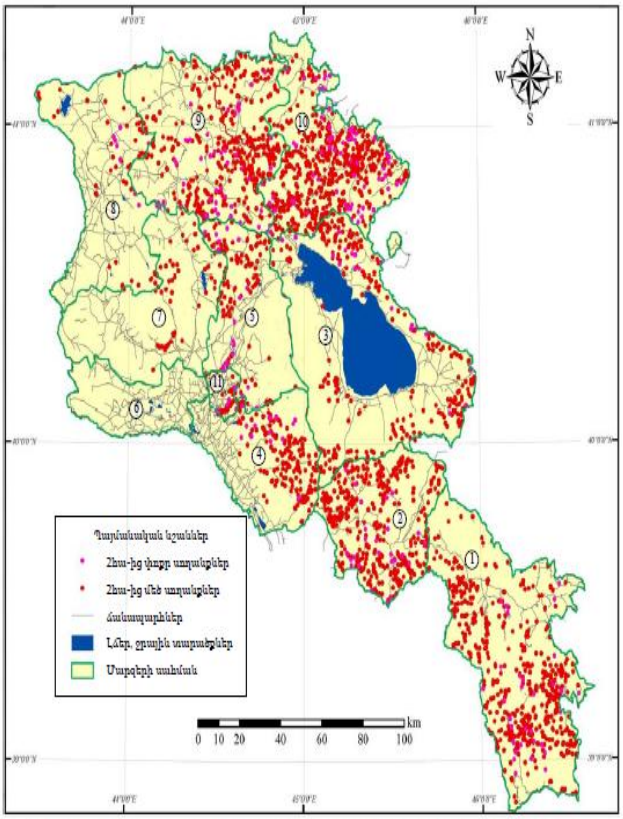
Map 4: Drought areas of the RA (in violet)

Landslides

Landslides are quite common in Armenia and, unfortunately, in recent decades their reactivation and growth is observed due to deforestation, improper organization of water management and irrigation works as well as changes in the water balance circulating within the landslides. Flows are mainly observable in Yeghegis, Azat and Vedi river valleys, north-eastern coast the Lake Sevan, the area around the town of Ijevan and other locations around the country.

Landslides cover over 1216 km^2 (around 4.1% of the area of the Republic), but according to the studies of the Japan International Cooperation Agency (JICA) 15% of the Armenian population (about 470,000 people) live in areas prone to landslides, and the JICA study on the management of landslide disasters (2004-2006) reports that 2.504 landslides were registered, making up 8% of the country's area.

According to the study "Reduction of vulnerability of agricultural systems to climate change in Armenia," 233 communities out of around 960 communities in Armenia are damaged due to landslides, in more than 100 of which significant activity of landslides is observed, causing damage to hundreds of houses, communication routes and other livelihood support facilities; approximately 3.2% of the road network and approximately 0.5% of the railway network has been damaged.



Հայաստանի Հանրապետությունն ամբողջությամբ (մարզերը և Երևան քաղաքը)

Map 5: Landslides in the Republic of Armenia

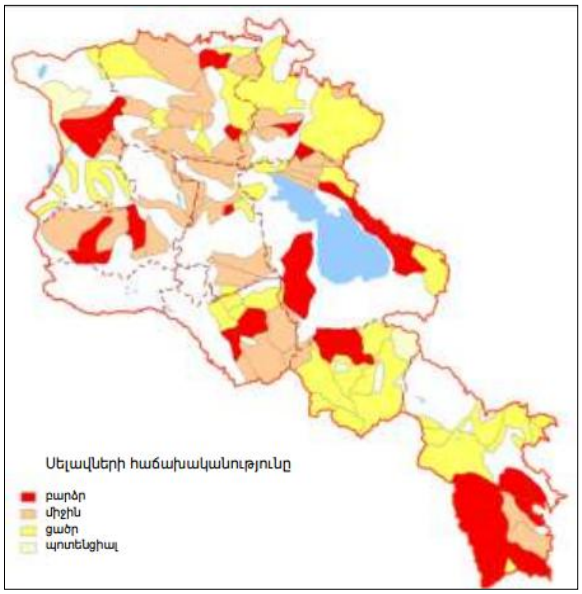
Map 6: Image of Khosrov landslide-flow in 2007

The distribution of landslides in RA is presented in Table 11.

Table 11. Distribution of landslides in RA across the marzes

Marz	Surface area, km^2	The number of landslides	The total area of landslides, km^2	The relative area of landslides, %
Aragatsotn	2763.4	19	75.5	3
Armavir	1191.6	0	0.0	0
Yerevan	222.3	152	13.0	6
Kotayk	2034.0	110	77.8	4
Tavush	2740.7	151	210.6	8
Shirak	2682.6	23	20.6	1
Ararat	2090.2	142	143.9	7
Gegharkunik	5369.6	126	202.8	4
Lori	3852.0	217	234.8	6
Syunik	4492.2	289	246.7	5
Vayots Dzor	2287.9	184	242.4	11

Mudflows



Map 7 Mudflow zones of Armenia based on the reoccurrence of the phenomena

In Armenia mudflows typically occur in the mountain zone of medium altitude, which occupies more than half of the country. The intensity of mudflows is caused by the material uncovered and storm-struck on the steep slopes as well as abundant atmospheric precipitations. Yerevan, Vanadzor, Gyumri, Kapan, Goris, Alaverdi and other cities, rural communities, railways and roads regularly suffer from mudflows.

Table 12 presents the distribution of mudflows in RA, and the downpour districts across the marzes are presented in Table 12.

Mudflows are most dangerous in mining regions where there are enormous surfaces of uncovered landscapes, dumps, open pits as well as tailings, which contain various metals and hazardous substances.

Table 12: Mudflows across the marzes[5]

Marz	Surface area, km^2	The number of landslides	The total area of landslides, km^2	The relative area of landslides, %
Aragatsotn	2763.37	8	1441.3	52
Armavir	1191.6	0	0.0	0
Yerevan	222.3	0	0.0	0
Kotayk	2034.0	7	867.3	43
Tavush	2740.7	8	2147.0	78
Shirak	2682.6	8	1102.3	41
Ararat	2090.2	6	1033.6	49
Gegharkunik	5369.6	10	1551.4	29
Lori	3852.0	17	2494.6	65
Syunik	4492.2	13	3153.9	70
Vayots Dzor	2287.9	10	2277.3	100

Salinization of soil

The natural salinization of soils is common in the low-lying plains of the country where the groundwater level is close to the earth's surface. According to different professional estimations, their total area is estimated at 28-40 thousand hectares. Yet national reports report on about 30 thousand hectares of salinized soils, mainly in Armavir and Ararat regions. It should be mentioned that previously around 5400 hectares of saline soils have been meliorated, but due to the drainage system being closed, the salinization of the lands of Ararat valley continues.

5.3. Biodiversity

The region, where Armenia is situated, i.e. the Caucasus, with its exceptionally rich biodiversity, is included in the list of 200 eco-regions of global significance by World Wildlife Fund (WWF), while Conservation International has recognized it as an endangered area and included it in the list of 34 key affected areas. The area of the country is one of the centers of formation of flora and fauna in the region; it is a transit resting space for a number of migratory animals and birds, and serves also as a breeding area for some of them.

Armenia is considered to be one of the world's five biocenosis for origination of crops. Around 3600 species of high-level floral plants, 4,700 species of fungi, more than 17,500 kinds of animals, including about 540 large vertebrates and numerous, still unverified low-level plants and bacteria are known in the region.

Currently 3 state reserves operate in Armenia ("Khosrov Forest," "Shikahogh" and "Erebuni"), occupying an area of 35439.6 hectares or 1.19% of Armenia's total area.

[5] Third National Communication on Climate Change. Yerevan 2015, Lusabats Publishing, 190 pages

Protected Areas and waste management situation within them

There are 4 national parks ("Sevan," "Dilijan," "Lake Arpi" and "Arevik"), occupying an area of 236802.1 ha or 7.96% of the total territory of Armenia.

There are 27 state sanctuaries, occupying an area of 114812.7ha or 3.95% of the total territory of Armenia. There are 232 natural monuments in Armenia.

If we exclude the area of the Lake Sevan, it will remain 6-7%. According to regulations, every country puts around 17% of the total area of its territory under protection.

In Armenia, specially protected areas form 385 thousand ha; forest lands make up 334.3thousand ha, of which woodlands – 289.5thousand ha. From the abovementioned 232 natural monuments in the country 106 are geological, 48 - hydro geological, 40 - hydrographic, 17 - natural-historical and 21 are biological monuments. Most of the natural monuments are located in Syunik marz – 56, Vayots Dzor marz – 49 and Kotayk – 33.

Garbage collection in Armenia's SPNAs is carried out irregularly; it is not being planned and is not implemented in organized manner. Perhaps the only exception is "Sevan National Park" SNCO where garbage collection is carried out in public beaches, and only during the season.

It is necessary to pay special attention to waste management in SPNAs, since in the nearest future this issue, together with the development of eco-tourism, will become a priority.

5.3.1. Wildlife stock

Lake Sevan with its endemic fish species and huge reserves of drinking water is considered to be a more sensitive and endangered area for Armenia. NKR region, that is rich in biodiversity, and is situated in the area of armed conflicts, is also considered to be sensitive.

The tables below present the plant and animal species, endemic species and frequencies of occurrence of species according to taxonomic groups.

Table 13. The Number of Plant and Animal Species as well as Endemics in the Republic of Armenia based on Taxonomic Groups

Taxonomic groups	Number of species	Number of endemics
Plants		
Seaweeds	388	**--**
Fungi	4167	**2**
Lichen	300	**--**
Moss	395	**--**
Vascular plants	≈ 3600	**125**
Total:	≈ 8850	**127**
Animals		
Iinvertebrates	≈ 17000	**316**
Fishes	39	**9**
Amphibians	7	**1**
Reptiles	53	**6**
Mammals	83	**6**
Birds	353	**1**
Total:	**≈ 17523**	**339**

Table 14. The Frequency of Occurrence of Taxonomic Groups in the Republic of Armenia (number/ per thousand sq. km.)

Taxonomic groups	Number of species in RA	Number of species per 1000 sq.km	
		In the Republic of Armenia	**In the world**
Plants			
Low-rank plants	4855	161,8	**0,15**
High-rank plants	≈ 4000	131,66	**1,67**
Animals			
Molluscs	155	5,16	**0,10**
Arthropods	≈ 5900	194,33	**5,86**
Fishes	39	1,31	**0,05**
Amphibians	7	0,23	**0,02**
Reptiles	53	1,76	**0,05**
Mammals	83	2,76	**0,03**
Birds	**353**	**11,86**	**0,06**

Loss of habitats is triggered by open mining, constructions, agricultural practices, loggings, development of hydropower production sector, recreation and tourism. Municipal waste disposal directly into surrounding nature sites, biodiversity hotspots, specially protected areas, and waterways affects biodiversity of Armenia.

Waste dumping results in accumulation of harmful chemical substances in soil, air pollution with solid and gas particles, pollution of underground waters and rivers, accumulation of industrial waste and tailings and landscape degradation, unfavorable conditions for growth, development and reproduction of species, elimination of valuable, threatened and rare species in forest ecosystems, reduction of productivity and yield quality. As a result of negative impact of waste on biodiversity, population encounters various health problems, reduced income due to disruption of Ecosystem Services, decline of living standards, reduction of the quality of biodiversity /agrobiodiversity affecting agriculture and trade which serve as a main source of income generation for communities in the regions.

Soil and water pollution, elimination of soil biodiversity (invertebrates, bacteria), change of species composition of plant cover, reduction of valuable and rare plant species, health problems due to disruption of ESs, lined with lack of statistical data on the used volumes of mineral fertilizers and relevant monitoring occur as a result of negative impact of waste and environmental pollution.

Changes of biodiversity and ESs disturb water regime and current state of the agrarian and forest sectors, which can become real threat to human health, food and water supply.

5.3.2. Threats for biodiversity

Today, Syunik, Lori, Gegharkunik and Kotayk marzes are considered to be more vulnerable, since the most intensive mining processes are underway there. Agarak and Alaverdi copper-molybdenum plants as well as Kajaran, Teghut and other mines are located in these areas that are crucial for the industry of the country.

Today there are 22 operating and conserved tailings in RA, the collective capacity of which is 600-700mln and the occupied space is 700ha. Animals are pastured around all the tailings. All tailings are of wet type, while dry type is acceptable in the world.

3780 ha of agricultural lands have been atrophied. 81.9% or 24353 km2 of the RA lands are subjected to varying degrees of desertification. These areas are rich in biodiversity and become more vulnerable due to sustainable development.

5.3.3. Threats to biodiversity due to industry: mining waste, cement production waste, agricultural

The main geo-ecological consequences of the mining industry also threatening local biodiversity include the damage to land cover, expansion of tailings ponds, accumulations of wastes, and pollution of water resources. It is natural, that the damage/removal of land cover and accumulation of wastes definitely cause fragmentation of plant and animal populations and communities, disturb migration routes of animals and even threatened the existence of some rare species. The expanding tailings ponds of mines and ore processing plants continue to be alarming. In some of them (for example, in Akhtala, Region of Lori, northern Armenia) ore enrichment is done by flotation method: as a result it is contaminated only by several surface active substances having a negative impact on water ecosystems. Meanwhile, in the case of industries applying older technologies much more dangerous substances are used with production of much more toxic wastes. According to the data of the Center for Ecological Noosphere Studies of the NAS RA the contamination of soil and water in many areas of the country significantly exceeds the maximum allowable concentrations and the main source of contamination is the leakage from tailings ponds.

The cement producing industry also has a negative impact. Due to imperfect technical equipment the cement dust is emitted into air, which affects natural ecosystems and their components by changing soil conditions as well as causing impacts on invertebrate fauna and photosynthetic activity of plants. Surface watercourses and landscapes are polluted also by solid domestic wastes.

The main threat in agriculture is the excessive use of fertilizers and pesticides. At the same time, often the expired substances are used and in more quantities for higher productivity, which cause serious threat to human health through agricultural products. The official data on this process in recent years have been missing.

In the field of agriculture the problems connected with the environment include losses of water due to ineffective irrigation as well as salination of soils, erosion and pollution by agricultural wastes. At present about 33% or 150 thousand ha of arable lands is not used for the target purpose. This threatens wild biodiversity as the abandoned cultivated areas get covered by aggressive weeds and become the centers of their reproduction. For the natural ecosystems being used as pastures the biggest threat is the disproportional distribution of the pasture load, when the distant pastures suffer from under-grazing. This results in change of ecosystems, in particular replacement of alpine carpets with alpine meadows as well as active penetration of sub-alpine weeds into alpine ecosystems. At present, the activation of water erosion and expansion of marsh areas is observed in 12 natural pastures. Water use for development of agriculture and energy production sector often causes drying of river courses, which result in elimination of littoral and water ecosystems, especially fish species and the species they feed on. The works on cleaning and change of water courses are often not justified and result in elimination of river biotopes including food base for fish and their spawning grounds.

5.3.4. Other threats

Pollution of picnic sites with domestic waste also causes problems, especially if such sites are not adjusted for recreation with provision of respective services. The situation has been improving in recent years, in particular in Dilijan National Park in Haghartsin gorge the specially equipped sites for open-door

recreation have been established, the same is underway in some other often visited areas such as Garni, Orgov and others, though the scale is not sufficient. Climate change and greenhouse gases.

According to the first national report on climate change, based on most optimistic estimates, average annual temperature increase of 1.7 degrees and precipitation decrease of 10% was projected for the Republic of Armenia in 2010. The increase of the annual average temperature recorded at the development of the 2-nd phase report (2006), as compared to that in 1961-1990, was 0,85 ^{o}C, and the total precipitation decrease was 6%. According to 2012 data, the average temperature in the entire region increased by 1,03 ^{o} C and precipitation decreased by 10%.

Climate change will have three main influences on crops of Armenia. First, each cultivation zone will go up with 100m by 2030 and with 200-400m by 2100. Larger cultivation areas will be developed in high zones which will cause some competition in higher zones related to pastures and hayfields.

Second, if the irrigation level is not increased and irrigated lands are not enhanced, the higher temperatures, increased evaporation and decrease of precipitation in many parts of Armenia will lead to the reduction of productivity of a number of crops.

Third, changes in weather will cause such damage to crops and land, which cannot be predicted on the basis of the increase in average temperatures or annual precipitation changes.

Climate change is very important for countries with such conditions as those in Armenia, since the country becomes more vulnerable due to them. In this regard, it is necessary to decrease the emissions to the minimum acceptable quantities - such quantities that can be absorbed by nature (oceans and land vegetation), preventing the growth of the gas concentrations in the atmosphere. The remaining surplus of emissions should be gradually reduced by the countries, to the extent that it falls to the territory according to per capita data.

In Armenia, like in other former Soviet Union countries, the emissions were drastically reduced as compared to that of 1990 and up until now remain at a lower level as compared to 1990. According to Recent Estimates of Climate Change Experts of the Intergovernmental Panel the Main Findings related to New Challenges are:

Armenia is a small country and greenhouse gas (CO2, methane, water vapor, nitrogen dioxide) emissions have vital significance. When compared to China which produces 21.9% of GHGs, or United States with 18.1%, India with 6.6%, Russia with 5.1% and Japan with 3.7%, Armenia almost does not pollute the environment.

Armenia has no commitment to reduce GHG emissions and is not included in Appendix 1 of the "United Nations Framework Convention on Climate Change." Emission rate has fallen and currently 0, 0015 Gg CO2 per capita is emitted annually, which is 1/3 of the 0, 0043 Gg per capita global indicator.

In programs intended to reduce GHG emissions in RA, one can note the use of guano in poultry farms as fuel and, for example, Nubarashen landfill can be used towards the same purpose. In RA increase in GHG emissions is expected which will total up to 23 thousand tons if no measures are undertaken and to15 thousand tons if respective measures are undertaken. To reduce the amount of emissions it is necessary to save energy and produce electricity through gas.

It is necessary to increase forested areas, since they absorb GHGs. For secure functioning one person needs 15-24 square meters of green area. In 2005, that figure for Armenia was 4-5km, and that for Yerevan was 7-8km, as estimated by the municipality.

It cannot be clearly stated which gases have greater role in the emergence of the greenhouse effect, yet it is believed that the role of water vapour in the occurrence of this phenomenon is 36-70%, that of CO2 is 9-26%, that of methane is 4 -9%, and that of nitrogen is 3 -7.

In Armenia, the share of carbon dioxide in total emissions of GHGs was 62.8%, that of methane was 34.2%, and that of nitrogen dioxide grew by 3% (year 2000).

The main sources of methane production are landfills, manure and rice fields.

Cadastre of greenhouse gases

The cadastre of greenhouse gases includes the baseline assessment of GHG emissions and absorptions as of 2010 as well as tendencies for the period of 2000-2010. The following sectors have been taken into consideration: "Energy," "Industrial processes and product use» (IPPU), "Agriculture, Forestry and Other Land Use" (AFOLU), "Waste."

In 2010, the total amount of emissions in RA was equivalent to 7463.6 Gg CO2. As compared to that of 1990, the GHG emissions were reduced by 70% and as compared to 2000, they were reduced by 26%.

*Table 17. Emissions of greenhouse gases in RA by sectors (Gg), 2010**

Sectors	CO2	CH4	N2O	HFC	CO2 հաս.
Energy	4231.0	35.64	0.094	0	5008.6
Industrial processes and product use	225.9	0	0	0.133	481.1
Agriculture	0	44.26	1.26	0	1320.5
Waste	7.64	27.77	0.202	0	653.4
Total	4464.54	107.67	1.556	0.133	7463.6

*Without forestry and other land use

59.8% of greenhouse gases in 2010 fell to carbon dioxide gas, 30.3% to methane, 6.5% to nitrogen oxide, 3.4 to 5 fluorine gases. Distribution of emissions by main sectors is as follows:

- Energy - 67%,
- IPPU - 6.4%,
- agriculture, forestry and other land use (AFOLU) - 17.9%, and
- waste - 8.7%.

Sources of GHG emissions in the waste Sector in Armenia include:

- MSW disposal sites (CO2);
- Open burning of MSW (CO2, CH4, N2O);
- Wastewater (CH4, N2O).

Key emission sources: CH4 emissions from MSW (72% of total emissions); CH4 emissions from residential and commercial wastewater (14%); N2O emissions from wastewater (8.6%); CH4 emissions from MSW open burning (3.4%). The first two of these sources are also included in the key categories of the general inventory.

Tendencies of GHG Emissions, 2000-2010

Table 18. Emissions of Greenhouse gases in RA (Gg CO2)

Gas	2000թ.	2003թ.	2005թ.	2008թ.	2010թ.
CO2	3207.0	3181.9	4077.7	5109.1	4464.6
CH4	1844.7	1869.1	2097.5	2458.0	2261.0
N2O	479.8	569.4	632.1	483.9	482.8
HFCs	3.7	17.8	45.0	173.0	255.2
Total	5535.2	5638.2	6852.3	8224.0	7463.6

In 2000-2008, in general, growth of GHG emissions was observed driven by high rates of economic development, and in 2009-2010, decline of GHG emissions was observed predominantly in "Energy" and "IPPU" sectors driven by global economic crisis.

Increase of emissions of F gases (HFCs) that are used as substitutes for ozone-depleting substances is mainly conditioned by the development of refrigeration and air conditioning systems.

Beyond this entire process, monitoring of air pollution is carried out, which, on the one hand, provides an opportunity to evaluate the activities directed towards protection and, on the other hand, reveals the problematic pollutants and major pollution sources, serving as an incentive for the protection of atmospheric air. To assess the condition of the air, the maximum permissible concentration level of substances polluting the atmospheric air as well as the maximum permissible standards of physical harmful influences are defined.

Sources of emissions of harmful substances are divided into 2 groups: stationary pollution sources (plants, equipment) and mobile pollution sources (cars, other vehicles). At the moment, there are 1483 organizations in the system of state registration and standardization of emissions with over 3850 emission sources. They cover more than 90% of emissions from stationary sources of the country, and the State Environmental Inspection carries out state oversight towards them in the manner prescribed by legislation. The limitation of emissions from mobile sources of pollution is based on fuel quality, engine quality and good working conditions.

In order to reduce emissions from automobile transport, the RA Government has adopted strategy and action plan, has banned the use of fuel composed of lead and the import of cars without catalyst convertors. In recent years, the permitted amount of sulfur in the content of gasoline and diesel fuel has been reduced about 10 times. The use of compressed natural gas increased year by year, at the expense of reducing the usage of gasoline. As a result of this the growth of harmful emissions from automobile transport has been significantly suppressed.

The systems of International Standardization Organization (ISO) are not yet effective in the Republic of Armenia and there is no "good faith" approach to environmental issues. Level of public awareness in this area is also limited. Therefore, if emission amounts satisfy the requirements for obtaining emission permits then enterprises do not take serious steps for replacing or investing in their technologies. The principle of technological standardization for stationary sources and the introduction of new technologies are currently the most important challenges facing the protection of atmospheric air.

5.4. Atmospheric air

5.4.1. Emission of hazardous substances

The emission of hazardous substances affects the environment. The tables below present the amount and distribution of harmful substances emitted from steady sources and transport.

Table 15. The Amount and Distribution of Harmful Substances Emitted from Steady Sources by RA Marzes and Yerevan, 2012

	The amount of harmful substances emitted	The amount of harmful substances chased	The amount of substances emitted into the atmosphere
Yerevan	18734,2	3518,6	**15215,6**
Aragatsotn	608,3	--	**608,8**
Ararat	148314,2	146728,2	**1586,0**
Armavir	3127,1	--	**3127,1**
Officials	2345,4	--	**2345,4**
Lori	40540,3	--	**40540,3**
Kotayk	23271,6	1296,0	**21975,6**
Shirak	1987,6	--	**1987,6**
Syunik	8775,8	156,0	**8619,8**
Vayots Dzor	3121,6	4,5	**3117,1**
Tavush	18289,4	--	**18289,4**
Total:	**269115,5**	**151703,3**	**117412,2**

Table 16. The amount of harmful substances due to vehicle emissions and their specific indicators (2007-2012)

Date	Emissions		
	Total (tons)	Per 1 sq. km (tons)	**Per capita (kg)**
2007	149659,8	5,0	**46,4**
2008	172155,9	6,0	**53,2**
2009	160406,9	5,6	**49,5**
2010	166450,9	5,8	**51,1**
2011	154675,8	5,4	**47,3**
2012	**142417,7**	**5,0**	**47,1**

5.4.2. The management of the protection of atmospheric air is carried out based on the following principles: regulation (limitation) of emissions, accounting and control. Emissions

Stationary Sources of Pollution

At the moment, there are 1483 organizations in the sphere of state registration and standardization of emissions with over 3850 emission sources. They cover more than 90% of emissions from stationary sources of the country, and the State Environmental Inspection carries out state oversight towards them in the manner prescribed by legislation. Overall, the amount of emissions amounted to 128400, 6 tons.

Emissions of Harmful Substances from Stationary Sources

Emissions of harmful substances in 2013 amounted to 261.4 thousand tons, of which 54.2 percent was attributed to vehicles, while 45.8% to stationary sources of emissions.

The amount of stationary sources of emissions in 2013 amounted to 3176, 77.0 percent of which met the approved permissible criteria. The amount of harmful substances emitted from stationary sources amounted to 314.4 thousand tons, of which 61.9% was captured, and the remaining 38.1% was emitted into the atmosphere. 26.6% of harmful substances emitted to the atmosphere was made up of sulfuric anhydride (31.8 tons), 2.2% (2.6 tons) - from carbon monoxide, oxides of 1.3% of nitrogen (without by oxide) (1.5 tons). The total quantity of heavy metals in atmospheric emissions totaled to 49.4 tons. The amount of dust emissions totaled to 362, 2 tons, of which 4.1% (148.4 tons) fell to organic dust. In 2013 the amount of volatile organic compounds in the total amount of atmospheric emissions amounted to 417.6 tons.

5.4.3. Mobile Sources of Pollution

Armenia vehicles are mostly worn out. As of 2014, according to official data, 533886 vehicles are registered in the Republic of Armenia.

According to official data, 129208 tons of petrol was imported, 346259 tons of liquefied gas was consumed and emissions from automobile transport amounted to 142207 tons. If only petrol was used as fuel instead of gasoline, emissions would make up 416 694 tons.

5.4.4. Hazardous emissions from automobile transport

The amount of harmful substances from vehicle emissions amounted to 141.7 thousand tons in 2013. Among them are carbon monoxide - 102.6 thousand tons or 74.2% of total emissions, volatile organic compounds - 23.3 tons or 16.4%, and nitrogen oxides - 15.3 tons or 10.8%.

Although environment is less polluted as a result of increased gas use instead of petrol, this does not mean that the environment is in perfect state. Due to overloading with transport, the state of the atmosphere in regional centres, big cities and especially Yerevan is still not satisfactory. The state of atmosphere is also unsatisfactory in the towns and villages that are immediately close to the major mining areas or are located in the area of their influence, such as the immediate neighbourhood of Hrazdan and Ararat cement factories, Agarak, Alaverdi, Kajaran, Amulsar, Teghut, Sotk and other mines. Such settlements are Alaverdi, Teghut, Kajaran, Agarak, Ararat, Hrazdan, Tsakhkadzor, Lernadzor, Shnogh, Akor, Akner, Sotk, etc.

5.5. Waste

5.5.1. Issues in waste sector

The main issues identified through the Strategic Development Plan of waste management sector, the road map and the interim report of long-term investment program are as follows:

- Currently about 700 tones of household waste is accumulated per year or about 0.6 kg per capita per day. It is predicted that by 2036, 950 thousand tons of waste or 0.8 kg per capita per day will be accumulated.

- Waste collection quality and the coverage are below the optimal level in the country, despite the fact that the situation is better off in urban areas as compared to rural communities. The collection and transportation equipment is largely outdated and insufficient for providing regular service.

- Waste is removed from uncontrolled and technically unequipped landfills, where no environmental protection measures are observed. There are also many so-called "wild" landfills, where people dump waste themselves.

- Due to these factors there are a number of environmental impacts that should be addressed by the NGO, taking over great responsibility towards environmental protection and financial resources.

- Waste removal from non-standard landfills is limited by processing of waste conditioned by small but developing independent markets for the processed products with little economic value - mainly plastic, glass, paper and aluminum.

- For the current system the rates range from 0.20 to 0.40 euros per capita, this is not enough to finance the existing system, not to speak of upgrading the latter.

- At the moment waste management services are delivered by privatized and operational city service organizations subordinate to the municipality or short-term contracts are signed with private, local operators, they are entirely funded from low fees, few capital grants from public sector budgets or donations occasionally given by different countries.

- So far, national and international initiatives have been characterized by relatively uncoordinated, fragmental and gradual approach, with no accessible general national policy, planning and priority-setting framework upon which the decision-making on investments is based upon.

- In 2012 39.0 mln. tons of waste has been accumulated in the areas around organizations. Waste generated per capita averaged 12.9 tons, while waste per square km (without the surface area of the lake Sevan) amounted to 1.4 mln. tons.

5.6. Baseline situation in waste sector

Production of municipal waste is growing faster than urbanization does. By 2025 it is anticipated that every human being will produce 1.42 kg of municipal solid waste per day, instead of the average 0.6 kg produced today.

Currently there are 5 projects registered by the International Executive Board of the "Clean development mechanism" that are in the process of implementation or operation, including solid waste landfill biogas project in Nubarashen, Yerevan, the importance of which is given by the disposal problem of large amounts of waste in Yerevan and nearby regions. In order to reduce harmful emissions from Nubarashen landfill in Yerevan (with a total area of 52.3 hectares) an Armenian-Japanese project of Biogas Power Generation has been planned and carried out, the discussions of which started back in 2002.

30 landfills have been registered as real estate by the State Committee of the Real Estate Cadastre adjacent to RA Government in the manner specified by legislation, while the administrative area near Ashtarak-Etchmiadzin highway in the Oshakan village of Aragatsotn region with 1.58 hectare area of landfill, where some part of trash from Yerevan is also disposed, not only does not have state registration but is also regarded as land (pasture) with agricultural significance. The inter-community landfills of the Vedi city as well as those of Artashat and Masis cities of Ararat marz, although licensed, do not meet the standards of landfill operation, since the level of ground water is high in the Ararat valley, while, for example, the landfill of the Masis city is located in the immediate vicinity of the river. The landfill with around 1.0 hectares in the area of cultivated lands with agricultural significance in the immediate vicinity of the river - right next to the newly opened section of the Yerevan-Masis highway is also not legitimate.

According to statistical data around 1.5 million m3 or 535.2 thousand tons of household waste (1,000 m3 in case of 350 tons) is accumulated and transported in the area of the Republic of Armenia. Moreover, 57%, i.e. 868 thousand m3 falls to the share of the city of Yerevan. According to the data of Armenia's Ministry of Urban Development more than 700,000 tons of waste is generated annually in Armenia. On average around 450-470 tons of household waste is transported to Nubarashen landfill per day, i.e. 170-180.000 tons per year.

242 legitimate landfills operate in the Republic of Armenia, which occupy 1344 hectares. In addition, there are 196 officially not registered landfills occupying 171.2 hectares. The largest is Nubarashen's landfill, which occupies about 50 hectares. The landfills are gradually increasing in Armenia at the expense of lands under cultivation.

Accumulation and burning of waste in landfills contribute to air, water and soil pollution, as well as generate noise and other unpleasant phenomena. In addition, the economic costs of municipal and hazardous waste management capacity reach around 75 billion euros.

Growth in the levels of waste conditions contributes to the growth of the environmental, social and economic challenges. Waste management is one of the four priority goals declared by the EU's 6th Environmental Action Plan. Landfills not only occupy more and more large and valuable lands, but also pollute the air, water and soil, emit carbon dioxide (CO2), methane (CH4) and other gases into the atmosphere, pollute the soil and groundwater reserves with chemical materials and pesticides, which in turn are harmful to human health, plants and animals.

The solid waste collection in the Republic of Armenia is carried out in 49 urban and 468 rural communities. 46% of rural communities are not included in the waste collection service.

There are communities where waste collection is done haphazardly and garbage that is not collected or disposed usually appears on the banks of rivers polluting the environment and creating risks for human health. Sometimes landfills are located in upland areas, such as the landfill with 5.6 hectares located near the Arjut village of Lori region - waters flow from the melting snow in such areas, their adjacent areas are used for agricultural purposes that are constantly polluted by waste and sewage. Certain landfills are used for feeding farm animals, which is a great threat to human health. Wild animals such as foxes use these landfills, which are a source of serious infection and threat to biodiversity, as well as transmit the infection to other animals.

Unsorted household waste, according to the legislation on waste, is considered to be hazardous, while the law on "Waste management and sanitation" does not regulate the relations related to hazardous waste, therefore, the provisions of that law cannot be applied to household waste collection process.

According to statistical data, in the Republic of Armenia around 1 529 000 m^3 or 5 352 000 tons of solid waste is generated and transported to landfills annually, of which 57.0% (868.0 m^3) in Yerevan.

There are some problems with the control in the waste management sector; in particular there are 242 officially registered landfills in the country, of which only 19 are registered in the register of waste disposal sites (as recorded by the Chamber of Control). According to unofficial data there are approximately 196 illegal landfills and dumps in the country that occupy an area of about 170 hectares.


At the same time the adjacent areas of the landfills are in extremely poor condition, many of them do not comply with the norms of sanitary protection zones.

SW collection in Armenia is implemented in 49 urban and 468 rural communities while 398 rural communities (46% of rural communities) are not included in the waste collection service. The total area of municipal landfills is 219 hectares. Large landfills are situated in Yerevan (with 52.3 hectares and 8 million tons of waste accumulated), Vanadzor (13 hectares), Gyumri (10 hectares), Armavir (8 hectares), Echmiadzin (7 hectares) and Hrazdan (6 ha).

SW includes household, commercial, and other types of waste. In all landfills waste is accumulated without prior classification and separation. The quantity of solid waste generated is approximately 700 thousand tons, out of which waste transported and stored in landfills is about 510 thousand tons (241 kg per capita). All landfills, with the exception of the largest landfill found in Yerevan, are not controlled. Degradable organic carbon in the solid waste forms 50- 60%. There are violations of the relevant decisions of the RA Government related to the installation space for landfills, their disposal, neutralization and destruction.

5.7. Impacts of mining waste

In Armenia waste is generated mainly due to production, the majority of which is mining waste in the form of rock dumps and rocky waste accumulated in tailings as well as in the form of solid waste (SW).

Table 19 presents the quantities of hazardous waste and indicators of their use and neutralization.

Table 19: Generation, use and neutralization of the production-based hazardous waste, 1000 tons

Years	Was generated	Was used	Was neutralized
2005	10899.1	0.8	2.5
2006	12069.0	0.8	2.3
2007	13346.0	2.5	2.5
2008	11455.4	2.4	1.5
2009	14766.1	2.4	0.5
2010	23307.8	159.9	0.3
2011	27609.0	134.0	0.02
2012	39030.9	9.1	0.2
2013	49332.1	5.9	4.3
2014	46511.9	9.1	8.7

In the country, there are more than 300 million tons of ore tailings in the form of rocks, the volume of which is increasing at about 20 million tons annually. At the same time, their annual production will increase as a result of Teghut mine reaching its projected capacity, as well as exploitation of other mines.

The current situation can be assessed as disastrous since currently there are no effective mechanisms in the soil management sector to reduce waste or damage arising from it and the application of the Best Available Technologies (BAT) and Best Environmental Practices (BEP) is not encouraged. An exception is, perhaps, the tails' processing of the Ararat Gold tailing in 2000-ies by the organization AGRC which had been granted certain tax benefits.

5.8. Socio-economic situation in Armenia

The Economy

Armenia's economic growth in 2013-2014 was 3.5%, which decreased slightly in 2015, amounting to 3.1%. Gross domestic product in 2015 amounted to 3864 dollars per capita in the country, and the economic activity index was 3.1% which is not a bad indicator given the current socio-economic development of the country. It should be noted that although the economic growth rates are lower than the pre-crisis growth rates (since 2011) due to the global financial crisis, there have been significant qualitative changes in the economic structure of the country, in favor of more productive industries, which mostly contributed to the economic growth in the export sector, particularly agriculture and industry /especially the mining industry/.

In 2013 Armenia almost fully restored its pre-crisis level of GDP (2002-2006), which was accompanied by relatively high recovery rates in all sectors of the economy except for construction.

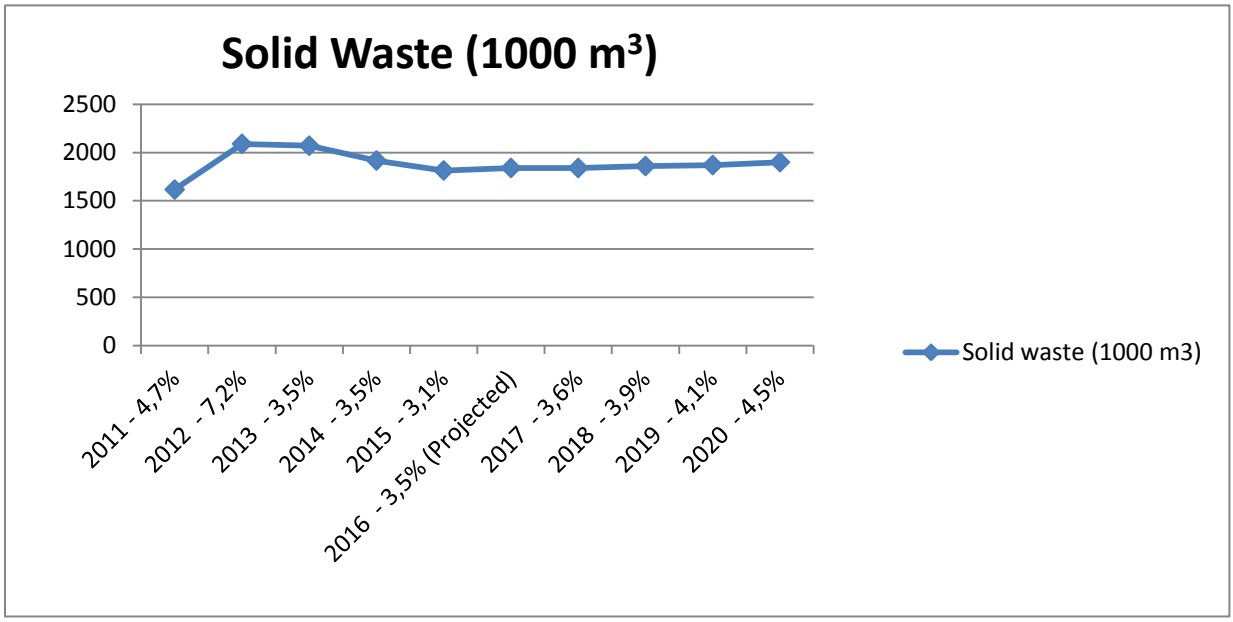
In 2015, as compared to 2014, all sectors of Armenia's economy registered certain level of growth, except that in construction and trade sectors, which declined by 3.1 and 7.1 percent respectively.

In 2015 the highest growth in the country's economy was recorded in agriculture - around 12%, which was due to favorable climatic conditions, as well as a number of programs aimed at supporting the agricultural sector initiated by the government. At the same time it is obvious that the development trends observed in previous years as well as the state policy directed at the development of the agricultural sector serve as prerequisites for ensuring sustainable and viable growth of the sector during the upcoming years.

Table. 20. The yearly growth of Armenia's sectors of economy/ with value added /

Sectors of economy	**2011**	**2012**	**2013**	**2014**	**2015**	**2016 /Prediction/**
Industry	13.9	8.8	6.9	2.7	5.2	5.0
Agriculture	14.0	9.5	7.1	7.2	11.7	9.5
Construction	-9.1	-2.6	-7.7	0.2	-3.1	1.0
Services	5.4	10.8	3.6	8.7	2.7	3.0
Product taxes /subsidies excluded/	3.8	9.9	2.8	4.0	4.5	4.2

Figure 7. The annual volume of solid waste (thousand cubic meters) and GDP (%) by years



According to economic projections GDP in the Republic of Armenia will vary from 3.5 to 4.5% in 2016 – 2020. Furthermore, this indicator will demonstrate small, yet steady growth rate. At the same time it should be noted that the volume of solid waste increases parallel to the GDP growth.

It should be noted that in recent years enormous investments have been made predominantly in the sectors of transportation, energy and agriculture, which in their turn contributed to the moderate, yet stable growth of the economy.

Demographic data and social situation of the population

According to projections, Armenia's population will grow by 10 - 15 thousand over the next 5 years and will reach 3 million 50 thousand in 2020 or population will grow by 1.7% as compared to 2015, due to economic growth and creation of new jobs. In parallel, over the next 5 years, the volume of solid waste will increase by 86 thousand cubic meters or 4.7%, which means that the annual growth of solid waste in Armenia will not exceed 1% by 2020. Almost the same situation may be maintained over the decade following 2020.

It follows that the current strategy for solid waste management can be considered relevant for at least the upcoming 15 years.

Parallel to the recovery of the economy, respective changes were reported in the labor market. For example, if the unemployment rate was 19% in 2010, it amounted to 15.8% in 2015 as a result of the continued decline of this indicator. It should be noted that 56% of the unemployed people are women, while 44% are men. However, the level of unemployment in cities and villages is quite varied. Thus for example, unemployment rate in rural areas is 85%, while in urban areas it is only 15%.

Over the past 3 years the average wages of people engaged in the public and private sectors have also increased. In 2013, nearly 4% of growth in the average wage was recorded, while that in 2014 amounted to 6% and in 2015 to 3.4%. Given the average inflation, real wages rose by 3.9% and totaled to 142, 1 thousand AMD in the public sector and around 195 thousand AMD in the private sector.

Due to the above-mentioned indicators recent years can be described as development era for the social assistance provided to the elderly and the disabled. The quality of services provided to the elderly and the disabled improved, the range of the services provided expanded, and new structures supporting the vulnerable groups of the population were founded.

In recent years, significant progress has also been observed in the legislative field. According to the findings revealed through the CIVICUS Civil Society Index Initiative the majority of civil society organizations operating in the country / 65.6% / consider that the laws and legislative acts of the country are either moderately or fully favorable for the functioning of civil society in the country: the regulatory framework governing the activities of the Armenian civil society received the score of 3.9, which means that the legislative framework is in the transitional period.

Fee collection in waste management sector

As it was mentioned above, Armenia's population is concentrated in 48 urban and 925 rural communities. The table below demonstrates the volume of the accumulated solid waste in Yerevan and urban communities of the country during the recent years, as well as the collected fees.

Table 21. The volume of solid waste in Yerevan and urban communities of the country, thousand cubic meters and the collected fees, AMD:

	2011	2012	2013	2014	2015	Payment for solid waste in 2015, in AMD
Yerevan	939.5	1380.2	1386.5	1188.3	1075.3	33 900.7
Aragatsotn	63.8	63.6	37.5	58.4	57.7	1 757.4
Ararat	32.7	53.0	59.0	65.0	67.4	3 097.1
Armavir	133.9	140.5	138.7	154.9	160.6	5 108.6
Gegharkunik	59.8	60.9	60.1	52.4	51.4	2 218.5
Lori	87.0	84.4	80.0	85.3	86.1	4 051.7
Kotayk	74.2	62.7	81.7	97.8	102.3	4 566.9
Shirak	77.8	84.8	67.4	60.4	59.8	2 169.0
Syunik	57.7	59.3	51.0	44.2	41.4	5 140.8
Vayots Dzor	5.4	14.5	15.3	18.7	19.5	487.6
Tavush	84.0	86.1	93.5	91.9	92.4	2 277.1
Total for the country	1615.8	2090.0	2070.7	1917.3	1813.9	64 775.4

As the data of the above table show, the volume of solid waste reduced in the last 3 years, due to the reduction of the population: in 2015 the charge for disposing solid waste in landfills amounted to around 64.8 million, accounting for 4.5% of the total environmental payments.

Cultural Heritage

In the Republic of Armenia there are 3 state reserves, 4 national parks, 27 national sanctuaries. In addition, there are 232 natural monuments in the country, of which: 106 geological, 48 hydro geological, 40 hydrographic, 17 natural-historical and 21 biological monuments. Naturally, the abovementioned facts are being considered in the waste management plans and landfills are installed in areas that are away from the abovementioned sites based on the set standards.

Socio-cultural challenges facing the country

Despite the abovementioned achievements, there are still many unresolved issues and various problems in the social and economic sector of Armenia that directly impact the country's economy and social state of the population. The most urgent problems facing the socio-economic sector are:

1. Decline in population due to migration. If in 2013 the number of population amounted to 3,027 million people, then in 2014 it amounted to 3,017 million, while in 2015 it reduced from 3 million to 2 million 998 thousand people;
2. Decline in the purchasing power of the population, as a result of decreasing transfers from abroad by almost 40%;
3. High level of poverty of the population. Analyses show that the poverty rate has not been declining over the last 3-4 years and fluctuates around 30 percent.

Fee collected from citizens for waste collection is around 400 AMD per month per capita. 3000 AMD is the fee for non household and bulky waste according to the Law on Waste collection and sanitary cleaning of the RA. Thus, in comparison with minimum salary of 55,000 AMD, 400 AMD fee is more or less affordable for citizens, however the non payment of fees is not a rare case due to the unemployment, low incomes and poverty, especially in the regions with lowest economic activity. Considering data from Armenian statistical service the values between 24 000 AMD and 28 000 AMD per month per adult may serve as a lower poverty line based on various reference population and food basket structure.6

The non-payment of waste collection fees is also explained by the low services which communities receive from municipalities of private companies implementing waste collection.

Table. 22. Current problems and linkage with the waste management plan

Main issues	Specific concerns and problems	Geographic area	Possible relation to the waste management plan
Socio-economic sector	Existence of a cemetery with severely hazardous pesticides in the nearby landslide soils	Area adjacent to the landfill in Nubarashen situated in the suburbs of Yerevan	A project is being implemented to conserve them - ensure it does not contradict the Plan
	Expansion of the territories for landfills at the expanse of agricultural lands	In most of the urban-type sites and villages	Absence of an overall spatial plan for the installation of landfills
	Stench spread in 500-1000 meter radius around the landfills	Settlements, where landfills are situated at the distance of 500-1000 m /in around 25% of villages/	The Plan to include the distance criteria for setting the landfills
	The use of components of natural monuments / the use of polyhedral basalt of smooth layer for the purposes of tiling	"Symphony of stones" natural monument, Kotayk marz, Republic of Armenia	
	Collection of bread and food from the landfills for feeding the pigs	Landfill of Nubarashen situated in the suburbs of Yerevan	Organization of the recycling of waste

[6] http://www.armstat.am/file/article/9._poverty_2015e_6.pdf, Measuring Poverty In Armenia: Methodological Clarifications, pg. 185

5.9. Public health

Human health related issues and waste management

In Armenia every program that is carried out with the goal of changing the collection, transportation and processing of the existing solid waste recycling system, is justified. The current system of solid waste management is imperfect, it carries many risks, especially with regard to the factors affecting human health. The population in all areas of the territory, all age and risk groups (children, the elderly, adults, pregnant women, people with low immunity, patients, etc.) are impacted by the latter throughout the total life span.

The impact of solid waste on human health takes place through the following media - soil, surface water and drinking water, atmospheric air, air of the working zone, the food chain and through organoleptic. Sensology is the assessment or perception of quality indicators through sensory organs. The sensological indicator for harmfulness characterizes the changes of the smell in an environment or changes of the smell, taste and nutritional value of fitotest plants in a given environment, as well as changes of color and smell in atmospheric air, ground and surface waters in areas adjacent to the operating polygon. For example, smell, as a sensological indicator, can have a profound impact on human emotions, receptivity, state of mind and consciousness, even leading to human aggression.

The affecting factors are chemical, bacterial, viral and parasitic factors. Diseases that are due to the factors presenting epidemiological risk, i.e. bacterial, viral and parasitic infections, are among the most studied diseases by the RA healthcare system.

Namely following aspects are important in the context of the assessment of health risks associated with the planning in the field of waste management:

1) According to the studies (Order N03- N of the RA Ministry of Healthcare dated March 4, 2008, 2000 data of WTO approved by SanK and N N2.1.3-3, Ecology of CIS countries, city of Tver, etc), the areas around the dustbins with a radius of 15 meters, are considered to be the most infected areas based on microbiological indicators and, in practice, during the growth period of infectious diseases the flies sampled from these areas are mostly infected with entero virus.

2) It is known that the flies are able to move/transfer more than 63 types of microorganisms (intestinal bacteria, bacterial agents of dysentery, polio viruses and the like) as well as helminth eggs and minor ticks from all sorts of objects, including solid waste. Rats and mice can serve as additional transmitters and / or carriers of microorganisms and mites, which are direct indicators of poor sanitation.

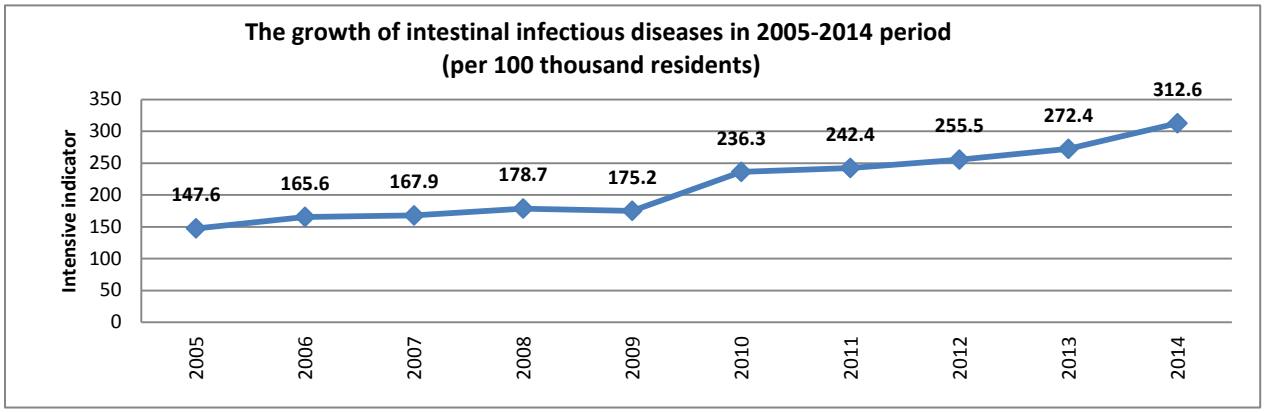
3) In international practice cases of people infected with HIV/AIDs and hepatitis B have been registered as a result of medical waste. Most commonly those children who play with syringes and vials in the area of landfills are infected.

4) Below some examples of intestinal infectious diseases due to epidemic unfavorable conditions are presented and the solid waste and the lack of their proper management play role in the transmission of such diseases.

a. Common intestinal group includes dysentery, iersinioze, unconfirmed acute intestinal infections, gastroenterokolit, enteroviral infections and rotavirus, as well as nutritional toxic infections etc. Starting in 2005:

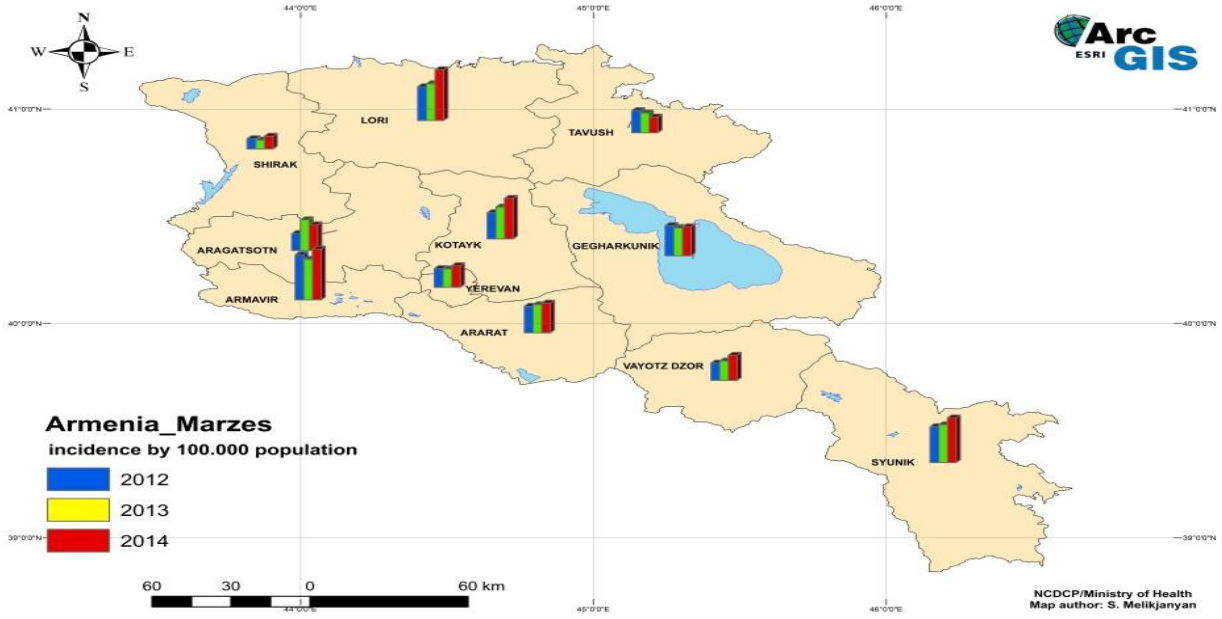
- In Armenia, growth of intestinal infectious diseases is observed, 147. 6 - 312.6 100 thousand per capita (Figure 8.)

Figure 8.



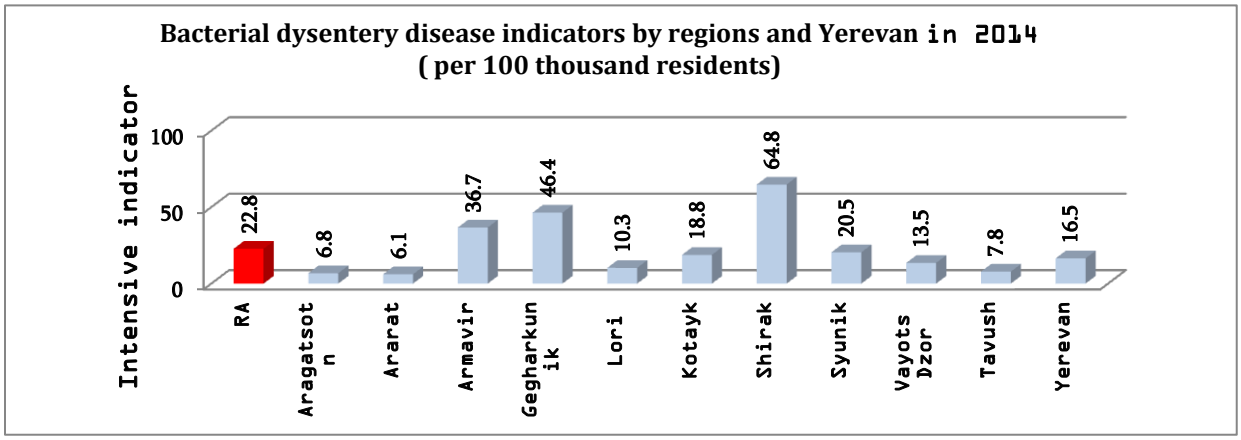
Based on the comparison of 2012-2014 intestinal infectious diseases, morbidity growth is observed in Lori, Kotayk, Shirak, Syunik and Yerevan. In Gegharkunik region the level of morbidity remains stably high (Map 7).

Map 7. Intestinal diseases in the Republic of Armenia in 2012-2014



In 2014 morbidity rate caused by bacterial dysentery per 100 thousand residents is 22.8; morbidity rate higher than the national average has been recorded in Shirak region - 64.8, Gegharkunik region - 46.4 and Armavir region - 36.7. In other regions morbidity rate below the national average was observed, particularly: 20.5 in Syunik region, 18.8 – in Kotayk region, 16.5 – in Yerevan city, 13.5 - in Vayots Dzor region, 10.3 - in Lori region, 7.8 - in Tavush region, 6.8 in Aragatsotn region and 6.1 - in Ararat region (Figure 9).

Figure 9.



- In 2013-2014 growth was recorded in the country with relation to "Gastro enterocolits, nutritional toxic infection," as compared to that of previous years, in 2005-2014 a growth of the infection by 4.3 times was observed per 100 thousand residents (Figure 10 and 11, in the Republic of Armenia, based on regions).

Figure 10.

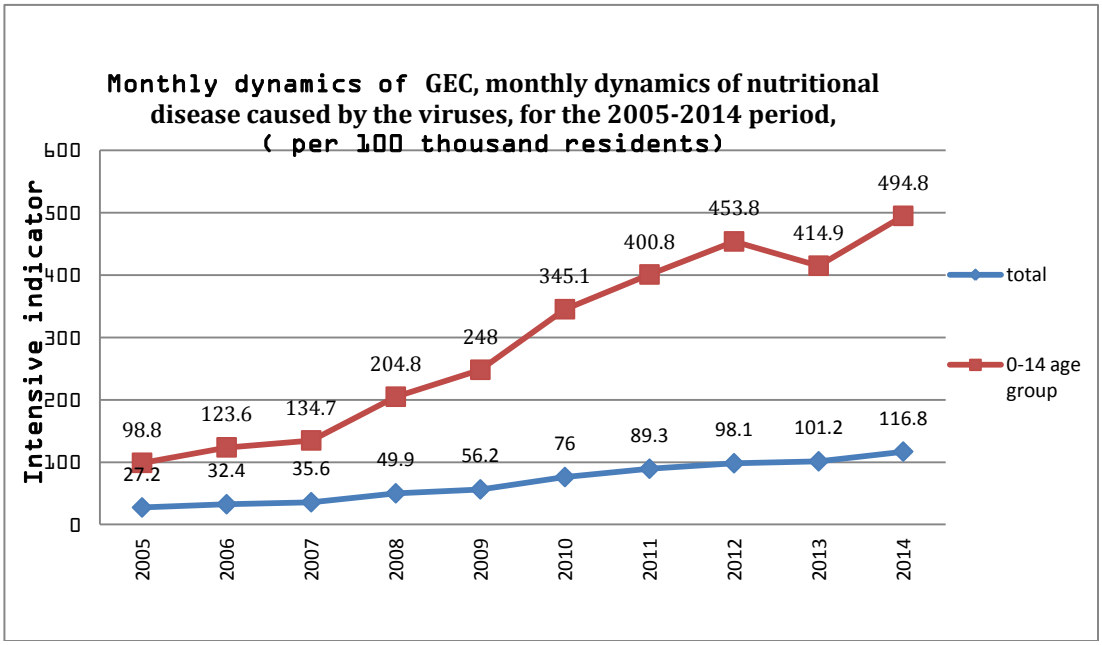
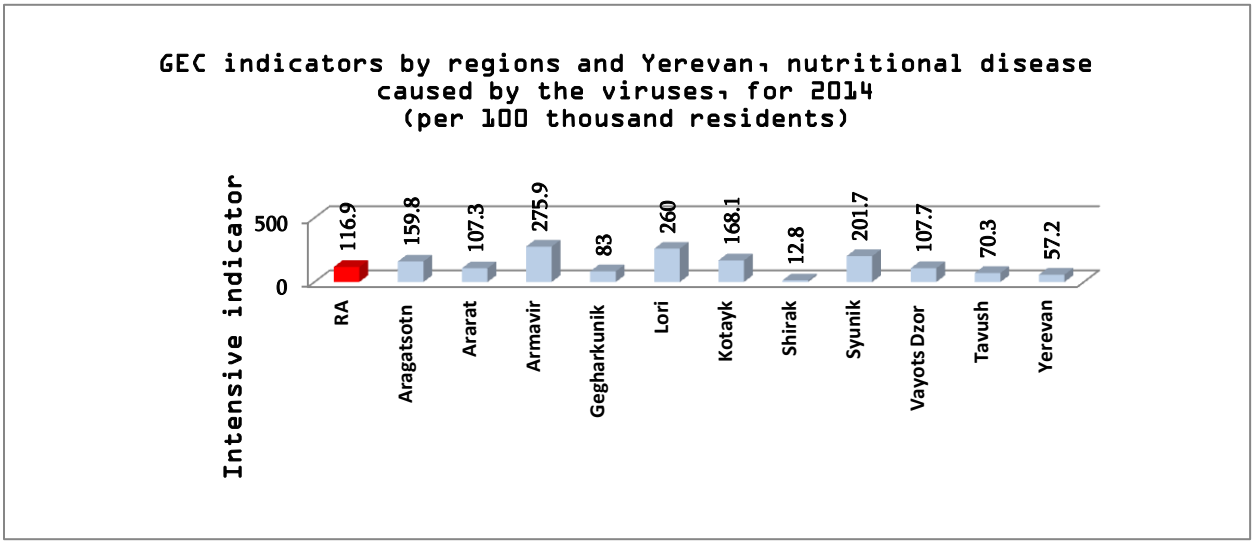


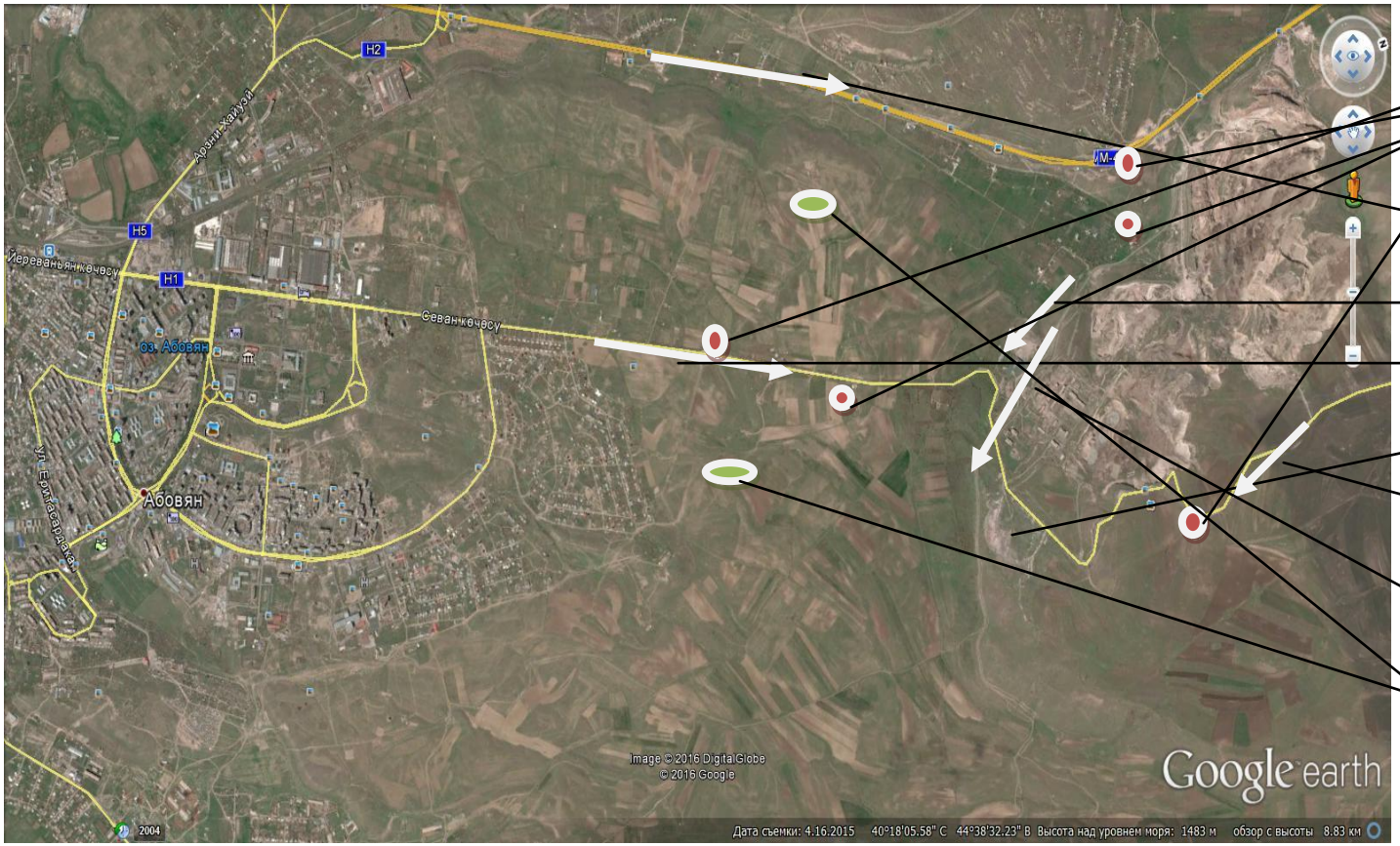
Figure 11.



1. The target groups of the population most exposed to the adverse effects of the solid waste in the area of the Republic of Armenia are,
   1) residents of the areas adjacent to the sanitary protection zones of large landfills,
   2) employees of the public utilities involved in garbage collection, transportation and processing,
   3) residents of lower floors in multi-storey buildings.

2. The following factors present obstacles to the assessment of the impact of the solid waste on human health:
   1) Methods for assessing the hazards of solid waste have not been developed so far;
   2) Solid waste is still not classified according to its potential impact on environment and public health;
   3) Relevant methods and algorithms for hygienic research to determine the level of harmfulness of the solid waste are not yet developed;
   4) There is no research-based and / or monitoring-based data on the link between the diseases and the harmful impact of solid waste on the target groups of the population.
3. Despite the absence of evidence-based data, and consequently, the absence of findings confirming the causal link between the diseases and the harmful impact of solid waste, mere visual observations are sufficient to report on the potential harmful impact of the solid waste. For example, the examination of the landfill used in Abovyan town and surrounding villages of the Kotayk Marz, makes the harmful effect of the landfill obvious. Map 8 presents the landfill situated at approximately 5 km distance away from the Abovyan town to the north.

Map 8



Unorganized landfills

Yerevan-Sevan highway

Makravan- Abovyan

Road leading to the landfill

Road leading to the landfill

Sevan canal

Lands used for gardening and agricultural purposes

1) The landfill site is not in any way isolated from the surrounding area;

2) At the edges of all the roads leading to the landfill garbage dumps are formed, which have turned into illegal landfills;

3) The surrounding areas, bordering the irrigation canal of the Lake Sevan, are contaminated with the outlets of solid wastes, which are partially filled in the canal;

4) The solid wastes outlets are also filled in the sanitary protection zone of the drinkable water of Makravan – Abovyan district, with d = 500 mm diameter;

5) The landfill is burning or smoking during the whole year. The generated smoke with persistent organic contaminants is reaching the city of Abovyan and nearby villages;
6) It is evident that waste of various origin, including chemical, biological, industrial and other unknown origins, exists both in the landfill of the city of Abovyan as well as in garbage dumps generated on the roads;
7) Pastures, villas, gardens (with fruit trees and vegetable crops) are situated in the surrounding areas, heavily polluted with wastewater from the area of the landfill during the downfall;
8) This situation is typical to other areas of the Republic of Armenia.

The aforementioned facts – the contamination of the soil, irrigation and drinking water, air, as well as the impact caused through the food chain inevitably impact the human health.

Main public health issues relevant to the waste management plan

Table 23. The main public health issues relevant to the waste management plan

Main issues	Specific concerns and problems	Geographic area	Possible relation to the waste management plan
Public health	1. Expansion of the landfill areas and violations related to the water pipes and canals within the sanitary protection zone, 2. Burning of garbage 3. Violations in sanitary zones of the landfills, 4. Existence of toxic waste (heavy metals, chemicals) and medical waste (syringes, ampoules, etc.) in the landfills,	Pollution of the areas adjacent to the landfills (Air, soil, water, filtrates, groundwater and surface water)	**1. Lack of monitoring spots for the study of the effects of landfills on the environment,** **2. Lack of polygons for non-disposable waste**
	Quality of air in the areas surrounding the landfills of the multi-storey residential buildings and apartments 2. Presence of insects and rodents in the garbage	Internal floors of multi-storey buildings, garbage and garbage cabs	**Absence of garbage cabs' cleaning and disinfection system**
	Employees of public utilities and people engaged in illegal recycling of waste	**Landfill**	**Imperfect organization of regular medical examination and morbidity studies**

6. INITIAL IDENTIFICATION OF THE PRIORITY ISSUES TO BE ADDRESSED IN SEA

The overview of key environmental and health issues for further analysis in the subsequent stages of the SEA process is provided in this section. It represents the main findings of the initial analysis of the area (i.e. the phase of the draft Scoping Report). The scoping matrix presented below is prepared to facilitate the consultations with relevant stakeholders as well as it will serve as a departing point for the SEA evaluation of potential effects of the WMP in the subsequent phase of the SEA.

Table 24: SCOPING MATRIX FOR THE SEA ON WASTE MANAGEMENT PLAN

Main issues	Main concerns and problems	Geographical territory of the concerns	Possible links to the waste management plan
General Waste Management-related Issues			
Lack of sound waste management	Poor waste collection and transportation to the station	In the whole territory of RA	Waste transfer stations network needs to be planned and implemented
	Lack of Waste sorting – increase risk of hazardous substances entering to surface waters because of the lack of waste sorting	In the whole territory of RA	Separate waste collection and sorting measures to be implemented
Uncontrolled accumulation of unsorted solid waste	Presence of solid waste illegally disposed on the ground - increase risk of contamination of the environment with hazardous substances and pathogens	In the whole territory of RA	WMP have potential to address this problem
Water/Groundwater Related Issues:			
Water& groundwater	Wastewater treatment is applied in limited areas, only mechanical treatment is available Pollution of surface water with chemicals from households and industry Microbiological pollution of surface water Due to missing landfills domestic waste occurs on river banks causing surface water pollution	Nationwide, but closer attention to Ararat Basin and Lake Sevan	Absence of proper landfills compliant to international and/or EU standards Water control and leachate management The location of a landfill must take into consideration: -the distances from the boundary of the site to residential and recreation areas, waterways, water bodies and other agricultural or urban sites; -the existence of groundwater in the area Criteria for acceptance at a specific class of landfill must be derived from considerations pertaining to: protection of the surrounding environment (in particular groundwater and surface water); Due to the absence of waste separation chemicals,

			such as paints and other construction materials, as well as medicament etc pollute surface water and/or leaks into the ground)
Underground waters	No appropriate geological research conducted before dumping (illegal)	At many locations in the RA	Geological survey needs to be conducted as a basis for identifying locations for landfills and other waste management facilities
Socio-economic Issues:			
Socio-economic sphere	Existence of the extremely dangerous toxic waste dump in the landslide areas nearby settlements	Surrounding territory of Nubarashen landfill in the outskirts of Yerevan	A project for rehabilitation of the affected sites is being implemented
	Territorial expansion of garbage dumping sites at the expense of agricultural land (due to illegal waste dumping)	Most of the places in country towns, villages	Lack of spatial plan for the installation of garbage landfills
	Spreading of waste smell within the radius of 500-1000 meters from garbage collectors	Settlements in which the waste collectors are located at a distance of 500-1000 m, / in about 25% of villages /	This should be addressed by the Plan
	Collection of bread and food residue for pigs feeding from the landfills and dumps – risks to public health	Nubarashen landfill located in outskirts of Yerevan	Organization of waste recycling and restriction of access to the landfilled waste
Biodiversity			
Biodiversity	Scavenging by animals	In the territory of the RA	Proper installation of the landfills
	Pesticide graves	Kotayk region, RA, Pesticide storage	The Plan should consider this issue
	Legacy mining waste dumps left from the mining industry	Syunik, Gegharkunik, Kotayq, Lori, Tavush and other regions of RA	Issues required complex response shall be addressed by the WMP
	Waste management of PAs	PAs, Gegharkunik, Tavush, Kotayq, Ararart, Syunik, Shirak and Lori Regions, RA	Specific issue - shall be addressed by the WMP
	Fragmentation of migration routes of fauna	Landfill and its surrounding areas, sanitary protection zone	Proper biodiversity survey prior to setting the locations for waste facilities
	Loss of fauna habitats (conservation) due to waste management facilities construction/expansion	Landfill and its surrounding areas, sanitary protection zone	Proper biodiversity survey prior to setting the locations for waste management facilities
	Improper recovery of the relief damage caused after mining activities	In the whole territory of RA	Prevention of using the sites as dumps shall be ensured

The impact on flora and fauna in special protected areas	Preservation sanitary zones	Syunik mining dust, groundwater pollution	Measures for minimization of impacts from construction of roads and transport routes in 5 regions related to new waste management facilities shall be implemented
	Existence of unorganized, unsorted, unprotected landfills in PA	Protected areas	Measures for minimization of impacts from construction of roads and transport routes in 5 regions related to new waste management facilities shall be implemented
	Maintaining appropriate distance of sanitary zones of landfills	In the territory of the RA	Conditions for the implementation of the Plan (i.e. for construction and operation of specific projects) shall be put forth
Acceleration of decomposition processes in landfills	Increase of gas emission volumes	RA regions where polygons are located	Systematic approach to landfill gas emissions treatment shall be ensured during the WMP implementation
Health			
Reduction of morbidity level with infectious diseases **Decrease of morbidity level with non-infectious diseases**	1. Expansion of the landfill areas and violations related to the water pipes and canals within the sanitary protection zone, 2. Burning of garbage 3. Violations in sanitary zones of the landfills, 4. Existence of toxic waste (heavy metals, chemicals) and medical waste (syringes, ampoules, etc.) in the landfills,	Areas adjacent to the landfills (Air, soil, water, filtrates, groundwater and surface water)	The WMP should address: 1. Lack of monitoring spots for the study of the effects of landfills on the environment, 2. Lack of polygons for non-disposable waste 3. More stringent control over the health and safety performance of waste management facilities
	1. Quality of air in the areas surrounding the landfills/dumps of the multi-storey residential buildings and apartments 2. Presence of insects and rodents in the garbage	Internal floors of multi-storey buildings, garbage and garbage cabs	1. Location of landfill far from the residential areas (as per the national standards) needs to be ensured 2. Absence of waste baskets/cans cleaning and disinfection system shall be addressed
	Health risks for employees of public utilities and people engaged in illegal recycling of waste	Waste management facilitates	Imperfect organization of regular medical examination and morbidity studies – might be addressed partially by the WMP
Decrease of morbidity level with non-infectious diseases	Noise stemming from waste collection and transport	Areas adjacent to residential buildings, roads leading to landfills	Depreciation of the current garbage collection mechanisms, lack of modern technologies and machinery
Land and Natural Resources			
Natural Resources	Loss of mineral resources, impossibility	Syunik, Ararat, Lori, Gegharkunik	Coordination of Waste facilities location and

	for their realization due to construction of dumping sites on the territories of mineral resources deposits	and Shirak marzes (in the area of all the envisaged polygons)	mineral deposits protections shall be addressed
Land use	Waste development, increase of cumulative impact on the region	Mainly Lori and Syunik marzes	Combination of household and industrial waste, increase of cumulative impact.
	Land uptake (loss of agricultural land to polygons and their sanitary protective zones	Polygons and their sanitary protective zones	Loss of agricultural lands shall be minimized Protection of valuable and environmental (specially protected) lands in the context of WM site selection shall be ensured
Mudflows	Loss of fertile vegetation, destruction of biodiversity	RA Gegharkunik, Shirak, Vayots Dzor, Syunik and Ararat marzes	The issue shall be considered in the course of WMP implementation (to prevent associated risks)
Saline alkaline soils	Saline alkaline soils not used by designation	Ararat and Armavir marzes	Prevent the use of saline alkaline lands for the construction of sanitary polygons In order to protect their potential for agriculture use.
Air and Climate Change			
Air pollution from industrial sources	Cleaning equipment investment Industrial capacities development and modernization	Kapan, Alaverdi, Agarak, industrial cities of Armenia	Potential for cumulative effects with the air pollution from waste management
Air pollution resulting from the polygon	Gas emissions to atmosphere from polygons, emissions resulting from burning, GHG emissions	Polygon and surrounding areas	Absorption and use of gases (development of goals for use), investment of clean and organic methods for the reduction of the negative impacts shall be promoted by the WMP Investment in clean and organic methods in order to reduce the negative impact. Development of green areas around the facilities can also partially offset the negative effects.
GHG emission	Excess trends being noticed	In the whole territory of the RA	GHG emission from waste management shall be systematically addressed
Waste transportation-related emissions	Air pollution and emissions resulting from waste collection and transportation to the station	In the territory of the RA	Optimize the transportation routes and avoid settlement centers and residential areas. Consider low-emissions vehicles for the waste management operations
High density of urban space	High density location of buildings, decrease of green areas	Yerevan, RA	To be considered in the provisions set for site selection

7. INITIAL SEA RECOMMENDATIONS AND INDICATORS TO MONITOR ENVIRONMENTAL/HEALTH IMPACTS OF THE WASTE MANAGEMENT PLAN

Based on "Strategic Development Plan, Road Map and Long Term Investment Plan for the Solid Waste Management Sector in Armenia" the following preliminary recommendations are put forth in order to comply with the requirement of the Law to present a *Plan of environmental measures directed at the elimination, reduction and compensation for the harmful impact on environment*. The nature and level of detail of the recommendations corresponds with the current (i.e. scoping) stage of the SEA. In addition to recommendations relevant for the WMP implementation, several recommendations are also presented towards improvement of institutional and legal conditions for the waste management and environmental assessment systems in general.

7.1. Institutional and legal conditions

- National legislation shall be fully harmonized with requirements the EU directives on management of landfills
- Waste Law shall be amended based on provisions regulating the processes of waste reduction, sorting and recycling
- The definition of state authority powers implementing waste management coordination, sectorial control and defining responsibilities of the state authority implementing waste management and coordination shall be further elaborated in order to ensure efficient functioning of the waste management in RA. Waste management agencies, authorities and their responsibilities are defined, distinct and separated. Regulatory authority responsible for control and waste management is defined by law.
- Waste collection locations, as well as criteria/standards on the storage of waste are defined by correspondent by-law
- Differentiated mechanisms associated with increased waste management fees shall be introduced to ease the social burden for certain socially vulnerable categories of the population
- Opportunities for waste separation and recycling at waste collection points shall be facilitated by the local self-governance authorities and waste processing/management enterprises (including placement of containers, waste sorting, supply per demand. etc.)
- Legislative amendments should be considered in order to elaborate existing national regulatory legislation on SEA and comply with international standards, including implementation of amendments in the **RA Law on Environmental Impact Assessment and Expertise** though enshrining provisions related to the waste sector.
- In order to simplify the process SEA guidance should be developed which will help the state and local government agencies in elaboration and implementation of national SEA sectorial guidelines, containing instructions on step-by-step SEA process, preparation and completion of documents, along with the descriptions of duties (Terms of reference) and functions for responsible parties. The latter will also contribute to the definition and clarification of responsibilities and obligations of stakeholder parties involved in waste management sector.

7.2. Human health

- Establish monitoring system to study the adverse effects of landfills on health and environment
- Improved conditions of solid waste dumps, especially in rural areas threatening human health and spread of diseases shall be a priority within the implementation of the WMP
    - Washing and sterilization systems for waste containers and waste pipes shall be implemented along with all relevant investment to the WM infrastructure
    - Development of proper hazardous waste treatment facilities
- Relevant research and monitoring
    - Organization of in-depth medical examinations and study of morbidity for employees of communal utilities involved in waste collection, transportation and recycling processes.
    - Availability of Parasitic Research related to landfills and territories of waste collection container placement
    - Availability of studies of infectious and non-infectious diseases among population living near landfills and waste containers placement
    - Availability of study of occupational morbidity and morbidity trends among employees involved in waste collection communal service.
    - Implementation of monitoring and/or studies determining the casual link between the negative impacts of solid waste, as well as the diseases among target groups of population.
    - Microbiological monitoring shall be conducted and results made available for land areas adjacent to landfills and territories of waste container placement
    - Bacteriological air monitoring available for land areas adjacent to Landfills and territories of waste container placement

7.3. Socio economic section

- Apply facilities design, technology and management system ensuring the good ambient air quality and clean environment for the communities adjacent to the WM facilities
- Allow for reduction of Waste collection fees for the frontier rural community population (implementation of waste collection exceptionally with the community budget) and other disadvantages communities (e.g. socially insecure families, taking into consideration the ones with high unemployment rates)
- Promote development of waste recycling skills namely compost production skills among the local population, production and utilization of organic waste can also contribute to the solution of socio-economic issues and improved compost production, development of relevant projects and provision of compost to the local rural population. Compost production can also promote economic savings in agricultural production, improved land management, sanitary hygienic situation (through removal of harmful bacteria in compost management site).
- Promote awareness of the public on waste neutralization rules of unusable household appliances, devices, electric lamps, hazardous details /components of packaging, procedures of waste/hazard neutralization related to recycling and waste management processes in households, as well as usefulness of differentiated waste collection and resource management practices.

7.4. Water/ groundwater section

- Ensure that following factors are considered when location decision for a waste management facility is prepared: Proximity of landfill sites to water protection sanitary zones, available aquifers, environmental protection zones, flow formation zones, floods, mudflows etc. (consult Water Resources Management Agency of the MNP, Hydrogeological Monitoring Center SNCO of the MNP, and Hydro meteorological Monitoring Center SNCO of the MES).

- Groundwater monitoring system shall be improved in order to ensure timely identification of risks both during the planning and operational stages in the course of the WMP implementation (Hydrogeological Monitoring Center SNCO of the MNP)

- Presence of water pollution prevention measures, such as proper lining or geological barriers in the landfill facilities shall be consistently inspected (State Environmental Inspectorate of the MNP)

- Surface water quality monitoring program for the landfill sites shall be part of the project implementation plans. (Environmental Impact Monitoring Center SNCO of the MNP).

- Solid Waste Strategy shall consider and be in line with the Water Basin Management Plans that includes information on the main environmental pressures and impacts, delineation of water bodies at risk and propose program of measures for improved environmental quality in the basin. Water Basin Management Plans have already been officially adopted for Ararat and Southern Water Basins. The draft Akhuryan Basin Management Plan is currently under discussion with relevant stakeholders and is in the process of environmental expertise including public hearings in local communities.

7.5. Biodiversity, Climate, Air pollution

- Ensure that regular monitoring of atmospheric air pollution is conducted,
- Use of wrecked, old techniques is prohibited, and replaced with new equipment and filters
- Inventory of harmful substance emissions into the atmosphere, reduction of hazardous substances through the investment into new technologies and use of filters,
- Consider ban on import of more than10 years old cars and without emission catalyzers
- Standards of International Organization for Standardization (ISO) shall be promoted among other systems for improving efficiency (including waste minimization).
- Establish control of management of pesticides and monitoring of their presence in agricultural products
- Invasive species research and data available to define the impact of climate change and respective adaptation measures in terms of land degradation and biodiversity conservation
- Reduction of GHG emissions through capture and utilization of GHG from landfills shall be ensured
- Increased reforestation activities/measures, and territories to reduce GHG emissions and prevent negative impact of climate change
- Promote public awareness on waste management and its impact on biodiversity, climate change, GHG emissions

7.6. Waste management

- Waste pre-selection and processing, rational use of landfills shall be ensured
- Inventory of non-official landfills, their status and research on associated risks should be conducted. Monitoring of landfills inventory is implemented.
- Burning of waste shall be prevented

- Information and data collection on waste management shall be conducted and make available for waste management/collecting companies and other relevant stakeholders. Consider introduction of relevant provisions (on reporting) in the Waste Management Plan so that monitoring data is required to be published.
- Information and registry of legal and illegal landfills in upland areas shall be created, including those caused by the water flows as a result of snow melting
- Waste inventory, waste management/collection organized within the natural protected areas and required infrastructure (waste bins available at natural monuments in the surrounding areas available for use) shall be included in the WM planning.
- Prevention of use of the landfills/their neighboring territories as farm grazing and animal feeding territories for (cows, pigs, chickens) and wildlife (foxes, jackals) causing infection to spread into the wild and farm animals (meat becomes dangerous and risky) shall be ensured
- Regular inspections conducted to prevent selling untested food in the yards and streets, especially in the areas surrounding large landfills shall be carried out.
- Prevention of waste generation should be preferred to recycling and secondary use of waste (waste prevention by cleaner production and resource efficiency, increased consumer demand for green products and packaging).
- Use of reusable packaging materials (bags and sacks), green procurement and packaging shall be promoted

7.7. Land and mining

- Placement of sanitary landfills at moderate slant territories (for easy removal of filtrates from the territory of the landfill, and easier anti-filtration process) is recommended
- Prevention of damage to the rural farms and natural sites shall be among the site selection criteria
- Effective buffer zone within the landfills and habitats shall be established
- During landfill design process, it is recommended to make sure that the landfill base and lateral walls consist of a mineral layer which will meet landfill terrain and density requirements according to the required technical standards.
- Potential for addressing the impacts of the old mining wastes in the context of development new landfill capacities shall be examined. Reduction of negative impact on environment due to the elimination of the waste source (mining sites are not re-cultivated, and create pollution, hence, re-cultivation is a key to improve usage of these type of territories) should be possible.

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APPENDICES

***Appendix 1*. Map of Basin Management Areas in Armenia.**

Summary Statistics on Basin Management Areas in Armenia

Basin Management Areas	Area km²	Usable Water Resources mln m³/year	Strategic Water Reserve mln m³/year	National Water Reserve mln m³/year
Northern	7185	1897	59.2	63.3
Sevan	4745	2068	500	34583.6
Hrazdan	4045	733	229.3	254.1
Ararat	4256	1306	229	245.3
Akhuryan	5024	1602	564	608.2
Southern	4481	1443	90.5	101.1
Total	29736	9049	1672	35855.6