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Protection of Jeita Spring

TECHNICAL REPORT NO. 3

Guideline for Environmental Impact Assessments for Wastewater Facilities in Lebanon
–
Recommendations from the Perspective of Groundwater Resources Protection

Ballouneh
November 2011

Guideline for Environmental Impact Assessments for Wastewater Facilities in Lebanon
–
Recommendations from the Perspective of Groundwater Resources Protection

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cover page:
picture 1: risk of flooding for Jeita – Dbaye raw water canal
picture 2: construction of open cess pit for new building in karstified limestone

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Acronyms

ACSAD	Arab Center for the Studies of Arid Zones and Dry Lands, Damascus (www.acsad.org)
ARD	Arab Resources Development
CDR	Council for Development and Reconstruction
CEAA	Canadian Environmental Assessment Act
DEADPWC	Department of Environmental Affairs and Development Planning of Western Cape (http://www.capegateway.gov.za/eadp)
DVGW	Deutscher Verein des Gas- und Wasserfaches (www.dvgw.de)
EC-LIFE	European Commission, Environment, LIFE Programme, (ec.europa.eu/environment/life/)
EIA	Environmental Impact Assessment
MoE	Ministry of Environment (www.moe.gov.lb)
MoEW	Ministry of Energy and Water (www.moew.gov.lb)
MWI	Ministry of Water and Irrigation, Amman/Jordan (www.mwi.gov.jo)
NDEQ	Nebraska Department of Environmental Quality
SEA	Strategic environmental assessment
SELDAS	Strengthening the Environmental Legislation Development and Application System in Lebanon (http://www.balamand.edu.lb/seldas/)
NEPA	National Environmental Policy Act, USA
UNDP	United Nations Development Programme (www.undp.org)
UNEP	United Nations Environment Programme, Nairobi/Kenia (www.unep.org)
UNEP ETB	United Nations Environment Programme, Geneva/Switzerland (www.unep.ch/etb/)

List of Reports prepared by the Technical Cooperation Project Protection of Jeita Spring

Report No.	Title	Date Published
Technical Reports		
1	Site Selection for Wastewater Facilities in the Nahr el Kalb Catchment – General Recommendations from the Perspective of Groundwater Resources Protection	January 2011
2	Best Management Practice Guideline for Wastewater Facilities in Karstic Areas of Lebanon – with special respect to the protection of ground- and surface waters	March 2011
3	Guideline for Environmental Impact Assessments for Wastewater Facilities in Lebanon – Recommendations from the Perspective of Groundwater Resources Protection	November 2011
4	Geological Map, Tectonics and Karstification of the Jeita Spring Catchment	In progress
5	Hydrogeology of the Groundwater Contribution Zone of Jeita Spring	In progress
6	Water Balance for the Groundwater Contribution Zone of Jeita Spring using WEAP including Water Resources Management Options and Scenarios	In progress
7	Groundwater Vulnerability Mapping in the Jeita Spring Catchment	In Progress
Special Reports		
1	Artificial Tracer Tests 1 - April 2010 (prepared with University of Goettingen)	July 2010
2	Artificial Tracer Tests 2 - August 2010 (prepared with University of Goettingen)	November 2010
3	Practice Guide for Tracer Tests	January 2011
4	Proposed National Standard for Treated Domestic Wastewater Reuse for Irrigation	July 2011
5	Artificial Tracer Tests 4B - May 2011 (prepared with University of Goettingen)	September 2011
6	Artificial Tracer Tests 5A - June 2011 (prepared with University of Goettingen)	September 2011
7	Mapping of Surface Karst Features in the Jeita Spring Catchment	October 2011
8	Monitoring of Spring Discharge and Surface Water Runoff in the Jeita Spring Catchment	In Progress

Guideline for Environmental Impact Assessment for Wastewater Facilities in Lebanon
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Report No.	Title	Date Published
9	Soil Survey in the Jeita Spring Catchment	November 2011
10	Mapping of the Irrigation System in the Jeita Catchment	In Progress
11	Artificial Tracer Tests 5C - September 2011 (prepared with University of Goettingen)	February 2012
12	Stable Isotope Investigations in the Jeita Spring Catchment	In Progress
13	Micropollutant Investigations in the Jeita Spring Catchment	In Progress
14	Guideline for Gas Stations - Recommendations from the Perspective of Groundwater Resources Protection	February 2012
15	Tritium - Helium Investigations in the Jeita Spring Catchment	In Progress
16	Hazards to Groundwater and Assessment of Pollution Risk in the Jeita Spring Catchment	In Progress
Reports with KfW Development Bank (jointly prepared and submitted to CDR)		
1	Jeita Spring Protection Project Phase I - Regional Sewage Plan	October 2011
2	Jeita Spring Protection Project - Feasibility Study - Rehabilitation of Transmission Channel Jeita Spring Intake – Dbaye WTP	In Progress
3	Jeita Spring Protection Project - Environmental Impact Assessment for the Proposed CDR/KfW Wastewater Scheme in the Lower Nahr el Kalb Catchment	In Progress

Acknowledgements

In its effort to protect the water resources in the Nahr el Kalb catchment, the project *Protection of Jeita Spring* experienced great support not only at the political and institutional level but also from many municipalities and people in the catchment area.

We are especially grateful for the backing and support of the Council for Development and Reconstruction (CDR), namely its president, Nabil Jisr and Eng. Ismail Makki (manager), the Ministry of Energy and Water (MoEW), namely H.E. Gebran Bassil and his staff, the Water Establishment Beirut and Mount Lebanon (WEBML), namely its president, Joseph Nseir, as well as George el Kadi (project manager), Maher Chrabieh (Director of the Dbaye treatment plant) and Dr. Paul Souaid (Director of the Water Laboratory at the Dbaye treatment plant).

Many mayors and staff of municipalities but also private investors in the catchment saw the opportunities which the project hopes to provide in the near future as a chance for development. Among those which very actively assisted the project we would like to highlight the municipalities of Ballouneh and Jeita.

The technical cooperation project, implemented by BGR, is closely working together with a financial cooperation project, implemented by KfW Development Bank and the local consultant GITEC. This is a new approach in German development aid, in order to find the best solution for wastewater collection and treatment in the Jeita catchment. BGR expresses its thanks for the very successful cooperation between the two projects.

The BGR project is also working on many cross issues, such as presented in this report, and therefore is depending on the cooperation with many other ministries and agencies. Unfortunately, although there are many pressing issues, environmental issues do not yet have the full attention of some decision-makers.

The project was made possible by grants of the German Government, allocated through the Ministry of Economic Cooperation and Development (BMZ). Our thanks therefore go to the staff of the BMZ, KfW and German Embassy. We experienced that this assistance is very much appreciated not only among the involved institutions and stakeholders but also the population living in the area.

0 Executive Summary

The two main tasks of the Technical Cooperation project *Protection of Jeita Spring* are to protect these important drinking water resources through establishment of groundwater protection zones and by providing geoscientific advice to foreign donor projects, especially the KfW project, implementing wastewater schemes in the Jeita catchment.

Environmental impact assessments for wastewater projects until now are often insufficiently covering potential impacts on water resources. In a highly karstic environment such as Lebanon this, however, can be crucial for the success of wastewater projects. If geoscientific aspects are not taken sufficiently into consideration such costly investments may fail to reach their objective. Tracer tests conducted by the project in the Jeita catchment have shown that hydrogeological connections often exist where they were not expected and that groundwater flow velocities can be extremely high.

The integration of geoscientific investigations in EIAs, as proposed in this document, will help to reduce pollution risks and find the optimal solution for the proposed wastewater schemes.

Because there are currently numerous wastewater schemes in the planning, it is important to follow the same procedure. To this end a standard outline for EIAs is proposed in this document. The report explains which aspects should be covered in each chapter.

1 International Guidelines for EIAs in Wastewater Projects

The International Association for Impact Assessment (IAIA) defines environmental impact assessment as "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made".

In the US EIA was introduced in 1969 by law through the National Environmental Policy Act (NEPA). In Australia the State Pollution Control Commission of New South Wales issued EIA guidelines in 1974. Most European countries introduced laws and guidelines for EIA in the 1990s.

In Canada the Canadian Environmental Assessment Act (CEAA) was issued in 1995. In this case any government department or agency which proposes a project becomes the responsible authority and has to conduct an EIA according to CEAA regulations. CEAA is valid even for CIDA development aid projects projects.

The United Nations Environmental Programme (UNEP) has prepared extensive guidance documents and reference manuals for environmental impact assessments.

Most environmental laws of developed countries do not differentiate between different categories of projects although in practice some type specific EIA methods are available (RYCHTECKA, 2004).

Basis for decisions of the World Bank for granting loans are the provisions of the operational manual OP 4.01 (internet source only). For category A projects (significant adverse environmental impacts are likely) the World Bank follows a similar structure as proposed in this guideline.

At the initial stage of environmental impact assessments it is generally distinguished between screening and scoping processes. **Screening** is the process of deciding whether a policy, plan, program or project should be subject to a form of environmental assessment (SEA or EIA), i.e. whether it is likely to have significant effects on the environment. **Scoping** is the process of determining the parameters, boundaries and key issues to be address by an environmental assessment (ICON, 2004).

Strategic environmental assessment (SEA) is a form of EIA, that essentially intendeds to identify and assess the likely significant effects of a policy, plan or program on the environment, the results of which are then taken into account in the decision-making process before detailed planning is done.

2 Legal Framework governing EIAs

The Ministry of Environment MoE was created by Law 216 of 2 April 1993. This law was amended in 2005 by law 690/2005. Tasks of the MoE are (ARD, 2003):

- to formulate a general environmental policy
- to develop a strategy for solid waste and waste water disposal treatment;
- to develop a strategy permitting conditions for new industry, agriculture, quarrying and mining, and the enforcement of appropriate remedial measures for installations existing before promulgation of this law;
- to develop a strategy for conditions and regulations for the use of public land, marine and riverine resources, in such a way as to protect the environment;
- to encourage private and collective initiatives which improve environmental conditions; and

- to provide a classification of natural sites and landscapes and to make decisions and issue decrees concerning their protection.

A decree for environmental impact assessment was drafted by MoE in 2001 but was not yet accepted by the council of ministers. In the meanwhile, resolution No. 7/1 (2003) of MoE defined authorized companies for the preparation of environmental impact assessments. Though the SELDAS project on strengthening the national environmental framework, a review of the draft EIA law has been made.

Law 444 dated 29 July 2002:

§ 1	Giving the legal framework of the national environment protection policy
§ 2	Definitions of every technical term mentioned in the law
§ 3	States that the citizen has the right for a clean environment
§ 4	States the main principles of environmental protection and nature resources management.
§ 5	Environmental protection strategy
§ 6, 7	Creation of a national council for environment and its tasks
§ 8-11	Creation of a Fund for financing of the activities of MoEnv
§ 12, 13	Monitoring and implementation of EIAs
§ 14-20	Environmental information policy, implementation in schools and institutions, motivation for the implementation.
§ 21-23	Procedure governing the preparation of EIAs
§ 35-37	Surface and groundwater protection
§ 38-41	Protection of surface and underground environment
§ 39	Asking the council of ministers to create a decree concerning wastewater treatment plants and waste disposal sites
§ 40-68	Enforcement of the law based on law 64/88 12-08-1988

Decision 1/8, dated 30 January 2001 under the title 'Air pollutants and liquid wastes resulting from classified establishments and wastewater treatment plants' regulates the release of liquid wastes into the environment (Annex 2). Attachment 3 of this decision is about liquid wastes drained to the sea, attachment 4 about liquid wastes drained to surface water, attachment 5 about wastewater drained into the wastewater network.

A draft decree concerning strategic environmental assessment was prepared with assistance of the EC-LIFE/ UNDP/ Strategic Environmental Assessment and Land Use Planning project.

With support of foreign donors some proposals of wastewater facilities were already following internationally accepted regulations (e.g. Aammatour in the Chouf mountains; ARD, 2003).

3 Process for Acceptance of EIAs

United Nations Environment Programme suggests the below procedure for EIA development and acceptance.

The current report focuses on the impact analysis, the mitigation proposal and the report preparation.

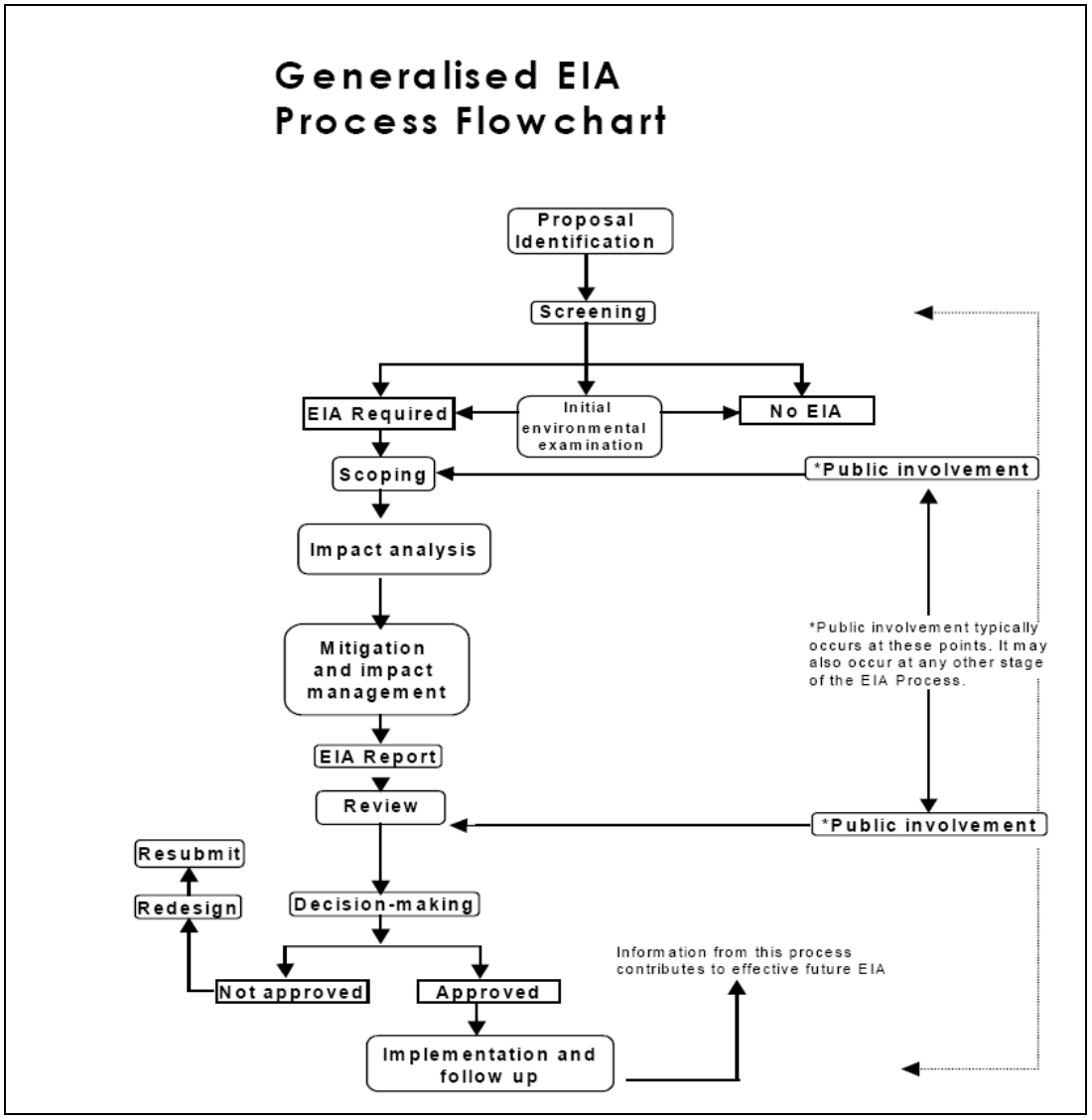

Figure 1: Proposed Procedure for EIAs
(UNEP ETB EIA training manual 1st edition< online resource only)

The process of developing a strategic environmental assessment which is proposed for the EU (ICON, 2001; EU, 2001) is shown below.

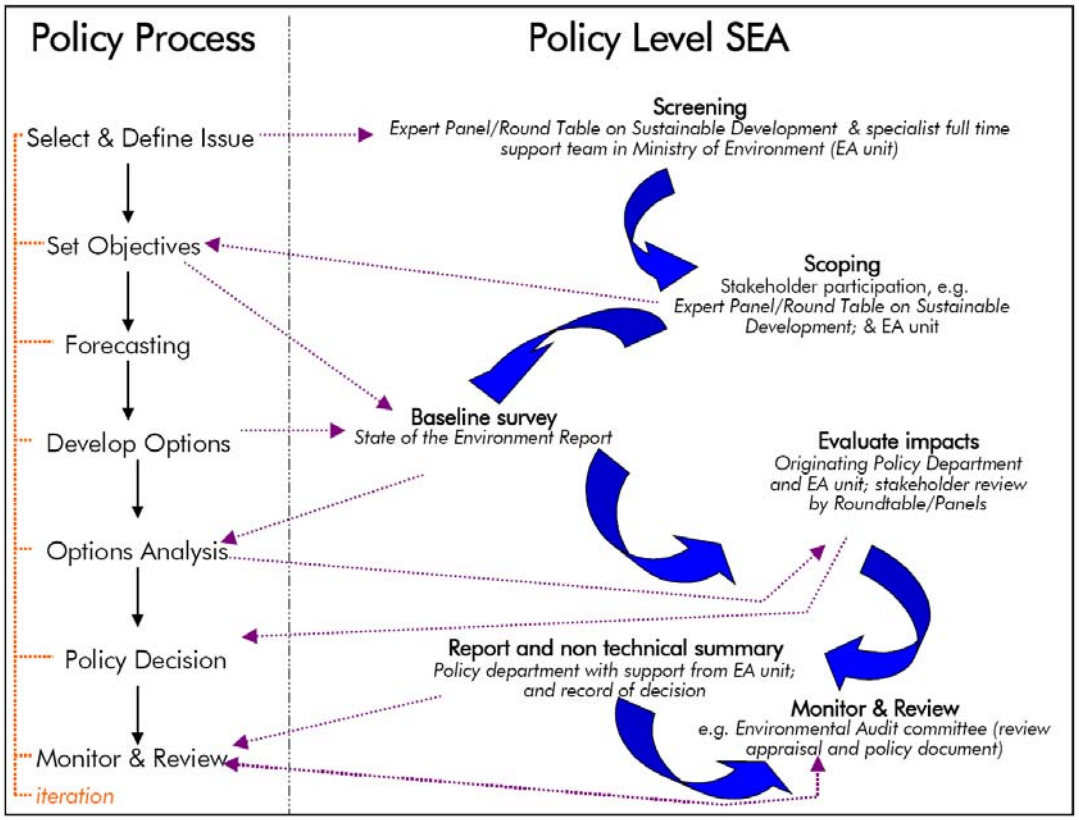

Figure 2: Flowchart for SEAs in the EU (ICON 2001)

Paragraph 4 of Law 444, dated 29 July 2002, titled Environmental Impact Assessment, is giving the MoE the right for a final decision after receiving EIAs of any project (§ 21). It is defined which projects need EIA. In § 22, section 1 it is defined what MoE means by 'project':

1-a: implementation of construction works or other works.

1-b: any interfering in the natural surrounding, excavating or adding materials.

1-c: any suggested plan or study or investment concerning an entire area or a plan for a type of activity (master plan for building of residential areas, industrial zones, etc.).

1-d: any changes, extensions, rehabilitation or closing of any of the above mentioned activities (1-a,b,c).

2: the costs for EIA or initial environmental examination as well as the monitoring costs must be paid by the project owner.

Paragraph 23 states that the details of implementation concerning § 21-23 must be prepared with a list of projects that need EIAs or initial environmental examination, and the cost of follow-up must be defined in a decree from the council of ministers based on the suggestion of the Ministers of Environment and Finance.

4 Stakeholder Participation

The purpose of public involvement is to (UNU, 2011):

- inform the stakeholders about the proposal and its likely effects;
- ask for their views and concerns; and
- take account of the information and views of the public received in the EIA process and decision-making.

The key objectives of public involvement are to (UNU, 2011):

- obtain local knowledge that may be useful for decision-making;
- facilitate consideration of alternatives, mitigation measures and tradeoffs;
- ensure that important impacts are not overlooked and benefits are maximized;
- reduce conflict through the early identification of controversial issues;
- provide an opportunity for the public to influence project design in a positive manner (thereby creating a sense of local ownership of the proposal);
- improve transparency and accountability of decision-making; and
- increase public confidence in the EIA process.

However, true stakeholder participation is not yet practiced in Lebanon.

5 Current Practice of Environmental Impact Assessments in Wastewater Projects

The Council for Development and Reconstruction, CDR, implements most wastewater projects in Lebanon. For such projects there is currently no consistent policy which format EIAs should follow and which aspects need to be covered in an EIA. Because such a guideline is neither available at CDR nor the Ministry of Energy and Water, MoEW, nor the Ministry of Environment MoEnv, several donors have adopted their own rules for EIAs.

Unfortunately the draft decree for environmental impact assessment, proposed by the Ministry of Environment, is not yet enacted.

In order to achieve the optimal protection of water resources, the current report proposes to follow a standard outline for each EIA related to wastewater projects.

6 Importance of the Integration of Water Resources Protection Aspects into EIAs for Wastewater Facilities

Water resources protection can only be successful if landuse practices are adapted which avoid the infiltration of substances harmful to human health into the subsurface. Usually guidelines, such as in place in practically all developed countries (MARGANE, 2003a; http://www.bgr.bund.de/EN/Themen/Wasser/Projekte/abgeschlossen/TZ_Acsad/Vol_5_fb.html) and in some countries of the Middle-East (MARGANE & SUNNA, 2002; MARGANE & SUBAH, 2007; MWI 2006) list specific landuse restrictions for **groundwater protection zones** 1, 2 and 3 in order to avoid contamination of water resources. Protection zones are important not only for drinking water sources based on groundwater but also on surface water, such as dams.

The German Guidelines for Drinking Water Protection (DVGW, 2006) are documented in the attachment.

7 Aspects to be covered in EIAs for Wastewater Projects

This report is mainly concerned with aspects which might have a potentially negative impact on the quality of water resources, surface and groundwater, alike.

Since wastewater is the major source of contamination in Lebanon, it is important to look at all individual components of a proposed wastewater facility or scheme and determine how their operation could be negatively affected by external factors, such as **geohazards** (tectonic movements, earthquakes, landslides, rockfalls, rock collapse structures, soil liquefaction, land subsidence, flooding) as well as determine how the individual components could have a negative impact on the quality of water resources (effluent discharge location, bypass, overflow of pressure breaks, etc.). Geohazard and **contamination risks** must be considered **separately for all individual components of a proposed wastewater facility** or scheme and mitigation measures must be proposed for each of those. Because those risks

can considerably vary during the construction and the operation phase, the risk assessment and mitigation measures must cover both phases.

In case of **treated domestic wastewater reuse** it must be considered where reuse could be allowed. A best management practice guideline (STEINEL & MARGANE, 2011) and a related proposal for a national Lebanese standard were prepared by the project *Protection of Jeita Spring* in order to facilitate the decision process for treated wastewater reuse and sludge reuse (MARGANE & STEINEL, 2011). Treated wastewater reuse cannot be allowed in groundwater protection zones 1 and 2 (MARGANE, 2003a). Concerning protection zone 3, or where protection zones have not yet been established, it is proposed that groundwater vulnerability maps (MARGANE, 2003b) should be used in order to determine whether reuse could be allowed.

Also **sludge management**, i.e. storage, transfer, disposal or reuse must be integrated into the EIA.

The details which should be covered in the different parts of the EIA for wastewater facilities are dealt with in the following chapters.

7.1 Legislative and Institutional Frameworks

The currently applied laws and regulations of all relevant sectors should be listed here with the required details, such as e.g. the parameter lists of the drinking water standard, the wastewater standards (domestic, industry, reuse), the related monitoring schemes, etc.

7.2 Description of the Project

The boundary of the project area as the area regarded in the EIA should be defined and described first. It should cover an area larger than the area comprised by all components of the wastewater facility.

The locations, the proposed time schedule for construction and all components of the wastewater facility should be documented and described in detail in this chapter, addressing all aspects relevant for the EIA:

- what is the function of each component and which method and technology is applied
- which materials are used for each component, including all aspects where leakages could possibly occur (e.g. connections)
- list all relevant issues, e.g.

- is stormwater collected by the network; which amounts might occur; will this lead to frequent bypassing of untreated wastewater ?
- bypass: at which inflow amount raw sewage would have to be bypassed
- diameters and gradients along collector lines, diameter and spacing of manholes, location and size of pressure breaks
- location and size of temporary storage basins (in case of high inflow)
- what installations/constructions are planned to provide the optimal protection of water resources ?
- will the treated effluent be discharge into surface waters ?
- will all or part of the treated effluent be reused in agriculture ?
- where will sludge from the WWTP be deposited or reused ?
- which treated effluent quality parameters will be monitored; by whom and where ? Who supervises and controls these analyses ? How can reliable analysis results be ensured ?
- what procedures will be in place in case of emergency ?

7.3 Description of the Environment

The current status of the environment or baseline condition in the entire project area should be documented here in order to be able to verify later whether an environmental impact was caused by the project or not. This baseline study should cover the physical and biological aspects of the environment, as well as socio-economic conditions.

The documentation should list where there are important environmental resources that need to be protected, e.g. springs or wells which are used for drinking water supply, forest conservation area or natural habitats. It should state what is the current status of these resources. Concerning water resources it is important to mention which resources are used in which amount, where and for which purpose.

This documentation pertains to :

- environmental status of water resources (groundwater, surface water, sea water)
- environmental status of vegetation and soil
- environmental status of air quality
- environmental status of noise level
- environmental status of fauna, flora and their dependency on certain natural conditions (natural habitat)
- cultural heritage sites that need to be preserved

Water resources :

- water analyses from springs, wells, dams, irrigation canals, major water conveyors and surface water streams which could possibly be affected, should be collected and documented, especially covering microbiological constituents and all parameters that could potentially be associated with wastewater

The documentation of the current status should be accompanied by results of certified laboratories, photos, etc. which must be part of the report.

7.4 Impact Identification and Analysis

Based on the description of the project and the environment in the project area, all potential impacts must be named and described. The description has to state where and under which circumstances an impact may take place, what the scale of the impact may be and which resources may be impacted. The consequences of such potential impacts must be made clear, i.e. who would be affected. Whenever possible the risk must be quantified.

Since this report focuses on geoscientific aspects and the protection of water resources, mainly these topics will be covered below.

The impact identification has to address :
a) the **impact of** certain hazards, especially geohazards on resources and
b) the **impact** of certain activities **on** resources

Impacts can be considered as significant if they are (modified after ASHE & SADLER 1997):

- extensive over space and time
- intensive in relation to the natural assimilative capacity
- above or close to environmental standards or guideline values
- non-compliant with environmental policies, landuse plans, sustainability strategy
- likely to threaten public health or safety
- likely to limit the use of resources (water, soil, forest/wood) on which people rely for subsistence
- likely to reduce quality or quantity of natural resources (water, soil, forest/wood) that are exploited and on which life of a large number of people depends
- likely to affect declared protection areas, nature or water conservation areas, ecologically sensitive areas, rare or endangered species or cultural heritage sites; and
- likely to disrupt or threaten the lifestyle of a large number of people.

At least the following potential impacts have to be covered.

7.4.1 Impacts of Geohazards

All geohazards which may potentially occur in the project area must be covered. Those are commonly, but not exclusively :

- tectonic movements
- earthquakes
- landslides
- rockfalls
- rock collapse structures (e.g. dolines)
- land subsidence
- soil liquefaction (instable soil)
- flooding

Generally the construction of wastewater facilities on or near major fault zones should be avoided because earth movements in a tectonically active region like Lebanon will most certainly have immense negative environmental impacts, not only on humans but especially on water resources. Not all identified fault zones must, however, necessarily be still active but could indicate tectonic movements which happened millions of years ago. It is therefore important to identify the current regional tectonic stress field.

Concerning landslides and rockfalls preexisting features will give a good indication which geological units in which topographic setting are prone to such risks. However, human activities, like mining, construction of roads and buildings, etc. will lead to an increased risk, especially where topographic gradients are high. Generally wastewater facilities should not be built on existing landslide masses because the underground might not be well consolidated and not be stable enough.

Rock collapse structures, such as dolines, should also generally be avoided as locations for major components of a wastewater facility. Dissolution and widening of the underground karst system might still continue and lead to further collapses.

Land subsidence might occur in areas where insufficiently consolidated recent sediments have accumulated, in Lebanon especially in landslide areas.

Soil liquefaction is a process which occurs where loosely packed water saturated sediments are suddenly transferred from a solid to a liquid mass by an increase in water pressure. Commonly soil liquefaction is triggered by earthquakes or explosions (e.g. in quarries or mines).

All components of the proposed wastewater facilities must be designed in such a way that flooding would not cause any negative environmental impact. Wastewater treatment plants should be entirely safe from flooding. Due to lack of surface water runoff monitoring in Lebanon it will be difficult to predict the highest possible level of flooding. Predicting the highest possible level of flooding therefore often will have to follow proxy-information, like historic records or witnesses. When using records from gauging stations, it must be taken into consideration that those apply only for this specific section.

7.4.2 Impacts on Water Resources

This chapter should address impacts of each individual component of the proposed wastewater facilities on groundwater and surface water resources in terms of quality and quantity.

Impacts on water resources might be caused by :

- inadequate site selection
- inadequate design (methods, technology, capacities, diameters, etc.)
- inadequate materials
- mistakes during installation/construction
- mistakes during operation (e.g. inadequate maintenance, monitoring, etc.)
- impacts of geohazards

Among others potential impacts of the wastewater collector and conveyor system, the wastewater treatment plant and the treated wastewater effluent discharge on water resources can be resulting from:

- breakage, structural failure of used materials,
- leakages from gaskets and joints (e.g. due to inadequate material or wrong installation),
- leakage or overflow due to insufficient capacity or periodically high inflow
- overflow from pressure-breaks at times of high inflow or due to insufficient cleaning

In case that the surface drainage would be modified through constructions, their impacts must be analyzed.

7.4.3 Impacts of Site Clearance, Preparation and Construction

Environmentally sound practices must be applied during the construction of wastewater facilities. Among others :

- only materials not hazardous to the environment, especially to water should be used;
- during transportation, storage, handling, collection and safe disposal of substances hazardous to the environment, especially to water resources special precautions have to be taken (e.g. oil and fuel for machinery should be stored and handled safely).

7.5 Mitigating Adverse Project Impacts

In this chapter it should be discussed how the previously identified impacts could be mitigated.

This could comprise:

- suggestion of alternative solutions concerning site selection (location);
- suggestion of alternative solutions concerning design (methods, technology, capacities, diameters, etc.);
- suggestion of alternative solutions concerning the selected materials;
- suggestion of alternative solutions concerning installation/construction procedures;
- suggestion of alternative solutions concerning operational procedures;
- suggestions how to mitigate the impact of individual geohazards through alternative sites or constructional changes.

Alterative solutions concerning the course of collector and conveyor lines may lead to a reduced risk of water resources contamination. Even though certainly more costly, discharging the treated effluent at a location downstream of wells or springs used for drinking water supply usually provides a better protection of water resources.

The likelihood, significance and extent of residual impacts after mitigation should be analyzed in order to allow decision makers to determine whether those could be accepted.

A **contingency and emergency plan** should be prepared in case of adverse impacts of large scale (e.g. uncontrolled discharge of untreated wastewater). Contingency planning is especially important for adverse impacts on drinking water resources such as springs and wells. Here contingency planning means the development and implementation of both long and short-term drinking water supply replacement strategies for supplying safe drinking water to the consumer in case of adverse impacts of large scale (e.g. uncontrolled discharge of untreated wastewater). It has to mention what alternative water

sources are to be used in case of disruption of water supply due to contamination.

This should be complemented by a **remedial action plan** that describes what needs to be done and who is responsible for the individual actions in case a water source became polluted, for instance by an accidental spill. Remedial action are usually long-term response actions that seek to permanently and significantly reduce the risks associated with releases or threats of releases of substances adverse to human health.

7.6 Environmental Management Plan

An environmental management plan (EMP) is a tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented and that the positive benefits of the projects are enhanced (DEADPWC, online resources).

The environmental management plan should contain the following elements :

- list of mitigation actions;
- description of each mitigation action;
- time schedule and location of implementation;
- expected result;
- responsibility for implementation (name);
- monitoring strategy needed to follow up on implementation and level of success;
- proposed procedures for reporting and responsibilities;
- procedures in case of unforeseen impacts and unexpected results;
- contingency and emergency plan;
- remedial action plan;
- monitoring of the quality of treated effluent
- monitoring of the quality of downstream water resources, especially if used for drinking water supply.

7.7 Impact Management and Impact Monitoring

The environmental management plan proposed in the EIA must be strictly followed during construction and operation.

During construction each impact mitigation action must be meticulously documented and the success of mitigation actions (compliance monitoring) must be continuously monitored. When adverse impacts are higher than

predicted and threaten to violate or already passed environmental standards actions must be taken according to the proposed procedures of the EMP.

During the operational phase monitoring of the impact on water resources (impact detection monitoring) is an important part of impact monitoring. This covers:

- **monitoring of treated wastewater quality** according to environmental standards (release of treated wastewater into rivers or reuse of treated wastewater in agriculture or reuse of treated wastewater for landscaping);
- **monitoring of the quality of downstream water resources** according to environmental standards (drinking water standard).

8 Proposed Standard Outline for EIAs for Wastewater Projects

A standard outline based on practical regional experiences in the wastewater sector is attached as Annex 1. It covers the following chapters :

1 Introduction
2 Legislative and Institutional Frameworks
3 Description of the Project
4 Description of the Environment
5 Impact Identification and Analysis
6 Mitigating Adverse Project Impacts
7 Environmental Management Plan
8 Public Involvement and Participation
9 References

Annex 1: Topographic Map of the Study Area
Annex 2: Geological Map of the Study Area
Annex 3: Hydrogeological Map of the Study Area
Annex 4: Map showing all Components of the Proposed Wastewater Facility (overview and detailed views)

9 References

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ANNEX 1: Standard Outline

Guideline for Environmental Impact Assessment for Wastewater Facilities in Lebanon

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ANNEX 2: Excerpt from Decision 1/8, dated 30 January 2001, 'Air pollutants and liquid wastes resulting from classified establishments and wastewater treatment plants'

(translated by BGR project)

Attachment 3:

Limit values for liquid wastes drained to the sea:
The first column shows the parameters to be monitored, the second column shows the limit values for existing establishments and the third column shows the limit values for future establishments.

The second column values will be deleted when the Lebanese government will ratify the Barcelona Protocol. Then the third column values will be the only ones to be valid.

Length and depth of the outfall pipelines to the sea must consider:

3-1 information about seabed:
- 3-1-1 depth
- 3-1-2 soil
- 3-1-3 stability

3-2 environmental information:
- 3-2-1 wind speed
- 3-2-2 local topography and influence on wind and wave currants
- 3-2-3 navigation, fishing, diving, swimming, and all activities

3-3 effluents information:

3-4 Features of the receiving water:
- 3-4-1 the time required for the die-off of bacteria (T90)
- 3-4-2 horizontal and lateral proliferation factor
- 3-4-3 vertical proliferation factor
- 3-4-4 temperature, salinity, density

Limit values for liquid wastes drained to the sea		
1	2	3
Parameter	Existing establishments	New establishments
pH	5-9	6-9
Temperature	35ºC	35ºC
BOD_5 (mg/L)	100	25
COD (mg/L)	250	125
Fe (mg/L)	5	5
Hg (mg/L)	0.05	0.05
Cu (mg/L)	1.5	1.5
Ni (mg/L)	2	0.5
Al (mg/L)	10	10
NH_4 (mg/L)	10	10
Sb (mg/L)	0.3	0.3
Pb (mg/L)	0.5	0.5
Phosphor (mg/L)	16	10
Sn (mg/L)	2	2
TOC (mg/L)	75	75
Cr (mg/L)	2	2
Total nitrogen (mg/L) [1]	40	30
Zn (mg/L)	10	5
Ba (mg/L)	10	2
Total coliform[2] (MPN/100ml)	2000	2000
Phenol (mg/L)	0.3	0.3
As (mg/L)	0.1	0.1
Oil and fat (mg/L)	30	30
Salmonella	Absence	Absence
SO_4 (mg/L)	1000	1000
S (mg/L)	5	1
CN (mg/L)	0.1	0.1
Ag (mg/g)	0.1	0.1
F (mg/L)	25	25
PO_4 (mg/L)	5	5
Cd (mg/L)	0.2	0.2
Cr-VI (mg/L)	0.5	0.2
Cl_2 (mg/L)	1	1
Co (mg/L)	0.5	0.5
Mn (mg/L)	1	1
Hydrocarbons (mg/L)	20	20
Detergents (mg/L)	3	3
TSS (mg/L)	200	60
NO_3 (mg/L)	90	90
AOX	5	5

[1] Total nitrogen (organic nitrogen + ammonium; NO_3, NO_2 , NH_4)
[2] For wastes drained close to bathing area threshold values used are more strict

Attachment 4:

Limit values for liquid wastes drained to surface water:

The first column shows the parameters to be monitored, the second column shows the limit values for existing establishments and the third column shows the limit values for future establishments.

The second column values will be deleted when the Lebanese government will ratify the Barcelona Protocol. Then the third column values will be the only ones to be valid.

Surface water is the water permanently or temporary flowing on surface of land through river beds or directly from a spring. Draining liquid wastes in surface water is permitted in condition that the minimum discharge is 0.1 m³/s.

Limit values for liquid wastes drained to surface water		
1	2	3
Parameter	Existing establishments	New establishments
PH	5-9	6-9
Temperature	30ºC	30ºC
BOD_5 (mg/L)	100	25
COD (mg/L)	250	125
Fe (mg/L)	5	5
Pb (mg/L)	0.5	0.5
Hg (mg/L)	0.05	0.05
Zn (mg/L)	5	5
Sn (mg/L)	2	2
Cr (mg/L)	2	2
Cu (mg/L)	1.5	0.5
Ni (mg/L)	2	0.5
Al (mg/L)	10	10
NH_4 (mg/L)	10	10
Sb (mg/L)	0.3	0.3
Phosphor (mg/L)	16	10
TOC (mg/L)	75	75
Total nitrogen (mg/L) [3]	40	30
Ba (mg/L)	2	2
Total coliform[4] (MPN/100ml)	2000	2000
Phenol (mg/L)	0.3	0.3
As (mg/L)	0.1	0.1
Oil and fat (mg/L)	30	30
Salmonella	Absence	Absence
SO_4 (mg/L)	1000	1000
S (mg/L)	1	1
CN (mg/L)	0.1	0.1
Ag (mg/g)	0.1	0.1
F (mg/L)	25	25
PO4 - - - (mg/L)	5	5
Cd (mg/L)	0.2	0.2
Cr-VI (mg/L)	0.5	0.2

[3] Total Nitrogen (organic nitrogen + ammonium; NO_3, NO_2, NH_4)
[4] For wastes drained close to swimming area Limit values used are more restricted

Limit values for liquid wastes drained to surface water		
1	2	3
Parameter	Existing establishments	New establishments
Cl_2 (mg/L)	1	1
Co (mg/L)	0.5	0.5
Mn (mg/L)	1	1
Hydrocarbons (mg/L)	20	20
Detergents (mg/L)	3	3
TSS (mg/L)	200	60
NO_3 (mg/L)	90	90
AOX	5	5

Attachment 5:

Limit values for wastewater drained into the wastewater network:
The first column shows the pollutant indicator to monitor, the second column shows the values for existing and new establishments.
The stakeholders can have an agreement on environmental Limit values with the operators of the treatment plant in condition of respecting the Limit values for the outfall of the treatment plant.

Limit values for liquid wastes drained into the wastewater network	
1	2
Parameter	Existing and new establishments
PH	6-9
Temperature	35ºC
BOD_5[5] (O mg/L)	125
COD[6] (O mg/L)	500
Fe (mg/L)	5
Pb[7] (mg/L)	1
Hg (mg/L)	0.05
Zn[8] (mg/L)	10
Sn (mg/L)	2
Cr (mg/L)	2
Cu[9] (mg/L)	1
Ni[10] (mg/L)	2
Al (mg/L)	10
NH_4[11] (mg/L)	-
Sb (mg/L)	0.3
TOC (mg/L)	750
Total nitrogen[12] (mg/L)	60

[5] Supposed concentration 25 (mg/L) at the outfall with a cleaning potential of 80%
[6] Supposed concentration 125 (mg/L) at the outfall with a cleaning potential of 75%
[7] Environmental Limit value 0.5 (mg/L) at the outfall of the treatment plant
[8] Environmental Limit value 5 (mg/L) at the outfall of the treatment plant
[9] Environmental Limit value 0.5 (mg/L) at the outfall of the treatment plant
[10] Environmental Limit value 0.5 (mg/L) at the outfall of the treatment plant
[11] Supposed to be linked to a biologic treatment plant, efficiency 70 – 80%, environmental limit value at the outfall 15 (mg/L) nitrogen.
[12] Supposed to be linked to a biologic treatment plant, efficiency 70 – 80%, environmental limit value at the outfall 15 (mg/L) nitrogen.

Guideline for Environmental Impact Assessment for Wastewater Facilities in Lebanon
General –Recommendations from the Perspective of Groundwater Resources Protection

Limit values for liquid wastes drained into the wastewater network	
1	2
Parameter	Existing and new establishments
Phosphor[13] (mg/L)	10
Ba (mg/L)	2
Phenol (mg/L)	5
As (mg/L)	0.1
Oil and fat (mg/L)	50
Salmonella	Absence
SO_4 (mg/L)	10000
S (mg/L)	1
CN (mg/L)	1
Ag (mg/g)	0.1
F (mg/L)	15
PO_4[14] (mg/L)	-
Cd (mg/L)	0.2
Cr-VI (mg/L)	0.2
Co (mg/L)	1
Hydrocarbons (mg/L)	20
Mn (mg/L)	1
TSS (mg/L)	600
NO_3[15] (mg/L)	-
AOX	5

[13] Supposed concentration 2 (mg/L) at the outfall with a cleaning potential of 80%
[14] In condition to respect the environmental limit value of phosphor
[15] In condition to respect the environmental limit value of total nitrogen