Strategic Environmental Assessment (SEA)

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

Strategic Environmental Assessment Report

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NON TECHNICAL SUMMARY

The implementation of the SEA pilot project of the waste management plan (WMP) has contributed to identification of a number of environmental inlcuding health and social, risks. Having taken a pre-cautionary approach, the SEA has allowed for assessing the potential risks and effects, proposing mitigation measures and establishing a visible system of monitoring to make the WMP implementation more operational, safe and practical. The implementation of the SEA pilot project of the WMP has also contributed to the analysis of linkages between the objectives of the proposed WMP's and and those established in the institutional and legal sector policies/plans/programmes. . In particular,

- The WMP's SEA process has been implemented based on the RA Law on "Environmental Impact Assessment and Expertise". During the SEA process, the deficiencies of the provisions towards the implementation of the SEA process and their inconsistency with the provisions of the SEA Protocol were revealed.
- Possible impact of the WMP on the environment and human health was revealed and solutions were proposed towards the prevention and mitigation.
- Recommendations and measures revealed during the SEA process will be incorporated in the WMP and thus will contribute to its more environmental and socially delivery.
- From the very first stages, the public has been engaged in the SEA process and their views have been taken into account to the largest extent possible.
- Based on the pilot SEA for the WMP it will be possible to better understand the benefits and the need for SEA and to more comprehensively present these to state governing bodies and local self-government bodies.

The RA Ministry of Nature Protection and the Ministry of Territorial Development (responsible for WMP) will us the current SEA process as an opportunity to achieve effective, environmentally friendly and health neutral Solid Waste Management Plan implementation, including landfill planning and further implementation of the planned activities within SWM Action Plan and the Road Map.

The implementation of the waste management plan will, to a certain degree assist to find appropriate solutions and prevent shortcomings in the waste management sector. Namely:

- Due to the envisaged activities the impact of unorganized waste on the environmental compounds / human health, land and water resources, landscape, biodiversity, etc. / will significantly decrease.
- Waste sorting system will gradually develop in the country.
- The constructed landfills will correspond to the defined permitted internationally recognized standards.
- Monitoring system will be introduced in the sector, mitigation measures will be identified and monitored throughout the implementation and construction of the landfills
- Liabilities and responsibilities of the authorized bodies will be clarified.
- Monitoring will be carried out in the sector.

The overall impact of the SWMP implementation will have a positive impact for the environment, preservation of natural resources, including air, soil, water resources, conservation of biodiversity, climate change mitigation and prevention of the negative impact of waste and landfills on environment and human health. However, the development and implementation of adequate mitigation measures as well as of monitoring programs during the pre-selection of landfill sites, as well as during the construction and operation of landfills is essential.

Compliance with the requirements and methodology of the EU Waste Framework Directive (2008/98/EC) will ensure adequate lining of the landfill to avoid leachate leakages and pollution of groundwater resources.

Waste transportation through large distances may lead to their disposal at the neighbouring coombs. Such pollution may carry local nature. Mainly not populated and sparsely populated areas fall under this impact zone. This can also lead to considerable, indirect negative socio-economic, environmental and health related impact on the neighbouring communities. Impact can take long-term nature.

Waste collection through modern technologies will reduce pollution of the neighbouring areas. Due to waste recycling, the amount of waste and, hence, surface areas for waste disposal will be reduced. At the same time, level of pollution of soil (as well as water and air) through various hazardous substances will decrease due to recycling.

Mitigation and controlling measures need to be implemented to reduce the risk of not licensed waste disposal during waste transportation to transfer stations and polygons. In particular, it is necessary to apply navigation systems to control the movement of vehicles before and after waste transportation from one area to another to avoid waste disposal into the environment due to human factor.

The conduct of audit and monitoring is an integral component of the sanitary landfill management strategy. The proper and timely conduct of audit and monitoring can prevent or reduce damage caused to the environment.

Accumulation of large amount of waste in the neighbourhood of big communities as a result of which the assimilation function of the nature can be violated. From 50.0 to 1200.0 residents will be under indirect impact zone. The residents of the neighboring communities will be under direct impact zone. The considerable part of the negative impact may carry long-term nature, while not significant permanent impact will always persist. At the same time the areas of the alienated lands may be a significant loss to the land fund of the sanitary landfills. It should also be taken into consideration that except land allocation directly from the area of the polygon other areas envisaged for the sanitary protection zone will be alienated which, for example in France, takes at least 200 meters. Hence, for a polygon with a surface area of 20 ha, the sanitary protection zone will take 64 – 68 ha (depending on the form of the polygon – round or square).

The construction and exploitation of a sanitary landfill in line with international standards can significantly reduce the pollution of soil (as well as water and air) since it does not envisage open incineration of waste and requires proper re-cultivation of lands (fencing of the area, etc.).

It is necessary to conduct intensive activities towards waste compression and coverage with soil, for example through BOMAG technologies, which ensure up to 1m3/1t compression, which in its turn will lead to the rational use of lands. At the same time waste coverage with soil will contribute to the reduction of emissions.

The SEA pilot project has resulted in the improved the capacities of local stakeholders, government, national experts, civil society and all interested agencies (e.g., they have gained insights into the SEA stages and process, obtained understanding of how SEA is applied in practice and what its aims and tasks are. The SEA Pilot project has served as a tool for strengthening a public dialogue and public participation and for improving environmental awareness (including in the marzes and regions involved in the SWMP) through an extensitve public consultations mechanism. The SEA Pilot has helped to integrate environmental and health concerns into development planning. It is essential to continue delivering SEA capacity building and awareness events (educational programmes or trainings) to further support legislative and institutional reforms towards greener economy.

1. INTRODUCTION

1.1. Strategic environmental assessment in Armenia

Strategic environmental assessment (SEA) is a systematic and anticipatory process, undertaken to analyze the environmental effects of proposed plans, programmes and other strategic initiatives and to integrate the findings into decision-making. 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). The UNECE Protocol on SEA was adopted in Kyiv in 2003. It entered into force in 2010 and as of May 2017 it has 31 Parties. including the European Union.The Protocol requires its Parties to apply SEA to development plans and programmes at the earliest stages of their preparation (and recommends to carry out SEA also for policies and legislation) — and thus to lay a basis for sustainable development.

The Protocol on SEA provides that plans and programmes (as well as policies and legislation) in the key sectors, with likely significant adverse environmental and health effects are developed taking into account relevant environmental and health concerns and considerations. Efficient application of SEA should ensure identification of the most sustainable and cost-effective strategic development alternatives for attracting new investments and improving the quality of 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.

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" 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 Espoo Convention 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.

'Strategic environmental assessment' means the evaluation of the likely environmental, including health, effects, which comprises the determination of the scope of an environmental report and its preparation, the carrying-out of public participation and consultations, and the taking into account of the environmental report and the results of the public participation and consultations in a plan or programme. (art. 2, para. 6 of the SEA Protocol).

The main purpose of SEA is to ensure that environmental considerations inform and are integrated into strategic decision-making in support of environmentally sound and sustainable development. In particular, SEA assists authorities responsible for plans/programmes, as well as decision-makers, to take into account:

- Key environmental trends, potentials and constraints that may affect or may be affected by the plan/programme.
- Environmental objectives and indicators that are relevant to the plan/programme.
- Likely significant environmental effects of proposed options and the implementation of the plan/programme.
- Measures to avoid, reduce or mitigate adverse effects and to enhance positive effects.
- Views and information from relevant authorities, the public and, as and when relevant, potentially affected States.

1.2. Pilot SEA application in Armenia

Based on the discussion with the Ministry of Nature Protection, which is in charge of implementing the Law on Environmental Impact Assessment and Expertise, the **SEA of "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', the SWMP/WMP or the Plan) was selected as a SEA pilot project in Armenia.

The pilot SEA was conducted within the Greening Economies in the Eastern Neighbourhood (EaP GREEN) project.[1]

The overall aim of the SEA pilot was to build capacities for practical application of SEA procedures at a national level and to raise awareness of SEA benefits among various national stakeholders. Its specific objectives included:

- To test and demonstrate opportunities of practical application of the draft Law based on the implementation of a pilot SEA project;
- To provide recommendations for environmental optimisation and modifications of the selected plan/programme;

[1] EaP GREEN is a large regional programme implemented in 2013-2016 by the United Nations Economic Commission for Europe (ECE), OECD, UN Environment, and UNIDO to assist the six European Union's Eastern Partnership (EaP) countries: Armenia, Azerbaijan, Belarus, Georgia, the Republic of Moldova and Ukraine, in their transition to green economy. The programme is financed by the European Commission, the four implementing organisations and other donors.

- To develop recommendations for further improvement of national legislative and institutional frameworks on SEA in a country.

The pilot SEA was implemented in accordance with the provisions of the RA Law on "Environmental Impact Assessment and Expertise", and the Protocol on SEA.

1.3. Process of SEA

1.3.1. A summary of the main SEA steps

The SEA pilot was launched in December 2015 by establishing the team of the national SEA team, which – in cooperation with the UNECE international experts – started to work on the initial baseline analysis. The training workshop on scoping and baseline analysis was organized in Yerevan in March 9 – 10, 2016, followed by the workshop on the impacts assessment and SEA report (Yerevan, June 23 – 24, 2016).

The scoping report was drafted in May 2016 and published. The scoping public consultation meetings were organized in July - August 2016 altogether in five regions i.e. Kotayk Region, Lori Region, Shirak Region, Syunik Region, and Yerevan City (see section 1.3.2 below). Following the conclusions from the scoping consultations the scoping report was finalized in November 2016 (it is available both in English[2] and Armenian[3] languages).

The work on the draft SEA Report was initiated in September 2016. Its first version was prepared in December 2016, and the public consultation workshop on the draft SEA Report was organized in March 2017 (see Section 1.3.3 below).

1.3.2. Public consultations on SEA scoping report and draft SWMP and recommendations received

Public consultations and discussions were held in the municipalities of Yerevan, Shirak, Lori, Kotayk and Syunik regions **in line with requirements of the Law on environmental impact assessment and expertize.** All municipalities of the Republic of Armenia were notified about the public hearings beforehand and in written form. During the hearings project experts presented in detail the waste management plan, the goal of the implementation of the SEA pilot project, the legislative field as well as environmental and health related issues and challenges faced by Armenia. Project experts responded and provided feedback to all issues raised during the discussions.

2 http://www.unece.org/fileadmin/DAM/env/eia/documents/EaP_GREEN/Armenia_SEA_Pilot_Project_2016/SEA_scoping_report_ENGLISH_final.pdf

3 http://www.unece.org/fileadmin/DAM/env/eia/documents/EaP_GREEN/Armenia_SEA_Pilot_Project_2016/SEA_Scoping_report_Translated_ARM_cleared_20102016.pdf

- The main public concern raised in nearly all marzes was the increase of the social burden. Namely, due to the implementation of the Waste management plan garbage fees will increase which may create additional problems especially for the poor. Different financial mechanisms and solutions were discussed.
- The creation, management and control of landfill sanitary zones as well as environmental protection issues were also under public concern. The recommendations are incorporated into the SEA report and they need to be incorporated into the Waste management plan.
- The locations proposed for five regional sanitary landfills were also questioned given the climatic and terrain conditions of Armenia. This is also reflected in the Section on alternative options of the SEA report.
- It was proposed to exclude the provision of the agricultural lands for the purposes of landfill areas. This is also incorporated in the SEA report.
- Lori marz representatives were worried about the fact that data on Spitak, Tashir and Stepanavan were not included in the WMP. This needs to be discussed with the planning team.
- It was proposed to extend the 20-year timeframe of the project up to the 25-year. This recommendation needs to be discussed with the planning team.
- The Public raised issues related to the garbage sorting, selection of areas based on norms, development of waste management strategy, incorporation and utilization of monitoring mechanisms. The raised issues are incorporated in the SEA report.
- A concern was raised that there is no laboratory in Armenia dealing with the analysis of hydrosphere and dioxins emerging due to the production of plastic bottles.
- It was proposed to approximate the strategy and policy of the sector to the European standards and to the requirements of the sustainable development program that was adopted by UN in September 2015 “Transforming our world,” joined by Armenia. The program addresses also the issue of sustainable waste management. The raised issue is reflected in the report.
- A concern was raised that the liabilities and responsibilities of the actors in the waste management sector are not clearly separated and defined /included in the SEA report/.
- It was proposed to include the waste management issues in the school curriculas as a basis for environmental education of the children.

This SEA report already reflects several issues raised by the public. However, certain issues need to be presented and discussed with the Ministry of Territorial Administration and Development as the governmental authority responsible for implementation of the Waste Management Plan (see section 1.3.4 for further details).

1.3.3. Public consultations on SEA report and draft SWMP and recommendations received

The national public consultation workshop on the SEA report was organized on 21 March 2017 in Yerevan. The purpose of the workshop was to present and discuss the draft SEA report with a special emphasis on main conclusions of the assessment and proposed mitigation measures and recommendations towards the waste management planning in the country. Participants of the workshop were introduced to the steps in SEA process conducted so far, as well as methodological approach applied in SEA pilot. The main results of the discussion can be summarized as follows:

- Ms. Eleonora Grigoryan, UNECE Espoo Convention National Focal Point, raised an issue of SEA mandatory implementation, and provided that it is a mandatory requirement based on international standards. National SEA experts expressed their opinion that the Protocol on SEA is an international instrument which supports implementation of SEA procedures at the national level; however, each country can choose approaches and implementation modalities.
- It was suggested to fix SEA as mandatory requirement within the sectors outlined by the national legislation, including the sectoral one, which in its turn, will ease the process of SEA implementation in Armenia;
- Representative of the Ministry of Energy mentioned that the Ministry was preparing a package on legislative amendments to the law of energy, and was interested how to apply SEA procedures in this context. The energy sector is among the sectors the SEA should be applied for relevant plans and programmes. The budget for SEA financing should be planned and allocated by the national budget line;
- Ministry of Territorial Adminstration and Development discussed the deadlines of preparation of SEA. Each public authority, local government body is responsible for the implementation of SEA, and if the ministry develops a conceptual document, there is no deadline set for SEA application. The deadlines are defined when the report is passing expertise, when 60 working days are set for implementation. Each public authority decides the term for the implementation of SEA;
- The representative of Regional Administration of Shirak, Mr. Karen Badishyan, raised the issue who does apply for SEA, and how to find appropriate organization or experts to carry out the strategic environmental assessment. The issue of creating a specialized national expertize on SEA was discussed. It was suggested to establish a database of experts with contact information, publish them on various websites, to provide continuous training of professionals;
- The representative of Regional Administration of Shirak RA further proposed to create regional licensed specialized groups in regional centers;
- Ministry of Territorial Administration and Development, Department of Territorial Investment Policy, Mr. Artashes Bakhshyan, suggested that proposals/recommended measures were aimed at increasing the number of landfills which adds to the current expenses. He asked if these calculations are done based on SEA recommendations. The expert team answered that recommendations on increasing the number of

landfills are done based on assessment and feedback from regions, since waste collection services are scarce, and landfills are not accessible for them.

Ms. Nune Harutyunyan, SEA National Team Leader suggested that that location of the expert doesn't matter instead expert must have a good methodology and be good specialist in his field. She has presented "Main findings and conclusions of SEA – for each issue addressed in SEA pilot". The main points of the presentation covered existing challenges, significant impacts and risks related to the Strategic Development Plan, Road Map and Long Term Investment Plan for the Solid Waste Management Sector in Armenia, and key recommendations and mitigation measures. …

1.3.4. Further steps

Final SEA Report will be submitted to the MTAES for further processing to launch the process of State Ecological Expertise. The full package of required documents will be submitted by the MTAES to the State Ecological Expertise, together with the draft SWMP.

2. RELEVANT NATIONAL LEGAL FRAMEWORK

2.1. Legal framework for SEA

SEA in Armenia is regulated by the RA Law on **"Environmental Impact Assessment and Ecological Expertise"** (hereafter referred to as the '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 i.e.:

- 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." 4
- RA Government decision N 1325-N, November 19, 2014 on "Defining the procedure for public consultations and the conduct of public discussions."
- RA Government decision 428-N, April 22, 2015, on "setting the order of revocation of the expert conclusion."

RA Law on "Environmental Impact Expert Assessment" 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 the assessment and expertise processes. In accordance with the Law, the main goal of the environmental assessment is to tpredict, prevent or reduce to the minimum the hazardous impact of an activity or procedure on human health, the environment, regular economic and social development.

The Law stipulates that the strategic assessment is a complete assessment process of the likely impacts 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 management and coordination 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.

According to the Law, the 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

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

responsible for the public consultations 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 of Expertise for Environmental Impact Assessment). This means that SEA execution for relevant documents is obligatory.

2.2. National Legislation on Waste Management

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.[5]

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.

Upon the resolution of the RA Government N 442 – N, adopted on March 27, 2014, "Long-term Development Strategic Plan" was adopted which pays special attention to the environmental problems of the country, including problems of the waste management sector. The document

[5] Waste management and sanitation issues are regulated by the
- RA Land Code,
- RA Law on "Local Self-Government,"
- RA Law on "Garbage Disposal and Sanitation,"
- Ra Law on "Waste,"
- RA Law on "Ensuring sanitary-and-epidemiologic safety of the population" as well as other legal acts and international treaties.

states that the identified issues of the environmental sector are still relevant and shall remain among priority issues of the Government.

In the upcoming years, it will become a prerogative to reduce environmental risks to the extent possible, along with Government's efforts towards economic growth. This refers, in particular, to the water resources, pollution of the atmospheric air as well as protection of green areas. The document specifically highlights the importance of introducing modern waste collection and waste recycling systems.

Armenian Law on Waste (November 24, 2004) regulates legal and economic relations connected to the collection, transfer, maintenance, development, reduction of volumes, and prevention of negative impact on human health and environment. The law defines objects of waste usage, the main principles and directions of state policy, the principles of state standardisation, inventory, and introduction of statistical data, the implementation of their requirements and mechanisms, the principles of waste processing, the requirements for presenting waste for the state monitoring, activities to reduce the amount of the waste, including nature utilization payments, as well as the compensation forthe damages caused to the human health and environment by the legal entities and individuals, using the waste, as well as requirements for state monitoring and legal violations.

Table 1 below provides an overview of relevant national legal and strategic documents and their linkages to the waste management programme.

Table 1. Legislative and strategic acts related to waste management program

Law/ Strategy	**The main scope of legislative regulation**	**Linkage with the Waste management program**
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 o 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.	+

Law/ Strategy	The main scope of legislative regulation	Linkage with the Waste management program
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.	++

- ++ This mark indicates the considerable connection of the legislative act to the waste management plan
- + This mark indicates the weak connection.

2.3. International treaties pertaining to waste ratified by Armenia

The table below provides an overview of the international treaties Armenia is a Party to, which has certain linkages to the waste management sector.

Table 2. International conventions and treaties Armenia is a Party to with linkages to the waste management sector

No	Convention or Protocol, Name and Place	In Force	Signed	Ratified	Comment
1	Convention on Wetlands of International Significance especially as Waterfowl Habitat (Ramsar, 1971)	1975	1993	Ratified by USSR	
2	Convention on Biological Diversity (Rio-De-Janeiro, 1992)	1993	1992	1993	Re-registered in UN 1993
3	Cartagena Protocol on Biological Safety (Cartagena, 2000)		2000	2004	
4	UN Framework Convention on Climate	1994	1992	1993	Re-registered

No	Convention or Protocol, Name and Place	In Force	Signed	Ratified	Comment
	Change (New York, 1992)				in UN 1993
5	Kyoto Protocol (Kyoto, 1997)			2002	Re-registered in UN 2003
6	Convention on Long-range Transboundary Air Pollution (Geneva, 1979)	1983		1996	Re-registered in UN 1997
7	Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991)	1997		1996	Re-registered in UN 1997
	Protocol on Strategic Environmental Assessment (Kiev, 2003)		2003		
8	Convention on the Transboundary Effects of Industrial Accidents (Helsinki, 1992)	2000		1996	Re-registered in UN 1997
	Protocol on Civil Liability and Compensation for Damage caused by the Transboundary Effects of Industrial Accidents on Transboundary Waters (Kiev, 2003)		2003		
9	UN Convention to Combat Desertification (Paris, 1994)	1996	1994	1997	Re-registered in UN 1997
10	Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel, 1989)	1992		1999	Re-registered in UN 1999
11	Convention for the flof Ozone Layer (Vienna, 1985)	1988		1999	Re-registered in UN 1999
	Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal, 1987)	1989		1999	Re-registered in UN 1999
12	Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus, 1998)	2001	1998	2001	
13	Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam, 1998)		1998	2003	
14	Convention on Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992)	1996	1999		
	Protocol on Water and Health (London, 1999)		1999		
15	Stockholm Convention on Persistent		2001	2003	

No	Convention or Protocol, Name and Place	In Force	Signed	Ratified	Comment
	Organic Pollutants (Stockholm, 2001)				
16	Convention on the Prohibition of Military or any Other Hostile Use of Environmental Modification Techniques (Geneva, 1976)	1978		2001	Re-registered in UN 2002
17	European Convention on Landscape (Florence, 2000)			2004	
18	Convention on Protection of the World Cultural and Natural Heritage (Paris 1972)			1993	
19	Energy Charter Treaty (Lisbon, 1994)			1997	
	Energy Charter Protocol on Energy efficiency and Related Environmental Aspects (Lisbon, 1994)			1997	
20	European Convention on Protection of Wild Nature and Habitat (Bern, 1979)	1982	2006		

It is envisaged to develop economic and legal mechanisms in line with "green" innovations consistent with the requirements of the UN Rio+20 sustainable development summit, through international assistance to the state, among other things. The provisions enshrined in the above mentioned international strategic documents are directly linked to the waste management plan. The implementation of the waste management plan along with the enactment of issues raised in the SEA report will, in its turn, contribute to the solution of a number of issues raised through the mentioned strategic document towards the development of more conducive economic environment with respect to nature protection.

In September, 2015 the UN office initiated "Transforming our World" sustainable development program, joined also by the Republic of Armenia, which includes the sustainable waste management issue and is directly linked to the Waste management plan.

3. THE CONTENT AND THE MAIN OBJECTIVES OF THE WASTE MANAGEMENT PLAN AND ITS LINK WITH LOWER LEVEL WASTE MANAGEMENT PLANS / PROGRAMMES AND OTHER INITIATIVES IN THE WASTE MANAGEMENT SECTOR IN ARMENIA

The Government of the Republic of Armenia and Asian Development Bank (ADB) initiated a two-phase technical assistance for project preparation assignment, which aimed at improving the planning of the solid waste management sector. The assignment included also preparation of the Strategic Development Plan, Road Map and Long Term Investment Plan for the Solid Waste Management Sector in Armenia. The entity responsible for the implementation of this document is the RA Ministry of Territorial Administration and Development (Yerevan, Republic Square, Governmental Building 3).

3.1. Goals and the content of the Solid Waste Management Plan

Primary activities for Armenia's solid waste management (SWM) sector are as follows:

- Development of a national SWM strategy,
- Formulation and implementation of a major SWM investment program,
- Support the sector and the investments with a long-term, multifaceted capacity support programme.

Initial evaluation infers that Armenia may eventually require a capital investment of over US$ 200 million to fully address national municipal SWM priorities over the long term. Much can be done however with a phased investment program implemented over the next decade, starting with the previously presented key cities/regions prioritized on the basis of their populations, population densities, economic importance, and importantly, the relative severity of environmental degradation and public health impacts endured by their current SWM practices. .[6]

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 **Strategic Development Plan, Road Map and Long Term Investment Plan for the Solid Waste Management Sector in Armenia** (hereinafter also 'Waste Management Plan' or 'WMP') was prepared in 2013 with its ultimate goal defined 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*

6ADB SWM investment program, pg 6

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 20 years is a long period for planning, it is envisioned that changes will be made throughout the implementation process.

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

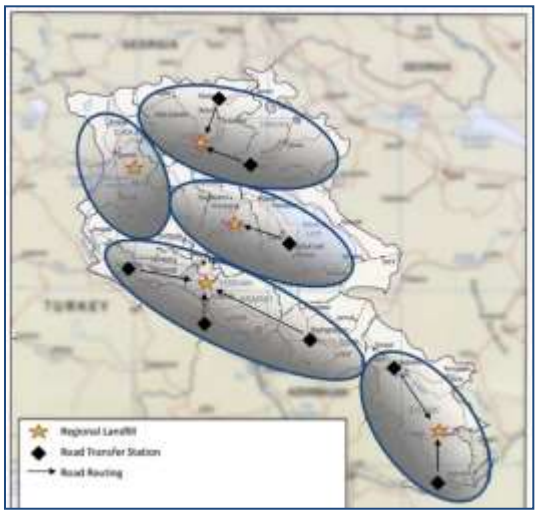
3.2. Characteristics of the Waste Management Plan and its planned impact on pilot communities

3.2.1. Overview

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 an upgraded extension of the Nubarashen landfill and 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 three transfer stations. Yerevan would pursue its own development of collection, transport and upgraded disposal/diversion capability. The regional landfills are planned to occupy 20 hectares and to serve for 20 years. They will be served via 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.

3.2.2. Alternatives

The SWP considered four scenarious (or 'full-scale alternatives', as they are refered to in this Report) and two major technological solutions (in addition to landfilling).

The four full-scale alternatives included:

- 1a: Centralized system based on a single large landfill and transport by rail;
- 1b: Centralized system based on a single large landfill and transport by road;
- 3a: Regional system with Yerevan receiving waste from neighboring marzes (with 5 regional landfills), and
- 4b: Regional system developed independently of Yerevan (with 6 regional landfills).

The SWP recommended that option 3a would be the preferred alternative (as presented in Section 3.2.1. above).

The two major technological solutions analysed in the WMP were Mechanical-Biological Treatment (MBT) and Waste-to-Energy (WtE) incineration. The WMP developers concluded that MBT could be used in Armenia in combination with the landfilling system, althought would require significant investment; whilst the WtE incineration was not considered a viable option in the short to medium term for Armenia.

Both types of alternatives are analysed in Chapter 9 of this report.

3.2.3. 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.

Tthe WMP considered the model with 9 transfer stations in total (see Table 1).

Table 2. 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

3.2.4. Sanitary landfills

The collected solid waste will be disposed of to the planned 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 capacity 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 extending the landfills using additional space in the future.

Table 3. 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

Service area	Location of the landfills	Capacity for 20 years (mln tons)	Necessary total area (ha)
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 (in Yerevan)	8.0 (including waste from Yerevan)	Extended and upgraded landfill existing in Nubarashen
Syunik marz	Kapan region	0.5	10

Source: ADB, 2013

Future landfill cells, with 3 years of capacity each, will be established up to the end of the planning period.

In those rural areas, where villages are accessible for high-capacity vehicles, waste collection will be carried out as 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 (e.g., once a week).

For those rural areas that cannot be accessed by large trucks or where roads are in bad conditions, the "rural collection centres" approach is suggested to gradually reduce dumps and other inappropriate practices in rural areas, such as burning or waste dumping.

The rural 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 placed 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 nd, 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.

3.3. Lower level waste management plans

In the framework of the WMP, five sub-programmes will be implemented in Kotayk, Shirak, Syunik, Lori and Yerevan (this will serve the neighbouring communities). Currently the WMPs for Kotayk marz and Shirak marz are in the process of development. In February 2013, KfW financed (EUR 300,000) a study on technological options of SWM in Lori region focused on Vanadzor (capital of Lori region). The landfill should serve Vanadzor and 17 surrounding communities. [7]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. As per the update provided by the MTAES Mr. Artashes Bakhshyan, Advisor to MTAES, preliminary works and planning process on landfill construction are in place however no construction works have been initiated.

[7] Solid Waste Management Solutions for Remote and Small Communities, Asian Development Bank, file:///D:/install/My%20Documents/NUNE%20MY%20DOC%202017/2017%20admin/Asian%20Development%20Bank%20-%20Solid%20Waste%20Management%20Solutions%20for%20Remote%20and%20Small%20Communities%20-%202017-07-26.pdf

3.4. Other plans and projects in waste management sector

The following projects and initiatives targeting the improvement of SWM in Armenia were implemented by donor organizations, including European Bank for Reconstruction and Development (EBRD), German Development Bank (KfW), European Union (EU), United Nations Development Programs (UNDP), and World Bank (WB), who are involved in SWM development in Armenia.

In October 2009, **WB financed a TA ($750,000) for an Advisory Study on the Municipal Solid Waste Management in Yerevan City.** As the city government approached a decision-making point for tendering long-term arrangements for municipal SWM in Yerevan, the Armenian Ministry of Economy requested WB's advice and assistance in supporting the process. WB responded by tendering a study funded by a grant from the Public-Private Infrastructure Advisory Facility (PPIAF). Fichtner GmbH & Co. was selected as the consultant. The study was focused on Yerevan and provided recommendations for improving collection and upgrading the current city dumpsite to a sanitary landfill.

In April 2012, **EBRD funded a feasibility study (EUR 350,000) for the Kotayk region** of Armenia and considered providing a EUR 3.5 million sovereign loan for the construction of the first EU-compliant regional landfill and relevant infrastructure in the country. In addition, the EU Neighborhood Investment Facility (NIF) has approved a grant in the amount of EUR 3.5 million to provide co-financing for the project. The landfill will be located in Hrazdan, capital of Kotayk region in the central part of Armenia, and will be used by eight municipalities in the nearby region: Hrazdan, Abovian, Charentsavan, Yeghvard, Nor Hachn, Tsakhadzor, Byureghavan and Sevan (participating municipalities). The project aimed at tendering of waste collection to the private sector and the creation of a fully commercial solid waste management company. The project also included the acquisition of vehicles, bins, and equipment for waste management.

In February 2013, **KfW financed (EUR 300,000) a study on technological options of SWM in Lori region focused on Vanadzor (capital of Lori region).** The landfill should serve Vanadzor and 17 surrounding communities. In 2010-2013, a public-private partnership project for recycling of polyethylene terephthalate (PET) bottles in Armenia was funded by UNDP ($90,000) and USAID ($450,000) with Eco-Engineering Company, one of the first private recycling initiatives in Armenia. The project's purpose was to support the implementation of an efficient and economically-viable PET recycling program in Armenia and, in the long-term, improve access to clean, safe, and reliable water. The project aimed to reach the level of 70% collection of PET in Armenia, or 3,500 tons of PET per year.

In 2009, the **EU financed a regional project to improve waste governance in eastern region countries (ENPI) (Armenia, Azerbaijan, Belarus, Georgia, Moldova, Russia, and Ukraine).** Under this project, a consultant team has prepared a SWM strategy for the Lori region of Armenia. The Armenian Environmental Network (AEN) in partnership with Green Lane, the Urban Foundation for Sustainable Development (UFSD), the Government of Norway, Jinishian

Foundation, and others, endeavour to create Armenia's first appropriate technology sanitary landfill. Appropriate technology refers to embracing a technology and application that is low-tech, locally sustained, small-scale, less expensive, environmentally sound, and more labor-intensive than typical western-style mechanized operations.[8]

The Nubarashen Landfill Gas Capture and Power Generation Project for Yerevan (2002-2009) was implemented by Shimizu Corporation (Japan) in cooperation with the Municipality of Yerevan. The project's overall objective is to collect landfill gas (LFG) from the Nubarashen landfill site in Yerevan, and utilize it in a gas engine generator (GEG) with a view to generating electricity. This project activity intended to collect landfill gas (LFG) from Nubarashen landfill site in Yerevan City, the capital city of the Republic of Armenia, and to burn methane, which is a combustible greenhouse gas (GHG) contained in LFG, by using a flare and a gas engine generator (GEG) with a view to generate renewable electricity to the grid.

The Advisory Study on the Solid Waste Management in the City of Yerevan through Private Sector Participation, 2008-2009, was financed by the World Bank executed grant from the Public-Private Infrastructure Advisory Facility (PPIAF) and was implemented by Fichtner GmbH & Co. KG. The overall objective of the project was to: (i) improve the MSW management of Yerevan City and (ii) evaluate private sector involvement to achieve this goal.

The project 'Private Sector Involvement in Municipal Solid Waste Management of the City of Yerevan in Armenia: Consulting Services for Transaction Advisory Services (2009-2010)' was also financed by the World Bank and implemented by Integrated Skills. The objective of this Transaction Advisory Services (TAS) was to assist the Government of Armenia to engage qualified operators through transparent and competitive bidding process in (i) waste collection and sanitary cleaning in the city of Yerevan and (ii) the development and operation of the Nubarashen landfill. The first objective has been met. The second objective is in the process of implementation. The TAS team will support and guide the Municipality in preparation, implementation and financial closure of (i) two concessions for waste collection and sanitary cleaning of the two city zones as well as (ii) a landfill design, build, and operate (DBO) model. The overall aim of the TAS is to enable the Municipality of Yerevan to have a SWM system for the city through private sector participation.

The EU Waste Governance – ENPI East Regional Project, 2009-2016, is an EUR 5.8 million, EU-funded regional project implemented by a consortium headed by EPTISA from Spain. It aims at improving waste governance within the countries of the European Neighborhood and Partnership Region (ENPI East). It started on 10 December 2009 and ended on 9 December 2013. The objective of the project was to reduce the risks arising from inappropriate management of wastes in the ENPI East that thereby create environmental pollution hazards to the community and to natural resources, through co-operation with, and amongst, partner states in the region. The purpose was to support sustainable consumption and production practices and to maximize social benefits by improving the management of waste through promotion of higher

[8] Armenia: Solid Waste Management Solutions for Remote and Small Communities

standards at waste facilities, more effective waste prevention initiatives, increased capacities for waste collection and sorting, as well as increasing reuse, recovery, and safe disposal of waste. In Armeni, the project focused on the region of Lori and had 3 main activities: i) inventory of illegal waste disposal sites; ii) strengthening waste classification practices; and iii) development of Regional Waste Management Strategy with the last being most relevant in this case. This is based on the division of Lori Marz into three sub-regional waste management zones, oriented towards operation of three sub-regional landfills.

The Armenia Solid Waste Management Improvement Project (2015) was implemented and funded by Asian Development Bank (ADB) via Government of Japan through the Japan Fund for Poverty Reduction with COWI A/S being a Consultant working in close cooperation with the Ministry of Territorial Administration and Emergency Situations of Armenia (MTAES). The focus of the project is to prepare a diagnostic study on SWM with prefeasibility studies for pilot projects and an indicative investment plan for small and remote communities. The study will focus on key development and policy challenges in small and remote communities related to SWM, and will help identify solutions.Institutional capacity for effective SWM in remote and small communities is completely lacking. Technical parameters guiding SWM are absent. Lack of awareness of proper SWM has led to slow emergence of fee-based solutions and the low prioritization accorded to SWM. This is leading to acute environmental degradation and threats to public health, in turn constraining the future development of the communities. According to the ToR, the study should focus on remote and small communities of two south-eastern regions (Marzes) of Armenia – Vayots Dzor Marz and Syunik Marz.

The Yerevan Solid Waste Project included the financing for a new sanitary landfill for Yerevan (2016 and on until end of construction and repayment of loan). The project comprises a EUR 8 million loan from EBRD, proposed to be co-financed by a EUR 8 million loan from EIB and a EUR 8 million grant from the European Union Neighbourhood Facility (NIF). As a result of agreement signed between Armenian Government and EBRD loan and grant will finance the construction and operation of a sanitary landfill in Yerevan.The landfill will be constructed at the same location as the existing Nubarashen dumpsite where the waste from Yerevan's 1.1 million inhabitants is presently dumped in hazardous environmental and sanitary conditions.There is an urgent need to improve waste management practices across Armenia, with waste currently being dumped at uncontrolled dumpsites of unacceptable technical and environmental standards. Yerevan's existing Nubarashen dumpsite, which is the largest one in Armenia and which has served the capital since the early 1960s, operates without adequate environmental protection measures and needs to be closed and replaced with a new sanitary landfill site.

The KFW project 'Solid Waste Management Expert Analysis in the Armenian city of Vanadzor and Surrounding Communities (2011-2014)' aimed to develop a feasibility study for the establishment of an integrated solid waste management system for Vanadzor City and surrounding villages/municipalities. The study was to specify the activities needed for closure of current landfills, choice of new landfill locations in accordance with EU norms and identifying steps for their construction.

4. SOLID WASTE MANAGEMENT SECTOR: CURRENT STATE AND ISSUES

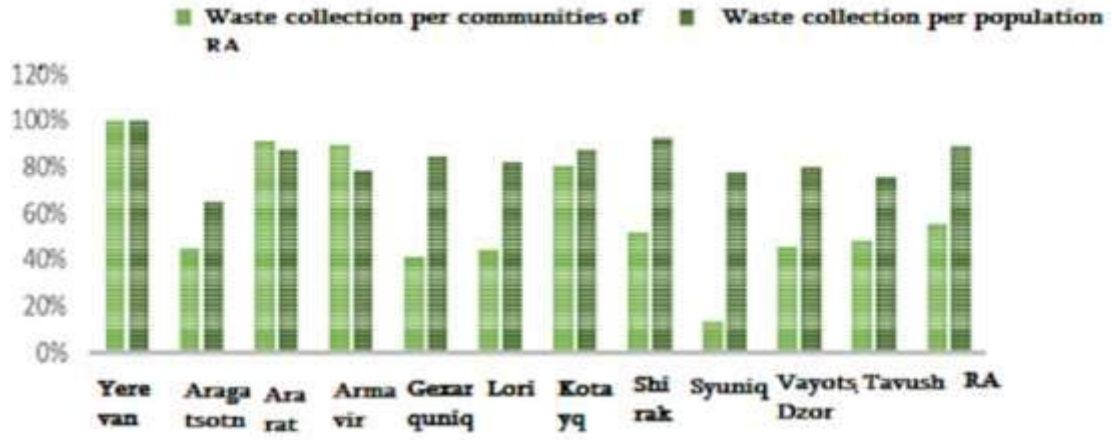
4.1. Waste Management in RA Marzes: Current Status

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.

Overall, waste generated per capita in Armenia averaged 12.9 tons in 2012, while waste per square km (without the surface area of the lake Sevan) amounted to 1.4 mln tons.

As of January 1, 2016, among 896 communities of Armenia, 489 communities (54.6%) have allocated garbage collection fee costs in their budgets. However, considering that waste collection is mainly carried out by large communities the use of waste collection service is implemented partially, only by 89 % of the country's population. In this respect, the situation in the city of Yerevan (100%), Shirak (92.2%), Kotayk (87.5%) and Ararat (87.4%) regions is satisfactory.

Figure 2. Waste management is RA marzes and in Yerevan



Aragatsotn region is suffering from the lowest percentage of waste management in the region equal only to 65%. The chart below describes the charts are the most visible in the area of waste management.

Table 4. Waste collection in Yerevan and in the marzes of the RA

Marzes and Yerevan	Number of communities	Population	Waste collection			
			As per the number of communities		As per population number	
Yerevan	1	1054698	1	100%	1054698	100%
Aragatsotn	114	125539	51	45%	81541	65%
Ararat	97	246880	88	91%	215768	87%
Armavir	97	256639	87	90%	200564	78%
Gegharkounik	92	211828	38	41%	179402	85%
Lori	107	217103	47	44%	177081	82%
Kotayq	67	245324	54	81%	214533	87%
Shirak	119	233308	62	52%	215084	92%
Syuniq	102	119873	14	14%	93281	78%
Vayotz Dzor	44	47659	20	45%	37999	80%
Tavoush	56	112920	27	48%	85031	75%
Total RA	**896**	**2871771**	**489**	**55%**	**2555002**	**89%**

According to Armenian Statistical Service[9], in 2014, 517.7 thsd. tons of solid waste was transported into municipal landfills.

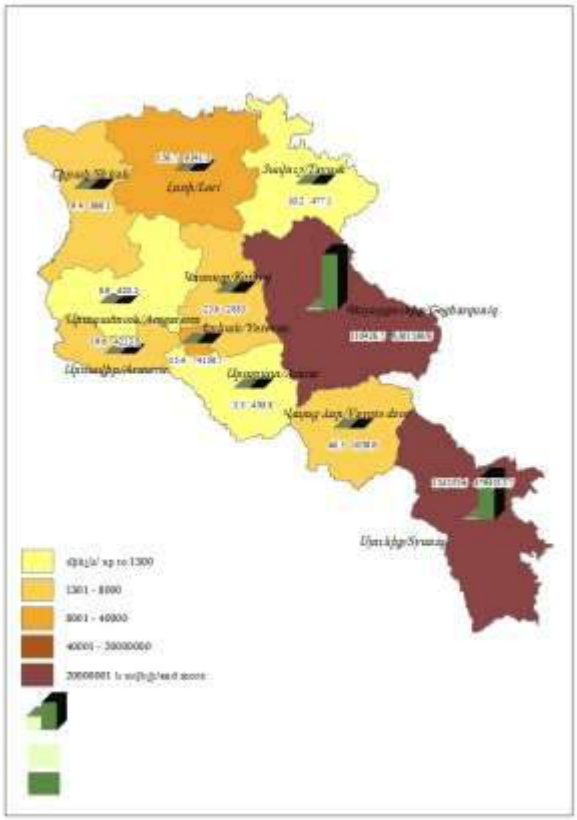
Table 5. Solid waste transported into municipal landfills by RA marzes and Yerevan city, 2014

Solid waste was transported	thsd. tones
Yerevan city	320.9
Aragatsotn	15.8
Ararat	17.6
Armavir	41.8
Gegharkunik	14.1
Lori	23.1
Kotayk	26.4

[9] http://www.armstat.am/file/article/12.tapon.pdf

Shirak	16.3
Syunik	11.9
Vayots Dzor	5.0
Tavush	24.8
Total RA	517

Figure 3. Waste generated in organizations according to marzes



Source: RA statistical service, Environment and natural resources in the RA for 2015.

4.1.1. Waste management in Shirak and Lori Regions

The study conducted by COWI Kotayk Solid Waste Management Project - Environmental and Social Due-Diligence, Non-Technical Summary Draft for public comments November 2011 Project No. 75143 Document no. 5 Version 04 Date of issue 25.11.2011 Prepared LLA Checked CASK Approved CASK, http://www.ebrd.com/english/pages/project/eia/39603nts.pdf analysed in detail situation in Kotayq regarding the waste management.

German Development Bank (KfW) Integrated Solid Waste Management in Vanadzor (Lori marz) has been working to develop a Feasibility Study for the establishment of an integrated SWM system, considering the full range of waste streams to be managed by Vanadzor City and surrounding villages/municipalities. As a result, "The Final report of technical-economic statement" was elaborated and discussed with stakeholders, on 31 October of year 2014 with RA Ministry of Territorial Administration where SWCM system (regional landfills) were presented and implementation program was discussed.

The information below therefore represent an examples of detailed studies, which are currently available for mentioned regions. Similar studies should be optimally prepared for all regions in Armenia as an important basis for formulating the criteria for locating the landfills (these were also used for formulation of the mitigation measures in SEA

Shirak region (Gyumri city)

Shirak, with its capital city of Gyumri is the second largest city in Armenia, with specific history and conditions, complex socio-economic situation and still under the pressure of largest earthquake (1997) which had a devastating impact on city's infrastructure. Waste management services in Shirak are inadequate in terms of the solid waste collection, transportation and disposal. Therefore, the importance of identifying a location for construction and operation of a new sanitary landfill meeting the solid waste disposal demand for the Shirak marz has been recognized by both the Guymri Town and by the surrounding municipalities.

Selection criteria for landfill site:

A modern sanitary landfill is a disposal facility, where different types of waste are placed on a prepared ground under controlled and environmentally acceptable conditions. Landfill is a common name for facilities for waste disposal, which are typically established with approval by relevant local authorities. At landfills, different types of waste can be disposed of, and effective control of waste disposal and contamination control measures can be undertaken to ensure protection of the environment.

Landfills can be designed with a set of environmental protection measures, depending on the expected character of the waste and on the vulnerability of the surrounding environment. In accordance with the SWMP, there should be only one regional modern landfill in Shirak, servicing the entire marz.

The following criteria is suggested by ADB **for exclusion from mapping** during the selection of the landfill in Gyumri, as per conducted feasibility study and in accordance to EU standard procedures:

- Transport conditions may have large impact on both investment costs and operation costs related to solid waste collection and transport. Furthermore, waste transport may have large impact on public safety and on the ambient environment. Especially in areas with poor road conditions, transport to and from the landfill should be considered carefully.

- Thus, considering waste transport conditions is not only a question of transport distance or transport time. It is just as much a question of environmental and health and safety impacts on residents and road users along the roads
- Waste transport may either happen as direct transport by means of the collection vehicles or by means of large transfer vehicles after discharge and reloading at a transfer station. Preferably, a site accessible within 30 minutes travel time (a function of road and traffic conditions) is to be sought, because of the need to avoid adversely affecting the productivity of collection vehicles. At distances greater than 30 minutes travel, for collection operations to be economic, investment in either large capacity collection vehicles or transfer stations with large capacity vehicles (30 tons or more) would be necessary.
- One-way transport time more than 30 minutes from the collection area or from a transfer station to the landfill should be avoided
- A landfill should not be established on high valuable agricultural land nor in forests
- A new landfill should not be located in areas with mineral deposits of interest for future excavation.
- Areas with active faults, underlying mines or caverns, with flooding, landslides should be avoided.
- Areas of unique archaeological or historical interest should be avoided. A minimum distance of 1 km from such areas is recommended. Areas of settlements, recreation zones and protected nature areas or wildlife habitat, areas prone to scavenging wildlife should be avoided. A minimum distance of 1 km from such areas is recommended.
- Due to shortage and high value of surface water resources in Shirak marz, the protective zones of surface water bodies (rivers, water reservoirs, irrigation canals, lakes) should be taken into consideration.
- Landfills should not be located in drinking water well fields and neither in well field protection zones. The distance from a large landfill to ground water exploitation plants should at least be as follows:
    - Capacity below 100 m3/day: distance > 100 m
    - Capacity from 100 m3/day to 10,000 m3/day: distance > 500 m
    - Capacity over 10,000 m3/day: distance > 1,000 m
- Minimum distance of 1,000 m to be observed to nearest surface water intakes.
- Deviation from this rule should only be permitted after a careful assessment and documentation of the actual water flow directions (incl. seasonal variations).
- Landfills should be located far from airports: The distance between a landfill and an airport should not be less than 10 km as guidance and preferably not less than 15 km.

- To reduce the general nuisance from a landfill to residents, the urban areas and areas within 1 km from urban areas are not considered acceptable for a landfill. The distance to a stand-alone house should not be less than 500 m. Urban areas including a 1 km buffer zone and single houses including a 500 m buffer zone shall be excluded.
- Areas next to the cemeteries should be avoided.

In Shirak, the dumpsite is located at the area of abandoned borrow pit, however there could be some agricultural lands located in the vicinity of dumpsite. The waste falling, sliding and washed by rain water and can flow down to the agricultural plots located at lower elevation. The area is not fenced, thus the exact boundaries of the dumpsite are not known on site, and waste can be spread over the areas located out of area designated for the dumpsite. Some cases of waste burning were observed on the site. The smoke causes nuisance for the residents, as the nearby residential buildings are located at a distance of about 500m only. Certain measures could also be considered for mitigation of visual impact of the dumpsite. There is a surface water spring observed nearby the dumpsite that can be polluted with the rainwater outflowing from the dumpsite area. In addition, the presence of groundwater in the area should be investigated. Some scavengers were also reported to visit the site.

- Protection of natural resources (particularly the river valleys) and development of tourism are the priorities relevant for SWM solutions
- Regular waste collection in residential areas and from traditional places of picnics close to residential areas should be part of the SWM solutions.
- Prevention of dumping along the roads and arrangements for waste collection from road stop places related to the transit traffic is as enforcement issue for the local regulatory authorities.

Lori region (Vanadzor City)

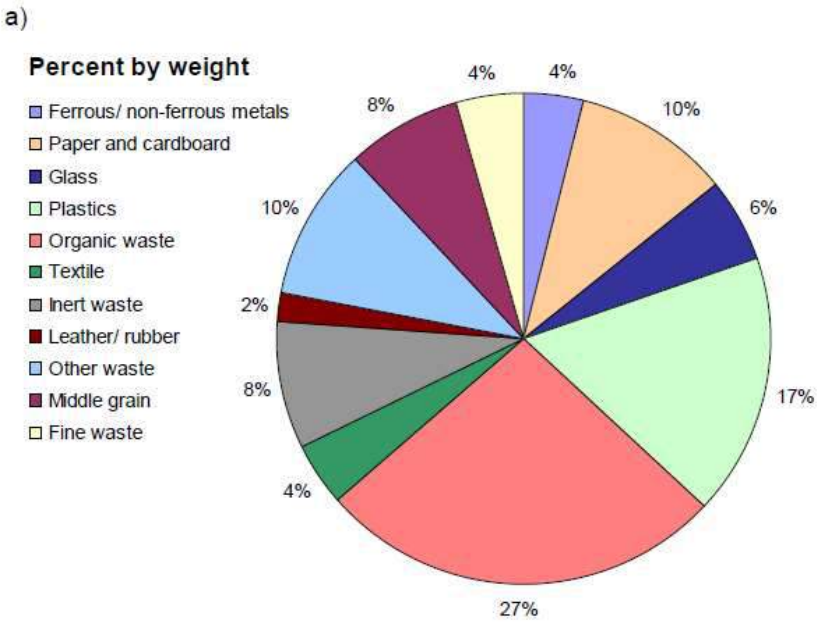
Gathering of waste in Vanadzor is carried out by very out-of-date collection vehicles. The containers are of open build (without lid) with a capacity of 500 or 700 l. In consequence waste in the containers is not protected from water and frequently very wet causing rotting processes to begin very early. The apartment houses (multi-story buildings) are frequently equipped with rubbish chutes. These refuse chutes don't always have no containers for storage which means that waste is frequently distributed in the shaft and then has to be manually shoveled into the MSFZ.

There is a lack of waste collection containers and the containers frequently overflow and the waste lies next to them. It can be concluded that inhabitants of side streets that aren't equipped with containers of their own, frequent the containers chosen for sorting as well. In addition, waste from a nearby market was also included. Waste from households, small businesses and public institutions is all collected together.

The average results of the sorting analyses for all seasons (4 sorting analyses) in the city of Vanadzor show a high mass percentage of organic waste (27 %), plastic material/plastic (17 %), and cardboard/paper/cardboard packaging (10 %).Volume percentages of this waste group are for organic waste (12 %), plastic material/plastic (33 %), cardboard/paper/cardboard packaging (28 %).The percentage of plastics was abnormally large during spring in comparison with the

other seasons (mass: 29 % and volume: 42 %).Plastic reduction from 29 % in the spring to 11 % in the summer. Mass percentage of plastics remains almost constant at 11 % and 13 % in summer, autumn and winter. The large amount of plastics can be explained by wastes collected from small businesses (the weekly market, small shops), which contains a very large share of PET-bottles and plastic composites.

Figure 4: Results of the sorting campaigns in Vanadzor –average values for the whole year



4.2. Key issues of the SWM system

Improvement in the municipal waste sector is still a challenge, especially within communities which are located in the remote mountainous areas of the country where the issues of transportation and waste collection and removal are still as challenging as before. Privatization of the former State-operated system in the waste sector was initiated during the nineties. This process consisted of replacing centralized waste management by the decentralized system, where waste management activities are taken over by communities and the private sector.[10]

The main issues identified within the waste management sector are as follows (ADB, 2013):

[10] Municipal Solid Waste Management in Armenia, Current Trends and Steps Forward, G. Arzumanyan, Thesis for the fulfilment of the Master of Science in Environmental Management and Policy Lund, Sweden, October 2004, p.3.

- Currently about 700 tons 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.
- 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 addition, in 2012, 39.0 mln tons of waste was accumulated in the areas around various organizations.

Further, asbestos waste represent a specific issue. Although no exact data are available, there are many asbestos roofs in Armania, which are being replaced by modern construction materials and the generated waste is disposed in domestic landfills which may also cause human health-related problems. A similar situation can be observed in relation to waste containing mercury. Fluorescent lamps that are used in household and towards other purposes contain mercury and are also disposed into landfills thereby permeating into land and air.

4.3. Guiding principles for better SWM

According to the SWMP plan (ADB, 2013), the overall guiding principles applicable to the envisioned national SWM system are as follows:

- Provision of a high quality, comprehensive level of service to a maximum proportion of the population and ensuring a reasonable level of service to all others, particularly in remote and low population areas;
- Application of uniform technical, service and environmental performance standards consistent with international reference standards, specifically those in the EU in recognition of Armenia's long term intentions for association with the EU;
- Optimize "economies of scale" to achieve lowest cost in all aspects of the SWM system, both in terms of design and operation of its physical components (collection, transportation, disposal and recycling) and in realizing efficiencies in its administration, financing, and over sight;
- Maximize the attractiveness of the SWM system to private sector participation in the form of investment and expertise;
- Provision of market-based waste diversion/ recycling capacity at source, operating to a common standard as a stepping stone to the introduction in the longer term of more aggressive waste diversion infrastructure including centralized processing, particularly for organic waste, based on meeting EU waste diversion targets.

The proposed recycling system and targets, in combination with the assumed waste composition, should result in collection of recyclable materials as presented in Table 6 below.

Table 6. Collected recyclable materials in Armenia (excluding Yerevan)

	2017	2022	2036	Average
In % of recyclable materials in collected waste	5%	22%	37%	27%
In % of recyclable materials in generated waste	3%	15%	33%	20%
In % of total municipal waste stream collected	2%	8%	13%	10%
In % of total municipal waste stream generated	1%	5%	11%	7%

Thus, in the planning model, developed within the SWM, assumed that 5% of the potential recyclable materials in collected waste are recycled in 2017, increasing to 37% in 2036 and with an average of 27% in the 20 years planning period.

One of the environmental objectives of the SWMP is provide high-quality, complete and comprehensive services to a maximum number of people and beneficiaries, that is - in highly populated and large areas. Another objective is the adequate service delivery in small communities, especially in remote and low-populated communities. It is necessary to improve and reinforce the mechanisms that prevent the waste disposal in landfills and promote its re-use and recycling.

Each production process leads to certain type of waste generation. Besides, all the materials available in the market, at some point in time, are turned into waste. Thus, furher increase of waste generation can be expected. One of the solutions in the field can be the extension of the areas of landfills, yet this can lead to serious problems. The more is the quantity of landfills, the

more difficult is the organization of waste management. The growth in the amount of landfills shall be accompanied with the growth in the amount of the recycling enterprises.

The so - called "Economies of scale" notion has a significant role in the SWMP to achieve the minimum requirements – collection, transportation, disposal and recycling - in all communities of the SWM system, as well as to reach high level of effectiveness in terms of administration, financing and control. The attractiveness of the WM system shall be raised to promote the participation of the private sector.

To raise the attractiveness of the landfills it is necessary to eliminate small and medium sized landfills and review the process of disposing paper, metal, glass and polyethylene from the landfills by the private sector. This issue needs to be addressed in Armenia since only paper, metal, glass and polyethylene are of interest to the private investors since they present specific value and can be used for recycling purposes. The rest of the waste either remains in place or is **incinerated causing pollution of the environment.** The main goal of the stakeholders of the field shall be the conduct of **monitoring and improvement of the waste management**.

The objective of state policy in this field is to prevent the hazardous impact of waste on the environment and public health accompanied with the maximum use of waste as secondary raw material.

The proper and qualified organization of waste management causes less harm to the environment and ensures clean areas, providing with additional jobs and raw materials rather than damaging the environment. Having examined the environmental risks and benefits it is necessary to address the mitigation measures. For example, to make the landfills attractive it is necessary to create large landfills and exclude their access to random people such as waste collectors or livestock holders so that useful materials are not removed, landfills are not incinerated and infections are not spread. It is necessary to separate all the landfills, enclose them and prohibit access to domestic and wild animals.

The next important issue that needs to be addressed is that of transfer stations. The proper selection of their location remains critical since the considerable part of the area of the country is subject to landslides and, generally, there are many seismic zones in the country. During the selection of the location one shall take into account the proximity to river banks and the height level of communities so that infections and waste water are not spread into lowland areas during downward water flows. Transfer stations can accumulate waste placed in the vicinity as well as the newly disposed waste, freeing the mentioned areas which can later be used for agricultural, forestation and other purposes exerting positive impact on environment.

The construction and centralization of the main landfills allows eliminating the small and medium-sized landfills as well as their negative impact on the environment. The environmental protection will benefit if the primary waste collection is accompanied with such processes of remnants' destruction and neutralization as biological methods (composting, land cultivation, etc.), thermal methods (incineration, heat separation, desorption), chemical methods (neutralization, stabilization) and physical methods (distillation).

The construction of main landfills is vital also when it comes to climate change since the freed zones will be landscaped and reforested which will positively impact climate change.

Major mechanical and biological solutions will reduce the amount of emissions while the existing harmful materials of the landfills will not be incinerated and will not spread into the atmosphere. Waste-to-energy incineration will lighten the burden of SHPs and other sources of energy, yet it will not have significant impact on climatic zones.

5. ENVIRONMENTAL AND HEALTH BASELINE

This chapter aims to outline the current situation and trends regarding the environmental and health aspects related to the waste management and to highlight existing environmental and health threats and risks which may be relevant to the WMP. Thus, this baseline analysis represents a basis for assessing the likely effects of the Waste Management Plan and formulating mitigation measures.

The key issues identified through the below baseline analysis are summaried in Chapter 6.

5.1. Atmospheric air

5.1.1. 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 7. 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 8. 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**

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

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.

5.1.2. 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.

5.1.3. Mobile Sources of Pollution

Armenia vehicles are mostly worn out. As of 2014, according to official data, 533,886 vehicles are registered in the Republic of Armenia.

According to official data, 129,208 tons of petrol was imported, 346,259 tons of liquefied gas was consumed and emissions from automobile transport amounted to 142,207 tons. If only petrol was used as fuel instead of gasoline, emissions would make up 416,694 tons.

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.

In case of Yerevan[11] which is surrounded by mountains from its three sides, it hampers the natural dispersion of pollutants in the atmosphere leading to high concentrations of pollutants in the "urban" air. The main source of air pollutants are emissions arising from automobiles, which is exacerbated by overloaded road network. In the Yerevan Master Plan, it is estimated that approximately 95% of the air pollutants are associated with the operation of urban transport.

Table 9.[12] Results of Air Quality Monitoring in Yerevan Based on Active Sampliang

Decision Substances (number of monitoring stations)		Maximum concentration monitored	Number of times MPCs were exceeded		Average Annual Concentration	Average daily MPC
		mg/3 (monitoring station)	>1 MPC	>5 MPC	(mg/m3)	(mg/m3)
2015	Sulfur dioxide (7)	0.072 (station N1)	101	0	0.029	0.05
	Nitrogen dioxide (7)	0.101 (station N18)	186	0	0.016	0.04
	Dust (7)	1.548 (station N18)	301	26	0.103	0.15
	Ground-level Ozone (7)	0.043 (station N18)	3	0	0.007	0.03

5.2. 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.

[11]Armenia: Yerevan Solid Waste Project – Environmental And Social Due Diligence, Environmental And Social Impact Assessment 19th May 2015, p.47

[12] http://www.armmonitoring.am/Bulletin/Annual/Pdf/Annual-15.pdf

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 as follows:

- 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.

5.2.1. 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 CO_2. As compared to that of 1990, the GHG emissions were reduced by 70% and as compared to 2000, they were reduced by 26%.

*Table 10. Emissions of greenhouse gases in RA by sectors (Gg), 2010**

Sectors	CO_2	CH_4	N_2O	HFC	CO_2 հաշ.
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 (CH_4, N_2O).

Key emission sources: CH4 emissions from MSW (72% of total emissions); CH4 emissions from residential and commercial wastewater (14%); N_2O emissions from wastewater (8.6%); CH_4 emissions from MSW open burning (3.4%). The first two of these sources are also included in the key categories of the general inventory.

5.2.2. Trends in GHG Emissions, 2000-2010

Table 11. Emissions of Greenhouse gases in RA (Gg CO2)

Gas	2000թ.	2003թ.	2005թ.	2008թ.	2010թ.
CO_2	3207.0	3181.9	4077.7	5109.1	4464.6
CH_4	1844.7	1869.1	2097.5	2458.0	2261.0

N_2O	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.

5.3. Water/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. Most rivers are small, rapid, and fed by melting snow, springs, and groundwater.

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). Specific challenges of water resources management are therefore a good management of water abstractions in dry regions and during dry seasons, effective flood protection in spring, management of water transfers from mountain regions to urban demand centers.

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 (ADB 2011).

Groundwater supplies the base flow for most rivers and serves as a buffer through dry periods. Serious attention should be given to monitoring, management and protection of groundwater in Armenia, since it is used for drinking and domestic purposes, irrigation and industrial needs. Metsamor Nuclear Power Plant also uses groundwater for cooling. However, groundwater insufficient monitoring and poor management led to serious consequences and Ararat artesian basin (Armavir and Ararat Marzes), where most agricultural lands are located, has been depleted.

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.

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.

Armenia's sanitation services are inadequate. In rural areas, over half (51%) of the population use unimproved facilities, causing direct damage to the environment and exposing inhabitants to health risks. In urban areas, the situation is substantially better, with 96% of the population having access to improved facilities through the sewerage system. Yet, this figure hides the poor conditions of the network, which poses health hazards due to potential cross-contamination between sewage and drinking water. Furthermore, out of 20 existing waste water treatment plants (WWTPs), only four are currently functioning, serving Yerevan, Gavar, Martuni and Vardenis. These WWTPs only provide partial treatment, comprising preliminary screening and grit removal and primary sedimentation. The reduction in biological load, suspended solids and nitrogen is limited, which means that this kind of treatment has limited beneficial impact on the environment. As a result, 48% of wastewater discharged in the environment without treatment.

Untreated wastewater is commonly used for irrigation, with no control of health risks. This poor situation is exacerbated by the lack of enforcement and regulation of industrial wastewater discharges: a large number of industrial or commercial users are not connected to the sewer networks and discharge untreated sewage into water bodies. This creates negative environmental impacts, degrading the state of surface water bodies and harming biodiversity.

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%.

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 5). 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).

There is a need to expand the existing chemical monitoring network, but more importantly to introduce biological and hydromorphological monitoring in the country, as well as monitoring of the Water Framework Directive's priority pollutants.

It is also important to improve a water quality information exchange system. Though the State Water Cadastre Information System is meant to comprehensively consolidate this information and make it available online for a broad audience, this has yet to be achieved. Further strengthening of data-sharing mechanisms between various relevant agencies (Ministry of Territorial Development, local self-governing authorities, Water Resources Management Agency, Arm State Hydromet Service, State Environmental Inspectorate etc.) is needed.

Overall, improved coordination and harmonization of surface water and groundwater quantity and quality monitoring activities will be critical. Requirements that are relevant to the SWMP can be found in Government of RA Resolution No 64-N "On Criteria for Definition of Areas for Sanitary Conservation of Aquatic Ecosystems, Flow Formation, Conservation of Groundwater, and Identification of Water Protection Zones, Ecotones, and Inalienable Areas", January 20, 2005.

The criteria for defining *sanitary conservation areas* of aquatic ecosystems are as follows:

- areas, which maintain biological, hydrological, and recreational values of water resources;
- areas, which maintain such quantity and quality of surface and groundwater that is used for medicinal and ecological integrity purposes and is required for human health and well-being;
- sanitary conservation areas of aquatic ecosystems can include sections of rivers or lakes, wetlands, ponds, as well as adjacent areas subject to conservation in their natural state as operating wealthy ecosystems, where rehabilitation of natural environment may be required due to floods causing pollution of water, erosion processes and other negative impacts;
- sanitary conservation areas of aquatic ecosystems are defined with a radius up to 90 meters.

The criteria for defining areas for *flow formation* are as follows:

- areas, which maintain such quantity and quality of surface and groundwater that is required for human well-being as well as for ensuring ecological integrity of the ecosystem;
- areas for flow formation include the entire river source, the entire source of underground water springs and natural springs, as well as adjacent areas subject to conservation in their natural state as operating wealthy ecosystems;
- areas for flow formation are defined with a radius up to 4000 meters.

The criteria for defining areas for *groundwater conservation* are as follows:

- areas, where conservation of aquifers is ensured as well as such hydro-geological, hydrological and climate conditions are maintained that do not violate ecological integrity;
- areas for groundwater conservation can include also embanked community watersheds;
- areas for groundwater conservation are defined with a radius up to 150 meters.

The criteria for defining *water protection zones* are as follows:

- areas, where the prevention of pollution and degradation of water resources is ensured, as well as favorable conditions for water regime is maintained;
- water protection zones include all the areas envisaged under the protection of water resources.
- water protection zones are defined in a form of a layer with a length up to 32 meters.

The criteria for defining *ecotones* are:

- the most vulnerable areas adjacent to water courses or banks, which are under protection from human activities due to high vulnerability;
- the areas for ecotone include sections of the areas adjacent to water courses or banks of rivers, lakes, ponds and other natural reservoirs;
- areas for ecotone are defined with a radius up to 150 meters.

The criteria for defining *inalienable areas* are as follows:

- areas where the exploitation, rehabilitation and conservation of water supply and sewage systems as well as hydro-technical structures are maintained;
- inalienable areas include areas adjacent to water supply and sewage systems and hydro-technical structures
- inalienable areas are defined in a form of a layer with a length up to 10 meters.

Due to the lack of modern landfills, domestic waste is dumped on river banks causing surface water pollution, thus the implementation of the SWMP will help in pollution prevention in all six basin management districts of Armenia.

5.4. Land/Soil

5.4.1. Overview

640 sections of total 7530 hectares of degraded land have been recorded in Armenia, of which 3780 ha used to serve as agricultural lands before the degradation [7]. Overall, 81.9% or 24.353 km2 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)

Forest soils occupy 697 thousand hectares (22.4% of the territory), forested areas occupy 334.2 thousand hectares (11.7%).

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 12).

Table 12. 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 was 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%.

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[7]. Increase in heavy metals is observed throughout the year (Table 8).

Table 13. 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

5.4.2. Droughts

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: these desertification processes are not expressed only on an area of 6742 km^2 (22.6%).

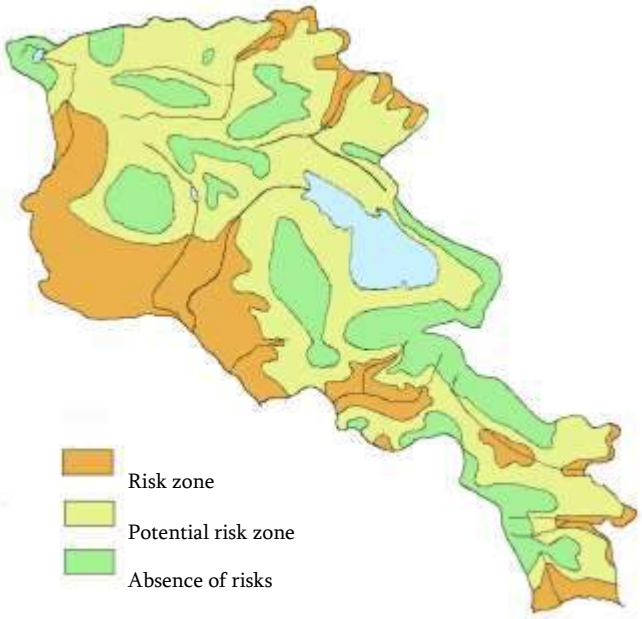


Figure 6: Desertification risk zone in Armenia

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.

Figure 7: Drought areas of the RA (in violet)

5.4.3. 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.

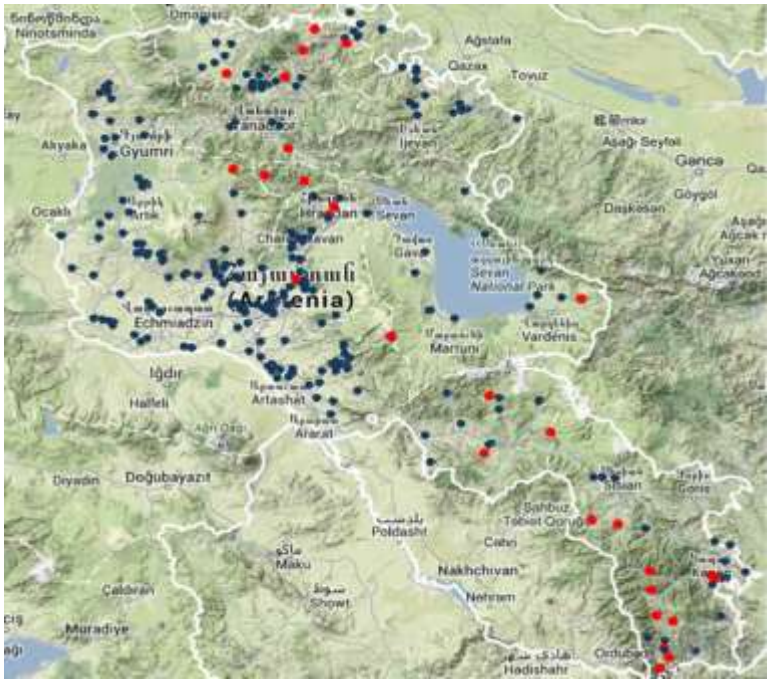


Figure 8: Map of mining regions of the Republic of Armenia

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.

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 Armenia.

As shown in Table14, 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 below N14).

*Table 14. 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

* Source: 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 ha. Land area of more than 250 thousand ha is allocated for the purposes of geological exploratory activities.

There are 21 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.

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 calcium – by 1.4-1.2 and 1.5-1.9 times.

5.4.4. 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.

Figure 9: Landslides in the Republic of Armenia

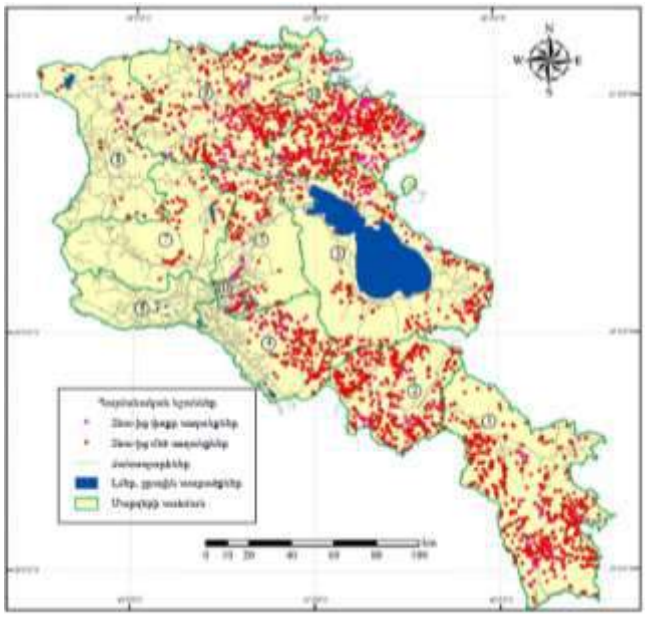


Figure 10: Image of Khosrov landslide-flow in 2007

The distribution of landslides in RA is presented in Table 10.

Table 15. 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

5.4.5. Mudflows

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.

Figure 11: Mudflow zones of Armenia based on the reoccurrence of the

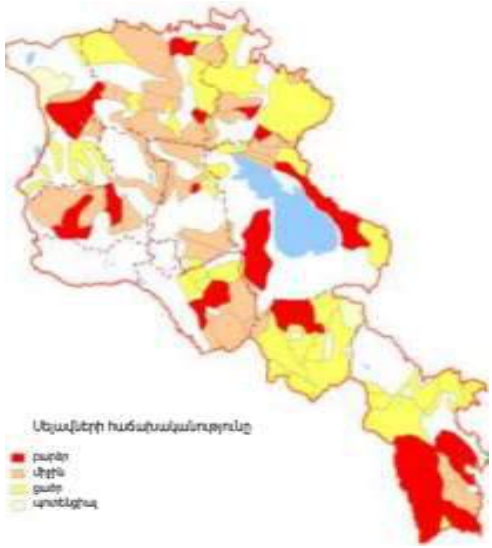


Figure 9 presents the distribution of mudflows in RA, and the downpour districts across the marzes are presented in Table 11.

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 16. Mudflows across the marzes[10]

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

5.4.6. 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.

5.5. 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.

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.

5.5.1. Waste management in Protected Areas

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.

Waste 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.

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.

5.5.2. 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.

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

Table 17. 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 18. 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.

5.5.3. Threats to biodiversity due to industry: mining waste, cement production waste, agriculture

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.

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 salinization 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.

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.

5.6. Public health

5.6.1. Overview

The RA Law on Waste of (from November 24, 2004) regulates legal and economic relations connected to the collection, transfer, maintenance, development, reduction of volumes, and prevention of negative impact on human health and environment. It also describes the aims of waste collection and the responsibility of authorized bodies.

The Ministry of Healthcare of the RA elaborates and implements the policy of the Republic of Armenia in the healthcare sector. The structure of the Ministry includes main staff and two subordinate bodies: National Healthcare Agency and National Hygiene and State Anti-Epidemiological Surveillance Inspectorate.State Anti-Epidemiological Surveillance Inspectorate with its 19 regional offices is responsible for participation in development of sanitary norms and standards; coordination of all issues related to healthcare; supervision of sanitary norms, hygienic and anti-epidemiological measures implementation by organizations and citizens.

Currently there is considerable impact of unfavorable factors of the environment on human health. The quality of water, including the current situation of the drinking water and waters of surface reservoirs can lead to different diseases, both infectious and not. In the past 20 years in rural areas more than 30% of water samples (based on the data of Sanitary – Hygienic Service) do not comply with sanitary norms and requirements in terms of their microbiological indicators. During the same period water pollution caused more than 100 outbreaks of intestinal infections.

In the target communities of Syunik and Lori marzes mining activities lead to the pollution of air, water and land through toxic elements as a result of which there is growing incidence of lung diseases, cancer, cardiovascular and other diseases among the population. According to the data of Sanitary – Hygienic Service, in the adjacent areas of Kapan city, maximum permissible concentrations of copper and zinc in soil outnumber the norms multiple times (copper - 40-50 times, zinc - about 10 times). In some areas of Alaverdi city, as a result of the activities of the mining and metallurgical plant, amount of arsenic in the soil is 10-40 times higher than the permissible norms, that of copper is 40 times higher than the permissible norms and that of zinc is up to 10 times than the permissible norms.

SW is a major contributor to environmental pollution, and can be blamed for spreading many harmful and infectious diseases within the communities where the landfills will be set up, imposing their negative impact on community dwellers, their health and environment.

Non-regulated waste management affects indoor and outdoor life of community dwellers, having its negative impact on the streets, roads and at other public places, which attracts flies, insects, rats etc., helps in spreading the diseases, and of course, in the first place, endangering the life and health conditions of the nearby communities located close to the waste site or landfill. Unattended waste is wet and has a bad odor due to decomposition. This type of waste could worsen health conditions, and cause spreading of different types of diseases and epidemics.

5.6.2. Human health related issues and waste management

In Armenia, any 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:

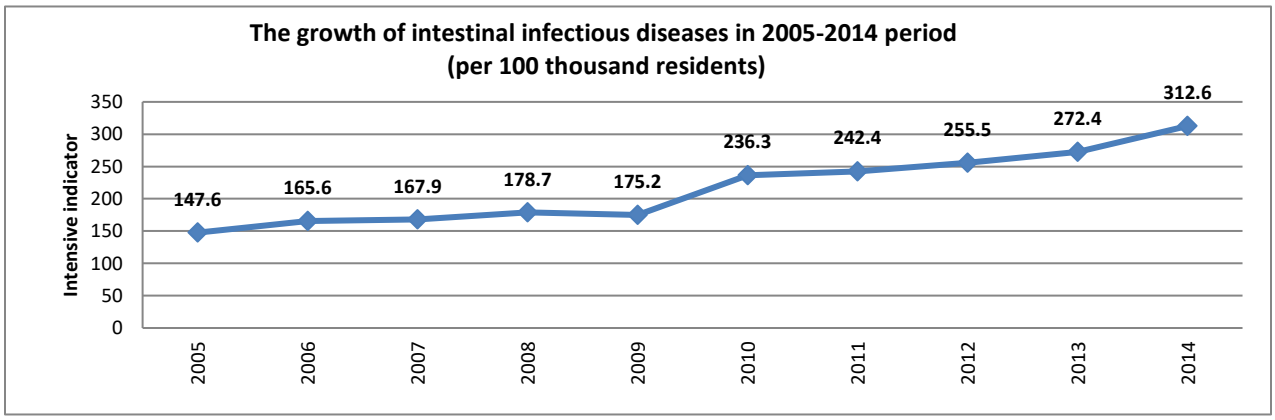
1) According to the studies (Order N03- N of the RA Ministry of Healthcare dated March 4, 2008, 2000 data of WTO approved by SanK and N N2.1.3-3, Ecology of CIS countries, city of Tver, etc), the areas around the dustbins with a radius of 15 meters, are considered to be the most infected areas based on microbiological indicators and, in practice, during the growth period of infectious diseases the flies sampled from these areas are mostly infected with enterovirus.
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 are presented 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.
5) 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 12.)

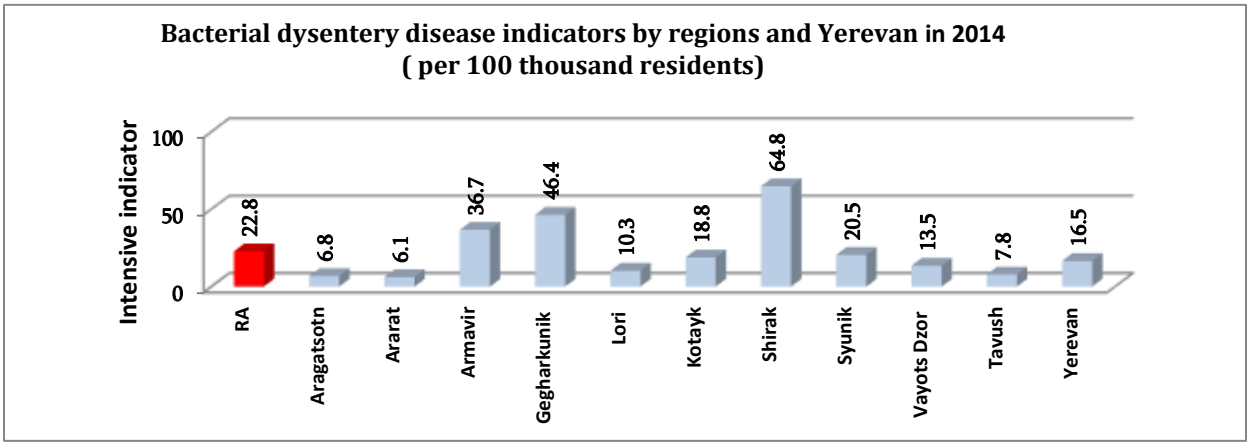
Figure 12.



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.

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 13).

Figure 13.



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 (Figures 10 and 11).

Figure14.

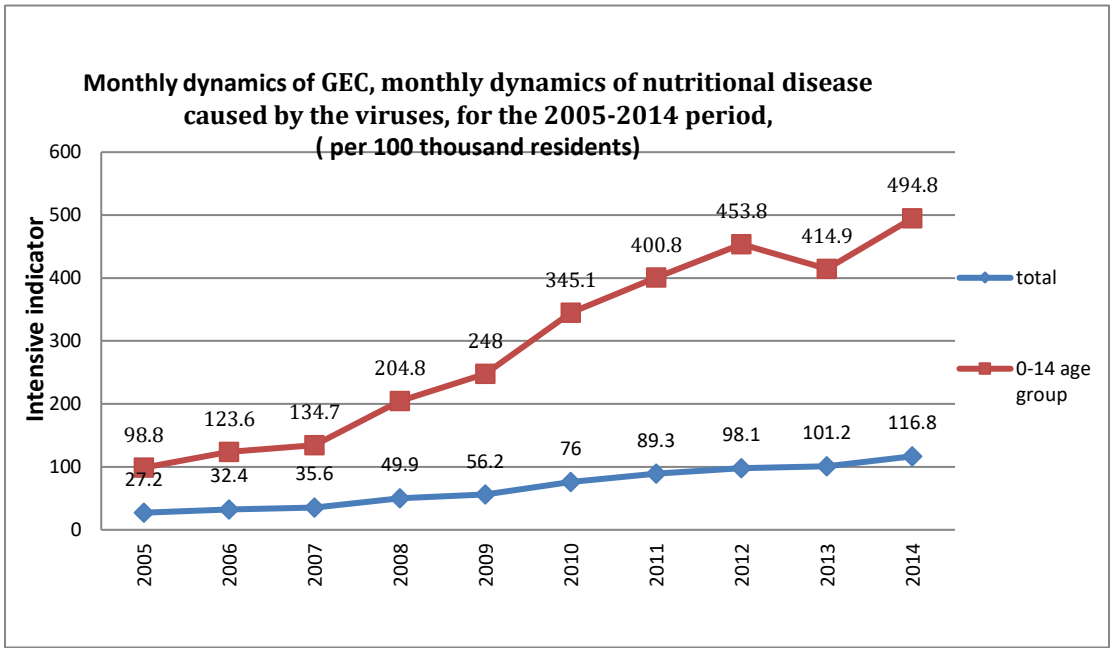
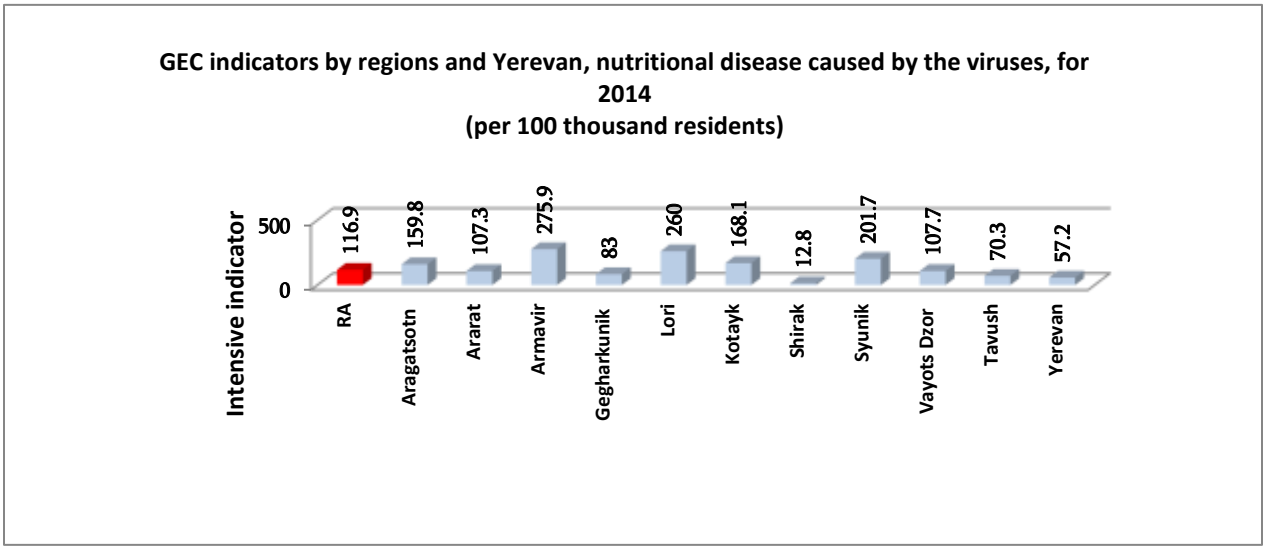


Figure 15.



The target groups of the population most exposed to the adverse effects of the solid waste in 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.

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.

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:

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.

6. KEY ENVIRONMENTAL AND HEALTH ISSUES

The table below aims to highlight significant environmental and health issues and concerns as well as opportunities in relation to SWM Plan and its implementation, based on the data and analysis drawn as a result of baseline assessment. The table outlines linkages and key problems identified as relevant to the SWM plan and waste management sectors with regards to environment (air quality, climate change, water and groundwater, land management, and biodiversity) and health (including socio-economic aspects). Cultural heritage has been scoped out as less affected by the proposed SWP.

Table19.The main public health issues relevant to the waste management plan

SEA topic	Key issues, concerns and opportunities
Air quality, climate change and GHGs	• Air emissions from poorly maintained and outdated vehicles used for collection and transport of waste or from poorly equipped waste facilities[13], • Poorly monitored air emissions from waste facilities waste burning on legal lndfills and illegal dumps. • Target areas/cities where the location of landfills is identified are surrounded by mountains, which would lead to the high concentration of pollutants in the atmosphere within the urban areas. • Increased trends of GHGs emissions are notced in the country; SWM facilities are a contributor, so there is a concern about GHGs emissions due to WM activities (burning at the landfills, methane from landfills, emissions from waste transport etc.)
Water	• Inefficient water monitoring systems, specilly for underground water • Surface and ground water contamination by waste leaking from dumps • Pollution of surface water with chemicals from households and industry • Occurrence of domestic waste on river banks causing surface water pollution • It can be forcasted that water demand can increase locally as a result of construction of waste management facilities
Soil	• Soil contamination from waste (leakages from landfills, atmospheric deposition, etc.)

[13] The systems of International Standardization Organization (ISO) are not yet effective in Armenia and there is no 'good faith' approach to environmental issues. The level of public awareness in this area is limited. Thus, if emission volumes satisfy the requirements for obtaining emission permits, enterprises holding permits do not upgrade 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.

SEA topic	Key issues, concerns and opportunities
	• Agriculture land uptake by further development of the landfills • Legacy mining waste dumps left from the mining industry
Biodiversity	• Municipal waste disposal occurs directly into the surrounding nature sites, biodiversity hotspots, specially protected areas, and waterways. It is necessary to pay special attention to waste management in SPNAs, since unregulated waste dumping affects development of eco-tourism and damages ecosystem and extinct species. • 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. • Damage/removal of topsoil and accumulation of wastes cause fragmentation of plant and animal populations and communities, disturb migration routes of animals and even threatened the existence of some rare species. • Loss of fauna habitats (conservation) due to waste management facilities construction/expansion
Population and Human Health	• Expansion of the landfill areas and violations related to the water pipes and canals within the sanitary protection zone, • Illegal burning of garbage • Violations of sanitary zones of the landfills, • Existence of toxic waste (heavy metals, chemicals) and medical waste (syringes, ampoules, etc.) in the landfills, • Poor quality of air in the areas surrounding the landfills (both houses and lower floors of multi-storey residential buildings) • Presence of insects and rodents in the garbage that spread deseases • Noise stemming from waste collection and transport
Socio-economic factors	• Low level of awareness within communities and public on waste neutralization rules, 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. • Poverty rate is about 30%, so there are concerns as to whether waste collection fees will be accessible and affordable for the most vulnerable segments of the population • Inadequite consideration of community health and safety risks in relation to WM facilities, as well as low stakeholder engagementin WM projects

7. THE ENVIRONMENTAL, INCLUDING HEALTH, OBJECTIVES ESTABLISHED AT INTERNATIONAL, NATIONAL AND OTHER LEVELS RELEVANT TO THE WASTE MANAGEMENT PLAN

This Chapter provides information on the relevant environmental, including health, objectives derived by the SEA expert team based on the review of environmental, health and socio-economic legal and policy documents adopted by Armenia. The key documents that served as the sources of the established objectives included the laws and policy documents mentioned in Chapter 2, as well as the listed below:

- Second National Environmental Action Plan, 2008
- RA Law On Protection of Atmospheric Air, 1994
- Action Plan for Harmful Substances Emissions Reduction from Motor Transportation, 2005.
- National Water Programme of Armenia, 2006,
- RA Law on the Fundamental Provisions of the National Water Policy, 2005
- Water Code, 2002
- Strategy of the Republic of Armenia on Conservation, Protection, Reproduction and Use of Biological Diversity, 2015
- Land Code, 2001
- RA Law on Nature Protection and Nature Use Payments, 1999
- RA Law on Flora, 1999
- RA Law on Fauna, 1999

These selected policy objectives are listed in the table below per legal/instiutrional and environemtnal, including health, SEA themes. These objectives constituted a framework against which the objectives of the SWMP were assessed when conducting the policy objective-led assessment (see Chapter 8).

Table 20. Environmental and Health Policy Objectives Relevant to the SWMP

SEA theme	Objective
Legal and institutional	• Approximate the national waste legislation to comply with international standards (EU waste legislation), • Define the responsibilities of the state authorities and other institutions involved in the implementation of waste management, coordination, and sectoral control, • Deliver waste management activities so that to prevent and reduce possible impacts on human health and environment
Air quality, climate change and GHG	• Reduce and control gas emissions to atmosphere from waste management facilities (e.g., emissions resulting from burning and transportation, GHG emissions from landfills) • Increase public awareness on waste management and its impact on air quality, climate

SEA theme	Objective
	change and GHG emissions
Surface and underground water	• Prevent negative impact of the SWM activities from having negative impact on water resources, • Re-establish groundwater resources monitoring system in Armenia • Improve public awareness and participation in water resources management (including awareness on water quality issues caused by the dumping of waste by communities in river beds/on river banks)
Biodiversity	• Enhance biodiversity and ecosystem conservation (through participatory planning, knowledge management and capacity building) and restore degraded habitats • Prevent, if impossible, reduce the pressure on biodiversity and promote its sustainable use
Soil, geology and mineral assets	• Encourage the use of previously developed land by municipal waste management facilities • Encourage the rational use of the territories of the SWM facilities after their closure • Set-up environmental monitoring of landfills (inlcuidng geological risks, e.g., landslides)
Human health	• Protect health of population living in areas adjacent to landfills and on low floors of multi-story buildings close to landfills • Prevent occupational diseases among employees of communal services engaged in the processes of waste collection, transportation and recycling
Socio-economic	• Develop local social infrastructure and public services sector, their accessibility and effectiveness, including provisions to protect and support the poor and vulnerable social layers. • Ensure that SWM activities do not harm the communities that depend on the existing dumpsites (e.g., provide alternative and legalized job opportunities to waste pickers)

8. THE LIKELY SIGNIFICANT ENVIRONMENTAL, INCLUDING HEALTH, EFFECTS

This section covers policy objective-led assessment of the SWMP, and analysis of SWMP priorities from the point of view of environmental and health objectives, as well as legal/institutional, water/groundwater, soil, climate, air pollution and climate change, socio-economic aspects. The assessment describes challenges and formulates recommendations in respective sectors to be considered by implementing/planning agency and contractors in accordance to the requirements of the national SEA legislation as well as the Protocol on SEA to the Espoo Convention.

8.1. Policy objectives-led assessment

As part of the SEA process, it was necessary to examine the relationship of the SWMP with other relevant policy and legal environmental and health objectives and to identify synergies, constraints and potential conflicts between the existing commitment/objectives and those proposed in the SWMP. To this end, the Policy objectives-led assessment was condicted that analyzed the five objectives/priorities of the WMP against the environmental and health objectives established in Chapter 7. The summary of this analysis, as well as the resulting recommendations for the improvement of the proposed SWMP are presented in the table below.

Note: the objectives of the SWMP are shorted for easier use in the below table as follows:

Provision of high quality, comprehensive level of services to a maximum proportion of the **population** and **ensuring** a **reasonable level of services** to all others**, particular**ly **in remote and low populated areas**	**Provision of high quality services to** the **population**
Application of uniform technical, service and environmental performance standards consistent with international standards (Armenia's national priorities vis-à-vis EU)	Application of uniform/international performance standards
Optimize "economies of scale" to achieve lowest cost in all aspects of the SWM system, both in terms of design and operation of its physical components (collection, transportation, disposal and recycling) and in realizing efficiencies in its administration, financing, and over sight	Efficient and affordable SWM system
Maximize the attractiveness of the SWM system for private sector to ensure their participation in the form of investment and expertise	Maximized co-operation with pritave sector
Market-based waste diversion/ recycling capacity at source, intro-duction in the longer term of more aggressive waste diversion infrastructure (centralized processing, particularly for organic waste, based on meeting EU waste diversion targets)	Market-based waste diversion

The analysis used the following format symbol system:

\+ Likely synergy between a priority of the WMPand given environmental/health objective (i.e. implementation of the WMP's priority will help to achieve the environmental/health objective)

0 No link between a priority of the WMP and given environmental/health objective

– Likely conflict between a priority of the Strategy and given environmental/health objective (i.e. implementation of the Strategy's priority may slow down or even make impossible achieving the environmental/health objective)

+/- Both a likely synergy and a possible conflict could be anticipated.

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Table 21. Review of the relevant environmental and health objectives

Environmental and Health Objectives	Waste Management Plan's Objectives					Recommended changes to the proposed priorities of the WMP
	Provision of high quality, services to the population	**Application of uniform / international perfor-mance standards**	**Efficient and affordable SWM system**	**Maximized co-operation with pritave sector**	**Market-based waste diversion**	
LEGAL AND INSTITUTIONAL						
Comply with the national waste regulations	+	-	+	+	+	The manual for design and maintenance of existing and operating landfills, order No. 321-A of December 29, 2009 (Ministry of Urban Development) requires that a minimum operation period of a landfill be 25 years, whereas the SWMP considered 20 years of operation. Thus, the SWMP should consider increasing the period of service for the landfills up to 25 years. The Plan should define the responsibilities of the state authorities and other institutions involved in the implementation of waste management, coordination, and sectoral control. It is recommended to increase the number of the proposed sanitary landfills, especially in remote high
Define the responsibilities of the state authorities and other institutions involved in the implementation of waste management, coordination, and sectoral control	+	+	+	+	+	
Deliver waste management activities so that to prevent and reduce possible impacts on human health and environment	+	+	+	0	+/-	

Environmental and Health Objectives	Waste Management Plan's Objectives					Recommended changes to the proposed priorities of the WMP
	Provision of high quality, services to the population	Application of uniform / international perfor-mance standards	Efficient and affordable SWM system	Maximized co-operation with pritave sector	Market-based waste diversion	
						mountain areas and complex climatic zones[14].
AIR QUALITY, CLIMATE CHANGE AND GHG						
Reduce and control gas emissions to atmosphere from waste management facilities (e.g., emissions resulting from burning and transportation, GHG emissions from landfills)	-	+	+	-	+	The Plan to require the landfill operators to conduct monitoring of and improve the waste management practices in the landfills. The Plan to incluce the public awareness raising activities aimed at enhancing the understanding by the public of waste management processes and their impact on air quality, climate change and GHG emissions
Increase public awareness on waste management and its impact on air quality, climate change and GHG emissions	0	0	+	+	+	
SURFACE AND UNDERGROUND WATER						
Prevent negative impact of the SWM activities from having negative impact on	+/-	+	+	+/-	+/-	The Plan to include the requirement to design and manage the waste management facilitie so that to

[14] It is logical to reach the minimum cost for the services by applying the "economies of scale". At the same time, this is doubtful since on the one hand, the costs and issues with the area maintenance and management are reduced, while on the other hand, transportation costs are increased (this will be most evident during winter months). This will be particularly troublesome in case of the landfill of the Syunik region (due to the complicated relief of the marz and poor conditions of the roads). Thus, there is a risk that illegal landfills will continue to be created.

Environmental and Health Objectives	Waste Management Plan's Objectives					Recommended changes to the proposed priorities of the WMP
	Provision of high quality, services to the population	Application of uniform / international perfor-mance standards	Efficient and affordable SWM system	Maximized co-operation with pritave sector	Market-based waste diversion	
water resources,						prevention any water pollution.
Re-establish groundwater resources monitoring system in Armenia	0	0	0	0	0	The WMP should include arrangments to monitor the impacts of the waste management facitlites to the water resources and thus contribute to overal water resources monitoring system in the country.
Improve public awareness and participation in water resources management (including awareness on water quality issues caused by the dumping of waste by communities in river beds/on river banks)	+	0	+/-	+	+	The WMP should consider knowledge- and awareness-raising measures as these would play a significant role in reducing the pollution.
SOIL, GEOLOGY AND MINERAL ASSETS						
Encourage the use of previously developed land by municipal waste management facilities	-	+	+	-	+	It is recommended that the SWM consider the requirement to minimize the uptake of new land, especially belonging to agricultural, forest and water land funds for SWM facilities.
Encourage the wise use of the territories of the SWM facilities after their closure	0	+	-	0	0	The WMP should stipulate measures on establishing monitoring system on geological conditions around the landfill (land use, irrigation, landslides, desertification).
Set-up environmental monitoring of landfills (inlcuidng geological risks, e.g., landslides)	0	0	0	0	0	The Plan should recommend that from the topographic point of view an area

Environmental and Health Objectives	Waste Management Plan's Objectives					Recommended changes to the proposed priorities of the WMP
	Provision of high quality, services to the population	Application of uniform / international perfor-mance standards	Efficient and affordable SWM system	Maximized co-operation with pritave sector	Market-based waste diversion	
						with a moderately steep relief is preferable for the sanitary landfill. Linked to this, it is advisable that the SWMP define basic standards for the selection of the area of the sanitary landfill, which will detemine the framework for the selection of the site.
BIODIVERSITY						
Enhance biodiversity and ecosystem conservation (through participatory planning, knowledge management and capacity building) and restore degraded habitats	-	+/-	+/-	0	0	The SWMP should promote (i) the reduction of hazardous substances through investment into new technologies preventing pollution of the environment and supporting biodiversity (land, water, air, etc,), (ii) prevention of accumulation of hazardous chemical substances in soil and water, and (iii) prevention of landscape degradation. The manual for design and maintenance of existing and operating landfills (2009) sets that agricultural lands and forests cannot be used as landfills. However, this does not mean that landfills cannot be arranged in areas adjacent to forest or agricultural land. Hence, SWM strategy should make provisions for considering compensations for potential negative impacts on forest and agricultural lands.
Prevent, if impossible, reduce the pressure on biodiversity and promote its sustainable use	-	+/-	+/-	0	0	

Environmental and Health Objectives	Waste Management Plan's Objectives					Recommended changes to the proposed priorities of the WMP
	Provision of high quality, services to the population	Application of uniform / international perfor-mance standards	Efficient and affordable SWM system	Maximized co-operation with pritave sector	Market-based waste diversion	
HUMAN HEALTH						
Protect health of population living in areas adjacent to landfills and on low floors of multi-story buildings close to landfills	-	+	+	+/-	+/-	The WMP should incorporate the following guidance for it activities: • Define the sanitary zones of the newly constructed landfills • Conserve and close the landfills with highly insufficient sanitary-hygienic conditions • Adjust waste collection and accumulation containers in the area of multi-story buildings to the Sanitary rules and norms requirements • Envisage research activities aimed at identifying diseases as well as prevention measures for employees of communal services engaged in the processes of waste collection, transportation and recycling
Prevent occupational diseases among employees of communal services engaged in the processes of waste collection, transportation and recycling	+	+	+	+	+	
SOCIO-ECONOMIC						
Develop local social infrastructure and public services sector, their accessibility and effectiveness, including provisions to protect and support the poor and	+	+	+	0	-	It is recommended to consider the following activities in the SWMP: • Improve the quality of local infrastructure and public services delivered to the community; • Make waste services accessible to

Environmental and Health Objectives	Waste Management Plan's Objectives					Recommended changes to the proposed priorities of the WMP
	Provision of high quality, services to the population	Application of uniform / international perfor-mance standards	Efficient and affordable SWM system	Maximized co-operation with pritave sector	Market-based waste diversion	
vulnerable social layers.						all and effective; • Incorporate social protection policy aimed at poverty reduction, mitigation of inequality, provision of opportunities for vulnerable groups of population (elderly people, poor, etc.), • Propose targeted social assistance, including monetary assistance, as well as comprehensive social services packages, to the socially vulnerable and groups of population; • Propose that the economic policy be developed for ensuring sustainable economic growth of communities located near the landfills and that the livelihood of the communities is not worsened (e.g., provide waste pickers with alternative and legalized job opportunities)

The above analysis allows for putting forward a range of recommendations that relate to the environmental, including health and social, legal and institutional nature aspects of the SWMP (see the table above). The recommendations are included in Chapter 11 of this Report.

It should be noted that the incorporation of these recommendations in the SWMP and their subsequent delivery will enable the SWMP to achieve compliance with the national legislation and be in line with the national environmental and health commitments.

8.2. Summary of the Assessment of Likely Effects and Risks

This section summarizes the likely adverse and positive effects of the individual components of the SWMP on the key environmental and health issues identified in the scoping. It is based on the detailed evaluation matrix given as Appendix XXX to this Report.

SWPM components	Summary of the likely effects
2.5.1 Waste collection and recycling	Likely positive effects can be expected as the enhanced waste collection and recycling system should lead to less waste to be processed by other means. Therefore it should result in: • Reducing risks related to air quality, water and soil contamination, and also reduce the pressures on ecosystems. Improved waste collection system and establishment of waste collection points with containers will reduce the amount of solid waste to be displaced in adjacent water bodies, thus it shall lead to better water quality. • Reduced health pressures through enhancing the quality of environment, and by eliminating the source of infectious diseases (rodents, insects). • Introducing waste collection and recycling system can also provide additional jobs for the local communities. The transport associated with the waste collection may negatively affect the air quality and will also become an additional source of GHGs emissions. It can also contribute to increased noise levels in populated areas. Similar likely impacts may be related to recycling facilities. However, these likely adverse effects will be mainly of a local nature.
2.5.2 Transfer stations	Likely positive impacts on air, water, and soil can be expected since new transfer stations together with the entire waste collection and recycling system should reduce waste disposal negatively affecting environmental components. Improving the quality of environment shall also shall lead to positive health effects. Establishing the transfer stations can also provide additional jobs for the local communities. Transfer stations may become additional sources of surface and groundwater pollution in case they are located in the sanitary zones of aquatic ecosystems, flow formation zones, water protection zones, ecotones and inalienable areas. The transfer stations may have local adverse impacts on the air quality. Together with increased noise and odours, and possibility of becoming a source of infectious diseases, it may negatively affect the health of the population in surrounding areas. There is also a risk of increased level of infectious and non-infectious diseases among the

SWPM components	Summary of the likely effects
	employees of the stations (to be operated by the communal services). However, these likely adverse effects will mainly be of a local nature.
2.5.3 Sanitary landfills	Generally, positive effects can be expected as the waste will not be accumulated in the vicinity of small and medium-sized landfills and the environment shall be cleaner from waste. In particular, likely positive impacts on the water quality can be expected as properly organized sanitary landfills will reduce the amount of waste dumped to the river banks in the communities where landfills do not exist and waste collection is not organized properly. Improving the quality of environment shall also shall lead to positive health effects. Establishing the sanitary landfills can also provide additional jobs for the local communities. There is a risk of leachate leakages, therefore sanitary landfills may become as additional sources of surface and groundwater pollution in case they are located in the sanitary zones of aquatic ecosystems, flow formation zones, water protection zones, ecotones and inalienable areas. It may also result in soil contamination and in reducing land available for adjacent communities. Sanitary landfills may have local adverse impacts on the air quality. Together with increased noise and odours, and possibility of becoming a source of infectious diseases, it may negatively affect the health of the population in surrounding areas. There is also a risk of increased level of infectious and non-infectious diseases among the employees of the landfills (to be operated by the communal services). However, these likely adverse effects will mainly be of a local nature.
2.5.4 Waste collection in poorly accessible rural areas	Likely positive effects can be expected as the enhanced waste collection should lead to less waste to be processed by other means. Especially in rural areas it should eliminate irregular landfills. Therefore it should result in: • Reducing risks related to air quality, water and soil contamination, and also reduce the pressures on ecosystems. Availability of waste collection points in rural areas will significantly reduce pollution of surface water by solid waste. • Reduced health pressures through enhancing the quality of environment, and by eliminating the source of infectious diseases (rodents, insects). • Introducing waste collection and recycling system can also provide additional jobs for the local communities. • Increase attractiveness of the SPNAs as these will be cleaner from waste and garbage. The transport associated with the waste collection may negatively affect the air quality and will also become an additional source of GHGs emissions. Rural collection points have the risk of polluting adjacent water bodies if their

SWPM components	Summary of the likely effects
	location is not appropriate or if not maintained properly. However, these likely adverse effects will be mainly of a local nature. There are certain economic and operation risks which need to be carefully considered in further planning: In winter months the waste transport vehicles can be hindered due to closure or possibility of the local roads as a result of a bad weather conditions. In such case, the waste will not be collected for several days, even for weeks. Also, due to the highland location of many rural areas, the fuel costs may increase which adds to the overall costs of the waste collection.
2.6 Alternative solutions	
2.6.1 Mechanical Biological Treatment (MBT)	There are likely positive effects including: • MBT reduces the amount of biodegradable waste, thereby reducing the leachate, and thus pollution and contamination of soil and water resources; • It prevents potential hazardous waste contaminants such as batteries, solvents, paints, light bulbs etc. to be deposit at the landfill sites. • MBT reduces the mass of the input waste through stabilisation and composting processes and therefore contribute to reduction of GHG and other emissions • It can support energy generation from waste (although additional planning and costs are needed) There are also certain risks associated: • Poor management of leachate during the MBT presents a risk of surface and underground water pollution • During the mechanical destruction of non-decontaminated waste pathogenic microorganisms and aerosols will be emitted, which may negatively affect the health of employees of the MBT facilities.
2.6.2 Waste-to-energy incineration	The likely positive effects are mainly linked to the assumption that waste incineration will result in less waste to be land filled. In this case, it will reduce soil and water pollution as well as health risks (infectious diseases). Incineration may also be considered as additional energy source. There are several likely adverse impacts:

SWPM components	Summary of the likely effects
	• Direct adverse impacts on the air quality. • Soil and water pollution in adjacent and neighbouring areas by atmospheric deposition • Increased demand of water for gas cooling processes in the process of incineration may negatively affect the quantity of water resources. Risk of pollution of water resources due to incineration gas emissions. • Application of old technologies as well as violations of technological processes may lead to significant air pollution causing health problems (carcinogenic, embryo, genetic mutations).
3.3 Recommendations for adjustments (of Institutional Framework)	
3.3.1 Changes in the legal/regulatory Framework:	
Approximation of EU legislation (to mirror at least the most important provisions of EU legislations.)	The national legal framework in line with the EU legislation should result in established waste management policies and institutional frameworks to assure that waste management is carried out without endangering human health, and without negative effects to the environment. The SWM envisages sorting the waste in transfer stations, as a result of which the space for landfills should decrease. According to EU directive on landfills it is required to follow procedures and guidelines to prevent or mitigate the negative effect of waste on environment and human health. To achieve this status, it is necessary to define similar requirements in RA, including waste sorting before it reaches the landfills, gradual reduction of joint removal /mixing hazardous waste with non-hazardous waste, as well as monitoring upon the closure of the landfills and their care/maintenance after the closure.
Setting targets for closure of existing dumpsites and for diversion of waste (recycling of dry materials and reduction of landfill of biodegradable waste).	This measure will have positive impact on environment – expected reduction of the amount of the waste should result in reduced emissions to the air and water, as well as GHG emissions. It should also lead to a considerable decrease of polluted land surfaces.
Precisely define the competences within the main functions of planning, implementation	Implementation of this measure should lead to enhanced control and to clear functional separation of responsibilities in waste management sector, including agencies, municipalities and private/waste collectors. This should result in improved waste management system in the country will less environmental and health risks.

SWPM components	Summary of the likely effects
(operation) and enforcement and ensure impartiality and transparency of institutions.	
The legal ceiling on waste tariffs should be removed to allow for qualified assessments of affordability and willingness-to-pay on individual basis (see 5.2). In addition economic instruments should be introduced to support the recycling business.	No major effects on the key issues were identified.
3.3.2 Changes in the institutional arrangements:	
National Waste Management Authority (NWMA) established under the Ministry of Territorial Administration	Designation of a specific authority responsible for coordination of the waste management should result in enhanced waste management system in the country with waste management practices in line with international and EU standards, better co-operation with private sector companies, communities and municipalities, and with more extensive involvement of the health authorities. Such system should lead to less environmental and health risks associated with the waste management.
The MENP would retain its independent authority with respect to setting of environmental standards, environmental expertise and permitting along with enforcement. Its capacities should be strengthened to provide independent, comprehensive and regular inspections of all landfills and waste handling facilities.	Existence of an independent authority with a full control/monitoring over the waste management system should contribute to enhanced waste management system in the country with less environmental and health risks associated with the waste management. It should also ensure that the entire process of waste removal in the pilot regions will be implemented in accordance with environmental standards.

SWPM components	Summary of the likely effects
The collection of tariffs, currently a responsibility of the local governments, may have to be placed at a higher level with the power to extract the tariff from municipalities whether they collect or not as the agent.	The likely impacts of the components are uncertain as institutional changes in tariff collection may either improve or worsen the collection rates. The system of tariffs may have positive impact of improved waste collection practice, however it can also have negative impact on vulnerable groups of population which will be unable to pay higher tariffs, therefore it is important to apply approach which would differentiate between the groups in the society. It is also important that a chosen mechanism allows directing certain part of collected payments to the improvement of the waste management sector.
5.3.1 Primary investment packages	
Regional collection system for the southern region with no investments for landfill (12 million EUR total, 7.3 million EUR initial).	The likely positive effects are related to enhanced waste collection system, which should lead to: • Reducing risks related to air quality, water and soil contamination, and also reduce the pressures on ecosystems. Improved waste collection system will reduce the amount of solid waste to be displaced in adjacent water bodies, thus it shall lead to better water quality. Similarly, elimination of irregular landfills and reduced risk of soil pollution. • Reduced health pressures through enhancing the quality of environment, and by eliminating the source of infectious diseases (rodents, insects). • Introducing waste collection and recycling system can also provide additional jobs for the local communities. The transport associated with the waste collection may negatively affect the air quality and will also become an additional source of GHGs emissions. It can also contribute to increased noise levels in populated areas. However, these likely adverse effects will be mainly of a local nature.
Expanded Kotayk project with collection/transfer capability for Gegharkunik marz (23 million EUR total, 8.3 million EUR initial).	Improved waste collection in Lake Sevan basin will have positive environmental impact on water resources as well as it will contribute to the cleaning of the territory of Sevan National Park Likely adverse effects include: • This component envisions adding a collection/transfer infrastructure in the Sevan area, therefore there is a risk of pollution of Sevan Lake (which is the most reliable resource of drinking water/water reservoir in the area) if the infrastructure is not properly located or maintained. • There is a risk of negative impacts on Sevan National Park (which represents a considerable part of

SWPM components	Summary of the likely effects
	Gegharqunik province).
Expanded Vanadzor project to encompass all of Lori and major centers in Tavush marz (21.3 million EUR total, 8.8 million EUR initial).	Implementation of this component should lead to elimination of irregular landfills and thus reduce a risk of air, water and soil pollution from the improper waste management. Improved waste management system should contribute to conservation of primary forests in the area. It should also represent an interesting opportunity for waste recycling businesses due to the accumulation of waste in Vanadzor to establish new waste management and recycling facilities and thus creating new jobs. Further planning (and related environmental studies) has to take into account: • The issue of Dendropark and its conservation/waste collection activities • Likely transboundary aspects related to impacts on water ecosystems (Debed River Basin) • The fact that both regions have large territories with a forest cover which can be negatively affected by improper waste management.
Regional system for Shirak marz with Gyumri regional landfill & upgraded collection system (16 million EUR, 5.8 million EUR initial).	Implementation of this component should lead to elimination of irregular landfills and thus reduce a risk of air, water and soil pollution from the improper waste management. It should also represent an interesting opportunity for waste recycling businesses in Gyumri and thus creating new jobs. There are isolated communities living in the areas difficult access and problematic roads (in Amasya region). Therefore, there is a risk that unsorted, non-regulated and ineffective waste management can cause environmental pollution in remote/mountainous communities, in particular during the winter time.
Regional system for Syunik marz (12 million EUR, 5.6 million EUR initial).	Implementation of this component should lead to elimination of irregular landfills and thus reduce a risk of air, water and soil pollution from the improper waste management. Further planning (and related environmental studies) has to take into account: • Unique position of Meghri region and long distances between communities, which may hinder the process of organizing a complete waste disposal procedure/cycle • Possibility that two local transfer stations in the South (Agarak-Meghri) and North (Goris) of Syuniq marz might not be sufficient due to unfavourable road and relief conditions.

SWPM components	Summary of the likely effects
	• Existence of Zangezur National Park • Necessity to preserve a forest cover
5.3.2 Indicative supporting investment and TA packages	
Technical Assistance for institutional, legal, regulatory and PPP promotion capacity strengthening, supporting waste reduction/diversion initiatives and public awareness raising.	The technical assistance, promotion of institutional and legal regulation as well as public-private partnerships and public awareness-raising is expected to contribute to more efficient waste management system and thus lead to the likely positive effects on biodiversity, air and water quality, and land resources. It also represents an opportunity to implement the public healthcare program aimed at public awareness raising on the health aspects related to the waste management. No risks regarding the key environmental and health issues were identified.
Demonstration projects applicable to remote rural collection and upgraded disposal	Implementation of demonstration projects should contribute to more efficient waste management system and thus lead to the likely positive effects on biodiversity, air and water quality, and land resources. In particular, the pilot projects in small remote rural communities would have positive impact on local water resources quality, since in the most cases there is no waste collection system in place and therefore domestic solid waste is usually dumped on river banks. Considering this, it is important to include remote areas with difficult access as the locations for implementation of the demonstration projects. No risks regarding the key environmental and health issues were identified.
Historical dumpsite closure and general solid waste legacy management. This could include a detailed mapping of dumpsites in Armenia and preparing individual closure plans as well as ground works to clean up the sites	Mapping of existing dumpsites will provide useful information for further decision-making and improved waste management. Individual closure plans and relevant ground work will also have overall positive impact on air, soil and water resources. The risks can be seen in relation to improper organization of landfill closure and reclamation activities as there is a lack of positive experience with the land reclamation in Armenia.

9. ANALYSIS OF ALTERNATIVES

9.1. Analysis of full-scale strategic alternatives

Four strategic alternatives outlined in the WMP are compared in terms of their potential environmental and health effects and against the business-as-usual alternative (this includes the trends identified via the baseline analysis at the scoping stage). The following symbols have been used to denote the change that could be expected from the realization of the alternatives against the business-as-usual one:

- "0" – the same state
- "-" a change to a worse state
- "+" a change to a better state
- "?" uncertain.

The results of this comparison are presented Table 19. Analysis of Full-scale strategic Alternatives below:

Table 22. Analysis of Full-scale strategic Alternatives

	Business as usual	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Effect / risk	**No plan implemented**	Centralized system based on a single large landfill and transport by rail	Centralized system based on a single large landfill and transport by road	Regional system with Yerevan receiving waste from neighboring marzes1)	Regional system developed independently of Yerevan
WASTE	Illegal dumping of waste will continue, all components of the environment will be affected	Option difficult to implement in Armenia, taking into consideration absence of railroad as well as financial difficulties of implementation Roads are not very much functional in general, and many communities are rather isolated. Successful implementation would require massive investment in transport infrastructure as a precondition of effective functioning of waste collection system.	Difficult to implement option which requires large investments taking into consideration Armenia's complex terrain climatic conditions and poor roads.	An acceptable option for organizing waste management process taking into consideration possibilities and resources of Yerevan	This option is also feasible and requires less investment
	-	+	-	-	-
AIR, CLIMATE CHANGE , BIODIVERSITY	In Armenia, especially in large industrial cities, air pollution is a major issue connected to a large number of transportation means and mining. The continuation of make-shift landfills and lack of strategic solutions will exacerbate negative	The construction of one centralized landfill makes it possible to avoid the local ambient environmental issues in other locations. The planed clean-up of the areas of the former small-sized landfills and re-forestation of the areas will clearly have positive environmental impacts. Still	The construction of one centralized landfill makes it possible to avoid the local ambient environmental issues in other locations. The planed clean-up of the areas of the former small-sized landfills and re-forestation of the areas will clearly have positive environmental impacts. Still the	Waste transportation from neighboring marzes and accumulation of waste in Yerevan will produce considerable volume of air emissions generated by intensive waste transports. The majority of the truck fleet is more than ten years old and the vehicles have poor capacity.	Regionally organized waste transportation will produce considerable volume of air emissions generated by intensive waste transports. The

Effect / risk	Business as usual No plan implemented	Alternative 1 Centralized system based on a single large landfill and transport by rail	Alternative 2 Centralized system based on a single large landfill and transport by road	Alternative 3 Regional system with Yerevan receiving waste from neighboring marzes1)	Alternative 4 Regional system developed independently of Yerevan
	impacts of waste-related pollution.	the construction of one large landfill will create large-scale local impacts, and the construction of a new railroad network to serve transportation of waste while wide railway network does not exist in Armenia would be associated with risks to biodiversity, and landscape.	construction of one large landfill will create large-scale local impacts, and the construction and maintenance of a road network to serve transportation of waste is not seen as feasible, namely due to seasonal conditions. Especially in case of highland, mountainous communities. For example, the greatest part of the RA Gegharkunik region is mountainous, which makes the waste transportation issues difficult especially during winter months and accumulated waste due to blocked roads can cause odor and infections spread through wild animals. The emissions generated by intensive waste transports serving to the centralized facility might be considerable.		majority of the truck fleet is more than ten years old and the vehicles have poor capacity.
SOIL, GEOLOGY AND MINERAL ASSETS	-	+	+/-	+	**0**

	Business as usual	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Effect / risk	**No plan implemented**	Centralized system based on a single large landfill and transport by rail	Centralized system based on a single large landfill and transport by road	Regional system with Yerevan receiving waste from neighboring marzes1)	Regional system developed independently of Yerevan
	Soil pollution in hundreds of landfills and their adjacent areas is a major issue. The majority of the landfills is not being monitored. The registered landfills are, as a general rule, constructed based on old standards and do not have respective protective (insulator) layers, as a result of which soil as well as underground water pollution occur. The landfill areas are not enclosed which contributes to the pollution of the adjacent lands as well as free access of the landfills for people and animals with all the related negative consequences.	Waste concentration in modern sanitary landfill will significantly reduce the level of pollution in the landfill and adjacent areas. At the same time waste transportation through railroad will also allow avoiding the danger of pollution of roadside lands and not licensed waste disposal. (Currently waste collection especially in remote rural areas is not being controlled and it is not excluded that dishonest waste collectors dispose of waste directly into the nearest coombs or rivers).	On the one hand, just in case of the previous alternative, waste centralization in a modern sanitary landfill will significantly reduce the pollution of the landfill and adjacent areas, still not licensed waste disposal in the roads further increases. This is especially relevant during waste collection from those areas where transfer stations are not envisaged. The relief of Armenia and the quality of roads considerably complicate the transportation of waste from the whole territory of Armenia into one area. At the same time this makes waste transportation from suburban areas more expensive. There is considerable risk that waste will not reach the landfill.	We will have five possible sources of pollution of landfills and adjacent areas which is much better than the policy that is currently being applied, yet it falls behind the first and second alternatives. At the same time risks of soil pollution as a result of waste transportation are reduced.	Again there will be more landfills, hence, associated risks of pollution of roadside and adjacent areas of the landfills. Monitoring towards reduction or minimization of pollution will become complicated.
SURFACE AND UNDERGROUND WATER	-	**0/+:**	**0/-:**	**0/-:**	**0/+:**
	Water pollution due to illegal dumpsites and solid	If all the waste is transported to the landfill via rail, there	Waste transportation by road may increase pollution of surface	Increased number of vehicles and longer transportation	

	Business as usual	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Effect / risk	**No plan implemented**	Centralized system based on a single large landfill and transport by rail	Centralized system based on a single large landfill and transport by road	Regional system with Yerevan receiving waste from neighboring marzes1)	Regional system developed independently of Yerevan
	waste is an issue in all river basins. Without WMP implementation the situation will continue and pollution impacts intensify.	will be less surface water pollution due to car emissions from the roads.	waters due to dust and car emissions.	distances will increase environmental pressure on Yerevan area; car emissions will eventually pollute adjacent water resources. However, this system may have positive impact on water resources only in case if relevant environmental standards are followed (special covered vehicles, proper lining of the landfill, distance from flow formation zones etc.).	
HUMAN HEALTH	**-**	**+**	**+/0**	**-/0**	**+/0**
	Uncontrolled landfills and other make-shift practices of waste management will continue with considerable risks to public health	Centralized system will probably limit the number of people engaged in waste handling and consequently the risk of impact on human health become limited. The positive effect will be that with railway transport the waste is more likely to reach its destination; it will not be shed along the way and pollute the environment. To minimize this risk, the	Centralized system will probably limit the number of people engaged in waste handling and consequently the risk of impact on human health become limited. Transportation of waste through vehicles will not have substantial impact from the public health perspective	The already existing landfills in Yerevan have significant negative impact on human health. Besides the abolition of old landfills and organization of new ones is a difficult problem. The regional system is more preferable in case necessary measures to assure protection of landfill workers' and community dwellers' health are undertaken, and landfills are constructed and functioning in accordance to environmental	The regional system is more preferable in case necessary measures to assure protection of landfill workers' and community dwellers' health are undertaken, and landfills are constructed and functioning in accordance to

	Business as usual	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Effect / risk	**No plan implemented**	Centralized system based on a single large landfill and transport by rail	Centralized system based on a single large landfill and transport by road	Regional system with Yerevan receiving waste from neighboring marzes1)	Regional system developed independently of Yerevan
		waste should be transported in containers.		and health standards	environmental and health standards
SOCIAL AND ECONOMIC	**0**	**-**	**-**	**-/0**	**+**
	In the absence of centralized and regulated waste collection, the environmental/health costs in the long run would be enormous.	There is no railroad infrastructures and wide railway network. It would require allocation of substantial resources to address this issue first, at the expense of other priorities.	The geographical location of certain regions and temporary inaccessibility of roads during winter months will hinder the process of regular waste transportation. It would require allocation of substantial resources to address this issue first, at the expense of other priorities.	Regional unit's options are more functional since it provides opportunity to communities, to develop their waste management capacities, improve infrastructure, etc. The transport infrastructure between Yerevan and adjacent marzes that shall be served by Yerevan landfill is in poor condition, it would require allocation of substantial resources to address this issue first, at the expense of other priorities.	Regional units options is more functional since it provides opportunity to communities, to develop their waste management capacities, improve infrastructure, etc. with more regard to local conditions

9.2. Analysis of technological alternatives

Table 23. Technological solutions alternatives

Effect / risk	Alternative 0 **Business as usual (no plan implemented)**	Alternative A **Primary: Landfilling**	Alternative B Primary + Mechanical-Biological Treatment (MBT*)	Alternative C Primary + Waste-to-Energy (WtE) incineration.
General				
	Continuous increase of the environment pollution	As a first step it will be preferable variant for landfilling, which will become a basis for further / other investment options / sorting, recycling and so on.	Next step is also preferable, as in case of implementation it will improve the impacts on environment and decrease of waste volumes to be landfilled.	Certain environmental benefits can be delivered but with risks of diverging resources from more fundamental WM components (separate collection, recycling)
AIR, CLIMATE CHANGE AND BIODIVERSITY				
AIR	-	+	+	+
	Protection of atmospheric air in Armenia is ensured by the RA law on „Protection of Atmospheric Air" and respective legislative acts If the amount of emissions meets the permission requirements then the enterprises do not initiate the replacing and modernizing their	The construction and centralization of the main landfills allows eliminating the small and medium-sized landfills as well as their negative impact on the environment.	The environmental protection will benefit if the primary waste collection is accompanied with such processes of remnants' destruction and neutralization as • Biological methods (compost, land cultivation, etc.), • Thermal methods (incineration, heat separation, desorption), • Chemical methods (neutralization, stabilization) and • Physical methods (distillation).	Waste not subject to recycling and re-use shall be incinerated in a safe manner to generate additional energy. In this case it is necessary to ensure BAT technology with state-of-the-art pollution abatement technology

Effect / risk	Alternative 0 **Business as usual (no plan implemented)**	Alternative A **Primary: Landfilling**	Alternative B Primary + Mechanical-Biological Treatment (MBT*)	Alternative C Primary + Waste-to-Energy (WtE) incineration.
	technologies.			
CLIMATE	**-/0**	**+**	**+**	**0**
	Uncontroled decomposition of waste produces GHG	The construction and maintenance of the main landfills will have positive impact on climatic factors since small and medium-sized landfills will be eliminated and the free zones will be used for forestation and vegetation growing purposes. This will positively impact the climatic conditions of the areas. The Methane emissions capture and utilization technologies shall be implemented on new landfills.	Primary, mechanical and biological treatment reduces atmospheric emissions and the hazardous materials available in the landfills are not incinerated and are not spread in the atmosphere.	Waste-to-energy incineration will, to a certain extent, lighten the burden of SHPs and other sources of energy, yet it will not have significant impact on GHG balance.
BIODIVERSITY	**-**	**+**	**+**	**0**
	Uncontroled dumpsites have negative impact on biodiversity.	The construction of primary landfilling sites will free the areas of small and medium-sized landfills and the rehabilitated territory migh recover ecosystem functions, pollution of the surface waters will be eliminated, direct burden on biodiversity will be reduced, sustainable use of biodiversity will be promoted, the state of biodiversity will be improved and its overuse will be prevented.	Primary, mechanical and biological solutions will allow for primary sorting and then recycling of waste. Landfill fires, as a result of which flora and fauna species, ncluding plants and animals listed in the Red Book disappear, will be prevented.	No major risk to biodiversity freom stae-of-the-art incineration technology. Secondary impacts can be due to intesive transport associated with supplying the facitlity with waste.
SOIL, GEOLOGY AND	**-**	**?**	**+**	**+**

Effect / risk	Alternative 0 **Business as usual (no plan implemented)**	Alternative A **Primary: Landfilling**	Alternative B Primary + Mechanical- Biological Treatment (MBT*)	Alternative C Primary + Waste-to-Energy (WtE) incineration.
MINERAL ASSETS				
	Uncontrollable exloitation of non-registered landfills will continue as a result of which large areas of land will continue being polluted. Pollution of landfills, their adjacent areas and waste transportation roadside areas will persist.	Waste transportation from remote communities to the designated areas is difficult to ensure. Main risk is continuation of irregular waste disposal.	The amount of waste in sanitary landfills will be reduced as a result of which land utilization areas will decrease. At the same time level of soil (water and air) pollution through hazardous substances will decrease.	The amount of waste in disposal areas will significantly reduce as a result of which land utilization areas will significantly decrease. At the same time level of soil (water and air) pollution through hazardous substances will decrease if the remianig ashes are disposed off in environmentaly sound manner
WATER	-	+/-	+/+	0/-
	Pollution of surface and groundwater will continue	The new sanitary landfills shall ensure environmentally sound management of leachate. Environmental risks for water resources may be associated with poor leachate management on the landfill causing pollution, as well as inadequate location of the landfill (flow formation zones, sanitary zones etc.).	MBT reduces the amount of biodegradable waste, thereby reducing the leachate. It also prevents potential hazardous waste contaminants such as batteries, solvents, paints, light bulbs etc. to reach the landfill sites.	Impact on water will occur through water abstraction for gas cooling processes in the process of incineration. Risk of pollution of water resources due to incineration gas emissions.
HUMAN HEALTH	-	+	+/-	+/-
	Problems of the health related to the waste sector are not solved	Advantages: 1. Ensured sanitary protection zone 2. Reduced pollution of the factors having impact on human health – air,	Advantages: 1. Reduction of the amount of waste and emission of filtrate, methane and greenhouse gases into the air	Advantages: 1. Reduction of the amount of waste as well as areas designated for landfills

Effect / risk	Alternative 0 **Business as usual (no plan implemented)**	Alternative A **Primary: Landfilling**	Alternative B Primary + Mechanical- Biological Treatment (MBT*)	Alternative C Primary + Waste-to-Energy (WtE) incineration.
		water and soil 3. Abolition of landfills in poor sanitary conditions	2. Prevention of the transfer of specific household waste (batteries, lamps containing mercury, etc.) to the landfill and their neutralization Deficiencies 1. These are not self-decontaminating processes and microorganisms are not being destroyed 2. During the mechanical destruction of non-decontaminated waste pathogenic microorganisms and aerosols will be emitted to the environment creating a risk to the employees and the environment	2. Destruction of agents and transmitters of infectious diseases Deficiencies 1. Risk of pollution of the atmospheric air due to emissions from combustion processes 2. Application of old technologies as well as violations of technological processes lead to mass pollution of the atmospheric air causing carcinogenic and embryo, genetic mutations through stable organic pollutants 3. Health risk to people working in the area 4. Problem with disposal – utilization of waste generated by the incineration (ashes)
SOCIAL AND ECONOMIC		**+**	**+**	**0/-**
	Uncontrollable exploitation of non-registered landfills will continue as a result of which large areas and community dwellers will be under the negative	Ensured improvement of waste collection and management Reduced pollution and positive impact on environment and health of the nearby communities in case of correct	The amount of waste in sanitary landfills will be reduced as a result of which land utilization areas will decrease. At the same time level of soil, water and air pollution through hazardous substances will decrease which will improve overall	Risk of pollution due to incineration gas emissions may and has an impact on community and waste workers, worsen the attractiveness of life and environment for dwellers

Effect / risk	Alternative 0 **Business as usual (no plan implemented)**	Alternative A **Primary: Landfilling**	Alternative B Primary + Mechanical- Biological Treatment (MBT*)	Alternative C Primary + Waste-to-Energy (WtE) incineration.
	impact of unsorted and uncontrolled waste, will be affected in terms of community's economic and social well being, status, poverty and polluted environment. Pollution of landfills, their adjacent areas and lack of waste treatment will have a negative impact on nearby community	organization Improved impact on human health – air, water and soil Employment opportunities and legalization of waste sorting, recycling, etc.	environmental conditions	

9.3. Summary of the key findings

From the discussion of strategic alternatives (see section 9.1) it appears that the centralized system based on a single large landfill served by the rail transport is not considered to be efficient, or even practically feasible in Armenia, taking into consideration the absence of the proper railroad and lack of funds to improve the railway network in the foreseeable future.

Both centralized systems (served by rail or road trucks) are vulnerable to factors like climate, mountainous terrain, and bad road conditions during the winter season. De-centralized regional system and Regional system with Yerevan receiving waste from neighboring marzes can constitute acceptable options for organizing waste management system. However the non-functional railroad network in the Yerevan area will make the utilization of the Yerevan landfill capacity for neighboring marzes rather costly.

In terms of environmental impacts, either alternative is better than continuation of the present practices. The centralized systems with one landfill can in theory be better supervised for the implementation of sound environmental management, whereas it will probably be more prone to risks associated with transportation of wastes on longer distances. In case one (the Regional system options to be used for further SWM planning and implementation), it is expected that there will be an increased number of vehicles and longer transportation distances which will increase environmental pressure on Yerevan area. Car emissions will eventually pollute environment, soil, air, increase emissions, water resources. In all scenarios, the most important environmental benefit is associated with the commitment to close and clean-up existing uncontrolled dump sites. In conclusion, from the environmental perspective, there is no significant difference between the proposed strategic options concerning territorial organization of the SWM system.

From the perspective of soil contamination, geology and mineral assets, disposing waste to a modern sanitary landfill will significantly reduce the level of pollution in the landfill and adjacent areas. At the same time, waste transportation through railroad will also allow avoiding the danger of pollution of roadside lands and not licensed waste disposal (currently waste collection especially in remote rural areas is not being controlled and it is not excluded that dishonest waste collectors dispose of waste directly into the nearest coombs or rivers).

In terms of emission reduction, air pollution and biodiversity preservation, the construction of one centralized landfill makes it possible to avoid the environmental issues in other locations. The planed clean-up of the areas of the former small-sized landfills and re-forestation of the areas will clearly have positive environmental impacts.

To minimize this soil, water and air contamination risks, the waste should be transported in closed containers.

The already existing landfills in Yerevan have significant negative impact on human health. The closure of old landfills and arrangement of new ones is a difficult problem. The regional system is more preferable in case necessary measures to assure that health and satefy of landfill workers' and community is properly protected, and that landfills are constructed and function in accordance with the legal requirements and environmental, health and sanitary norms and standards.

Socio-economic perspective suggests that a Regional unit option is more beneficial since it provides communities with the opportunity to develop their waste management capacities, improve infrastructure, etc. The transport infrastructure between Yerevan and adjacent marzes that shall be

served by Yerevan landfill, which is in poor condition, would require allocation of substantial resources to address this issue first, at the expense of other priorities.

As for the differences among the proposed technological options (see section 9.2), the Business as usual (no plan implemented) is clearly recognized as the least desirable. The development of central/regional landfills allows for eliminating the poorly managed small and medium-sized landfills and their negative impact on the environment. The construction and maintenance of the main new sanitary landfills will have positive impact on all environmental factors.

Environmental risks that may be associated with poor leachate management on the landfill causing pollution, as well as inadequate location of the landfill (flow formation zones, sanitary zones etc.), will almost certainly be significantly smaller then in case of continuation of existing practices.

Additional technological alternative consisting of Primary, mechanical and biological treatment (MBT) reduces the amount of biodegradable waste, thereby reducing the leachate. It also prevents potential hazardous waste contaminants such as batteries, solvents, paints, light bulbs etc. to reach the landfill sites. MBT could assist the reduction of the amount of waste and emission of filtrate, methane and greenhouse gases into the air. Therefore it is considered as an useful and environmentaly beneficial addition to the generally landfill-based system.

As for the Waste-to-energy option, the incineration of waste might to a certain extent, offset other sources of energy (with small positive effect in terms of GHG emission balance), and it can also reduce the volume of waste to be deposited to landfills (thus saving landfill capacity). However, there are significant risks associated with operating waste incineration technologies without context provided by functioning sound waste management system. These risk might include toxic air emissions (namely when technology is not properly operated), lack of capacity for the final disposal of incineration toxic residua (which needs to be treated as hazardous waste), and social and economic impacts on local communities (risks to public health, property prices decrease). Another important risk is that operation of large incinerator might undermine implementation of the separate waste collection and recycling initiatives as the economy of the incinerator project requires constant supply of waste with preference towards energy-rich components (e.g. paper, plastic). Therefore, in agreement with reasoning provided by the WMP, the SEA regards the Waste-to-energy option as not suitable for current Armenian context.

10. POSSIBLE TRANSBOUNDARY EFFECTS RELATED TO THE IMPLEMENTATION OF THE PLAN

No transboundary impact is expected due to the implementation of the program, on the contrary, the cleaning of the areas, the elimination of the unorganized waste and the cleaning of the water surfaces will contribute to the elimination of the possible transboundary effects (the spread of dust and waste through wind, waste transfer through rivers will decrease).

All the rivers in Armenia are tributaries of the Araks and Kura Rivers. Habitat destruction, fragmentation and degradation in combination with the excessive and unsustainable use of natural resources have shown to be destructive forces for ecosystems in many parts of the Kura and Araks river basin.

Implementation of environmental objectives prescribed in the National Water Program and River Basin Management Plans that have already been officially adopted are closely linked and could benefit from proper implementation of the SWMP, and thus will have positive impact on the overall transboundary ecological situation.

Many of the water management targets set on the national level, as well as their importance in terms of the impact on transboundary water resources in the Kura-Araks Basin, are linked to improved management of solid waste.

Transboundary impact could be assessed depending on the location of the landfills. In case of non implementation of the SWMP existing downstream pollution will remain the same.

Successful implementation of the strategy may improve the water quality and ecosystem health, as well as have positive impact on the aquatic biodiversity.

11. SUMMARY OF MEASURES TO PREVENT, REDUCE OR MITIGATE ANY SIGNIFICANT ADVERSE EFFECTS ON THE ENVIRONMENT, INCLUDING HEALTH, WHICH MAY RESULT FROM THE IMPLEMENTATION OF SWM PLAN

The WMP is by nature a strategy with a potential for a positive impact on various aspects of the environment and public health. This is largely due to the fact that the WMP is laying grounds for a complex national waste management system based on the principles set in the EU waste management policies and regulations. That represents substantial qualitative change and departure from existing country waste management practices, characterised by lack of strategic approach, unsystematic or non-existing record keeping, relying on low-tech and makeshift local solutions with substantial negative environmental side-effects.

Despite its unquestionable net positive environmental effect, the implementation of individual WMP components is not a risk-free and it is important to ensure that is accompanied with measures further enhancing the positive, and mitigating any potentially negative impacts. The SEA formulated several recommendations related to the further development of the institutional and regulatory framework as well as proposed number of recommendations and conditions for implementation of key components of the WMP. These are listed below:

Recommendations towards further development of the legal/regulatory framework:

For WMP to be implemented effectively it is necessary that envisaged and already approved waste management-related legislation is implemented and enforced. Following conditions need to be ensured:

- Continuing approximation of RA legislation to EU standards, triggering among other:
  - Gradual decrease of waste landfilling while increase separation, recycling and re-use
  - Control of waste flows from the generation to the final recycling and/or disposal
  - Waste collection sites as well as waste storage standards shall be defined by a respective legislative act
- Setting targets for closure of existing dumpsites (not meeting any standards) and for diversion of waste (recycling of dry materials and reduction of landfill of biodegradable waste to reduce need for using the landfills not complying with sound waste management principles.
- It is necessary to comply with the national regulations, in particular with the manual for design and maintenance of existing and operating landfills, order No. 321-A of December 29, 2009 (Ministry of Urban Development). This manual requires that a minimum operation period of a landfill be 25 years, whereas the SWMP considered 20 years of operation. Thus, the SWMP should consider increasing the period of service for the landfills up to 25 years.
- Develop transparent and fair pricing for waste tariffs - The legal ceiling on waste tariffs should be removed to allow for qualified assessments of affordability and willingness-to-pay on individual basis. In addition, economic instruments should be introduced to support the recycling business.
- National and regional/municipal WMPs shall be prepared taking into account the Water Basin Management Plans that include 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. The Water Basin Management Plans have already been officially adopted for the 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.

Recommendations for the institutional arrangements:

- NWMA should closely coordinate and exchange data and information with relevant monitoring agencies, as well as the waste management department under the Ministry of Natural Protection.
- The Ministry of Nature Protection would retain its independent authority with respect to setting of environmental standards, environmental expertise and permitting along with enforcement. Its capacities should be strengthened to provide independent, comprehensive and regular inspections of all landfills and waste handling facilities.
- Precisely define the competences within the waste management system, including planning, implementation (operation), coordination, and enforcement, and ensure impartiality and transparency of institutions.
- The collection of municipal waste collection tariffs, currently a responsibility of the local governments, might be transferred to higher administrative level with the power to extract the tariff from municipalities regardless of whether they actually collect the full prescribed amount from the population (and thus allow the local authorities to structure payments according to local conditions, e.g. with respect to situation of disadvantaged groups).
- Municipalities need to continue collecting the waste fees, but it is necessary to fix the collection and control mechanisms: for example, through electronic payment system/ which will enable public administration bodies regularly carry out control (with adequate responsibility)
- It is important to commit significant portion of collected payments to the improvement of the waste management sector
- It is advised to propose targeted social assistance, including monetary assistance, as well as comprehensive social services packages, to the socially vulnerable and groups of population;
- Propose that the economic policy be developed for ensuring sustainable economic growth of communities located near the landfills and that the livelihood of the communities is not worsened (e.g., provide waste pickers with alternative and legalized job opportunities).

Recommendations related to key components of WMP:

Waste collection

- Registration and clean-up of the existing unregulated dumps, and re-cultivation of the areas free of waste should be included in the new municipal WMPs and financial funds need to be secured for executing the clean-up activities
- It is necessary to ensure fencing the existing and future landfills, and prohibit access to domestic and wild animals as well as human scavengers in order to prevent spread of waste and associated pollution, and waste fires.
- Ensure adequate technical standards and maintenance of the collection trucks to minimize emissions
- New facilities shall be set up at a respective distance from specially protected natural areas
- Minimize risks to public health through following means:
    - Conduct research of infectious and non-infectious diseases among population
    - Conduct research of infectious and non-infectious diseases among employees of communal services
    - Regular proper decontamination of waste transportation means
    - Improved sanitary – hygienic conditions of the workplaces of employees of communal services engaged in the processes of waste collection,

transportation and recycling: bathing facilities available, individual protective measures, etc.

Development of transfer stations

- Installation of the transfer stations in the degraded, e.g. already contaminated areas shall be preferred to placing the facilities on virgin land.
- Increase number of transfer stations in areas with more complex topographic and climatic conditions to ensure accessibility. Specifically, two local transfer stations in the South (Agarak-Meghri) and North (Goris) of Syuniq marz might not be sufficient to ensure good functionality of the Regional system for Syunik marz.
- Taking into consideration highland climate of the Republic of Armenia, obstruction on roads in some marzes during winter months, bad condition of roads etc. might require also consider different seasonal regimes of operation in regional/municipal waste management planning.
- The selected locations should not affect the environment of local communities and specially protected natural areas.
- Conduct audit and monitoring of transfer stations on a regular basis
- Climatic (wind, precipitation) and erosion conditions should be considered while designing the transfer stations.
- Minimize risks to public health through following means:
    - Installation of transfer stations in non-residential zones and maintaining a buffer zone
    - Occupational morbidity study among employees of communal services
    - Improved sanitary – hygienic conditions of the workplaces of employees of transfer stations engaged in the processes of waste collection, transportation and recycling: availability of bathing facility, individual protective measures, etc.

Development of new sanitary landfills

- It is recommended that the Plan considers the possibility to increase the number of the proposed sanitary landfills, especially in remote high mountain areas and complex climatic zones, such as Syunik marz.
- Ensure application of technical standards for site selection and design of new landfills (available aquifers, environmental protection zones, flow formation zones, recreational zones, floods, mudflows, erosion etc.), e.g.:
    - Conduct surveys towards proper and rational selection of the location of landfills, including considering already degraded and contaminated areas. Avoid agricultural lands, water lands, and forest areas, as well as flood-prone zones when defining landfill location.
    - A moderately steep relief should be preferred for sanitary landfills where possible.
    - Ensured 500m distance of facility from residential areas, setting up a minimum distance from lakes, rivers and, surface basins
    - Installation of artificial insulation layer in the absence of clay to prevent leakage of leachate from the landfill
    - Maintaining permanent supervision and control over areas of potential landfills, setting fines and public awareness-raising

  - Introducing operational guidelines for waste covering and depositioning for the waste site operators and staff
  - Ensure compliance with the Gov. Resolution No 64-N "On Criteria for Definition of Areas for Sanitary Conservation of Aquatic Ecosystems, Flow Formation, Conservation of Groundwater, and Identification of Water Protection Zones, Ecotones, and Inalienable Areas".
- Take into consideration the transboundary aspects related to impacts on water ecosystems (Debed River Basin), e.g. for the Expanded Vanadzor project to encompass all of Lori and major centers in Tavush marz envisaged in the WMP.
- Minimize risks to public health through following means:
  - Conducting occupational morbidity study among employees of communal services
  - Conduct of proper laboratory monitoring of air, soil, underground and surface waters in areas outside the landfills
  - Define the sanitary zones of the newly constructed landfills

Waste collection in poorly accessible rural areas

- Renovation and restoration of the access roads used for waste transfer should be considered when allocating funds and setting priorities for transport infrastructure planning at municipal and regional levels.
- Installation of waste disposal prohibition signs, installation of waste bins and awareness-raising of tourists in the areas of SPNAs, especially in the areas of ecotourism routes.
- Public awareness-raising and information on collection of waste in one place and through closed containers, which will prevent animals from dispersing waste.
- Preventing animal grazing on landfills and adjacent areas
- Use the trucks with adequate design (covered platforms) for the waste transportation to avoid additional pollution
- Renovation / reconstruction of roads especially to the remote mountainous regions and marzes/communities to undertake solid waste management, waste removal procedures
- Use garbage trucks capable of operating in poor roads conditions.

Considerations concerning alternative technological solutions: Mechanical Biological Treatment (MBT) and Waste-to-energy incineration

- It is recognized that the MBT is not a technology addressing the final waste disposal; it aims at reduction in the amount of waste as well as utilization of dangerous waste.
- Proper management of leachate (lining, collection etc.) during the MBT is necessary to ensure overall environmental benefits and reduced pollution of surface and groundwater. The Best-available-technology (BAT) shall be required for any MBT installation.
- Considering the incineration technology, the WMP notes that the residual product from flue gas cleaning is heavily contaminated with heavy metals and must be disposed of in special hazardous waste landfill. It is recognized that introduction of

waste incineration technologies is not a viable option given existing conditions in Armenia, and shall be considered only after all key components of waste management system are implemented and functioning.

Recommendations to Indicative supporting investment and TA packages/ Technical Assistance for institutional, legal, regulatory and PPP promotion, capacity strengthening, supporting waste reduction/diversion initiatives and public awareness rising.

- It is necessary to conduct measures towards knowledge and awareness development among the public and at schools. In particular, development of publicly accessible manuals, conduct of trainings and discussions aimed at public awareness raising and information about waste separate waste collection, waste minimization, linkages between waste management and air quality, water quality, climate change and GHG emissions, etc.
- Assistance is necessary for local authorities to ensure the capacity for preparation of municipal WMPs and their implementation. This will require substantial allocation of funds and/or mobilization of external assistance (donors).
- Capacity development will be necessary for sanitary landfill operators and their staff to ensure sound waste management practices and minimization of risks of accidental pollution and proper operation of environmental mitigation measures (e.g. leachate collection, green house gases utilization) and monitoring systems, as well as proper record keeping and reporting.

12. MONITORING

12.1. Approach to monitoring

SEA monitoring is an ongoing process, which will be undertaken continuously for the duration of the implementation of the WMP and should be integrated into the monitoring reporting cycle of the WMP. The available version of the WMP does not contain the provisions for frequency of monitoring and reporting, however it defines some monitoring directions and outlines that "*A National Waste Management Board to monitor the overall implementation of waste management in Armenia, monitor the performance of the NWMA, assess developments in the regions and discuss new initiatives nationally and regionally.*"

Thus, the overarching recommendation of the SEA concerning the monitoring in the WMP will be to develop a clear scheme with the indication of parameters / indicators to be monitor, the frequency and the assigned responsibility.

Based on good practice, it is assumed that the reporting period of the SWM could be one year and thus, the monitoring of SEA recommendations, as well as the environmental and health monitoring, is advised to be conducted and reported upon **annually by the RA Ministry of Territorial Administration and Development** (the implementer of the WMP).

It should be noted that the WMP represents a high-level strategic document providing priorities for further development of the solid waste management sector in the country, therefore, it can be expected that its implementation will be ensured through follow-up documents (e.g. regional waste management plans to set-up regional priorities, spatial plans to select locations of waste management facilities etc.). Thus, it can be assumed that many recommendations formulated by the pilot SEA can be only implemented at a further level of planning or at the project stage. In this light, it is also important – besides monitoring environmental and health effects of the WMP implementation – to monitor if and how the recommendations formulated by the pilot SEA are further implemented.

Therefore, the overall SEA monitoring scheme can consist of two parts:

1. The monitoring of the SEA recommendations (including monitoring and mitigation) i.e. how these recommendations are implemented, and
2. Monitoring of environmental and health effects of the WMP implementation to identify the adverse effects and propose remedial actions, if needed.

Both elements of the proposed monitoring scheme are described below.

12.2. Monitoring and reporting on SEA recommendations

Montoring and reporting on SEA recommendations should be ensured by the governmental agency implementing the SWMP.

It is recommended that the regular (annual) monitoring reports should be prepared during implementation of the SWMP and published. The reports should cover following information:

- The activities implemented during the reporting period.
- The relevant SEA recommendations and impact mitigation and monitoring measures
- How the relevant SEA recommendations and mitigation and monitoring measures have been implemented.
- Further comments and future actions.

The above information can be presented in a tabular format as shown in Table 24, which also includes several examples on the type of information to be included in the report.

Such scheme will provide an important basis for futher amendmends of the SWMP and related assessment.

Table 24. Monitoring of SEA recommendations

Activities implemented during reporting period	**Relevant SEA mitigation recommendation(s)**	**How SEA recommendations have been implemented**	**Comments/further action required**
Construction of landfill site in area XY was initiated	The landfill site should not be located in the areas with underground water resources.	Area XY is located approx. 3km from the underground water protected site. Also, likely effects on water will be analysed in detail in EIA – the results will be reported in next monitoring report.	Next monitoring report shall provide a summary of EIA conclusions regarding underground water resources.
	It is necessary to ensure fencing the existing and future landfills, and prohibit access to domestic and wild animals as well as human scavengers in order to prevent spread of waste and associated pollution, and waste fires.	The construction of fencing for two existing landfilles started in recent implementing period. This requirement was also included in the construction permit for new landfill in area XY.	Next monitoring report should provide information regarding finalized works on fencing for two existing ladnfills and report on ongoing consutrion for a new landfill in area XY.
Construction of transfer station in area ZY was finalized	Installation of the transfer stations in the degraded, e.g. already contaminated areas shall be preferred to placing the facilities on virgin land.	The transfer station in area ZY is located in the brownfield area.	Relevant SEA recommendation was fully considered when deciding about location of the transfer station in area ZY. As the construction was finalized, no further monitoring regarding this SEA

			recommendation is needed.
Construction of two Mechanical Biological Treatment (MBT) facility in location 1 and location 2	The Best-available-technology (BAT) shall be required for any MBT installation.	The BAT shall be applied for MTB facility in location 1, however not in location 2. However, MTB facility in location 2 shall comply will all legal requirements and environmental standards.	If still possible, the Ministry of Nature Protection should initiate communication with investor in location 2 to ensure the BAT is used.

12.3. Monitoring of environmental and health effects during WMP implementation

The establishment of a national system for monitoring of waste composition and flows is one of the core measures proposed by the WMP, and prerequisition of any further systematic progress of waste management in RA. The lack of credible baseline information is recognized as one of the key barrier for environemntaly sound waste management system and therefore addressed by the WMP with high priority. The SEA therefore focuses on formulating additional indicators capable of capturing side-effects of the WMP implementation (i.e. indicators beyond statistics on waste types, recycling volumes, etc. that are expected to be produced by the national waste registry established by the WMP). Also, an inventory of existing landfills, including non-official, will be conducted as a part of the WMP implementation. The SEA anticipates that waste statistics and inventory data will be published regularly and available for consideration in future planning.

Table below indicates additional indicators proposed by the SEA to allow for monitoring of potential environmental and health impacts of the WMP. It is proposed to carry out monitoring by reporting on a simple set of indicators, which enable positive and negative effects on the environment to be measured in conditions where there is not available reliable information on baseline conditions. The system can/should be gradually expanded in the future, along with improvement of capacities of national environmental authorities to carry out regular general monitoring of the quality of the environment.

Table 25. Environmental, social and health monitoring of the WMP

Environmental, social and health receptor	**Proposed indicator**	**Data source/responsibility**
Water	Level of water pollution (surface water, ground water) in the watersheds impacted by landfills • Nutrients	The Environmental Impact Monitoring Center SNCO (EIMC) of the MNP Implementing

Environmental, social and health receptor	Proposed indicator	Data source/responsibility
	• Pesticides • BOD_5 • Oil products • Heavy metals	organization/contractor
Water	Volume of untreated wastewater flow (m3/year) from landfills	Landfill operators
	Number of landfills without leachate collection	Municipal authorities
Air	Amount of energy captured from waste facilities / energy recovered.	Landfill operators
	Number of vehicle/kilometers made by waste trucks	Municipal authorities
Climate	Estimate of landfill gases (CO2 and methane) emitted/year from facilities	National reporting - National communication under the United Nations Framework Convention on Climate Change (Convention/UNFCCC), and the Kyoto Protocol (Protocol/KP)
Soil	Landfill space used (ha)	Landfill operators
	Remediated landfill area after closure (ha)	Landfill operators
Biodiversity and PAs	Annual amount of waste collected at PAs	PA authorities
Public Health and Social	• Number of complaints received from residents in relation to adverse effects of waste management operations on human health. • Percentage of population with regular solid waste collection • Over-due waste collection fees (total amount, number	Municipal authorities

Environmental, social and health receptor	Proposed indicator	Data source/responsibility
	of late payers) • Percentage of the solid waste that is burned openly • Workers employed in waste management industry • Work-related hospitalizations among waste management workers • Work-related injuries among waste management workers	Waste management operators

The specific indicators proposed above shall be regularly monitored and monitoring results analyzed, published and considered in the course of implementation of the SWM Plan. In addition, several broader measures are formulated below aiming at gradual development of the conditions allowing for more effective and environmentally sound waste management:

- In-depth medical research and morbidity studies of the employees engaged in the waste transportation and recycling processes,
- Morbidity studies of both infectious and non-infectious diseases among the population living in areas adjacent to landfills and containers of waste,
- Occupational morbidity studies of employees engaged in waste collection processes.
- Establishment of baseline for future analyses of atmospheric air quality, surface and underground water quality and soil pollution due to the existence of the landfill through the adjustement of national network of sampling points developed by the Environmental Impact Monitoring Center SNCO (EIMC) of the MNP (i.e. location of sampling points in the vicinity of waste management facilities, or at the roads used for intense waste transport)
- Establishment of monitoring of geological and hydrogeological conditions of the waste facilities locations, and associated risks/hazards of floods, soil-slides, soil degradation, snowdrifts etc.
- Adress the contamination of soil and water due to leakages from tailing ponds. In many areas of the country the pollution associated with mining significantly exceeds the maximum allowable concentrations and is the main source of contamination. It is necessary to conduct rehabilitiation of the tailings.
- Determine the methods for health related hazard assessment (Impact of solid waste in particular site/landfill),
- Initiate classification of solid waste according to the potential impacts on the environment and public health sectors,
- Develop and implement methods and algorithms for hygiene surveys to determine the degree of the hazards resulting from waste, landfills, and waste collection points. Microbiological, Bacteriological air research and data should be available collected from the territories adjacent to landfills and territories of waste container placement.

- Monitoring of used waste transportation fleet (typical vehicles are more than 10 years old and without emission catalyzers)
- Microbiological, Bacteriological research is necessary and data collected from the territories adjacent to landfills and territories of waste container placement. Further research studies and monitoring of target groups is needed to establish and clarify the causal link between the disease spread to link the health trends and the harmful impact of solid waste in the local conditions.

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APPENDICES

Appendix 1.

Report on Public Consultations on SEA Scoping Report on "Strategic Development Plan, Road Map and Long Term Investment Plan for the Solid Waste Management Sector in Armenia"

Background

Strategic Environmental Assessment (SEA) effectively promotes sustainable development by mainstreaming environment into economic development at a national and local level. 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 impacts are efficiently developed taking into account environmental and health impacts and considerations. SEA ensures 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.

The new initiative on piloting application of SEA for the Solid waste management sector in Armenia has been undertaken by the Ministry of Nature Protection, UNECE and Regional environmental center for Caucasus Armenia National Office within the frames of the "Greening Economies in the Eastern Neighborhood" (EaP GREEN) programme funded by European Union. The overall aim of a SEA pilot project is to build capacities in application of SEA procedures at national level and raise awareness of SEA benefits among various national stakeholders.

In the frames of the project **"Application of SEA to the "Strategic Development Plan, Road Map and Long Term Investment Plan for the Solid Waste Management Sector in Armenia''** and in accordance with requirements of the National law on EIA and expertize, series of public consultation meetings were organized in the regions/marzes of Armenia aimed to improve public awareness on possible environmental and health impacts as a result of implementation of **Strategic Development Plan, Road Map and Long Term Investment Plan for the Solid Waste Management Sector. Consultations were aimed to steer discussions and useful feedback from local communities and stakeholders on current SEA study,** as well as draw ideas, recommendations, concerns of the interested parties, local government, civil society, experts, professionals, citizens through public participation, improved local knowledge on environmental policies and current planning documents and strategies, In particular, local stakeholders and communities were provided with analysis on WMS and Strategic Development Plan/Roadmap on solid waste management sector, including its impact on biodiversity, water/groundwater resources, land, climate change, air pollution, socio-economic challenges, waste management, institutional and legal aspects as well as health hazards which might occur as a result of project implementation.

Information about Scoping and Scoping Report

The scoping is usually considered to be the initial analytical 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 results of scoping analyses and findings have to be summarized in the SEA Scoping Report[15].

[15] http://rec-caucasus.am/sea-scoping-report-2016/ (English version),

http://rec-caucasus.am/new-initiative-on-strategic-environmental-assessment-for-solid-waste-management-sector-in-armenia-hy/?lang=hy (Armenian version) (Annex 1, Announcement).

The Scoping in SEA for the Waste Management Plan entailed the following activities and analyses.

According to guidelines for preparation of the scoping report that was provided by the UNECE international consultants as support within the framework of the program, the scoping report should include:

- 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.

Purpose of Public consultations on SEA scoping report of Waste Management Plan

The purpose of this document is to gather feedback and recommendations, suggestions and concerns raised by local stakeholders with regards to implementation of the WMP, and analysis performed within the framework of the SEA Scoping Report. Public consultations served as a main tool for involvement of public authorities, civil society organizations, professional associations, business organizations, active citizens and experts into the process of identification of environmental and health risks related to WMP, including preventive measures, collection of relevant data, accumulation and synthesis of local knowledge and experiences on waste management, its institutional setting, current challenges and interests of the local population directly involved in the process. SEA consultation meetings were carried out in selected 4 regions of Armenia and in Yerevan to understand the possible links between the correspondent environmental and health issues and impact of the WMP and its further consequences for the communities and marzes where the project in planning to construct landfills and continue implementation of WMP.

Public consultation in Hrazdan, Kotayq region

Overview of the Public Hearings /Consultation Process

As per the RA Law on ‘’Environmental Impact Assessment and Expertise’’ (21.06.2014) and the governmental decision (19.11.2014) Public Hearings /Consultation meetings on five Public Hearings were carried out in the frames of SEA in 4 regions of RA and in Yerevan.

Local consultations on SEA Scoping report were announced 10 days prior the hearings, placed on the website of REC Caucasus, all local stakeholders were informed in advance on upcoming consultations with official letters and announcement. Draft of the Scoping report was placed on the website and links were provided to the public at least 10 days before each consultation meeting in each community and marz where the impact of Waste management Plan and the roadmap will be visible.

Reference Links:

The Final Scoping Report on SEA can be found on the official webpage of RECC:

www.rec-caucasus.am/sea-scoping-report-2016/

The Public Hearings in 5 regions of Armenia, Kotayk, Lori, Shirak and Syunik regions and Yerevan were scheduled as follows:

Dates:

1. Kotayk Region, Hrazdan city, Municipality of Kotayk /Aarhus Centre of Hrazdan – 5 August, 2016
2. Lori Region, Vanadzor city, Municipality of Lori /Conference Hall – 9 August, 2016
3. Shirak Region, Gyumri City, Municipality of Gyumri /Conference Hall – 11 August, 2016
4. Syunik Region, Kapan City, Municipality of Syunik /Conference Hall – 16 August, 2016
5. Yerevan City, City Hall – 19 August, 2016.

Official notification letters to the local municipalities informing on the aim and content of the scoping report, undertaken project were sent to all marzes and heads of municipalities.

Consultation issues

The consultation meetings were supposed to bring together ideas, issues and recommendations that are related to the sectors (institutional and legal aspects of solid waste management, land and water contamination, socio-economic problems, conservation of biodiversity, climate change, GHG emissions, waste, health hazards, etc.) in each of the regions which could be impacted by the WMP. Some of the issues and concerns were related to the human health, water quality, environmental issues, land, socio-economic impacts of waste management, increased charges for waste collection as a result of new waste system, bad waste management, sustainability, emissions, lack of data and study research, environmental protection activities, better access and transparency of control and monitoring, international and European standards to be considered within in the Waste Management Plan (WMP) and strategy, separated waste collection, environmental projects to be included in educational systems of the schools, lack of monitoring, waste sorting, absence of laboratories etc. All of the issues raised were discussed and considered by experts, and will be included for further elaboration in the final drafts of the SEA report.

Participants of Public Consultation Meetings

The following participants were engaged in the SEA consultation meetings in 4 regions and in Yerevan city. Stakeholders include representatives of NGOs which are actively engaged in environmental topics, and were able to raise appropriate concerns related to the WMP. Municipality representatives of each region were also engaged in the discussions, representatives of different departments, Environmental, Agricultural, Urban Development, chief specialists and experts were

also able to raise their concerns and draw relevant feedback and recommendations on Scoping report.

The list of stakeholders:

1. ***Kotayk Region, Hrazdan city***

   ‘’Hrazdan Aarhus Centre’’ coordinator

   ‘’Civil Academy’’ NGO director

   ‘’Healthy Environment’’ NGO director

   Hrazdan Municipality representatives from the Departments of Environment,

   Hrazdan Municipality representatives from Department of Agriculture,

   Hrazdan Municipality representatives from Department of Urban Development.

2. ***Lori Region, Vanadzor city***

   ‘’Vanadzor Aarhus Centre’’ representatives

   Vanadzor Municipality representatives, including from the Department of Environment and Agriculture

   Chief specialists of Lori Municipality

3. ***Shirak Region, Gyumri City***

   ‘’GeoFon’’ NGO director

   ‘’Civil Voice’’ NGO director

   Chief Specialist of Environmental Department of the Shirak Municipality, RA

   ‘’BioSofia’’ NGO

   ‘’Aarhus Centre’’ of Gyumri

   ‘’Civil Voice’’ NGO

   Municipality representatives

4. ***Syunik Region, Kapan City***

   ‘’Zangezur’’ NGO

   ‘’Kapan Aarhus Centre’’ Coordinator

   Municipality representatives

5. ***Yerevan City***

   ‘’For Sustainable Human Development’’ NGO director

   ‘’EcoLur’’ NGO director

   ‘’Yerevan Aarhus Centre’’ coordinator

‘’For the Nature’’ NGO

Yerevan Municipality representatives

SEA Scoping Report Public Consultation in Kapan, Syuniq

Responses and Clarifications on the comments and questions raised at the Public Consultation Meetings

Q = Questions/Concerns, R = Recommendations, F=Feedback

Note: The overview below is very useful. I would suggest including it in the SEA report with further explanation how the comments have been considered in SEA report (or WMP)

Gyumri Public Hearings, August 11, 2016

Q: ‘’Civil Voice’’ NGO Director Mr. Arsen Vardanyan expressed his concern regarding to the planned landfill construction in Benjamin Village near the historic archaeological site located in the vicinity of the predetermined area. They suggested conducting some site

research in the area prior to carrying out any construction works to prevent any possible threats of damaging the ancient historical archeological area.

F: The team members assured that the area will be researched further, and will be considered in the process of SEA finalization. The issue should be passed to the Ministry of Territorial Administration for further clarification.

Public hearing of SEA Scoping report on Waste Management Plan, Gyumri
Team Leader Nune Harutyunyan is responding to the feedback raised by stakeholders

R: Gyumri Aarhus Centre representative, Mr. Gevorg Petrosyan suggested developing a waste management policy documents and strategies at the national level indicating the appropriate strategies /priorities prior to the adaptation and implementation of any projects related to waste management.

F: UNECE SEA team leader Ms. Nune Harutyunyan accepted the importance of the issue raised by Mr. Petrosyan and assured that it will be included in the recommendations list for further discussion.

R: Regarding his concern about the impact of landfills on the climate change, Mr. Petrosyan offered doing estimations which will show the possible increase of emissions and take appropriate measures.

Q: Environmental Department Chief Specialist of RA Shirak Municipality Mr. Tigran Ananikyan and the leading specialist of the same department Ms. Seda Tumanyan were

concerned about the possible increase of garbage collection fees related to the construction of 5 new landfills in the regions and introduction of new garbage collection system.

F: SEA expert on Climate Change and Air Pollution, Mr. Manucharyan addressed to the question and said that according to the research the fees for garbage collection services will possibly increase 5-6 times, and in the future they will decrease eventually due to the improvement of the sectoral work and investments, better coordination and as a result of more efficient work of responsible agencies. He also said that it is important to do monitoring on waste sorting.

R: RA Shirak Municipality representatives offered setting differentiated fees for garbage collection for different social sectors; business sector can pay much higher service fees than the low-income social class.

R: Representative of ''Advisory Research Center'' NGO, Mr.Gharib Harutyunyan suggested to include monitoring data on SWM services in the report which is currently being undertaken by their NGO.

R. Nune Harutyunyan, SEA Team Leader, REC Caucasus, has suggested that the NGO provides their fresh data and it can be placed as supplementary information on public service quality in the report or supplementary info as an annex to the Scoping report.

Q: Another issue was raised by Mr. Gevorg Petrosyan about existence of a laboratory in the republic which would examine the harmful impacts of hazardous emissions from the plastic bottles production process.

A: Ms. Nune Harutyunyan said that the issue will be introduced to the representative of the Ministry if Health of RA.

F: UNECE SEA team leader Ms. Nune Harutyunyan addressed to Mr. Petrosyans` concern assuring that the issue raised by him will be introduced to the corresponding representatives of the Ministry of Health of Armenia in charge of this type of issues.

F: All the concerns, issues raised, recommendations and suggestions that were introduced during the Gyumri SEA Public Hearings were assured by the team members and SEA national experts to be introduced into the SEA final report in a separate section on stakeholders' feedback. It was agreed that the recommendations be included in the report as soon as they are finalized and approved.

Hrazdan Public Hearings, 5 August, 2016

Q: The head of Urban Development Department for Housing and Infrastructures Mr. Aram Virabyan introduced the Waste Management Plan of the Kotayk region, which is already being implemented in the region and expressed his concern about whether the discussed program will contradict or support the Waste Management Plan in Kotayk region.

F: As an answer to Mr. Virabyan`s question, the project team represented the differences between the two projects and the fact that the Kotayk Waste Management Program is included in the general Waste Management Program, thus there can be no contradiction between the two.

Q: Participants' main concern was that the project will result in increasing fees charged for waste collection, which will increase the already large burden on the low-income social class.

A: The team members addressed to the question and said that according to the research the fees for waste collection services will increase 5-6 times in recent years, and in the future they will decrease eventually due to the improvement of the sectoral work and investments, as a result of more efficient work.

F: The project implementation team accepted the raised concern about the possible increase of fees charged in the future.

Q: Hrazdan Aarhus Centre Director Ms. Anahit Mnatsakanyan, ‘’Healthy Environment’’ NGO Director Mr. Ashot Ohanyan and other participants were also curious about the issues related to the establishment of sanitary landfill zones, management and control, as well as about issues related to the environmental protection.

F: Experts and project team took the issue into consideration: it will be discussed and, in case of being approved by the team, will be included in the SEA report.

Public hearings on Scoping Report in Hrazdan

Vanadzor Public Hearing, 9 August, 2016

Q: The Head of Agriculture and Environnemental Department of RA Lori Municipalité Mr. Artak Demirchyan expressed his concern about the use of agricultural lands for landfill construction purposes. He noticed the issue to be an urgent concern and needs to be addressed in this respect.

Q: There was a question by the Head of Agriculture and Environmental Department of Lori Municipality of RA, Mr. Demirchyan about the quantities of landfills to be constructed.

F: The question was answered by the team members, who mentioned that 5 landfills are planned for construction.

Q: Chief specialist of the Department of Urban Development of Lori Municipality, Ms. Nune Khachatryan raised a concern related to the fact that in the Waste Management Plan relevant data on Spitak, Tashir and Stepanavan cities is missing, while they also need to be taken into consideration in the implemented studies because in the mentioned cities the solid household waste will possibly leave some impact on the lifetime of the landfill and generated garbage volumes. It was also suggested to make some changes in the Waste Management Plan (WMP) by prolonging the period of landfill operation from 20-25 years by increasing the landfill volume.

Q: The meeting participants raised the issueof possible fee increases as a result of new landfill construction in 5 sites of Armenia, and, thus suggested to review this issue and come up with clever solutions to avoid from increasing the already large burden of low-income social classes of the population.

F: Project implementation team accepted the raised concerns and recommendations. Experts and project team assured that all the issues will be discussed and considered during the further work.

Yerevan Public Hearings, 19 August, 2016

R: Representative of Health Department of the Yerevan Municipality Ms. Zarine Gedelyan made suggestion on newly constructed Nubarashen Landfill about plastic waste separation since this practice it is not being used currently within the waste management in Yerevan

R: Recommendations were also made by the Yerevan Municipality representatives for considering application ofinternational and European standards on waste sorting/separation in the Waste Management Plan (WMP) strategy..

R: The Head of Development and Investment Programs Department of Yerevan Municipality, Ms. Nune Sukiasyan also suggested to conduct studies on possible tariff increases and implement economic estimations, develop financial mechanisms through an integrated approach.

F : ‘’For Nature’’ NGO coordinator Mr. Hamlet Smoyan mentioned that economic mechanisms should also be elaborated to help in developing the ‘’green economy’’.

F: In relation to the discussion topic on ‘’green economy’’ UNECE SEA team leader, Ms. Nune Harutyunyan introduced to the participants one of the ongoing projects in Armenia which is ‘’Resource Efficient and Cleaner Production’’ RECP project which , among other goals, is aimed at promoting the ‘’green’’ mentality of business organizations, by reducing the hazardous emissions and waste within SMEs, promoting more resource efficient use, waste management, better production process control, environmental safety, etc. The participants of the meeting showed their interest in gaining more background on the project by obtaining some materials. Ms. Nune Harutyunyan mentioned that the information on the project can be found in the website of the project in Armenia.

R: Monitoring in the landfills is missing everywhere in Armenia. Taking this issue into consideration, there was a suggestion to carry out monitoring and collect relevant data and results which will help later implementation of sectoral management.

R: ‘Chairman of “For Sustainable Human Development” Karine Danielyan mentioned that there are issues related to the coordination and supervision in the waste sector which is one of the reasons why the waste management system in Armenia is lacking in many ways. She suggested to take those issues into consideration. She also has mentioned that UN 17 goals to transform our world, which Armenia has already joined, and those obligations are a good start for improving waste management strategies, public participation and consideration of environmental and health impact through SEA for all strategic documents and national policies. She has also mentioned that waste management, knowledge on these type of studies, like Scoping reports, should also be available for educational institutions and students.R: The Specialist of Environmental Department, Ms. Diana Grigoryan and the representative of Architecture and Urban Development of Yerevan Municipality Ms. Lusine Mkrtchyan recommended including educational programs in the educational system of schools enabling children to develop environmental behavior from early ages and to obtain environmental, ecological elementary knowledge.

R: There was a recommendation by the Yerevan Aarhus Center coordinator, Ms. Silva Avagyan to take measures to prevent the household and industrial wastes from being intermixed.




Yerevan Public Consultations – Scoping Report

F: The project implementation team and the experts accepted all the issues raised and submitted them for further discussion by appropriate authorities.

Summary

All public consultations meetings resulted in understanding the main concerns and issues presented within the SEA Scoping report and WMP, those can be included in the further policy and strategy development for the WMP in relation to SEA, as well as considered by the national and international SEA experts for further consideration and feedback in the SEA report. Participants were people representing their communities, people who are well-informed on the main threats, problems and other issues of their communities, interested parties and stakeholders. Thus the recommendations gathered here overall shows the present situation of

Armenia and the most important issues that need to be considered in final Strategic Environmental Assessment (SEA) report.

Annex 1: Announcement on Public Hearings

Հայտարարություն[16]

Հայաստանում ԿԿԹԿ ոլորտի Ռազմավարական զարգացման ծրագիր, Ճանապարհային քարտեզ և Երկարաժամկետ ներդրումային ծրագրի Ռազմավարական էկոլոգիական գնահատում փորձնական ծրագիրը նախնական գնահատման հայտի վերաբերյալ: Կովկասի տարածաշրջանային բնապահպանական կենտրոն հիմնադրամը՝ ՀՀ բնապահպանության նախարարության և ՄԱԿ-ի Եվրապահան Տնտեսական Հանձնաժողովի հետ համատեղ իրականացնում է «Հայաստանում ԿԿԹԿ ոլորտի Ռազմավարական զարգացման ծրագրի, ճանապարհային քարտեզի և երկարաժամկետ ներդրումային ծրագրի» Ռազմավարական էկոլոգիական գնահատման ծրագիրը:

Շրջակա միջավայրի վրա ազդեցության գնահատման և փորձաքննության մասին ՀՀ օրե նքի 21.06.2014թ. Հ0-110-Ն համաձայն, ինչպես նաև *ՀՀ կառավարության 19.11.2014թ. N 1325-Ն որոշման հավելվածի 3-րդ գլխի 31-րդ մասովսահմանված կարգով* 2016թ.
օգոստոսի 5-ին, ժամը 11.00-ին ՀՀ Կոտայքի մարզպետարանում, օգոստոսի 9-ին, ժամը 12-ին ՀՀ Լոռու մարզպետարանում, օգոստոսի 11-ին, ժամը 12-ին ՀՀ Շիրակի մարզպետարանում, օգոստոսի 16-ին, ժամը 11-ին ՀՀ Սյունիքի մարզպետարանում, օգոստոսի 19-ին, ժամը 12-ին Երևանի քաղաքապետարանում տեղի կունենան ծրագրի նախնական գնահատման հայտի, և փորձագետների կողմից մշակված ՌԷԳ մեկտեղման զեկույցի նախագծի հանրային քննարկումները: Գրավոր դիտողությունները և առաջարկությունները կարող եք ներկայացնել ծանուցումից հետո 15 աշխատանքային օրվա ընթացքում: Փաստաթղթերին կարելի է ծանոթանալ ԿՏԲԿ հայաստանյան գրասենյակի՝ www.rec-caucasus.am պաշտոնական կայքէջում:

[16] http://rec-caucasus.am/1232-2/?lang=hy

Appendix 2. Assessment of Likely Effects and Proposed Mitigation measures

Following scale was used for evaluation of likely impacts:

+2 Very significant positive likely impacts

+1 Significant positive likely impacts

0 No impacts

-1 Significant negative likely impacts

-2 Very significant negative likely impacts

? Likely impacts uncertain

Components of the Strategy *(please consult the full text of the Strategy)*		**Evaluation** *(symbols)*	**Environmental risks** *(please describe likely negative impacts on „your" area of expertiese, details and supporting analyses can be attached in separate section)*	**Environmental benefits** *(please describe likely positive impacts)*	**Mitigation measures** *(please suggest improvements of the Strategy and measures preventing or minimizing potential negative effects)*
2.5 Elements of the system					
2.5.1 Waste collection and recycling	**LEGAL**	+1	1. Recycling is not envisaged in the preliminary stage 2. Recycling methods may have negative effects 3. Waste collection and transportation may be impeded due to long distances, complex topography and climatic conditions.	1. Cleaning of littered areas, use of areas for other purposes 2. Disposal of irregular waste 3. Management of hazardous waste 4. Decrease of the massive pollution of the environmental compounds	1.Registration and cleaning of the existing dumps 2. Regular transportation of waste 3. Recultivation of the areas free of waste 4. Waste disposal from rivers, lakes and other areas Development of the respective normative methodological basis for the mentioned measures

	AIR, CLIMATE CHANGE AND BIODIVERSITY	+2	Partial distillation of waste is conducted by non-registered organizations and individuals: the particles of waste - paper, metal, glass and polyethylene - that are accepted by companies as raw materials for recycling, are removed from waste. The mentioned situation makes the overall waste less attractive and profitable to waste managing companies, which in its turn repels both local and international recycling companies since they do not expet profit.	The proper and qualified organization of waste management causes less harm to the environment and ensures clean areas, providing with additional jobs and raw materials rather than damaging the environment.	To make the landfills attractive it is necessary to create large landfills and exclude their access to random people such as waste collectors or livestock holders so that useful materials are not removed, landfills are not incinerated and infections are not spread. It is necessary to separate all the landfills, enclose them and prohibit access to domestic and wild animals. Establish Landfills at a respective distance from specially protected natural areas
	SOIL, GEOLOGY AND MINERAL ASSETS	+1	Unlicensed waste disposal by transporting vehicles[1]	Application of modern waste collection technologies and equipment Possibility of waste recycling[2]	Application of SWM control system[3]
	SURFACE AND UNDERGROUND WATER	-1	Increased number of waste collection vehicles will have negative impact on surface water resources due to increased car emissions and dust	Improved waste collection system and establishment of waste collection points with containers will reduce the amount of solid waste entering in adjacent water bodies, thus improving the water quality.	Ensure adequate service of the collection trucks to minimize emissions.
	HUMAN HEALTH	+1	1. Increase of infectious and non-infectious diseases among population 2. Pollution of lands (soil and air) throughout the waste collection process 3. Increase of infectious and non-infectious diseases among employees of communal services 4. In the initial stage of the project waste recycling is not envisaged	1. Decrease / elimination of disseminators of infectious diseases (rodents, insects) in residential areas and buildings	2. Research of infectious and non-infectious diseases among population 3. Research of infectious and non-infectious diseases among employees of communal services 4. Proper decontamination of waste transportation means 5. Improved sanitary – hygienic conditions of the workplaces of employees of communal services engaged in the processes of waste collection, transportation and recycling:

					bath conditions, individual protective measures, etc.
	SOCIAL AND ECONOMIC ASSESSMENT	+2	• Existence of a cemetery with severely hazardous pesticides in the nearby landslide soils • Expansion of the territories for landfills at the expanse of agricultural lands • Existence of the extremely dangerous toxic waste dump in the landslide areas nearby settlements • Territorial expansion of garbage dumping sites at the expense of agricultural land (due to illegal waste dumping) • Spreading of waste smell within the radius of 500-1000 meters from garbage collectors • Collection of bread and food residue for pigs feeding from the landfills and dumps – risks to public health • Loss of income by the active waste pickers •	Clean area, clean environment Regular waste collection and proper management, Improved environmental and sanitary situation	• Conservation of dangerous toxic waste dump in the landslide areas nearby settlements • Elaboration of a spatial plan for the installation of landfills for each particular pilot site • Settlements in which the waste collectors are located at a distance of 500-1000 m, / in about 25% of villages / • Regular monitoring of landfill construction in accordance with environmental, health and safety regulations and international/EU standards • Organization of waste recycling and restriction of access to the landfilled waste • Legalization of waste /recycling market/employment opportunities for waste pickers and nearby community dwellers in accordance with environmental, health and safety regulations and standards • Capacity-building, awareness and education of waste collectors and community dwellers on waste management practice, standards (environmental, health and safety)
2.5.2 Transfer stations	**Waste**	+1	1. Insufficient number of containers 2. Difficulties with transportation 3. Complex topographic and climatic zones	1. Regulated waste disposal 2. Use of small waste disposing vehicles that have less negative impact	Installation of the transfer stations in the degraded, dirty areas Increase of transfer stations in complex topographic and climatic zones to ensure accessibility

				3. Reduction of dirt 4. Regulated quick transportation, improvement of the sanitary conditions	
	AIR, CLIMATE CHANGE AND BIODIVERSITY	+1	The proper selection of their location remains critical since they can be located in areas subject to landslides, in seismic zones or highland areas, while the downward flow of surface waters is a source of spread of infections	Positive impact can be expected since transfer stations can accumulate waste placed in the vicinity as well as the newly disposed waste, freeing the mentioned areas which can have positive impact on environment.	The selected areas should be remote from communities and specially protected natural areas.
	SOIL, GEOLOGY AND MINERAL ASSETS	+1	Alienation of lands and pollution[4]	Reduction of polluted areas[5]	Conduct of audit and monitoring[6]
	SURFACE AND UNDERGROUND WATER	-1	Transfer stations may become as additional sources of surface and groundwater pollution if not located in suitable areas, avoiding the sanitary zones of aquatic ecosystems, flow formation zones, water protection zones, ecotones and inalienable areas.	Transfer stations will allow	Refer to the Government Resolution No 64-N "On Criteria for Definition of Areas for Sanitary Conservation of Aquatic Ecosystems, Flow Formation, Conservation of Groundwater, and Identification of Water Protection Zones, Ecotones, and Inalienable Areas" (the details are in the Scoping Report). Climatic (wind, precipitation) and erosion conditions should also be considered while designing the transfer stations.
	HUMAN HEALTH	+1	• Pollution of transportation routes and dissemination of possible diseases during the transportation process • Pollution of new areas through organic, chemical pollutants and viruses of infectious diseases • Increase of infectious and non-infectious diseases among employees of communal services	• Exploitation of modernized waste collection vehicles with low capacity • Quick removal of waste from residential buildings	• Installation of transfer stations in non-residential zones • Occupational morbidity study among employees of communal services • Improved sanitary – hygienic conditions of the workplaces of employees of transfer stations engaged in the processes of waste collection, transportation and recycling: bath conditions, individual protective measures, etc.

	SOCIAL AND ECONOMIC ASSESSMENT	+1	Community impact with long-term effects	---	Selection of the location of the transfer stations, maintaining the buffer zones, secure environment and sanitary conditions for the nearby communities and waste workers
2.5.3 Sanitary landfills	**LEGAL**	+2	Selection of the area: 1. Contamination of the specially protected areas 2. Contamination of the residential areas 3. Contamination of the fertile layer of the land 4. Contamination of underground and surface waters 5. Long distance to the sanitary landfills	1. Creation of manageable waste dumps 2. Enforcement of coordinated control 3. Elimination of non-manageable waste dumps	1. Ensured distance from the specially protected areas 2. Ensured 500m distance from residential areas 3. Selection of degraded contaminated areas 4. Exclusion of agricultural lands and forest areas 5. Ensured distance from lakes, rivers and, surface basins 6. Installation of artificial layer in the absence of clay 7. Increase of sanitary landfills in complex topographic zones
	AIR, CLIMATE CHANGE AND BIODIVERSITY	+1	Sanitary landfills will have negative impact on environment should they be placed close to communities and SPNAs.	As a positive effect, waste will not be accumulated in the vicinity of small and medium-sized landfills and the environment will be clean from waste.	Control over areas of potential landfills, setting fines and public awareness-raising
	SOIL, GEOLOGY AND MINERAL ASSETS	+1	Accumulation of large amount of garbage adjacent to residual areas Direct and indirect impact on neighboring population Loss of land areas of adjacent communities[7]	Development of sanitary polygons in line with best practices [8]	Implementation of waste covering and depositioning activities [9]

	SURFACE AND UNDERGROUND WATER	-2	Sanitary landfills may become as additional sources of surface and groundwater pollution if not located in suitable areas, avoiding the sanitary zones of aquatic ecosystems, flow formation zones, water protection zones, ecotones and inalienable areas. Risk of leachate leakages.	Properly organized sanitary landfills will reduce the amount of waste dumped to the river banks in the communities where landfills do not exist and waste collection is not organized properly.	Proper lining to prevent groundwater pollution due to leachate leakages. Avoid flood-prone zones when defining landfill location. Ensure compliance with the Gov. Resolution No 64-N "On Criteria for Definition of Areas for Sanitary Conservation of Aquatic Ecosystems, Flow Formation, Conservation of Groundwater, and Identification of Water Protection Zones, Ecotones, and Inalienable Areas".
	HUMAN HEALTH	+1	1. Pollution of new areas, soil, underground and surface waters and atmospheric air 2. Certain segments of population will undergo certain level of impact which will imply emergence of new issues in target areas	1. Limited pollution of air, soil, underground and surface waters in areas adjacent to the landfills due to setting the sanitary zone 2. Limited access of residents and animals 3. Many landfills with highly insufficient sanitary-hygienic conditions are conserved and closed.	1. Occupational morbidity study among employees of communal services 2. Conduct of proper laboratory monitoring of air, soil, underground and surface waters in areas outside the landfills
	SOCIAL AND ECONOMIC ASSESSMENT	+1	Being very close to the residential areas	Availability of waste-free areas, lack of garbage scattered around	Conduct surveys towards proper and rational selection of the location of landfills
2.5.4 Waste collection in poorly accessible rural areas	**LEGAL**	+1	1.Distance of the hardly accessible rural area 2. Road obstructions in bad weather conditions	Improvement of the sanitary conditions of the areas	Renovation and restoration of the roads
	AIR, CLIMATE CHANGE AND BIODIVERSITY	+1	Unorganized waste in SPNAs contributes to the pollution of the natural environment and spreading of infections through animals. In winter months the movement of	There will be clean SPNAs, spreading of infections through animals will be prevented. The organization of waste management contributes to the	Installation of waste disposal prohibition signs, installation of waste bins and awareness-raising of tourists in the areas of SPNAs, especially in the areas of ecotourism routes.

			vehicles is hindered due to closure and freezing of roads, as a rsult of which waste is not collected for days, sometimes for weeks. Due to the highland location the fuel costs increase which, in its turn, adds to the costs of waste collection and further pollutes the environment.	increase of waste-free areas and the collected materials get the opportunity of being recycled.	Public awareness-raising on accumulating waste in one place and through closed containers, which will prevent animals from dispersing waste. Organization of animal grazing in areas remote from the areas of landfills.
	SOIL, GEOLOGY AND MINERAL ASSETS	+1	Unlicensed waste disposal by transporting vehicles[1]	Elimination of irregular landfills and reduction of environmental damage[10]	Application of SWM control system[3] Enhanced responsibilities of community authorities[11]
	SURFACE AND UNDERGROUND WATER	-1	Rural collection points have the risk of polluting adjacent water bodies if their location is not appropriate or if not maintained properly.	Availability of waste collection points in rural areas will significantly reduce pollution of surface water by solid waste, considering that currently significant pollution comes	Consider the above mentioned criteria while selecting the location for rural collection points. Make sure that the trucks with adequate design (covered bodies) are used for the waste transportation to avoid additional pollution
	HUMAN HEALTH	+2	1. Poor conditions of roads in rural areas, difficult accessibility depending on weather conditions 2. Availability of small amount of waste	1. Improvement of sanitary – hygienic state of the area	1. Renovation / reconstruction of roads 2. Use of high-road garbage trucks
	SOCIAL AND ECONOMIC ASSESSMENT	+1	Protraction of waste disposal activities due to the difficult location	Reduction of stench, increase of waste-free areas	Construction of more spacious landfills
2.6 Alternative solutions					
2.6.1 Mechanical Biological Treatment (MBT)	**LEGAL**	-1	Organized and controllable contamination of the environmental compounds / air, water, land, etc /	Reduction of incontrollable long-term contamination Organized and controllable emissions	EIA implementation, detailed assessment, envisaged measures, decreased contamination

	AIR, CLIMATE CHANGE AND BIODIVERSITY	+1	Using best methodologies of MBT the negative impact on environment can be reduced Additional expenses and MBT facilities/ capacities are needed for screening / sorting techniques to divide residual municipal waste into a recyclable material stream and a non-recyclable residual waste stream disposed to landfill MBT facility has to be designed and planned with additional budget State-of-the-art technology in global use including pollution control technology	MBT Reduces the mass of the input waste through stabilisation / composting processes (by ~20%) and makes an input for reduction of GHG and other emissions Can increase calorific value of waste through drying / separation Can help generate energy from waste (although additional planning and costs are needed)	Measure realistic options for using MBT (i.e. reduced or minimal risk to environment, human health), economic benefits, needed capacities Availability of proven and beneficial technology Waste separation and recycling using MBT should be based on current capacities and needs/potential of each landfill facility, Currently no research is done on potential of using MBT facility for each landfill
	SOIL, GEOLOGY AND MINERAL ASSETS	+2	-	Considerable decrease of the amount of waste accumulated in the polygon Reduction in the amount of biologically degradable waste Prevents access of dangerous waste into the polygon[12]	MBT is not a final option towards waste elimination; it solves the issues of reduction in the amount of waste as well as utilization of dangerous waste. Best practices envisage either MBT or incineration. I think the best solution from the viewpoint of rational utilization of soil is RDF (Refuse-derived fuel) for the purposes of energy generation.
	SURFACE AND UNDERGROUND WATER	+1	Poor management of leachate during the MBT is a risk.	MBT reduces the amount of biodegradable waste, thereby reducing the leachate. It also prevents potential hazardous waste contaminants such as batteries, solvents, paints, light bulbs etc. to reach the landfill sites.	Proper management of leachate (lining, collection etc.) during the MBT will lead to overall environmental benefits and reduced pollution of surface and groundwater.
	HUMAN HEALTH	-1	1. These are not self-decontaminating processes and microorganisms are not being destroyed	1. Reduction of the amount of waste and emission of filtrate, methane and	1. Air disinfection during the mechanical process and after it, before being emitted to the

			2. During the mechanical destruction of non-decontaminated waste pathogenic microorganisms and aerosols will be emitted to the environment creating a real threat to the employees and the environment	greenhouse gases into the air 2. Prevention of the transfer of specific household waste (batteries, lamps containing mercury, etc.) to the landfill and their neutralization 3. Makes the waste unrecognizable, including needles and syringes, thereby reducing the likelihood of puncture	environment 2. Regular disinfection of grinding and mixing devices 3. Research on impact of using MBT on human health should be undertaken (including dioxin emissions, waste sorting and separation, processing, recycling)
	SOCIAL AND ECONOMIC ASSESSMENT	+2	Utilization of the fruitful layers of soil due to the mechanical treatment, change of the landscape	Reliable waste conservation	Proper selection of areas and landscape
2.6.2 Waste-to-energy incineration	**LEGAL**	-1	Direct impact on atmospheric air Indirect impact on other environmental compounds	Energy generation Organized emissions	EIA implementation, detailed assessment, envisaged measures, decreased contamination
	AIR, CLIMATE CHANGE AND BIODIVERSITY	+1	Pollution of environment and damage to biodiversity, additional air pollution with unwanted gases Negative health impact Not effective for landfill facilities with weak air pollution control	Waste separation/ recycling (glass, paper, metal) Waste to energy generation Thermal processes Incineration, industrial combustion, advanced waste-to -energy technologies reducing GHG emissions, costly but effective mitigation potential in waste sector (short term effect)	Secure technologies for waste burning /incineration with reduced or no damage to environment and human health Required control over toxic emissions and preventive measures (dioxin, acids, heavy metals, etc.)

	SOIL, GEOLOGY AND MINERAL ASSETS	+2	Pollution of atmospheric air Pollution of adjacent and neighboring lands due to the depositioning of compounds emitted to the atmosphere.	Considerable decrease of the amount of waste accumulated in the polygon [13]	MBT is not a final option towards waste elimination; it solves the issues of reduction in the amount of waste as well as utilization of dangerous waste. Best practices envisage either MBT or incineration. I think the best solution from the viewpoint of rational utilization of soil is RDF (Refuse-derived fuel) for the purposes of energy generation.
	SURFACE AND UNDERGROUND WATER	-1	Water abstraction for gas cooling processes in the process of incineration. Risk of pollution of water resources due to incineration gas emissions.	Reduced amount of waste will need less area for landfills and, subsequently, less pollution risks.	The WMP notes that the residual product from flue gas cleaning is heavily contaminated with heavy metals and must be disposed of e.g. in special hazardous waste landfills. It would be useful to provide more details regarding the referred special hazardous waste landfills.
	HUMAN HEALTH	-2	1. Pollution of the atmospheric air 2. Application of old technologies as well as violations of technological processes lead to mass pollution of the atmospheric air causing carcinogenic and embryo, genetic mutations through stable organic pollutants 3. Health damage to people working in the given field	1. Reduction of the amount of waste as well as areas designated for landfills 2. Destruction of agents and transmitters of infectious diseases	1. Occupational morbidity study among employees of communal services 2. Conduct of monitoring of air pollutants 3. Application of new furnaces in line with the guidelines of Stockholm Convention
	SOCIAL AND ECONOMIC ASSESSMENT	+1	Air pollution, emission of undesirable gases into the environment	Energy generation, neutralization of waste	Application of mechanical and other filters

3.3 Recommendations for adjustments (of Institutional Framework)

3.3.1 Changes in the legal/regulatory Framework:

Approximation of EU legislation (to mirror at least the most important provisions of EU legislations.)	**LEGAL**	+2	1. Absence of waste sorting 2. Absence of recycling 3. Emergence of dioxins due to combustion	1.Sanitary cleaning of the areas, elimination of unorganized waste dumps .	Gradually replace waste accumulation with sorting, recycling and re-use Control from the moment of waste emergence to the final recycling stage Approximation of RA legislation to the provisions of EU legislation
	AIR, CLIMATE CHANGE AND BIODIVERSITY	+1	No risks	Established waste management polices and institutional frameworks to assure that waste management is carried out without endangering human health, without harming the environment, biodiversity, pollution of water, air, soli, damage of ecosystem (flora and fauna), Reduced or no harm to the environment and human health, absence of odours, toxic substances, etc.	DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 November 2008 on waste and repealing certain Directives Article 13. Protection of human health and the environment Necessary measures to ensure that waste management is carried out without endangering human health, without harming the environment and, in particular: (a) without risk to water, air, soil, plants or animals; (b) without causing a nuisance through noise or odours; and (c) without adversely affecting the countryside or places of special interest.
	SOIL, GEOLOGY AND MINERAL ASSETS	+1	SW is not sorted before reaching the landfills, it is envisaged to be buried in the sanitary landfill, which can negatively impact the pollution of land and other natural resources.	SWM envisages sorting and squeezing waste in transfer stations, as a result of which the space for landfills will somewhat decrease. SWM allows for collection of sorted waste in places of their occurrence in the future.	According to EU directive on landfills it is required to conduct events, follow procedures and guidelines to prevent or mitigate the negative effect of waste on environment and human health, which is not envisaged at the moment. To achieve this it is necessary to define similar requirements in RA, including waste sorting before it reaches the

					landfills, gradual reduction of joint removal /mixing dangerous waste with non-dangerous waste/ as well as monitoring upon the closure of the landfills and their care/maintenance after the closure.
	SURFACE AND UNDERGROUND WATER	+1	There is no negative impact, but local specifics should be considered to make legislation changes realistic and enforceable	Adequate legislation is the prerequisite for improved waste management. It will, definitely, have positive effect on water resources as well.	-
	HUMAN HEALTH	+2	1.Absence of waste sorting 2. Absence of waste recycling 3. Pollution of air through stable organic pollutants	1. Sanitary cleaning of areas	1. Amend the strategy envisaging waste sorting and recycling
	SOCIAL AND ECONOMIC ASSESSMENT	+2	Absence of respective infrastructure	Waste collection in line with environmental norms	Proper action planning
Setting targets for closure of existing dumpsites and for diversion of waste (recycling of dry materials and reduction of landfill of biodegradable waste).	**LEGAL**	+1	Great quantity of the existing landfills Existence of unsorted waste	Cleaning and restoration of the sites	Waste management law shall be amended based on provisions regulating waste reduction, sorting and recycling. Waste collection sites as well as waste storage standards shall be defined by a respective legislative act.
	AIR, CLIMATE CHANGE AND BIODIVERSITY		There are no observeable risks.	This will have positive impact on environment, air, reduce emissions, positive impact on CC	Recultivation of areas

	SOIL, GEOLOGY AND MINERAL ASSETS	+2	There are no observeable risks.	Considerable decrease of polluted land surfaces. Circulation of recultivated lands.	Monitoring of proper organization of recultivating activities.
	SURFACE AND UNDERGROUND WATER	+1	No negative impact on water.	This will have positive impact on surface and groundwater resources quality.	
	HUMAN HEALTH	+2	1. Large number of organized and unorganized landfills filled with various types of waste (including, toxic, agricultural, and medical)	1. Recultivation of areas	1. Waste sorting
	SOCIAL AND ECONOMIC ASSESSMENT	+2	Reduction of the amount of waste	Reduced environmental pollution	Proper definition of waste processing volumes
Precisely define the competences within the main functions of **planning, implementation (operation) and enforcement and ensure impartiality and** **transparency of institutions.**	**LEGAL**	+2	Not specified responsibilities of the authorized bodies Insufficient control Insufficient responsibility	-	Legally define the authorized bodies of the waste management sector, their authority, liabilities and responsibilities. Legally define the controlling bodies and set respective responsibilities. The body regulating waste management and control shall be defined by law.
	AIR, CLIMATE CHANGE AND BIODIVERSITY		Not specified responsibilities of the authorized bodies Insufficient control and clear functional separation of responsibilities in waste management sector, including agencies, municipalities and private/waste collectors Absence of waste separation functions, control over emissions, lack institutional and regulatory structures	Ensuring the execution of liabilities due to clear definition of responsibilities	Ensuring the execution of functions, defined liabilities due to clear definition of responsibilities Clear separation of powers and waste management functions between stakeholders, private sector, government agencies,

			with clearly identified mandate and long – term waste management, recycling strategy		
	SOIL, GEOLOGY AND MINERAL ASSETS	+2	Conflict of interest between different departments both during the planning processes as well as related to their use upon landfill closure and recultivation.	Ensuring the execution of liabilities due to clear definition of responsibilities.	Conducting legislative amendments (clearly defining the legal order of transfering recultivated/restored lands from one department into another, etc.)
	SURFACE AND UNDERGROUND WATER	+1	No negative impact.	Clear definition of functions will have positive impact on water resources and the environment in general.	-
	HUMAN HEALTH	+2	1. Poor control 2. Unclear separation of functions of the authorized bodies	-	1. Legislative reform
	SOCIAL AND ECONOMIC ASSESSMENT **There are few institutional structures for the promotion and planning process while their capacities are limited.In such a case it is difficult to ensure the objectivity and transparency.**	-1	Deviations from the effective waste management methods	As a result of waste management implementation in line with environmental norms, considerable reduction of pollution with solid waste	Development of correct programs and activities
The legal ceiling on waste tariffs should be removed to allow for qualified	**LEGAL**	+1	Absence of the payment system Absence of legal basis regulating the economic mechanisms to support the recycling businesses		Develop respective legal regulatory basis. Development of respective capacities / implementing and controlling bodies /

assessments of affordability and willingness-to-pay on individual basis (see 5.2). In addition economic instruments should be introduced to support the recycling business.	**AIR, CLIMATE CHANGE AND BIODIVERSITY**		There are no observable risks.		
	SOIL, GEOLOGY AND MINERAL ASSETS	0	There are no observable risks.	-	-
	SURFACE AND UNDERGROUND WATER	+1	No negative impact.	Economic assessment and use of appropriate instruments will have positive impact.	-
	HUMAN HEALTH	-	-	-	-
	SOCIAL AND ECONOMIC ASSESSMENT	+2	Ignoring environmental norms	Definition of corresponding waste tariffs as per waste volumes	Definition of the volumes of waste generation and recycling, Develop transparent and fair pricing for waste tariffs
3.3.2 Changes in the institutional arrangements:					
National Waste Management Authority (NWMA)" established under the Ministry of Territorial Administration	**LEGAL**	+2	-	-	-
	AIR, CLIMATE CHANGE AND BIODIVERSITY	+1	There are no observable risks.	Monitoring and emission/air pollution control Waste management, landfill construction and management with no or reduced impact on biodiversity, extinct species, specially protected areas and monuments	Clear definition of powers, functions, responsibilities Co-operation with private sector companies, communities and municipalities Support to enabling polities, infrastructure and practical use of waste separation, waste management practices in line with international and EU standards
	SOIL, GEOLOGY AND MINERAL ASSETS	+1	There are no observeable risks,	Monitoring of land resource use.	Separation of powers, defining the responsibilities.

	SURFACE AND UNDERGROUND WATER	+1	No negative impact.	Designation of a specific authority for waste management will bring positive impact.	NWMA should closely coordinate and exchange data and information with relevant monitoring agencies, as well as the waste management department under the MNP.
	HUMAN HEALTH	+1	No potential risks	Cooperation with the health authorities, which will lead to positive changes	Clear definition powers of newly created body
	SOCIO-ECONOMIC ASSESSMENT **The expansion of the functions of responsible agency**	+2	Ignoring environmental norms	Improvement of waste management process	Identification of all aspects related to Socio-economic sphere related to environmental norms
The Ministry of Nature Protect would retain its independent authority with respect to setting of environmental standards, environmental expertise and permitting along with enforcement. Its capacities should be strengthened to provide independent, comprehensive and regular inspections of all landfills and waste handling facilities.	**LEGAL**	+2	Absence of independent and regular control	Improvement of the waste management system	Separation of the liabilities, clarification and setting of responsibilities For the purposes of easing the process it is necessary to develop SEA guidelines that will help state and local government agencies in developing and implementing SEA national guidelines that will present the SEA process step by step, development and finalization of the documents, as well as the description of the responsibilities (terms of reference) and functions of the responsible partners.
	AIR, CLIMATE CHANGE AND BIODIVERSITY	+1	There are no observeable risks.	Environmental standards, regulation and increased capacity will have positive impact.	
	SOIL, GEOLOGY AND MINERAL ASSETS	+1	There are no observeable risks.	Capacity development can positively impact land use.	-
	SURFACE AND UNDERGROUND WATER	+1	No negative impact.	Environmental standards, regulation and increased capacity will have positive	-

				impact.	
	HUMAN HEALTH	+1	There are no potential risks	Independent and full control/monitoring will have a positive impact	-
	SOCIAL AND ECONOMIC ASSESSMENT	+2	Environmental risks are becoming almost zero	The entire process of waste removal in the pilot regions will be implemented in accordance with environmental standards	Regular meetings with the relevant structures of various departments, joint discussions Integration of all concerned structures of the Ministry of Nature Protection within the management process conducted by responsible agency
The collection of tariffs, currently a responsibility of the local governments, may have to be placed at a higher level with the power to extract the tariff from municipalities whether they collect or not as the agent.	**LEGAL**	+1	Fee collection by the higher circles (from around 900 communities) are hardly possible without municipalities	Regular implementation in waste collection	Municipalities need to continue collecting the waste fees, but it is necessary to fix the collection and control mechanisms: for example, through electronic payment system/which will enable public administration bodies regularly carry out control (with adequate responsibility)
	AIR, CLIMATE CHANGE AND BIODIVERSITY		The issue of collection of tariffs should be regulated by subsequent waste management regulations and strategies		
	SOIL, GEOLOGY AND MINERAL ASSETS		It is not possible to predict until it is clear which agency the powers will be transferred to.	-	-
	SURFACE AND UNDERGROUND WATER	?	Institutional changes in tariff collection may either improve or worsen the collection rates. However, at this point the impact of this component of the Strategy on water/groundwater resources is uncertain.	The impact of this component of the Strategy on water/groundwater resources is uncertain.	It is important to suggest a mechanism allowing to direct a portion of collected payments to the improvement of the waste management sector.

	HUMAN HEALTH	?	There could be potential risks if collection fees are increased.	Benefits are not expected since the collection system currently operational	A part of collected waste fees can be directed to the improvement of the waste collection process
	SOCIAL AND ECONOMIC ASSESSMENT	+2	The system of tariffs may have positive impact of improved waste collection practice, however it can also have negative impact on vulnerable groups of population which will be unable to pay for higher tariffs, differentiated approach should be used in tariff collection system	Effective solutions in terms of adequate tariffs on waste collection	
5.3.1 Primary investment packages					
Regional collection system for the southern region with no investments for landfill (12 million EUR total, 7.3 million EUR initial).	**LEGAL**	Existence of unorganized landfills	Organized and regular waste disposal Considerable decrease of impact on the environment	Implementation of EIA and expertise for all investment packages as stipulated by the RA legislation	Existence of unorganized landfills
	AIR, CLIMATE CHANGE AND BIODIVERSITY	+1	There is a risk that with no investment waste collection process can not be organized systematically, and will be spontaneous	- uncertain	Calculate economic benefits and efficiency of the regional collection system with no landfill
	SOIL, GEOLOGY AND MINERAL ASSETS	+1	Unclear since the landfill deployment location is not clearly known.	Elimination of irregular landfills and reduced risk of soil pollution.	Monitoring of the waste transfer process to prevent waste disposal in not licensed areas. Development of recultivation plans for the exisiting landfills and monitoring of the recultivation process.
	SURFACE AND UNDERGROUND WATER	?	Uncertain	Uncertain	-
	HUMAN HEALTH	?	illegal landfills will continue to operate	regulated waste disposal	Strengthening supervision over the transportation process

	SOCIO-ECONOMIC ASSESSMENT **Differences between the density of populations and socio-economic situation within communities located in the Southern regions**	+2	Differences between the density of populations and ignoring the social economic situation of being different	Relevant waste management in all regions according to all environmental requirements	Identify specific measures/activities taking into consideration all regional, environmental and social-economic specificities of the regions
Expanded Kotayk project with collection/transfer capability for Gegharkunik marz (23 million EUR total, 8.3 million EUR initial).	**LEGAL**	+2	The existence of non-regulated landfills	Organized, regular waste disposal Considerable reduction of impacts on the environment.	Separate EIA and expertise implementation for investment plans in accordance with RA legislation procedure Fix requirements of SEA recommendation and requirements in EIA reports
	AIR, CLIMATE CHANGE AND BIODIVERSITY	**+1**	Will be clear after selection of polygon	Elimination of irregular landfills and reduced risk of pollution Cleaning of the territory of Sevan National Parl	Clarify the issue of the waste collection scheme for Sevan National Part
	SOIL, GEOLOGY AND MINERAL ASSETS	+1	Unclear since the polygon location is not clearly known.	Elimination of irregular landfills and reduced risk of soil pollution.	Monitoring of the waste transfer process to prevent waste disposal in not licensed areas. Development of re-cultivation plans for the existing landfills and monitoring of the recultivation process.
	SURFACE AND UNDERGROUND WATER	?	This component envisions adding a collection/transfer infrastructure in the Sevan area. Risks may include pollution of the Lake if the infrastructure is not properly located or maintained.	Improved waste collection in Lake Sevan basin will have positive environmental impact on water resources.	Need more details to assess the impact.
	HUMAN HEALTH	+1	Potential pollution of Lake Sevan from the road transportation	Lake Sevan as the most reliable resource of drinking water/water reservoir	Strengthening supervision over the transportation/transfer process

	SOCIO-ECONOMIC ASSESSMENT **Take into consideration that Gegharkunik province is the largest regions in the country both in terms of territory and population.**	+2	The considerable part of Gegharqunik province is the "Sevan National Park" area and wrong organization of the waste management/collection process can ruin the area	Correct implementation of solid waste management within entire area	Develop action plan for two regions based on peculiarities of those
Expanded Vanadzor project to encompass all of Lori and major centers in Tavush marz (21.3 million EUR total, 8.8 million EUR initial).	**LEGAL**	+2	Existence of non- regulated landfills	Organized, regular waste removal Considerable reduction of impacts on the environment.	Separate EIA and expertise implementation for investment plans in accordance with RA legislation procedure Fix requirements of SEA recommendation and requirements in EIA reports
	AIR, CLIMATE CHANGE AND BIODIVERSITY		Unclear since the polygon location is not clearly known.	Elimination of irregular landfills and reduced risk of pollution Positive impact: attraction for waste recycling businesses due to the accumulation of waste in Vanadzor availing new opportunities for waste management and recycling facilities Solutions for Dendropark territory	The issue of Dendropark and its conservation/waste collection activities should be planned and appropriate solutions should be elaborated
	SOIL, GEOLOGY AND MINERAL ASSETS	+1	Unclear since the polygon location is not clearly known.	Elimination of irregular landfills and reduced risk of soil pollution.	Monitoring of the waste transfer process to prevent waste disposal in not licensed areas. Defining responsibilites for the process of waste transfer.
	SURFACE AND UNDERGROUND WATER	?	Uncertain on the risks	Uncertain	Take into consideration Transboundary aspects related to impacts on water ecosystems (Debed River Basin)
	HUMAN HEALTH	?	Risks are uncertain	Uncertain	Strengthening supervision over the

					transportation process
	SOCIO-ECONOMIC ASSESSMENT **Two regions with relatively similar conditions**	+2	Both regions have a large territories of forest cover, and not correct SWM process can ruin/threaten these areas	Due to proper solid waste management process, there is a availability for conserving virgin forest in two regions	Undertake implementation of appropriate measures According to regions similarities
Regional system for Shirak marz with Gyumri regional landfill & upgraded collection system (16 million EUR, 5.8 million EUR initial).	**LEGAL**	-	-	-	-
	AIR, CLIMATE CHANGE AND BIODIVERSITY		Existence of isolated, communities with difficult access and problematic roads (in Amasya region)	Good potential for waste managers and potential investors for start recycling business in Gyumri (with condition of correct organization)	Organization of waste collection and management facilities in Gyumri
	SOIL, GEOLOGY AND MINERAL ASSETS	+1	Unclear since the polygon location is not clearly known.	Elimination of irregular landfills and reduced risk of soil pollution.	Monitoring of the waste transfer process to prevent waste disposal in not licensed areas. Defining responsibilites for the process of waste transfer.
	SURFACE AND UNDERGROUND WATER	?	Uncertain, need more information for judgment	Uncertain, since the provided information is not sufficient. However, assuming positive impact due to improved waste management.	-
	HUMAN HEALTH	+1	Potential risks are not observed and studied for the particular area, additional research and data on health hazards is needed. Waste that is not properly managed, especially excreta and other liquid and solid waste from households and the community, are a serious health hazard and lead to the spread of infectious diseases. Unattended waste lying around attracts	The modernized solid waste collection system will reduce environmental pollution	Strengthening supervision over the waste collection process Determine the methods for health related hazard assessment (Impact of solid waste in particular site/landfill), Initiate classification of solid waste according to the potential impacts on the environment and public health sectors, Develop and implement methods and algorithms for hygiene surveys to determine the degree of the hazards resulting from waste, landfills, and waste collection points. Microbiological,

			flies, rats, and other creatures that in turn spread disease. Wet waste that decomposes and releases a bad odour. This leads to unhygienic conditions and thereby to a rise in the health problems. The group at risk from the unscientific disposal of solid waste include especially the pre-school/school children; waste workers; and workers in facilities producing toxic and infectious material. Other high-risk group include population living close to a waste dump and those, whose water supply has become contaminated either due to waste dumping or leakage from landfill sites. Uncollected solid waste also increases risk of injury, and infection		Bacteriological air research and data should be available collected from the territories adjacent to landfills and territories of waste container placement. Due to the lack of data, updated research studies and monitoring of target groups is needed to establish and clarify the causal link between the disease spread to link the health trends and the harmful impact of solid waste. To study the negative environmental impact of the landfills determintation of monitoring points is necessary: establishment of polygons for non neutralizable wastes, as well as creation of compaction, washing and disinfection system for waste bins meeting international and European sanitary norms and requirements.
	SOCIAL AND ECONOMIC ASSESSMENT **Differences in between selected communities in terms of population density, and socio-economic conditions**	+2	Unsorted, non-regulated and ineffective waste management could cause environmental pollution in remote/mountainous communities which are hardly accessible during the winter time	The existence of communities that are free from contamination	Undertake implementation of solid waste removal taking into consideration of peculiarities in the regions
Regional system for Syunik marz (12 million EUR, 5.6 million EUR initial).	**LEGAL**	+2	Existence of non-organized landfills	Organized, regular waste removal Considerable reduction of negative impacts on the environment.	Separate EIA expertise implementation for investment plans with RA procedure established by legislation. SEA proposals and requirements are fixed in EIA reports

	AIR, CLIMATE CHANGE AND BIODIVERSITY		Risks connected with bad roads and hard to access communities and cities in Syuniq	Consider needs of Zangezur national park And forest coverage which should be preserved	Landfills should be constructed as per norms, with an appropriate distance from the national parks
	SOIL, GEOLOGY AND MINERAL ASSETS	+1	Unclear since the polygon location is not clearly known.	Elimination of irregular landfills and reduced risk of soil pollution.	Monitoring of the waste transfer process to prevent waste disposal in not licensed areas. Defining responsibilites for the process of waste transfer.
	SURFACE AND UNDERGROUND WATER	?	Uncertain	Uncertain, but assuming positive impact due to improved waste management.	Need to consider that two local transfer stations in the South (Agarak-Meghri) and North (Goris) of Syuniq marz might not be sufficient due to unfavorable road and relief conditions.
	HUMAN HEALTH	+1	The probability of occurrence mixed waste such as industrial, and household wastes Potential risks are not observed and studied for the particular area, additional research and data on health hazards is needed. Waste that is not properly managed, especially excreta and other liquid and solid waste from households and the community, are a serious health hazard and lead to the spread of infectious diseases. Unattended waste lying around attracts flies, rats, and other creatures that in turn spread disease. Wet waste that decomposes and releases a bad odour. This leads to unhygienic conditions and thereby to a rise in the health problems. The group at risk from the unscientific	The regulation of waste collection process	Strengthening supervision over the waste collection Determine the methods for health related hazard assessment (Impact of solid waste in particular site/landfill), Initiate classification of solid waste according to the potential impacts on the environment and public health sectors, Develop and implement methods and algorithms for hygiene surveys to determine the degree of the hazards resulting from waste, landfills, and waste collection points. Microbiological, Bacteriological air research and data should be available collected from the territories adjacent to landfills and territories of waste container placement. Due to the lack of data, updated research studies and monitoring of target groups is needed to establish and clarify the causal link between the disease spread to link the health trends and the harmful impact of

			disposal of solid waste include especially the pre-school/school children; waste workers; and workers in facilities producing toxic and infectious material. Other high-risk group include population living close to a waste dump and those, whose water supply has become contaminated either due to waste dumping or leakage from landfill sites. Uncollected solid waste also increases risk of injury, and infection		solid waste. To study the negative environmental impact of the landfills determintation of monitoring points is necessary: establishment of polygons for non neutralizable wastes, as well as creation of compaction, washing and disinfection system for waste bins meeting international and European sanitary norms and requirements
	SOCIAL AND ECONOMIC ASSESSMENT **Differences in between selected communities in terms of population density, and socio-economic conditions**	+2	Unique position of Meghri region and long distanced in between communities may hinder the process of organizing a complete waste disposal procedure/cycle	The existence of communities that do not have waste removal	Organize waste removal and management in all communities, take into consideration conditions and peculiarities of the Meghri region.
5.3.2 Indicative supporting investment and TA packages					
Technical Assistance for institutional, legal, regulatory and PPP promotion capacity strengthening, supporting waste reduction/diversion initiatives and public awareness raising.	**LEGAL**	1. Low awareness level of the public 2. Poor socio-economic conditions 3. Weak purchasing power	Possibility for consultations and discussions Existence of legal basis	1.Review of legislation 3. Development of publicly accessible manuals 3. Conduct of trainings and discussions directed at increasing public awareness 4. Ensuring the skills, knowledge and capacity building for the effective implementation of waste management programs	1. Low awareness level of the public 2. Poor socio-economic conditions 3. Weak purchasing power

	AIR, CLIMATE CHANGE AND BIODIVERSITY	+1	There are no observeable risks.	The technical assistance, promotion of institutional and legal regulation as well as public-private partnerships and public awareness-raising is expected to positively impact biodiversity and improve air quality	
	SOIL, GEOLOGY AND MINERAL ASSETS	+1	There are no observeable risks.	The technical assistance, promotion of institutional and legal regulation as well as public-private partnerships and public awareness-raising is expected to positively impact the quality of the land resources.	
	SURFACE AND UNDERGROUND WATER	+1	No environmental risks	Positive impact on overall waste management system and, as a result of enhanced capacity, waste reduction and public awareness initiatives, positive impact on water resources quality is expected.	
	HUMAN HEALTH	-1	-	1. Implementation of public healthcare program aimed at public awareness raising	Poor level of sanitary (especially waste-related) culture among population
	SOCIO-ECONOMIC ASSESSMENT **Support to Sustainable waste management process through all the agencies and responsible governance, consistent PA raising with the help of mass media**	+2	(due to) As a result of correct and diverse activities targeting SWM environmental risks will be minimized	Carry out sustainable solid waste management throughout the territory according to international standards	Develop activities and actions implementation which will involve all stakeholders
Demonstration	**LEGAL**	+1	Difficult accessibility, poor climatic	Include remote areas with	Plan sanitary landfills in hardly

projects applicable to remote rural collection and upgraded disposal			conditions	difficult access in the strategy, create equal conditions for all territories	accessible rural areas Repair the roads and make communities more accessible
	AIR, CLIMATE CHANGE AND BIODIVERSITY	+2	There are no observeable risks.	Pilot projects may have positive impact on the management of biodiversity, air, etc.	Repair the roads and make communities more accessible
	SOIL, GEOLOGY AND MINERAL ASSETS	+2	There are no observeable risks.	Pilot projects may have positive impact on the management of the quality of land resources.	Conducting awareness-raising and explanatory activities on negative consequences of land polltution through SW.
	SURFACE AND UNDERGROUND WATER	+1	No visible risks could be drawn at this point based on the provided information.	It is assumed that pilots in small remote rural communities would have positive impact on local water resources quality, since in most cases there is no waste collection system in place and domestic solid waste is usually dumped on river banks.	Prefeasibility studies would be needed to have complete information on the type and amount of waste in pilot communities, as well as to get local population to buy-in. Awareness raising campaigns are also critical.
	HUMAN HEALTH	+1	Insufficient involvement of the rural population	Positive impact on rural areas, especially on their water resources	Sanitary and Enlightening activities within the rural population
	SOCIAL AND ECONOMIC ASSESSMENT **Implementation of pilot projects in selected communities of pilot regions (marzes)**	+2	Incorrect choice of community which does not have similarities with other communities	Joint actions by applying environmental norms	Correct selection of community propose correct solutions for existing problems Implementation of pilot projects in selected communities of pilot regions (marzes)
Historical dumpsite closure and general solid waste legacy management. This could include a	**LEGAL**	+2	The existence of non-regulated landfills, polluted environment, irregular waste disposal	Elimination of non regulated landfills, clean environment	The inventory of existing non -regulated landfills, accounting mapping, gradual, elimination of legal waste, conservation, land restoration. Activities can be carried out by regions.

detailed mapping of dumpsites in Armenia and preparing individual closure plans as well as ground works to clean up the sites					Before implementation include it in the relevant EIA reports
	AIR, CLIMATE CHANGE AND BIODIVERSITY	+2	Not proper organization of landfill closure and recultivation activiites. Risks associated with emergence of new distorted land areas. Investments and planning, proper organization of closure plans	Improved of waste collection and management system, improved environmental situation	Preliminary data collection, analysis, mapping, recultivation of land
	SOIL, GEOLOGY AND MINERAL ASSETS	+2	Not proper organization of landfill closure and recultivation activiites. Risks associated with emergence of new distorted land areas. There is no positive experience of land recultivation in Armenia. Necessity of financial resources.	Proper organization of the enviaged activities will considerably reduce surfaces of distorted lands and will allow for their circulation.	Development of landfill closure and recultivation (including biological) projects. Capital formation to implement the planned activities.
	SURFACE AND UNDERGROUND WATER	+1	NA	Mapping of existing dumpsites will provide useful information for further decision-making and improved waste management. Individual closure plans and relevant ground work will also have overall positive impact on water resources.	This should be coordinated with the Water Resources Management Agency under the MNP. Also, consider the issues identified and measures envisioned in the Water Basin Management Plans (those that have already been approved by the Government).
	HUMAN HEALTH	+2	-	Develop individual closure plans, the cleaning of landfills will have a considerable positive impact on environmental factors such as water, air, soil	Develop individual closure plans, Inventory of landfills, mapping Conduct research on existing health hazards around each landfill, especially within communities close to the landfills
	SOCIAL AND ECONOMIC ASSESSMENT	+2	Environmental risks will be minimized	All unused and incorrect managed landfills will pass through inventory process, appropriate maps will be designed, landfills will be conserved and cleaned	Use unified policy towards unused and incorrectly managed landfill Detailed research, correct monitoring and mapping