JASPERS

Joint Assistance to Support Projects in European Regions

Sectoral EIA Guidelines

Integrated Waste Management System Projects

ROMANIA

Jaspers
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Name of Guideline:

Sectoral EIA Guidelines for Integrated Waste Management System Projects

Table of Contents

Acronyms

BAT	Best Available Techniques
BREF	Reference documents on BAT
COD	Chemical Oxygen Demand
CS	Composting Station
EIA	Environmental Impact Assessment
EIA	Environmental Impact Assessment
GMF	Gas Management Facility
IWMC	Integrated Waste Management Centre
IWMS	Integrated Waste Management System
LTF	Leachate Treatment Facility
LWD	Landfill of Waste Directive
MBTS	Mecano-Biological Treatment Station
MWEP	Ministry of Water and Environment Protection
NMVOCs	Non-Methane Volatile Organic Compounds
NTS	Non-technical Summary
PPWD	Packaging and Packaging Waste Directive
SBR	Sequential Batch Reactor
SS	Sorting Station
TS	Transfer Station
TSS	Total Suspended Solids
VOCs	Volatile Organic Compounds
WEEED	Waste Electrical and Electronic Equipment Directive
WWTS	Wastewater Treatment Station

Preface

This Guidance document is primarily aimed at the EIA practitioners in the Romanian environmental authorities and at consultants. It is also envisaged to be of interest for the other authorities that must be consulted with in accordance with legal provisions, for Non-Governmental Organizations as well as the public and should facilitate their enhanced participation in the EIA process. The contained recommendations will be of practical benefit to those involved in the EIA process for integrated waste management system projects.

Note: This Guidance document does not attempt to reproduce the work of the statutory EIA Guidance documents that already exist in Romania and so should be read in conjunction with them.

1 BACKGROUND

1.1 INTRODUCTION

The overall objective of this Guidance document is to improve the content of the environmental reports prepared for projects prepared for EU funding in the integrated waste management (IWM) sector that includes a landfill as final disposal option and in this respect to ensure that those responsible for carrying out the assessment and preparing the EIA report are fully aware of the key issues for the sector and address these issues adequately.

An Integrated Waste Management system (IWMS) including a landfill for municipal waste as the main component, may include other facilities for waste processing that are not specifically included in either Annex I or Annex II of the EIA Directive. In this document the possible components of an integrated waste management system (based on a landfill as final option for final disposal) that will be taken into consideration are grouped and discussed as:

- Integrated Waste Management Centre (IWMC) that includes:
    - a municipal/nonhazardous waste landfill including gas management facility (GMF) and leachate treatment facility (LTF) and eventually a wastewater treatment station (WWTS);
    - a mecano-biological treatment station (MBTS) and/or a composting station (CS);
    - a sorting station (SS) for recyclable waste;
- composting stations off IWMC site;
- sorting stations off IWMC site;
- transfer stations (TS).

The special case of old (non-compliant) landfill closure (LC) is an activity that frequently precedes or follows, in most of the cases, the construction of a new landfill at regional/county level and will be considered where is the case.

1.2 LEGISLATIVE CONTEXT

The present Guidance document is prepared for the following type of projects as comprised in Annex II of the EIA Directive transposed by the Governmental Decision no. 445/2009:

- *"installation for waste disposal (projects not included in Annex I"* (Annex II, item 11 b);
- *"any change or extension of projects listed in Annex I or Annex II, already authorized, executed or in the process of being executed, which may have significant adverse effects on the environment*" (Annex II, item 13a);

The following installations fall under the provisions of Directive 2008/1/EC concerning integrated pollution prevention and control (IPPCD) (are IPPC installation):

- Installations for the disposal of non-hazardous waste as defined in Annex II A to Directive 2006/12/EC under headings D8 and D9, with a capacity exceeding 50 tonnes per day;
- Landfills receiving more than 10 tonnes per day or with a total capacity exceeding 25 000 tonnes, excluding landfills of inert waste. (in accordance with Annex 1).

These installations must be design based on BEST AVAILABLE techniques (BAT). The technical requirements included in the Council Directive 1999/31/EC on the landfill of waste (LWD) are considered as BATs.

From the perspective of European legislation, Member States have obligations established by Directive 1999/31/EC of the Council on the landfill of waste (LWD), by European Parliament and Council Directive

94/62/EC on packaging and packaging waste (PPWD) and by European Parliament and Council Directive 2002/96/EC on waste electrical and electronic equipment (WEEED) that are relevant to IWMS and new landfills, i.e:

- the EU Landfill Directive requires **pre-treatment of all waste before landfilling** (Article 6). The operator of a new landfill has to demonstrate to the EPA that all waste delivered to the landfill will have been adequately pre-treated, that is considered minimum BAT for new facilities;
- fulfil the specific **biodegradable** waste diversionary targets set by Article 5 of the LWD;
- fulfil the annual targets for **recycling/recovery of packaging waste** in accordance PPWD;
- fulfil the annual targets of **separate collection of WEEE** in accordance WEEED

In the case of an IWMS, it should be design to fulfil the targets from the Accession Treaty in relation with waste management at national level.

All analysed options have to take into account the relevant legislation presented in Annex 1 of this Guidance document and, also, any relevant waste management strategy, plan or program, as well as the local strategies concerning medium and long term development and operation of the sanitation services.

1.3 MAIN PRINCIPLES

The governing principles in preparation of this Guidance document can be found in its specific purposes:

- to support the relevant environmental authorities when preparing the guideline regarding the information to be included in the report, so-called scoping report (in Romanian so-called “indrumar”);
- to support the final beneficiaries/project developers to draft the terms of reference for the external support (EIA Consultants in Romanian so-called “evaluatori de mediu”).

This Guidance document comprises concise but tailored standardized recommendations regarding the content of the environmental impact assessment impact reports for integrated waste management systems that dispose the municipal waste by landfilling in nonhazardous waste landfills and should be read in conjunction with National Romanian Guidelines and methodology for EIA;
The overall purpose of this guideline document is to ensure that those responsible for actually carrying out the assessment and preparing the report are fully aware of key issues for Waste Management sector and that all specific issues are addressed adequately. Furthermore, after compilation and the formal submission of the report, the guidance document should also be used by the relevant environmental authorities to review the quality of the information, in particular to ensure that none of the key issues have been overlooked.

The structure of the Guidance document follows, to a large extent, the requirements provided in Annex IV of the EIA Directive with respect to the information referred to in the article 5 (1), i.e. the information which the developer has to supply to the competent authority or authorities for projects subjected to an environmental impact assessment.

These Guidance document is not exhaustive. Thus, some issues common to all type of projects may not be mentioned or addressed.

The Guidance document address all type of projects mentioned in section 1.2 in a unique document commenting on those issues which are specific to one or another type.

The order/ place of some subsections addressed in each of the following sections might be changed by the Reporter who also may introduce new subsections according to the specificity of each project with regard to its objectives, technical characteristics, location, natural and constructed environment and other elements.

2 DESCRIPTION OF PROJECT

The purpose of this section is to highlight the main issues to be addressed for each of the sub-sections below when describing a project prepared for IWMS construction:

- **Sub-Section 2.1:** a description of the physical characteristics of the whole project and the land-use requirements during the construction and operational phases;
- **Sub-section 2.2:** a description of the main characteristics of the processes and activities (e.g. waste handling, leachate treatment), for instance nature and quantity of materials used and an estimate, by type and quantity, of expected residues and emissions (water, air and soil pollution, noise vibration, light, radiation etc) resulting from the operation of the proposed project;
- **Sub-section 2.3:** an outline of the main alternatives studied by the developer and an indication of the main reasons for this choice, taking into account the environmental effects.

Note: *The two sub-sections will cover only the selected alternative.*

2.1 PHYSICAL CHARACTERISTICS OF THE PROJECT & LAND USE REQUIREMENTS

2.1.1 Description of Site Layout

The Reporter should consider the location of the proposed landfill/IWMC, SS, CS MBTS respectively TS in relation to its surroundings and in particular its proximity to sensitive receptors., The following elements should be briefly presented:

- location of the IWMC: latitude, longitude, site elevation (map);
- corelation with plans of urban and land planning ;
- proximity to the waste sources and/or TS(s): cities and communes that will be served by IWMS (map)
- distances from the boundary of the site (IWMC, CS, MBTS, TS, SS) to residential and recreation areas, waterways, water bodies and other agricultural or urban sites;
- transport distances from waste generation sources (cities and communes) to transfer station(s) and / or IWMC (map);
- distance to the available mineral resources in the region: clay, gravel and soil for the landfill construction
- landsurface occupied and land use categories (forest, agricultural, etc.);
- the risk of flooding (developers of landfills should ensure that the landfill is not located within the floodplain of rivers), subsidence, landslides or avalanches on the site;
- accessibility, site topography and site specific information;
- major natural hazards: seismic activity;
- meteorological factors: rainfall (as annual average, for example in the last 5 years), evapo-transpiration rate, wind strength and wind patterns;
- presence of sensitive locations : e.g. storing flammable or explosive materials, airports (if the case);
- socio-economic features; land use, demography, transportation impact;
- consideration of potential current and future land use conflicts: e.g. tourism.

For the location of other elements of the IWMS outside the IWMC (mainly transfer stations for the new projects), the above description should be followed where relevant.

The hydrogeological and geological studies (elaborated during one of the previous project stage) are based on on-site investigations that document and support the decision on the site selection from possible alternatives. In this sub-section, the presentation of their findings, conclusions and recommendations for the selected alternative should be provided including:

- geological and hydrogeological conditions below and in the vicinity of the landfill site;
- details of the structure and characteristics of the solid strata,
    - soil characteristics (type, depth, permeability), distribution, thickness and depth of the aquifers and protection zones;
    - bearing capacity and stability of landfill base: presence of unstable or weak soils (organic soil, soft clay or clay-sand mixtures, soils that lose strength with compaction or with wetting, clays with a shrink-swell character, sand subject to subsidence and hydraulic influence).
    - existence of ground water table fluctuation, ground water flow direction, ground water quality;
    - distribution, thickness and depth of the aquifers, including protection zones;

The groundwater distribution and its interaction with surface water is a major issue in the selection if landfill location due to its importance as water resource in rural areas and very low rate of self-purification.

For the region/county(s) that are served by the IWMS:

- a general description of the waste transport routes from TS(s) or other facilities (for example, sorting, composting, wastewater treatment station(s)) to IWMC, with reference to the maps/diagrams on which the area of study should be clearly presented;
- the human settlements (cities, villages) crossed by the roads in question should be clearly marked and the streets in the area of study should be clearly marked, if the case.

For the IWMC as well as for the Composting Station/MBT Station/ Sorting Station located outside the IWMC, layouts with identification of main operation areas like storage, processing, etc., has to be provided .

2.1.2 Description of Design including Size or Scale

Description should be given for each installation /component of the project using the tabular format whenever possible. This chapter has to include:

- description of general features that should cover:
    - main structural components of the IWMS/IWMC;
    - off-site developments (in terms of transportation, energy and utilities infrastructure) arising either directly or indirectly from the project operation;
- number of benefiting population/localities and
- daily incoming waste accepted in each facility (IWMC, SS, CS, MBTS, TS);
- total area and each IWMC component areas.

In accordance with Annex 1 of IPPCD, the following activities:

- installation for the disposal of non-hazardous waste as defined in Annex II A to Directive 2006/12/EC under headings D8 and D9, with a capacity exceeding 50 tonnes per day, and
- landfills receiving more than 10 tonnes per day or with a total capacity exceeding 25 000 tonnes, excluding landfills of inert waste

has to be design taking the appropriate preventive measures against pollution, in particular through application of the best available techniques, and are the subject of integrated environmental permit.

***Note**: The existing BREFS for: Waste Treatment Industries (2006), Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector (2003), General Principles of Monitoring (2003)* and *Emissions from Storage (2006)) could be consult to identify mitigation techniques.*

Landfill

- type and source of waste to be disposed of in the landfill, description of their treatment before landfilling (if it is the case);
- expected waste composition (%); it is recommended to use the most recent available data;

In accordance with Ministerial Order no.757/2004 for approval of the Technical Norms regarding waste landfilling, the sludge from municipal wastewater treatment stations, with water content less than 65%, can be landfilled in nonhazardous waste landfills only mixed with the household waste for a ratio of 1: 10. The quantities of sludge that will be landfilled have to be consider at landfill capacity evaluation and design and correlated with data included in the county water supply and sewage network Master Plan.

- capacity (in m^3) and landfill life time;
- number of cells (total and financed by the project), life time per cell and cell areas.

The landfill has to be designed in accordance with LWD; the EIA Report has to include a brief description with graphic support of the following key components in risk mitigation.

- geological barrier.

Where the geological barrier does not naturally meet the conditions state by LWD/National legislation it can be completed artificially and reinforced by other means giving equivalent protection, BUT it should be no less than 0.5 metres thick. Also the materials that will be used for artificially established geological barrier have to be tested. The adopted solution has to eliminate risks of soil, surface water and groundwater contamination from leachates by lining.

- landfill liner system;
- leachate management system;
- landfill gas management system.

It is very important to cover all the key features and not to omit any or to postpone for another stage of the project (for example, to leave for the designer or constructor the decision of leachate treatment techniques). Also, for example, where methane recovery is envisaged, this should be included as part of the initial project design as retrofitting is expensive and less effective.

- rainfall water management system;
- groundwater monitoring system;
- quality control/assurance system;
- landfill final cover.

For each structural component there should be presented technical characteristics of each facility/ object/ works and the resources / quantities of necessary materials (aggregates and minerals, water, energy, including electricity and fuels, others).

- construction techniques/ method(s), as adopted, including the nature of construction works and scale of machinery to be used.

Composting/MBT station/ Sorting Station

- capacity (in m^3) and area (operational and total);
- daily incoming waste and outputs;
- technical characteristics of facility/ works.

Transfer station

- capacity (in m^3) and area (operational and total);
- number of benefiting population/localities and daily incoming waste;
- technical characteristics of facility/ works.

Non-compliant landfill closure

- components of the landfill cap;
- landfill gas collection and treatment system;
- leachate collection system (if necessary); also must indicate where the collected leachate will be treated;
- slope runoff water management.

2.1.3 Description of Existing Development

If the case, the existing landfill that has to be closed or extended should be described on the same pattern mentioned above.

2.2 THE EXISTENCE OF THE PROJECT – MAIN PROCESSES

2.2.1 Description of Construction

- investigations preliminary to the construction phase (e.g. soil tests, drillings);
- number of people/ workers involved during construction;
- phasing;
- works involved by site preparation will refer to any of the following, as applicable:
  - clearing the existent land of vegetation;
  - remove and stockpile topsoil;
  - construct berms;
  - excavations/ blasting/ dredging/ backfilling: estimated volume will be indicated;
  - closing or deviation of existing transport routes or infrastructure; if temporary, the involved period of time should be mentioned;
  - land improvement works (e.g, homogeneity improvement);
  - install drainage improvements;
  - arrangements for transport of necessary equipments/machinery, goods and materials;
  - estimated number of vehicles used on the site during construction phase;
  - temporary storage of necessary goods and materials if outside of the building yard;
  - use of substances or materials which may be risky or toxic for the health of the population or the environment (flora, fauna, water supplies): type, quantity, purpose, way of handling;
  - building of access roads to IWMC and TS(s) (permanent and temporary);
- roads construction (permanent and temporary) to and inside IWMC, to SSs, SCs, TSs (if it is the case);
- utilities work constructions;
- construction works- description should cover the following, as applicable
  - location;
  - land area occupied temporarily on materials (soil, gravel, etc.);
  - description of handling and materials on site (unloading, loading, transport) with quantities and frequency);
  - arrangements for water supply (domestic and technologic if any);
  - installations for treatment and/ or removal of liquid effluents (leachate, wastewater, run-off water etc.);
  - constructions to be erected/assembled on site;

- containment – landfill and ponds liners installation (e.g., leachate, sludge, wastewater storage, if it is the case);
- landfill capping, sealing, drainage and venting installation etc.

2.2.2 Description of main Residues and Emissions from Construction

Actual residues and emissions (including their estimated volumes/ quantities) following to be generated due to the specificity of the respective project with respect to: works, actions, equipment, materials, climatic/ seasonal meteorological conditions, construction methods, and mitigation measures envisaged to be taken or applied. Reporter should avoid mentioning the residues and emissions in general terms, i.e. those *potential* to be generated by material transport.

The following types of waste can be generated during construction: material resulted from excavation/ blasting/ dredging not being used for backfilling, humus layer, contaminated soils or other materials, domestic waste, hazardous waste, waste resulted from constructions or demolitions etc. These types of waste have to be registered by EWL codes and quantitative estimated; their fate has to be mentioned (e.g. treatment or recovery base on contracts, storage for recovery as cover material, etc.).

2.2.3 Description of Project Operation

Landfill

Landfill operations and related issues are described in general terms and are listed as follows:

- perimeter security / control / access (for example: fences, access gate control, etc.);
- collection and transport of waste from sources of generation/TS(s) to landfill, directly or via on or off site recovery facilities; estimated number of vehicles used on the site during operation phase;
- quantity, type and significance (e.g., of sludge from municipal wastewater) of waste received; a list of waste types that will be accepted for landfill should be provided;
- wastes acceptance / inventory / placement in accordance with EU and national legislation;
- treatment of waste to improve rate of decomposition and avoid nuisances
- compaction requirements;
- operational times, daily procedures – compaction / covering and capping;
- leachate management:
    - production: rates, quantity and estimated composition
    - brief description of collection system operation including the drainage material;
    - brief description of the leachate treatment facility operation and auxiliary installations like leachate storage tanks, evaporation ponds, sludge and concentrate storage and disposal areas and/or tanks, etc.; graphic support: layout of the LTF and the technological scheme of the treatment processes;
    - information on the temporary storage capacity of collected leachate and resulted treated water;
    - estimated performance: effluent/treated water quality, rate of removal for ammonia, suspended solids, COD, BOD5;
    - identification and description of the receptor (water body of local sewage system) of the treated leachate;
    - fate of the resulted residues;
- gas release
    - production: rates, quantity and estimated composition;
    - description of gas collection system operation description;
    - description of the treatment system operation (burn at flares, thermal recovery of landfill gase, if it is the case);
    - gas purification (if the case);

- description of phasing (waste acceptance, landfilling, periodic cover, etc.);
- description of environmental quality monitoring equipment operation;
- operational monitoring and maintenance of equipment, including post-closure monitoring;
- final profile and landscape rehabilitation;

The following aspects are also common for CS, MBTS, SS and TS and shall be mentioned, as appropriate, during their operation description:

- wastewater and/or runoff collecting system;
- management/ maintenance of roads: accessibility vehicles to and inside landfill for the duration of construction and operation is essential;
- operation and maintenance of equipment, including their maintenance after landfill closure;
- litter, scavenging, pest and bird nuisance control (like periodic cover);
- management, equipment, staffing;
- management/ maintenance procedures: envisaged routine maintenance programmes including new planting, emergency intervention measures etc.

Composting/MBT Station

- describe acceptance procedure;
- waste acceptance hours;
- description of facility operation for biological treatment (e.g. waste delivery and feeding, control of operation parameter like temperature, oxygen content, humidity);
- present pre and/or after composting/biostabilisation sorting;
- compost/stabilized residue post-treatment and storage;
- exhaust/ventilated air treatment;
- leachate collection and treatment.

Sorting Station

- describe acceptance procedure;
- waste acceptance hours;
- description of facility/ works;
- sorting techniques and fractions;
- baling and storage of recyclables.

Transfer station

- describe acceptance procedure;
- waste acceptance hours;
- description of facility/ works;
- storage time and waste final disposal.

2.2.4 Description of main Residues and Emissions from Operations

During landfill and treatment processes various residues are generated and have to be considered in this chapter; the following data about residues and emissions have to be supplied:

- qualitative and quantitative estimation of generated landfill gas, including main air pollutants (CH_4, NO_x, SO_2, VOC, CO_2, dust) as resulted and included in the feasibility study;
- qualitative and quantitative estimation of generated leachate, including main water pollutants (COD, NH_3, suspensions, etc) as resulted from the and included in the feasibility study. Depending of

applied technique, it can be generated leachate also in CSs or MBTS and after the closure on non-compliant landfills. In all these cases the leachate must be treated in an appropriate treatment plant;
- qualitative and quantitative estimation of treated water (from leachate treatment) and its fate. If the reverse osmosis is used, the resulted permeate will have a much lower content of compounds than the receiver water body. In this respect, it should be considered the technique use to impact less the ecosystem of receving water;
- estimated quantities of sludge resulted from leachate treatment (coagulation-flocculation process, biological processes as SBR) and their fate;
- estimated quantities of concentrate resulted from leachate treatment by reverse osmosis and its fate;
- collection and fate of run-off water;
- estimated flows and fate of wastewater collected on site including domestic and wheel washing wastewater;
- detailed description of other air emissions generated due to the regular traffic and maintenance operations as well as due to the emergency interventions.

In this section the residues resulted from SS and CS/MBTS have to be characterised qualitative and quantitative.

- fate of the recyclable waste
- fate of the compost/stabilised residue

2.2.5 Description of Post-operation activities (Closure and Post-closure monitoring)

Post-operation is a construction phase that includes closure/capping, restoration and long term aftercare activities that is necessary to be taken in relation to the landfill for the purposes of preventing environmental pollution following the cessation of landfill activities. This phase includes also monitoring activities.

Post-operation phase refers to *compliant* as well as to *non-compliant landfills*.

- Descriptions of:
    - temporary sealing;
    - landfill closure and related issues
    - cover description (gas drainage system, liner, water drainage system, etc.);
    - leachate collection and treatment (if it is the case)
    - gas collection system;
    - final profile.
- brief description if the post-closure monitoring facilities and parameters.

2.2.6 Description of Changes to the Project

Descriptions of any anticipated changes to the project:

- any eventual future phases of the project;
- ageing of structural components causing deterioration and weathering of physical fabric, with anticipated time horizon depending on the maintenance system.

2.2.7 Other developments

The following type of developments carried out by parties other than the applicant could directly arise:

- changes in regional and national strategies concerning the waste management, especially recognition of waste incineration as energy recovery technique;
- changes in tariffs and citizens behaviour concerning separate selection of recyclables, composting: an increase of the quantities of recyclables and biodegradable waste for processing.

If it is the case, out of the potential developments in this category mentioned above, there should be mentioned only those which are *envisaged/ likely* to occur, specifying their location (for example, intensification of composting in rural area).

2.3 MAIN ALTERNATIVES STUDIED

The presentation and consideration of the various alternatives investigated by the applicant is an important requirement of the EIA process. Alternatives referred to as part of this section refers specifically to Annex IV paragraph (2) of the EIA Directive – *Information Referred to in Article 5 (1)* – unless otherwise specified – *"an outline of the main alternatives studied by the developer and an indication of the main reasons for this choice, taking into account the environmental effects."*

Thus, an outline of the main alternatives examined throughout the design and consultation process needs to be described. This serves to indicate the main reasons for choosing a particular location, leachate treatment technology, landfill gas management system, composting technique, etc., taking into consideration the environmental effects. However, as a part of the EIA process for integrated waste management projects, it is important that an assessment, as required under Article 6 of the Habitats Directive 92/437EEC, is carried out when analyzing main alternatives as required by the EIA Directive.

For the purposes of these guidelines therefore, taking into consideration the requirements of the EIA Directive and addressing requirements of Article 6 of the Habitats Directive, alternatives, specifically in the case IWMS projects, may be described at three levels:

- Alternative locations for the IWMC and TS but also for off site SSs and CSs;
- Alternative designs;
- Alternative processes.

However, as part of the EIA process regarding the IWMS projects, it is imperative that an assessment as required under Article 6 of the Habitats Directive 92/437EEC is carried out when analyzing main alternatives as required by the EIA Directive. Habitats Directive has been transposed in Romania by EOG 57/2007.

2.3.1 Description of alternative locations (including assessment as required under Article 6 of the Habitats Directive)

It is recommended that alternative locations for landfill and TS(s) are examined in early stages of planning, recognizing that the avoidance of impacts through the early consideration of alternatives may be the most important and effective mitigation strategy.

The alternative locations for some works (e.g. IWMC) have to be analysed on Strategic Environmental Assessment carried out for Urban Planning (Zonal Urban Planning, Locality/Municipality General Urban Planning); reference to this aspect should be made.

The description of alternatives considered in the EIA is, in effect, a summary of the landfill and all other IWMS facilities location selection process. This should include a description of the main alternatives considered, the criteria used for comparing and choosing between alternatives, and the main reasons for the choosing of the preferred location.

In conjunction with the above, the alternative locations are described. It is also important that the engineering and economic criteria are also assessed and described in detail.

Each of the alternative locations can present a number of issues and constraints including but not limited to the main technical and economic criteria:

- site topography, hydrogeology, hydrology;
- location access and utilities existence;
- proximity to other existing and future developments;
- existence of similar facilities (landfills, TSs, CS/MBTSs and SSs) in the region/county
- development plans for the proposed location(s);
- constraints on land ownership.

The description of alternative location is intrinsically linked to the description of the general design as the location conditions may impose certain design constraints. For example, one location may have a natural clay liner, another may not.

Exclusion criteria that should be taken into consideration when carrying out the site selection process include but are not limited to:

- existing or planned (i.e. already officially registered) drinking water-protection- and catchment-areas;
- existing or planned (i.e. already officially registered) airports;
- high-flood-areas;
- karst and areas with soil conditions which allow a fast penetration and permeation of water or possible leachate to the next aquifer;
- areas with unstable ground like swamps, moors and/or marshes;
- areas with unstable or weak soils: organic soil, soft clay or clay-sand mixtures, soils that lose strength with;compaction or with wetting, clays with a shrink-swell character, sand subject to subsidence and hydraulic influence;
- areas with an extreme morphology (steep slopes, danger of land-slides/avalanches etc.).

All these constratints have to be described as much as possible.

In addition, IWMS projects may cover a significant area and thus have a significant zone of influence, not only through project component locations but also through transport component of the system. Because of this, such projects may impact upon protected areas included or proposed to be included in the Natura 2000 network.

Thus, an assessment of the potential impact of such projects on NATURA 2000 sites as required by Article 6(3) and (4) of the Habitats Directive must be carried out at the earliest possible stage of IWMS project conception, i.e. when the alternative corridors and routes are investigated and assessed.

However, it is also clear from the above that any assessment carried out as a requirement under Article 6 of the Habitats Directive may also provide a number of constraints when determining the most suitable location, criteria that may not necessarily arise as part of an assessment of potential physical, engineering and economic constraints.

Thus, when presenting the findings of the alternative location assessment, it is recommended that the results of the assessment as required under Article 5 (1) of the EIA Directive i.e. *an outline of the main alternatives studied by the developer and an indication of the main reasons for this choice* (including physical, environmental, and financial constraints) are presented in conjunction with the conclusions of the assessment that is required under article 6 of the Habitats Directive, the details of this assessment which is outlined in Box 1 below. The reasoning and rationale of the conclusions both from the analysis under Article 5 (1) of the EIA Directive and those conclusions as a result of the assessment as required

under Article 6 of the Habitats Directive should be presented in a clear concise and above all, an integrated fashion.

Box 1 Addressing the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC

In order to assist Member States in interpreting the requirements of Article 6 of the Habitats Directive and to provide guidance in carrying out the assessment required by Article 6 of the Habitats Directive, the document entitled ***"Assessment of plans and projects significantly affecting Natura 2000 Sites – Methodological guidance on the provisions of Article 6 (3) and (4) of the Habitats Directive 92/43/EEC"*** has been published by the European Commission (DG Environment) The document proposes the assessment as a four stage process:

1. ***Stage One: Screening*** — the process which identifies the likely impacts upon a Natura 2000 site of a project or plan, either alone or in combination with other projects or plans, and considers whether these impacts are likely to be significant;
2. ***Stage Two: Appropriate assessment*** — the consideration of the impact on the integrity of the Natura 2000 site of the project or plan, either alone or in combination with other projects or plans, with respect to the site's structure and function and its conservation objectives. Additionally, where there are adverse impacts, an assessment of the potential mitigation of those impacts;
3. ***Stage Three: Assessment of alternative solutions*** — the process which examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the Natura 2000 site;
4. ***Stage Four: Assessment where no alternative solutions exist and where adverse impacts remain*** — an assessment of compensatory measures where, in the light of an assessment of imperative reasons of overriding public interest (IROPI), it is deemed that the project or plan should proceed (it is important to note that this guidance does not deal with the assessment of imperative reasons of overriding public interest).

Each stage determines whether a further stage in the process is required. If, for example, the conclusions of stage 1 are that there will be no significant impacts on Natura sites, there is no requirement to proceed further.

However, if, based on the screening decision, appropriate assessment is required (stage 2), the results of the appropriate assessment results may illustrate the necessity to carry out the Assessment of alternative solutions (stage three). In this stage, the alternative solutions are tested against their implication for the Natura 2000 site and, as stated in the Methodological guidance, "the conservation objectives and status of the Natura 2000 site will outweigh any consideration of costs, delays or other aspects of an alternative solution" i.e. "other assessment criteria, such as economic criteria, cannot be seen as overruling ecological criteria".

2.3.2 Description of Alternative Design

Alternatives may be considered in the context of the chosen location in terms of alternatives. The alternative design of IWMS with its main component, the landfill, is strongly correlated with the following aspects:

- minimisation of environmental impacts including, noise, odour and aspect;
- optimum capital and running costs;
- optimum transfer system based on a maximum load per km;
- modular – type design to meet both present and future design loads;
- design flexibility to allow for future extension or retrofitting;
- utilisation of landfill gas or biogas from sludge digestion tanks for electrical and heating purposes.

Where designers are briefed at an early stage about environmental factors, these can usually be incorporated along with other design parameters.

2.3.3 Description of Alternative Processes

Within each design solution there can be a number of different options as to how the processes or activities of the development can be carried out. These can include construction methods, choice of materials used for landfill and other constructions, technologies for leachate and wastewater treatment, management of landfill gas and other emissions (odors), residues, traffic planning during construction, traffic planning during operation etc. Consideration of environmental factors can influence the selection of processes which avoid adverse impacts.

All considered alternatives for IPPC installations (landfill and MBT) has to be BAT.

2.3.4 Alternative selection

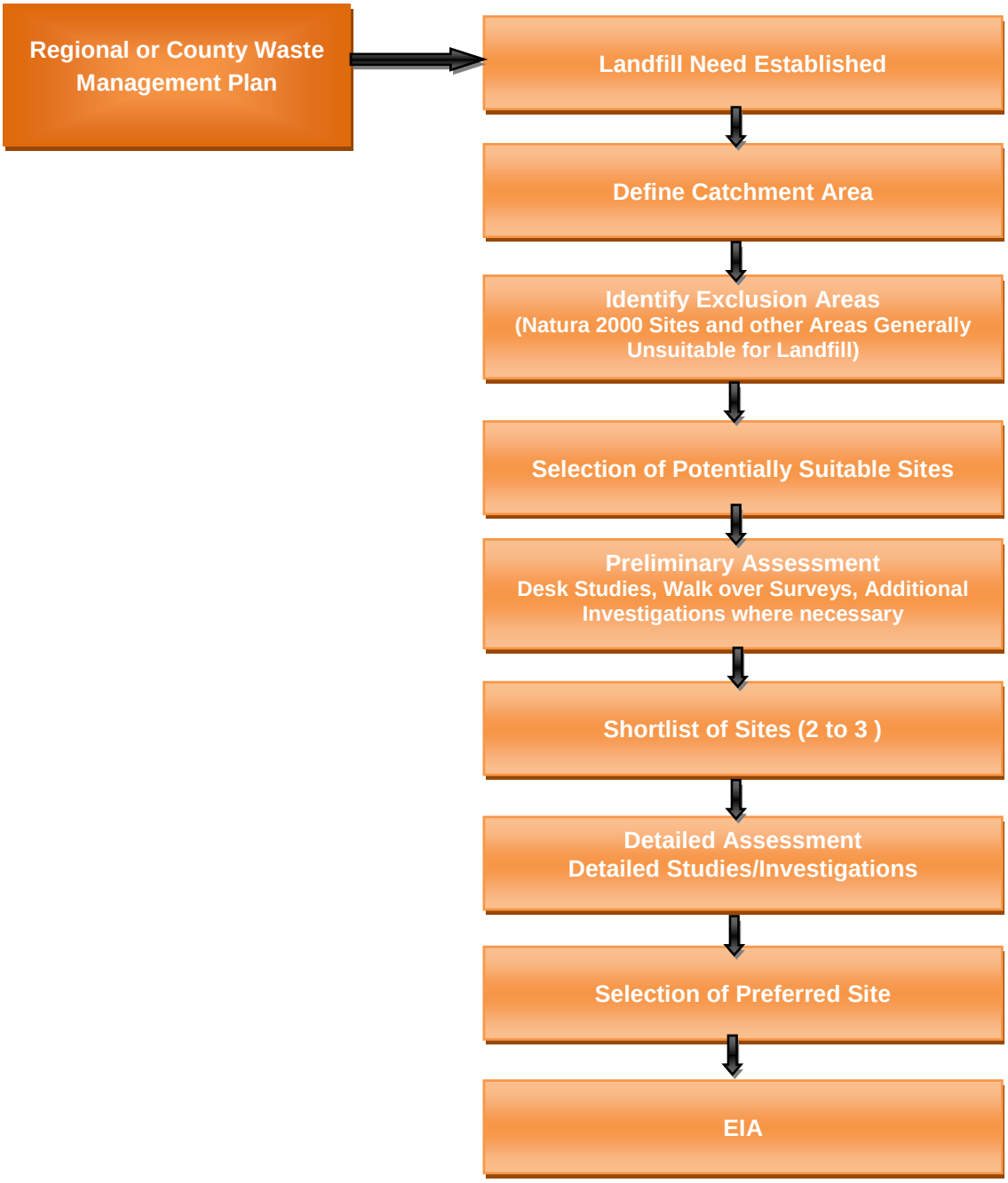
A summary of the analysis used to compare the different options/ alternatives technically identified in order to select the best one should be presented in a dedicated sub-section. It should provide the reviewers with the main elements necessary to follow the selection process. Reference should be made to the detailed analysis (performed within the process of carrying out the Feasibility study) as comprised in a separate document (attached to the EIA Report or otherwise made available to any interested party).

Consideration of alternatives has to refer also to alternative of project abandoning (so called option 0).

In presenting this information, some EIAs use a matrix to demonstrate how each alternative preformed against each selection criteria. While this may be a simplification of the location selection process, it provides a useful aid to the reader of the EIA in understanding how the chosen location was arrived at and the range of environmental factors considered.

Figure 1 illustrates the main issues that need to be addressed.

Figure 1 Landfill site selection steps (which should be described in the EIA Report)



3 DESCRIPTION OF EXISTING ENVIRONMENT

This section should highlight key issues as regards carrying out baseline assessment (description of the aspects of the environment likely to be significantly affected by the proposed project, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the inter-relationship between the above factors.)

3.1 CONTEXT

Soil & Geology

The footprint of the future IWMC site and surroundings should be described taking into account the conditions that have to be fulfilled in terms of geotechnical and hydrogeological aspects, the potential project impact on soil and underground water and their influence on the project features.

- a general description of the overall setting would include a description of the principal lithologies (types of strata) present, the structure and the relationship between the geology and the geomorphology of the area.
- the site characterisation should be presented in the form of a descriptive manner including maps and cross-sections.

Water & Groundwater

- maps and text describing the surface water bodies;
- the direction and relative magnitude of flow of all water movements both surface and groundwaters.

Air & Climate

- indicate the features of the development which could potentially impact the air quality, for example the transport during all stages (construction, operation and closure), landfill, composting/MBT and biological treatment of leachate emissions, flue gases from landfill gas treatment;
- identify the air sensitive receivers;
- describe existing potential sources of air pollution such as industrial areas, roads, rail.

Noise & Vibration

- describe features of the development which could potentially impact the noise environment;
- identify the noise and vibration sensitive locations and/or, fauna.

Human beings

- nature of surrounding environment and presence of air and noise sensitive receivers (including homes, farms, forest areas, industry, small business enterprises and other establishments) and proximity to these;
- describe existing land uses of the land to be occupied by the IWMC and the surrounding area people living on or using the land;
- traffic conditions along the major haul routes between the waste centres and the proposed landfill.
- indicate the number of inhabitants likely to be affected by IWMC, TS, waste collection vehicle routes;
- provide information on topics like: employment, welfare, health, occupation, recreational habits but only if they have direct/ indirect relation with the IWMS topics.

Fauna & Flora

- brief description of terrestrial and/or aquatic habitats, which are likely to be disturbed or obliterated during land preparation, construction, operation, reclamation. The distribution data should be presented as habitat or species location maps, shown in relation to position of the proposed project;
- existing habitats on-site with their flora (focusing more on natural areas), locations of sensitive or rare species illustrated with a scaled map or plan. An example of a habitat mapping is presented in figure 2.

Landscape

- describe and illustrate the principal landscape features including the topography and drainage; natural features and vegetation, land-uses; circulation routes etc;
- areas from which the selected location can be seen are generally noted giving particular attention to views from designated tourism routes and view points, roads, residences, hotels and amenities, sites and monuments of archaeological, architectural or historical interest.

Material Assets

- describe and illustrate the principal material assets (including buildings, other structures) responsible of production, development, maintenance, recreation in the area that may be affected by the IWMS components;
- describe existing economic activities in the nearby area (agriculture, tourism, mining, commerce, etc.);
- describe and illustrate the main natural material assets including mineral resources (cover soil, drainage gravel), water resources in the area that may be affected by the IWMS components;
- evaluate quality of life and employment (average per capita income, quality of the work force, labour market, employment dynamics), type of households; living conditions;
- evaluate evolution of investment in the area, price of land and its dynamics;
- local population environmental culture and awareness.

Cultural Heritage

- describe and illustrate the principal archaeological, architectural, historical or cultural features, etc. existing close to the selected location;
- establish archaeological, architectural, historical or cultural areas from which the selected location can be seen.

3.2 CHARACTER

Soil & Geology

Geological surveys and site visits conducted by certified geologists will provide the following information:

- description of the existing topography of the proposed areas which are likely to be affected by any aesthetic impact;
- determination of the geology of the area through a geological description of borings, soils samples, and geophysical surveys, as well as review of available literature and existing well logs on record for the region.
- each soil type present at a site will be described in terms of classification, profile, properties such as permeability, texture, structure, colour and root development;
- sufficient information has to be provided for the existing geological barrier. Based on that data the decision for the landfill bottom and side sealing design will be taken;
- description of all groundwater recharge areas and use of groundwater down gradient from the landfill;

- condition and present and planned use of the receiving water and standards for discharge to the receiving water.

Water & Groundwater

Baseline data collected should be sufficient for predicting conditions that should be calculated. The water indicators must be assessed for watercourses to which the treated/drainage water will be discharged: water flow (average and fluctuation range during the year), total soluble salts TSS, COD and BOD, aquatic biological indicators (invertebrates), nutrients (nitrogen and phosphorus), etc. Data should be obtained from a sufficient distance upstream of the proposed discharge location(s) to be able to estimate background conditions for the area/length of the watercourse affected, or likely to be affected.

Hydrological characteristics may either be affected by the construction, operating and closure phases. The issues to consider include:

- existing drainage patterns, identification of areas prone to flash floods, the range of water heights/depths in the area, daily flushing regime, storm surge or flood levels;
- groundwater regime, e.g. depth to groundwater level, whether groundwater is used for water supply;
- presence and importance of structures likely to be affected by changes in groundwater levels (such as buildings, bridges, flood mitigation works);
- aquifer vulnerability;
- relevant information from strategies/plans on national or regional level (River Basin Flood Strategy, River Basin Development Plan, River Basin Management Plan).

The existence of other discharges between the proposed discharge point and the point used for sampling background conditions and the parameters likely to be influenced has to be mentioned.

Air & Climate

- background air quality in the vicinity of the site. The data should cover the situation especially regarding odours, VOC, dust, methane, CO_2, NOx, SO_2; other pollutants specific to any industrial objective existing in the zone of influence;
- both the climate and the micro-climate conditions (precipitation and evapo-transpiration rate, annual rainfall , wind strength and wind patterns, days with freeze and snow/ snowstorms, solar radiation, very high temperature, etc.) The source of the data has to be mentioned (the metrological station, data bases).

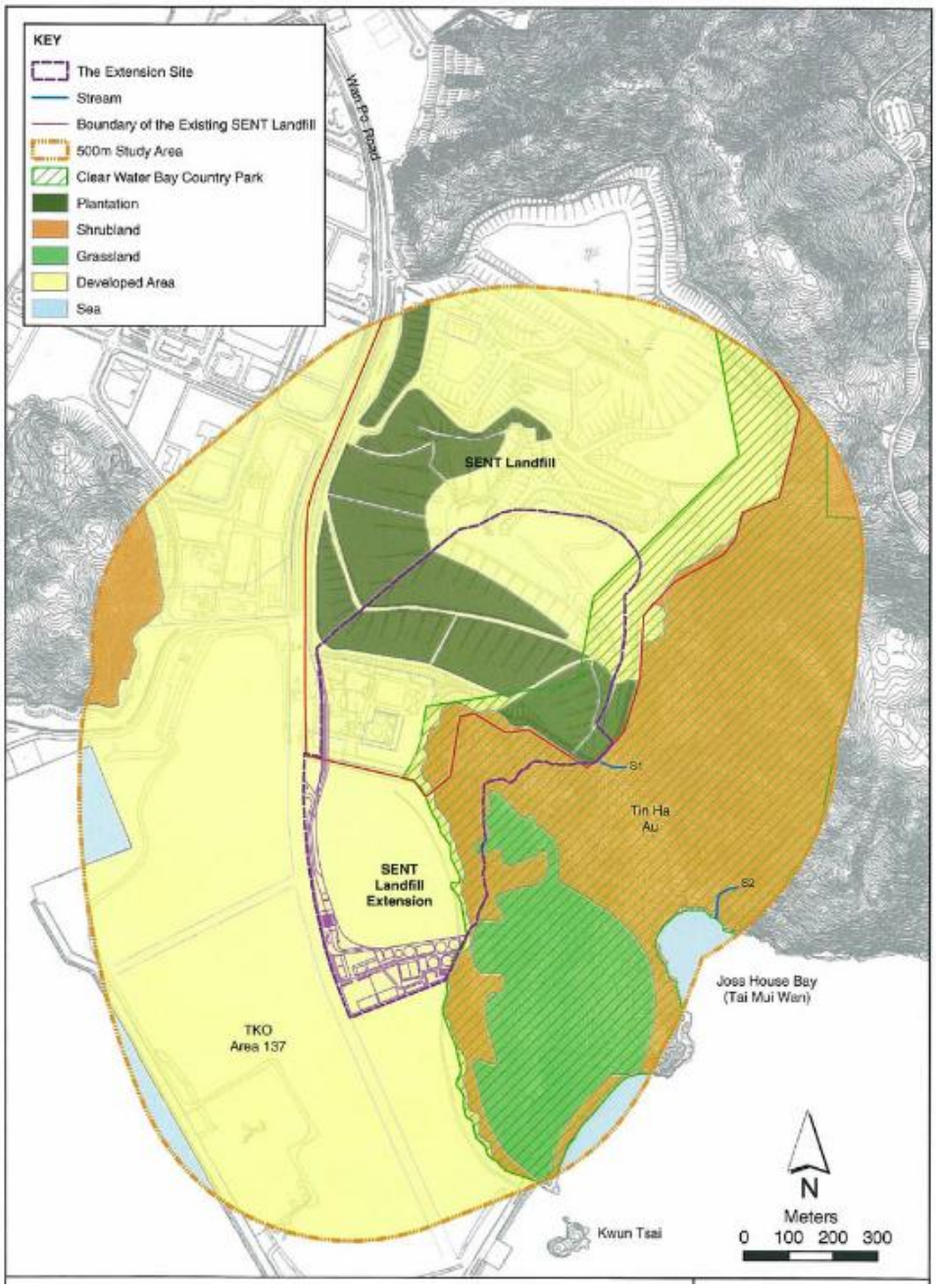
Noise & Vibration

- assess, measure, model and include in the report the values of noise/vibration level during daytime and the main sources; data from on site measurements, for example existing traffic, other industrial sites closed to the IWMC proposed location.
- Human beings
- indicate the occupations, activities or interests of principal potential receptors, like farming, tourism etc.;

Fauna & Flora

- flora and fauna species of special interest (in terms of abundance, distribution and diversity);
- the activities for which the animals use the site;
- special requirements of the fauna, e.g. territory size, habitat quality, current management, lack of disturbance;
- description of plant community based on dominant species, species diversity, dependence on particular environmental factors etc.

Figure 2 Example of land use and flora mapping for an EIA Report



Landscape

- describe the character of a landscape and assess by reference to both natural and cultural criteria.

Material Assets

- evaluate the character of natural resources, related to a sustainable use, that might be affected by the project.

Cultural Heritage

- describe the character of a archaeological, architectural, tourism, historical or cultural features in terms of age, size/area, etc.

3.3 SIGNIFICANCE

Soil & Geology

The value of soils and geological deposits as non-renewable natural resources are examined where large areas are cover. The use of the soil removed during the excavations for landfill base construction has to be presented.

Water & Groundwater

- describe the possible use of abstracted water (both for surface and underground water) for human consumption and/or industrial use in the area;
- describe the significance include designations, standards or publications which comment on any aspect of the quality of the water.

Air & Climate

- describe the air quality with reference to existing or pending designations, standards or limits;
- highlight locations with particularly low or high levels of pollution.

Noise & Vibration

- describe the noise environment with reference to established criteria, and formal noise zoning if relevant;
- highlight areas with especially low, or high noise levels.

Human beings

- indicate the significance of the principal groups or activities likely to be affected;
- provide information about any archaeological, historic, architectural or other community or cultural importance in the area that may be affected by the IWMC or TS, including any designated or protected sites, or bisected by collection vehicles routes.

Fauna & Flora

- significant habitats, whether they are terrestrial or aquatic, paying special attention to species that are rare, vulnerable, threatened, or likely to be designated as threatened or vulnerable, and endangered species;
- description of diversity, population size or density in the national and European context;
- use of the vegetation by significant fauna;
- current use of land, wildlife and plant resources, both terrestrial and aquatic, for traditional purposes (if relevant, specify the use of land and resources by local communities).

Landscape

- mention if the IWMC (or CS, SS, TS) will intrude upon any designated views or is within or adjacent to any designated landscape or amenity area;
- mention if any part of the site will be visible from a wide area, considering the final level (height) of the landfill.

Material Assets

- identify the nature and degree of significance of the resources that will be affected, i.e. rarity, representivity, integrity, etc.

Cultural Heritage

- identify the nature and degree of significance of a heritage resource, i.e. rarity, integrity, authenticity, legibility and associational values.

3.4 SENSITIVITY

Soil & Geology

A landfill construction assumes a high vulnerability of soils and geological formations to gross degradation or destruction by contamination, compaction and removal. Such vulnerabilities that have to be considered include:

- Compaction leading to loss of structure and changes in soil drainage;
- Hydrology - changes to the water table affecting many processes, both biotic and chemical;
- Hydrogeology - changes in soils and geological formations may increase or decrease the exposure of groundwater to infiltration.

Water & Groundwater

- describe any of the water's characteristic natural properties or beneficial uses critically respondent on any aspect of the quality of the characteristics of water;
- where water quality or availability is found to be vulnerable to significant impacts due to changes in any of its key properties; also the mechanisms which can trigger such changes and levels/values of the characteristics have to be clearly identified.

Air & Climate

- consider how the identified locations could be affected by changes in the air quality of the environment.

Noise & Vibration

- describe how the identified noise sensitive locations (areas with existing humans and fauna) could be affected by changes in the noise environment.

Human beings

- describe any significant concerns, fears or opposition to the IWMS project development (NIMBY syndrome) known to exist among residences/receptor groups. Identify, where possible, the particular aspect which is of concern, together with the part of the existing environment which may be threatened.

Fauna & Flora

- describe if any of the fauna of the site is known to be particularly sensitive to, or dependent on, the continued availability of some aspect of the existing environment such as food, shelter, isolation.

Landscape

- valuable features including their characteristics such as visibility at different times of the year, listed scenic routes in tourist maps or mentions in guide books; these should be presented only if relevant for the project, not just because literature data about them are available.

Material Assets

- evaluate if the natural material resources are used in a sustainable way;
- evaluate if the disturbance of soil surface horizon will cause the change in local flora.

Cultural Heritage

- mention if the IWMC (or CS, SS, TS) will be visible and intrude upon any cultural site;
- valuable features including their characteristics such as visibility at different times of the year, listed scenic routes in tourist maps or mentions in guide books; these should be presented only if relevant for the project, not just because literature data about them are available.

3.5 SUFFICIENCY OF DATA

"Sufficiency" is regarded as enough information upon which to base a decision whether to grant or withhold approval of project from environmental point of view.

Both the competent authority, the developer and ultimately the Reporter should be assured that the EIA contains sufficient data. The following criteria can provide useful guidance on this matter:

- Is the information necessary for identification of the main effects available?
- Is the information focused on effects which are *likely* and *significant*?

The certainty or confidence which the information provides is a good basis for evaluating the quality of data. In practice unsatisfactory information is more likely to result from omissions than from inaccuracy.

Where it is the case that incomplete information is provided in the Report, it must be made clear that this information has not been withheld intentionally and that all parties are aware of the incompleteness of the information. The resulting decision will usually be qualified or conditional on the information being provided at a later stage.

Box 2 Example of a report on Flora and Fauna which is qualified due to necessity of being carried out at an unsuitable time of year

The site was examined and was deemed to be grassland of a type which is very common throughout the region. It should be noted that the examination was carried out in December when the full range of potential flora and fauna was not evident. A further study will be made, of the damp areas in particular, to determine whether any significant species are present during May – July. The detailed design may need to be altered/adjusted if anything of significance is encountered.

3.6 REGULATORY FRAMEWORK

The purpose of this section is to give an overview of the national and EU legislation that has been taken into consideration in carrying out the environmental impact assessment.

The EU Directives and the international agreements and protocols applicable for road transport sector should be quoted together with the national legislative acts ensuring their transposition/ ratification and implementation. Simply listing relevant legislation and regulatory acts does not suffice. A brief description of the content should be given to provide the context as well as the reporters notes or comments on how the requirements of the relevant legislation will be addressed.

Furthermore, it is imperative that all relevant national, regional and local/municipal plans and strategies are clearly highlighted and their relevance and association to the proposed development described. As well as providing the national and regional strategic and planning context of the proposed project, it will also illustrate to the reviewer of the report, the development history of the proposed project.

4 SIGNIFICANT ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES

The purpose of this section is to provide recommendations for addressing in the EIA Report the aspects related to:

- the description of the likely significant effects of the IWMS project on the environment resulting from:
  - the existence of the IWMS project;
  - the use of natural resources (e.g., use of soil and gravel);
  - the emission of pollutants, the creation of nuisances and the elimination of waste;
- the description of the forecasting methods used to assess the effects on the environment (e.g., environmental monitoring and modelling);
- the general and particular mitigation measures that should be considered i.e. measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment during construction, operation and post-closure of a landfill;

The potential effects and mitigation measures are project component and phase specific. The amount of detail that will be provided in a particular EIA Report will be determined by the circumstances of each IWMS project.

The EIA should cover all activities involved by a IWMS project. It is not allowed to postpone the carrying out of the EIA for any of project components (like the leachate treatment station or landfill gas collection or treatment), on the reasons either that the appropriate techniques was not yet identify or later investments. Such situations could be encountered when treatment technology of leachate or the installation stage for gas treatment plant is decided.

Description of the impacts

In general, the effects and their sources/ causes (works, actions, material etc.) as well as the associated impacts are well known. Each sub-section below covers an environmental factor on which a waste project is likely to have significant effects and presents briefly which these might be.

The Reporter is recommended to not describe the general potential impacts but rather to present in the EIA Report those effects which have been identified and assessed for the proposed project and the causes for their appearance due to any specific conditions of the site, supply with construction materials, waste transport and so on as well as due to the characteristics of the receptors previously identified. If any significant effects have been identified in relation with a certain environmental factor, it is strongly recommended to present the similar specific conditions and the mitigation measures taken from the start which make unlikely the appearance of any effects.

The requisite criteria for the presentation of the characteristics of potential impacts sets out potential significant effects of the proposed development will be described with regards to:

- the extent of the impact (e.g. size of the area of the affected population that will be impacted by the landfill odors);
- the magnitude and complexity of the impact;
- the probability of the impact (probability of leachate infiltration in aquifer due to artificial liner damage);
- the duration, frequency and reversibility of the impact;
- the transboundary nature of the impact (if applicable).

The description of impacts is usually subjected to closer scrutiny than any other part of the EIA report. Clarity of method, language and meaning are vital to accurately explain the full range of impacts. The description should clearly and consistently identify four key aspects of any impact, namely its *character, magnitude, duration* and *consequence* (refer to Box 3 for further details).

Box 3 Impacts: key aspects

Character and Duration of Impacts

- Identify the aspect of the environment affected; Identify the receptors which will be affected, indicating their sensitivity and significance;
- Describe whether the impact is positive, neutral or negative; Highlight significant impacts (positive and negative).
- State whether the impact will be continuous, intermittent or occasional;
- Indicate whether the impact will be temporary, short, medium or long-term; Highlight permanent impacts.
- Indicate if the impact is reversible or irreversible

Extension, Magnitude and Complexity

- Quantify the amount or intensity by which the character/quality of any aspect of the environment will change (i.e. how much pollution);
- Indicate the spatial extent of the impact (will some, much or all of the areas be affected);
- Describe the degree of change; (i.e. imperceptible, slight, noticeable or significant);
- Highlight profound (i.e. complete) changes of character.

Consequences

- Indicate whether the impact can be avoided mitigated or remedied; Highlight irreversible impacts
- State whether compensation is available, possible or acceptable;
- Highlight when the consequence cannot be determined

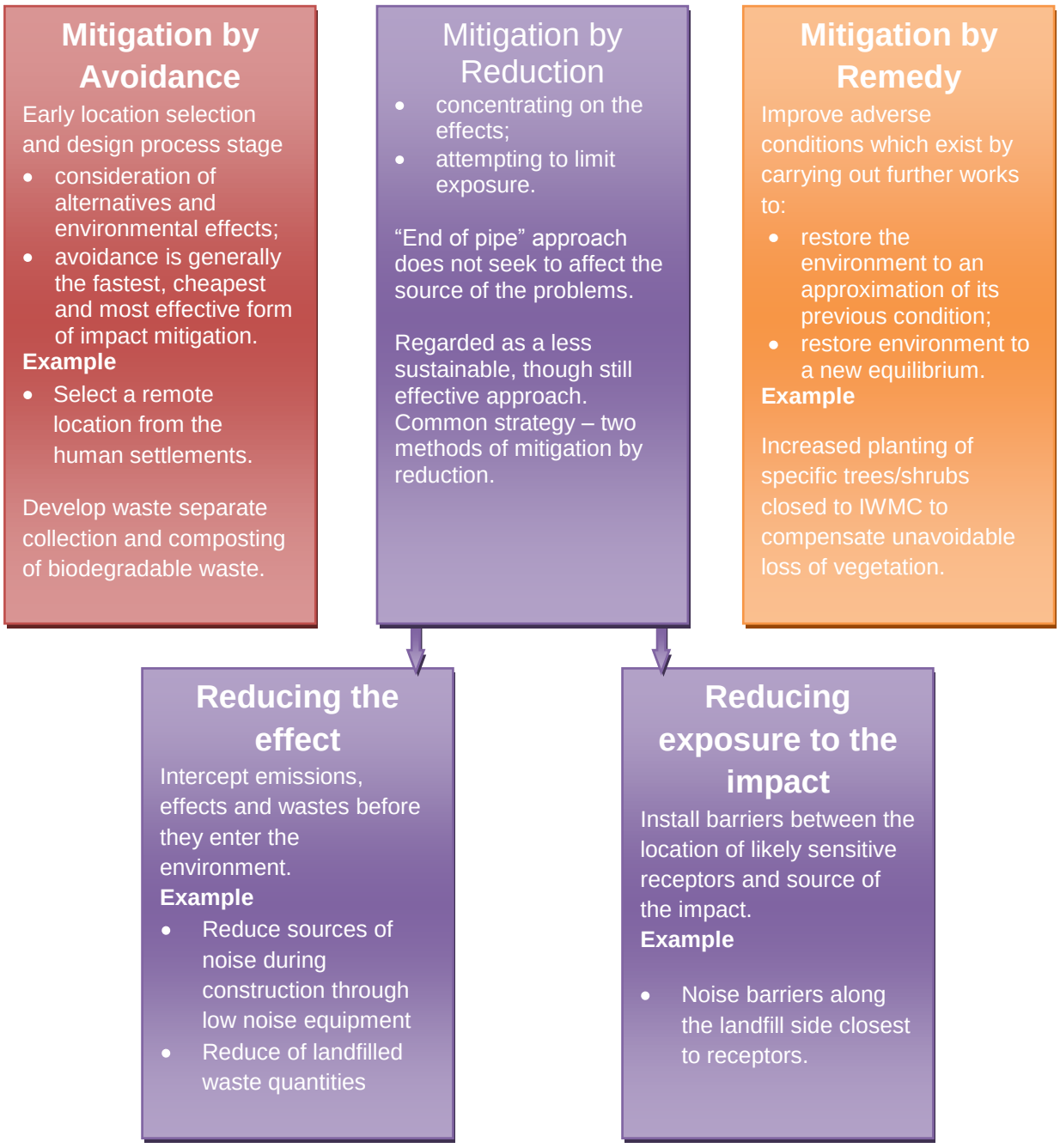
Description of the mitigation measures

The central purpose of EIA is to identify potentially significant adverse impacts, as outlined above, and to propose measures to mitigate such impacts. There are three established strategies for impact mitigation – avoidance, reduction, remedy. Refer to Figure 3 below for further details.

There may be the situation that the design was not much advanced when the EIA Report was prepared and explicit mitigation measures could not be specified. If so, the EIA Report should include proposals for establishing the appropriate mitigation measures. The options in this respect include: preparation of the technical documentation for sustaining the building permit issuing (for measures to be taken in the design stage contributing to mitigation in both construction and operation stage), preparation and implementation of the Environmental management plan for measures applicable during both construction and operation stage, etc.

The specified mitigation measures should be traceable in the project bill of quantities and further on presented in the Project Financing Application.

Figure 3 Mitigation of impact



Mitigation measures appropriate for each effect/impact of an IWMS are described in each subsection below. The Reporter should select and describe those actually envisaged for the proposed project, as concisely and accurately as possible.

4.1 SOILS & GEOLOGY

4.1.1 Possible Effects and Impacts

- Describe the possible impacts on soil and underground water in *IWMC and TS* caused by:

Construction

- temporary land use change (plots for construction yard, working points and temporary access and transport roads, borrow pits etc);
- loss of topsoil;
- raw material depletion at clay and gravel extraction sites;
- soil pollution due to on-site storage of fuels;
- infiltration in soil of leachate from uncontrolled deposits of wastes and construction materials.

Operation

- liner failure during the construction and operational phases;
- settlement or slippage of waste during the operational phase;
- leakage of landfill leachate collection system;
- leakage of wastewater/leachate ponds/storage tanks;
- leachate production during the composting operation (CS/MBT);

Post-operation

- settlement during the Post-Operational phase;
- need for material capping;
- instability of the covered landfill;
- deterioration of capping soils due to upward migration of contaminants.

4.1.2 Potential Mitigation Measures

Construction

- Describe mitigation measures proposed to:
    - prevent and control pollution: proper maintenance of transport and construction equipment, handling and transport of raw and excavated materials, temporary storage of materials in the special designed areas and in proper conditions etc;
    - prevent and control pollution generated by the leachate: design and install the artificial geological barrier, liner and drainage system in accordance with the legal provisions;

Operation

- avoid pollution through leachate leakage, like proper and safe management of the leachate, containment of storage tanks;
- prevent infiltration of surface run-off into soil of possible contaminated water: cover the working and storage area of TS, CS and SS, drainage and collection system for surface run-off (from TS, CS and SS areas and external sides of the temporary seal landfill).

Post-Operation

- rehabilitation of the yard, working areas and temporary access and roads, borrow pits etc);

4.2 WATER AND GROUNDWATER

4.2.1 Possible Effects and Impacts

- Describe the potential impact of emissions to water (including groundwater) and land arising from non-hazardous IWMC including:

Construction

- surface water pollution and groundwater contamination by uncontrolled surface run-off, altering the water's physical, chemical and biological qualities, due to the same causes described above for soils and to similar ones;,
- potential contamination of the surface water arising from any earthworks operation.

Operation

- surface water pollution and groundwater contamination by leachates or by insufficiently treated leachate discharge;
- direct impact determined by treated effluent discharges on the receptor water quality;
- direct impact accidental spills of non-treated wastewater;
- potential contamination of the surface water arising from soil cover operation and dissolved airborne contaminants;
- surface and underground water pollution by infiltration of water runoff from composting, sorting or temporary storage platforms.

Post-operation

- surface water pollution and groundwater contamination by leachate or by insufficiently treated leachate discharge;
- increase of leachate generation due to infiltration of rain water inside capped landfill through damaged cover;
- washing of soil cover during heavy rains etc.

4.2.2 Potential Mitigation Measures

Construction

For the operation phase, the mitigation measures applied for preventing and minimization of soil contamination are valid also for water protection.

Operation

Describe general mitigation measures proposed at IWMC to:

- ensure water does not accumulate in the working area where waste is stored;
- assure adequate surface water drainage system for all concrete platforms and roads;;
- assure that the roads and platforms/storage areas are impermeable (i.e. a recognised sealed surface, e.g. asphalt or concrete, that is not readily permeable to liquids) and designed;
- prevent spillage or escape of substances that could pollute the surface water system and suitable emergency procedures should be provided (for example, fuel/oil);
- oil interceptors and silt traps to safeguard against potential pollution from oil/chemical spillage and vehicle washing;
- surface water monitoring at discharge points;
- regular inspection of adjacent surface water courses.

Describe specific mitigation measures proposed at landfill to:

- minimise and contain of leachate. These measures will reduce the risk of its migration beyond the site boundary, where it could pollute groundwater, and enable its removal and treatment;
- ensure that the lining system is not damaged prior to and during the emplacement of waste and in particular the first layer of waste;
- ensure that continuing emplacement of waste does not compromise stability of the lining system;
- assure the limiting the amount of water getting in to the solid waste matrix. This can be achieved into a number of simple design and operational measures;
- ensure surface water does not enter the landfilled areas, or areas prepared for future landfilling by construction intercepting ditches between the working areas and surrounding unused parts of the site;
- ensure applying soil cover to the wastes at the end of each working day;
- ensure progressively completing and grading areas of the site with a capping layer, as they reach their final design heights.

Describe specific mitigation measures proposed at TS, SS and CS to:

- avoid water run of from the concrete platforms;
- reduce the leachate generation from waste windrows/piles in CS.

Post-Operation

Describe the measures that will be taken for prevention of contaminated water and leachate emissions from the capped landfill.

4.3 AIR QUALITY

4.3.1 Possible Effects and Impacts

Construction

- air pollution by dust possibly contaminated with other air pollutants resulting from earthworks, transport traffic, loading and unloading of raw materials etc;
- emissions of from transport and construction motor.

Operation

- methane and VOCs generation from landfill, with fire and explosion hazards;
- odour generation during transport and on site storage/processing of waste (from TS, landfill, CS/MBTS, SS);
- dust generation from on site transport and daily covering with soil or compost like output;
- gaseous emissions from the LG treatment facility (flare, boilers, internal combustion engine or gas turbine), from thermal oxidizer of LTP (for oxidizing and destroying of the stripped gases), from biological stages of LTP;
- emission of greenhouse emissions during the all operational phases (mainly landfill, composting and mechano-biological treatment).

Post-Operation

- dust generation during the landfill closure though transportation, preparation and spreading of cover materials;
- gaseous emissions and odours are continuously released for many years after cessation of operations.

4.3.2 Potential Mitigation Measures

Construction

- Present the measures for prevention and reduction of gaseous emissions and dust:
- control of the excavation works, transport vehicles and construction equipment;
- washing vehicles' wheels before leaving the site, watering site if necessary.

Operation

- Describe the measures that will be taken for prevention and reduction of harmful gaseous emissions and dust, like:
- use proper routes and covered vehicles for transport of waste mainly those from construction and demolition;
- controlling of the transport vehicles and construction equipment;
- grassing as large as possible areas inside the TS and IWMC site such as road sides;
- technical measures are to be taken for abatement of SO_2 emission from flare;
- periodic water spraying during transfer of excavated material and washing of vehicle wheels to suppress dust and odours emissions;
- pre-treatment of wastes, e.g. wetting, solidification and encapsulation for non-hazardous industrial waste that will be accepted for disposal;
- water sprinklers operated in waste handling areas area (IWMC and TS);
- regular sweeping of access road and area of hard-standing area (inside IWMC and TS);
- using of appropriate odour abatement techniques (for example, ventilation system to remove odours, dust and particulates from working areas/ buildings and treatment of ventilated air) in CS and SS;
- avoidance of waste storage (mainly the biodegradable ones) outside the dedicated areas;
- gas control starting at earlier stages to avoid methane release into the atmosphere;
- good aeration of the waste during composting to avoid methane generation in uncontrolled anaerobic processes.

Box 4 Control measures – landfill gas

- The elements of gas control are:
  - containment;
  - collection;
  - treatment.
- The method of controlling landfill gas will depend on a number of factors, which should be detailed in the EIA. In particular, it should consider:
  - landfill development – details for containment (lining and capping) and the phasing of landfill development and operation;
  - emission standards – these should be clearly stated based on agreed emission limits and the outcome of the risk assessment;
  - collection system – the report should describe the measures to collect landfill gas from the waste body, including the approach to be taken from initial development of the site through to the aftercare stage and should include details of the layout etc;
  - condensate management – the plan should describe the measures to manage condensate from the gas control system;
  - inspection, maintenance and servicing – details should be provided, for each element of the gas collection and control system, utilisation/flaring plant and supplementary processing/treatment equipment;
  - utilisation, flaring and treatment – the plan should set out in detail the measures to manage the collected landfill gas, including such methods as supplementary processing, utilisation, flaring, and methane oxidation. If utilisation is not proposed, this must be justified. A detailed appraisal of the proposed measures should be included in all cases.

Post-Operation

- Describe the measures that will be taken for prevention and reduction of harmful gaseous emissions from the capped landfill.

4.3.3 Sources of impact resulting from effects of some mitigation measures

- The water spraying and wheel washing process would generate important quantities of waste water that would be collected and treated on site together with other wastewaters with similar characteristics.

4.4 NOISE AND VIBRATION

4.4.1 Possible Effects and Impacts

Construction

- motor vehicle traffic and construction equipments traffic and activity will generate noise which can affect workers, population and animals living in the vicinity of working points;
- vibration generated during construction from activities like soil compression cause disturbance or annoyance on people or affect a person's ability to work.

Operation

- road noise generated by motor vehicle traffic can be a nuisance if it reaches the population settlements, especially for roads at higher operating speeds, near intersections and on uphill sections;
- however, new roads (if any) which divert traffic away from population centre have a positive impact relieving the in those inhabited areas;
- operational vibration (ground vibration produced by road traffic, clay barrier installation) is generally deemed unlikely to cause perceptible structural vibration in properties located near to well-maintained and smooth road surfaces.

4.4.2 Potential Mitigation Measures

- elimination or control of noise at source for fixed and mobile equipment ;
- reduction in noise propagation and level by use of noise barriers, and by ensuring sufficient distance to receivers;
- control of the time periods during which noise occurs.

4.5 HUMAN BEINGS

4.5.1 Possible Effects and Impacts

Construction

- population disruption in localities crossed by the vehicles transporting building materials (soil, gravel);
- disturbance and discomfort due to noise & vibration and air pollution ;
- safety and security on the site.

Operation

- positive effects on public health due to improvement of waste collection, reducing odors close to ex-dumping sites and avoiding of waste spreading;

- population disruption in localities crossed by the waste collection vehicles;
- disturbance and discomfort due to noise & vibration and air pollution ;
- negative health effects caused by release of toxic substances/odours to the environment from landfill, MBTS, SS, CS, TS in the inhabited areas;
- health risks arising from major hazards (explosions, fire, gas diffusion through soil) associated with the landfill;
- effects on vulnerable groups like that use landfill as source of living;
- safety and security on the site.

Post-operation

- possible health risks arising from hazards (e.g. landfill gas migration out of the closure).

4.5.2 Potential Mitigation Measures

Construction

- reduce workplace health risks:
    - use of personal protective equipment and seasonal working outfits;
    - use high quality fuels, transport and construction equipment;
    - emission control;
- reduce workplace and surrounding residential area health risks:
    - technical measures: use of new, highly efficient and reliable equipment;

Operation

- reduce public health risks with view of noise & ambient air pollution and of traffic accidents
    - analysis of ambient air quality;
    - real measurements of traffic flow and noise pollution after commissioning of the project;
    - introduce new measures for noise and pollution reduction adapted to the monitoring results.

Post-operation

- avoid cover deterioration and nuisance generation by maintaining security and supervision of the closed landfill;
- reduce public access on the covered landfill by fencing the area.

4.6 FAUNA & FLORA

4.6.1 Possible Effects and Impacts

Construction

- stress induced by the increased noise and vibration level to birds, bats and small mammals which may even relocate from the IWMC, CS, SS and TS areas;
- direct effects on flora consisting in possible total or partial vegetation destruction due to soil removal, vegetation cuttings and clearness;
- indirect effects on flora due to dust deposited on soil and plants.

Operation

- indirect effects on flora due to dust deposited on soil and plants,
- appearance and spreading of spontaneous or cultivated plant species, and species of unwanted animals;

- change of migration routes for some birds species;
- increased animal mortality from the higher traffic;

Post-operation

- erosion of the grass soil layer from the top of landfill.

4.6.2 Potential Mitigation Measures

Construction

- construction works should start before the breeding season of animals and birds;
- apply measures to mitigate the effects on soil, surface and groundwater and air quality;
- prevent and reduce the accidents and incidents during the construction and operational traffic to mitigate the impact on flora;
- measures specific for vegetation protection during construction and operation, such as:
    - maximum conservation of tree vegetation (save as many as possible trees and shrubs from cutting in the working areas);
    - enfolding trees and shrubs with protective nets and spraying them with water to wash down the deposited dust.

Operation

- restore as much vegetation as possible in the affected areas;
- promptly carry out the efficient elimination of any eventual spreading of dangerous invasive species;

Post-operation

- vegetating covered/capped landfills with native grass species or scrubs;
- post-closure maintenance to ensure that uniform vegetative growth exists on the landfill.

4.7 LANDSCAPE

4.7.1 Possible Effects and Impacts

- impacts on the physical structure and aesthetics of landscape depends on the changes in scale and dimensions, introduced by project structures in comparison with the existing landscape characteristics (height, plan dimensions and homogeneity);
- impacts on the visual amenity of the scenery to receptors: people living in the local settlement - more sensitive receptors due to the permanent exposure to the project once it is build;

Each kind of impact and its level of significance may be different and should be assessed in various sections of the project in relation with the initial landscape features and likely presence of receptors.

4.7.2 Potential Mitigation Measures

- include in IWMC and TS design the landscape engineering considerations;
- any possible aftercare measure that is necessary to be taken in relation to the restoration of the site.

Box 5 Sample Assessment Methodology for landscape and visual impact

The landscape and visual impact assessment for the preferred location will assess the detailed impacts of the development on the receiving landscape.

A zone of visual influence will be defined and utilised for the assessment. The various elements of the landscape within this zone will then be assessed for their effects. The proposed scheme will be assessed for its impact on the landscape in terms of impacts to landscape character, and visual impacts.

The purpose of the assessment of the preliminary locations is to determine the site which presents the least overall landscape and visual impact. A key element of this stage of the assessment was the difference between landscape and visual impacts. These are defined as follows:

Landscape impacts:

Landscape impacts are defined as changes in the material, character and quality of the landscape, and:

- direct impacts upon specific landscape elements;
- more subtle effects on the overall pattern of landscape, regional and local distinctiveness;
- impacts on designated landscapes, amenity and conservation areas.

Visual impacts:

- the direct impact of a particular development on views;
- the potential reaction of viewers, their location and number;
- the impact on visual amenity.

In terms of the initial assessment, the landscape and visual impacts are considered together. The site which is selected represents the optimum location, from a landscape perspective. The assessment of the preferred location will focus on the specific landscape and visual effects of this location.

These effects are measured as follows:

1. the visual effects of the scheme as constructed without any woodland or landscape planting. This includes specific visual effects to dwellings, areas of amenity and important landscape areas;
2. the listing and assessment of all areas of landscape significance and sensitive receptors in proximity of the location;
3. an approximation of the visual effects of the project after five and after twenty years from opening of the landfill. This allows an approximate estimation of the ameliorative quality of the proposed ameliorative works;
4. the interaction of landscape with other parameters, in particular cultural heritage, tourism and flora and fauna. This section will examine areas of historic landscape and landscapes of ecological importance, in terms of the effects which the development will have on the contextual nature of specific areas.
5. an approximation of the visual effects of the development post closure and rehabilitation

4.8 MATERIAL ASSETS

4.8.1 Possible Effects and Impacts

Construction

- effect on residential/ economic planned developments (for all project phases);
- positive influences on the labour market (employment, qualifications of the work force)
- effects due to accidents, during both construction and operation, which destroy or damage the respective assets (for example roads and bridges due to the heavy traffic);
- safety of the site and equipment.

Operation

- impact on agricultural land use and tourism;
- increase in waste charges & tariffs;
- negative impact on land and house prices;

- significant increase in heavy vehicle traffic – negative impact on road conditions, increase in traffic etc.

Post-Operation

- if closure and rehabilitation not completed properly, land and house prices may continue to suffer.

4.8.2 Potential Mitigation Measures

Construction

- measures aiming to mitigate the direct effects on water & groundwater, soil, air quality (for all project phases);
- usual measures for accidents prevention;
- safety measures for the construction site and equipment used in the constriction;
- avoid usage of roads inside cities/villages, if possible.

Operation

- optimisation of the major haul routes and divert waste transfer traffic away from city/village centres;
- operators could offer compensation (for example, rehabilitation of parks, public green areas inside the city/village to communities whose property would be in close proximity to landfills);

Post-Operation

- set up measures for monitoring of underground water and keep population informed about any change in water quality;
- set up an intervention plan and provide the necessary equipment for intervention in case of incidents.

4.9 CULTURAL HERITAGE (ARCHAEOLOGY & ARCHITECTURE)

4.9.1 Possible Effects and Impacts

- like in case of other large projects involving earthworks, there is a possibility of unearthing objects of archaeological, cultural and architectural heritage significance;
- Increased atmospheric aggressiveness as well as vibrations can influence the constructed environment including architectural and archaeological monuments.

4.9.2 Potential Mitigation Measures

- Carry out archaeological and cultural heritage assessment of the site prior to final selection and development
- Include any necessary measure to ensure the protection of such objects under the legal provisions.

For the purposes of the Convention for the Protection of the Architectural Heritage of Europe, Granada, 1985 (ratified by Romania by the Law 157/1997) the expression "architectural heritage" is considered to comprise the following permanent properties:

- **monuments:** all buildings and structures of conspicuous historical, archaeological, artistic, scientific, social or technical interest, including their fixtures and fittings;
- **groups of buildings:** homogeneous groups of urban or rural buildings conspicuous for their historical, archaeological, artistic, scientific, social or technical interest which are sufficiently coherent to form topographically definable units;
- **sites:** the combined works of man and nature, being areas which are partially built upon and sufficiently distinctive and homogeneous to be topographically definable and are of conspicuous historical, archaeological, artistic, scientific, social or technical interest.

Box 6 Examples of Architectural Heritage

Architectural Type	Examples – illustrative purposes only
Vernacular Rural and Urban	Farm buildings, cottages, houses
Industrial	Mills, breweries, distilleries
Transport	Road bridges, railway bridges, canals, canal locks
Ecclesiastical	Churches, chapels, graveyards
Country estate	Country houses, entrance gates, lodges
Maritime	Harbours, quay walls
Monuments	Roadside memorials, plaques, statues, historic monuments

4.10 NATURAL PROTECTED AREAS, NATURA 2000 SITES

When natural protected areas other than Natura 2000 sites do exist in the project "zone of influence" the effects on habitats and on protected species of flora and fauna within each such natural proteted area will be presented. For identification of the potential effects and mitigation measures see the sections 4.6. and 4.7. above.

If, according to Art. 9(1)c) of the MO 135/76/84/1284 from 2010, the Project was initially evaluated as falling under the scope of the Art. 28 of Emergency Ordinance of the Government no. 57/2007 regarding the natural protected areas, conservation of the natural habitats and of wild flora and fuana, (i.e. provisions for assessment of impact on the Natura 2000 sites), The EIA Report should present a description of the appropriate assessment procedural stages carried out and of their results.

It is mentioned that the methodological recommendations for the assessment of plans and programms significantly affectong the Natura 2000 sites are comprised in the *Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC* adapted through Ministerial order no. 19/ 13 January 2010 of the Ministry of Environment and Forests and thus the current guidance document will not repeat the issues described in that Methodological Guidance.

4.11 CUMULATIVE ENVIRONMENTAL EFFECTS AND INTERACTION OF THE FOREGOING

4.11.1 Cumulative Effects Assessment

The assessment of cumulative impacts can be most appropriately addressed at the strategic level rather than through project level EIA. However, cumulative impacts are very relevant for IWMS scheme EIAs and are specified as issues to be addressed by the EIA Directive (Annex IV(4)). The most effective way for cumulative impacts to be dealt with in the context of a IWMS scheme EIA is to coordinate its assessment process with assessment of adjacent schemes where this is relevant, i.e. to address the cumulation of effects generated by similar causes due to the all projects/ activities which are to be developed in the same time with the concerned project and in the same zone of influence. Information about these other projects/ activities should be collected for example from the existing development plans subjected already or not yet to SEA procedure. This approach should be clearly identified in the EIA.

The following cumulative potential effects for an IWMS Project should be considered:

- *Surface water quality*
  The known and future regulated point source discharges in the sub-watershed around the IWMC have to be identified. The in place mitigation measures at the landfill and the available evidence should indicate that the proposed project would not significantly impaire the water quality and its uses.

- *Groundwater quality*
  In unlined areas of the IWMC or landfill, leachate can potentially percolate downwards and/or laterally away from the refuse source, transporting contaminants that may affect groundwater.
  Another possible mechanism, although much less likely, is leachate leaking through the composite-lining of the landfill or leachate pond (if any). The liners should prevent any potential off-site migration and any leakage would be detected by leak detection lysimeters and underground water monitoring wells.

- *Greenhouse gas emissions*
  Landfills are a source of greenhouse gas emissions. The combustion of landfill gas will have the effect of reducing GHG emissions. Also vehicles used to transport of waste generates greenhouse gases. Technical condition of the vehicles used has to be checked and be of appropriate level and performance.

- *Odor, dust and noise.*
  For example, noise and dust generated by excavation activity and transport of excavated material from two adjacent projects could cumulate if the work period or track trips coincide.
  The existing traffic will overlap with an increasing number of vehicles both during the construction and operation and will generate cumulative effects on air quality and noise.

Elaboration of studies concerning the potential for cumulative impacts are not always necessary and the best expert judgment considering all assumptions and reasoning may be enough. Any other projects and/ or activities planned to be constructed and/ or commissioned in parallel with the assessed project, the “zone of influence” of which overlap totally or partially with the one of the assessed project should have been identified and briefly presented here.

4.11.2 Interaction of the foregoing

Interactions relate to the reactions between impacts within a project and the inter-relationship between impacts identified under one topic with impacts identified under another topic.

The consideration of impact inter-relationships and interactions provides an opportunity to consider the overall impacts of a scheme which might not be immediately apparent particularly when the EIA is structured around individual topics. These impacts can be addressed in the EIA by including a section at the end of each topic chapter dealing with impact inter-relationships and interactions or by including a separate chapter, normally towards the end of the EIA, dealing with the issue.

The table below shows an example that highlights the interactions and interrelations that may arise between different environmental factors. Factors selected for presentation to illustrate the interaction and relations between them were air and noise.

Some examples of interactions in a IWMS project context are summarized in Box 7.

Box 7 Example of a Summary of Potential interactions & inter-relationships - Air

Subject	Interaction with	Interactions/relationships
Air	Human beings	Air quality is a major concern both at the local community level and on a broader national/global scale. In terms of the proposed development, dust (both during the construction and operational phases) and emissions and its impact on the communities and residents adjacent to the proposed development will be the main issues.
	Flora and Fauna	Vegetation can act as a purifier for air in absorbing CO2 and giving out oxygen. Dust from the proposed development could affect fauna and flora.
	Water	Dust from the proposed development could affect surrounding watercourses
	Geology/Hydrogeology/ Soils	Dust from exposed soils during construction could cause deterioration of air quality in the immediate vicinity of the development.
	Climate	Emissions to the air will potentially effect/impact on air quality.
		Reduction in air quality caused by dust could impact on agricultural enterprises in the vicinity of the development particularly during construction.
Noise	Human Beings	Sensitive receptors located close to the proposed development may experience some increase in noise particularly during the construction stage of the proposed development.
	Landscape	The construction of landscaping berms and planting will mitigate the effect/impact of noise.
	Flora and Fauna	Construction and operation proposals could result in significant noise disturbance, which may impact on the fauna currently using the area.
	Material Assets	Dairy cattle and other sensitive animals are reputed to be sensitive to sudden noise events that may occur as part of the construction. Any sensitive agricultural enterprise will be facilitated through consultation with landowners.

Figure 4 was shows an example of how impact interactions can be highlighted in an EIA Report through the use of a matrix.

Figure 4 Sample Impact Inter-relationship Matrix

Inter Relationship Matrix	Soils & geology	Water & Groundwater	Air Quality	Noise & Vibration	Climate	Fauna	Flora	Landscape	Human Beings	Arch Heritage	Material assets
Soils & geology		◆				◆	◆	◆	◆		◆
Water & Groundwater	◆					◆	◆		◆		◆
Air Quality	◆				◆	◆	◆		◆		◆
Noise & Vibration						◆	◆		◆		◆
Climate			◆			◆	◆		◆		◆
Fauna	◆	◆					◆	◆	◆		
Flora	◆	◆	◆			◆		◆	◆		◆
Landscape	◆					◆	◆		◆	◆	◆
Human Beings											
Arch Heritage								◆			◆
Material assets									◆		

4.11.3 Summary of Impacts, Mitigation, Residual Impacts

Such a summary is usually presented in tabular format which allows an overview of the impacts on each environmental factor corresponding to each stage of project realization

The format might be rather simple or more complicated to address also the impact characteristics: magnitude and significance, duration (permanent/ temporary), extent (coverage and receptors), nature (direct/ indirect, adverse /beneficial), reversibility (reversible/ irreversible), sensitivity of receptors, probability of occurrence, confidence limits to prediction, mitigation and monitoring measures, scope of mitigation/ monitoring, residual impact.

4.12 MONITORING

- The on-site monitoring presumes both operational and environmental monitoring. Monitoring regimes are run during construction, operational and post closure phases, in accordance with LWD, and have to be described in the EIA report. . Basic environmental monitoring involves:
- planning a survey and sampling (continuous or discontinuous) program for systematic collection of relevant data/information;
- conduction of the survey and sampling program;
- analysis of samples and data/information collected, and interpretation of data and information; and
- preparation of reports to support environmental management.

Operational monitoring:

- quality and quantity of inflows and outflows waste and products;
    - types of materials accepted at the landfill for the period: mixed, biodegradables, recyclables, sludge from coagulation flocculation and biological treatment etc.;
    - quantities of materials accepted at the landfill for a period;
    - quantities of materials landfilled;
    - quantities of materials separated for reuse and recycling; and
    - quantities of composted waste, compost produced.
- quality and quantity of leachate and landfill gas during operation. The leachate and gas characteristics are different at different operation stages and a their variation during the whole live time of landfill/cell has to be documented and; presented:
    - leachate monitoring, both pre-treatment and post-treatment, including total flows, peak and average flows; and leachate quality;
    - gas production monitoring including total production, peak and average for landfills with landfill gas management systems.
- quality and quantity of leachate and landfill gas post-operation;
- landfill stormwater runoff quality before discharging;
- state of the bearms, roads; slope stability;

Post-closure monitoring

After closure the landfill has to be monitored mostly for the same gas and leachate indicators as in operational phase with a frequency that will be set by the authorities. Also it must be mentioned how and how often the height of the landfill and state of the final cover etc. will be monitored

Environmental monitoring:

- meteorological data monitoring that could be done on site with operator equipment or based on data received from the nearest meteo-station;
- surface water and groundwater monitoring quality data;
- air quality above the landfill site and outside IWMC site.

The main monitored parameters should be presented in a tabular format including the responsibility and frequency of measurement (See **Error! Reference source not found.**).

Box 8 Type of sampling location and typical monitoring frequencies for landfill gas (illustrative purposes only)

Monitoring Points	Frequency of monitoring during operational phase	Frequency of post-operational monitoring	Parameters to be monitored
Surface emissions CH4 concentration flux • Walk over survey • Flux box monitoring	Annually Site specific (1-5 yrs)	Annually Site specific (1-5 yrs)	CH_4 concentration/flux Atmospheric pressure and temperature General surface type and condition
Monitoring boreholes (external to the landfill)	Monthly	Six monthly	CH_4, CO_2, O_2 Atmospheric pressure Differential pressure Temperature
Monitoring wells (within the landfill)	Monthly	Six monthly	CH_4, CO_2, O_2 Atmospheric pressure Differential pressure Temperature
Collection wells	Fortnightly	Six monthly	CH_4, CO_2, O_2 Atmospheric pressure Differential pressure Temperature Gas flow rate of suction
Gas collection system (site specific) e.g. manifolds	Annually	Annually	Composition of raw landfill gas from the extraction line and prior to the disposal system
Flares	Annually	Annually	NOx, CO, VOCs, NMVOCs
Utilisation plant	Annually	Annually	NOx, CO, VOCs, NMVOCs

5 ENVIRONMENTAL MANAGEMENT PLAN

5.1 PURPOSE AND SCOPE OF ENVIRONMENTAL MANAGEMENT PLANS (EMP)

When prepared within the EIA context, an environmental management plan (EMP) is a document designed to demonstrate that sound environmental practices will be followed during the construction, operation, rehabilitation and after use of the development.

Even if the EIA Directive does not explicitly requires preparation of such a plan, the EMP is internationally found out to be among the EIA best practices[1].

The EMP should show what mitigation measures have been proposed as responses to potentially adverse impacts in order to reach an admissible environmental impact, what is necessary for ensuring that those responses are made effectively and in a timely manner (responsibilities and schedule for applying these measures) and which are the involved means i.e. the material and financial efforts such as to ensure that all conditions are/ will be in place to fully implement the commitments taken in the EIA.

The EMP should be integrated into the project's overall planning, design, budget and implementation moment to ensure that the plan will receive funding and supervision along with the other project's components.

5.1.1 Objectives of an EMP

The objectives of an EMP should include:

- ensuring compliance with regulatory authority stipulations and guidelines which may be local, provincial, national and/or international;
- ensuring that there is sufficient allocation of resources on the project budget so that the scale of EMP-related activities is consistent with the significance of project impacts;
- verifying environmental performance through information on impacts as they occur;
- responding to changes in project implementation not considered in the EIA;
- responding to unforeseen events;
- providing feedback for continual improvement in environmental performance.

5.1.2 Generic Scope of an EMP

In order to achieve the above objectives, the generic scope of an EMP should include the following:

- definition of the environmental management objectives to be realized during the life of a project (i.e. pre-construction, construction, operation and/or decommissioning phases) in order to enhance benefits and minimise adverse environmental impacts;
- description of the detailed actions needed to achieve these objectives, including how they will be achieved, by whom, by when, with what resources, with what monitoring/verification, and to what

[1] The operational procedures of World Bank provide for such a plan to accompany the Report on environmental assessment. As defined in OP 4.01: "A project's environmental management plan (EMP) consists of the set of mitigation, monitoring, and institutional measures to be taken during implementation and operation to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels. The plan also includes the actions needed to implement these measures. More specifically, the EMP includes the following components: mitigation, monitoring, capacity development and training, implementation schedule and cost estimates, integration of EMP with project.

target or performance level. Mechanisms must also be provided to address changes in the project implementation, emergencies or unexpected events, and the associated approval processes;
- clarification of institutional structures, roles, communication and reporting processes required as part of the implementation of the EMP;
- description of the link between the EMP and associated legislative requirements;
- description of requirements for record keeping, reporting, review, auditing and updating of the EMP.

5.2 CONTENT AND FORMAT OF EM PLANS

The format needs to fit the circumstances in which the EMP is being developed and the requirements that it is designed to meet. The level of detail in the EMP may vary from a few pages for a project with low project-related environmental risks to a substantial document for a large-scale complex project with potentially high environmental risks.

The following sections provide an overview of information that should be included in an EMP for an IWMC and any other waste management facility:

1. Overview of the proposed activity and the local context

Provide a brief summary of the:

- proposed project and associated construction or operational activities;
- affected biophysical, economic and social environment;
- local environmental management, legal and planning context relevant to the EMP.

2. Summary of impacts associated with the proposed activity

Summarise the predicted negative and positive impacts associated with the proposed project, particularly those presenting impacts of medium to high significance.

3. Project Proponent's environmental management policies and commitments

Summarise the Project Proponent's existing policies, guidelines and commitments relating to health, safety and environment.

4. Institutional arrangements: roles and responsibilities

Clearly define the responsibilities for management actions contained in the EMP and clarify arrangements for coordination among the role players involved in implementation.

5. Legal requirements

Identify the legislation, standards, guidelines and associated permits or licenses that apply to the project and are related to management activities specified in the EMP.

6. Implementation programme

Presents the objectives to be achieved through the EMP and the management actions that need to be implemented in order to mitigate the negative impacts and enhance the benefits of the project. Associated responsibilities, monitoring, criteria/targets and timeframes are clearly specified.

The implementation programme provides the core of the EMP and should include a description of the following:

I. objectives;
II. management actions;
III. responsibilities for the identified actions;
IV. monitoring;
V. performance specifications (i.e. criteria and targets);

VI. implementation schedule.

I. The EMP should provide over-arching **objectives** to be achieved through the management of project activities and risk sources. These objectives are based on managing the environmental impacts identified *inter alia* through an EIA process; and specify the desired outcomes from effectively minimizing the negative impacts and enhancing the positive impacts.

II. Management actions are actions that are feasible, practical and cost-effective, and need to be implemented in order to achieve the objectives described above. These actions are based on the mitigation and enhancement actions identified in the EIA, together with additional information that may become available subsequent to completing the EIA. The EMP must specify a programme for implementing the management actions, including: who, when and how; as well as what resources should be allocated. Enhancing the positive impacts of a project is often overlooked, and it is important that the EMP contains clear actions in this regard, based, for example, on the EIA recommendations.

As part of implementing the management actions, **Method Statements** should be prepared by the Contractor and/or Sub-contractor. These Method Statements should specify how they will manage potential environmental impacts in line with the requirements of the EMP, and, where relevant, environmental best practice; and how they will practically ensure that the objectives of the EMP are achieved.

Box 9 Requirements for determining whether management actions are clearly defined

To determine whether the management actions are adequately defined they need to satisfy the following

key requirements:

- ***Written*:** Management actions should be stipulated in writing, this forces the formulators to think through each action carefully.
- ***Dated:*** A management action must indicate a specific time by when the action should be implemented.
- ***Risk- or impact-specific**:* Each management action must link to a specific impact (either positive or negative) or environmental risk, and should be worded in specific terms rather than in general terms.
- ***Time and space specific:*** An indication must be given as to the conditions under which the management action applies (continuously or only in the event of contingencies). The time (such as the season or time of day) and location of the application of the management action.
- ***Measurable:*** Management actions must, where possible, be quantitatively defined. A standard with which performance can be compared, must thus be set. Objectives and targets of the management action must be clearly stated.
- ***Achievable:*** The management action must be realistic, feasible and hence achievable;
- ***Reasonable:*** The management action must be readily implementable within the time and budget constraints of a project.
- ***Timely:*** Measures must be put in place to coincide with specific project activities.
- ***Understandable:*** Management actions must be described simply, using clear, non-technical language where possible.

III. Responsibilities must be clearly identified for the different parties involved in implementing the management actions and monitoring.

IV. Monitoring programmes should be prepared to determine the effectiveness of the management actions and to understand the actual residual impact of the construction and/or operations on the environment. These monitoring programmes (e.g. air quality or groundwater monitoring) may be designed by specialists in consultation with the Project Proponent and relevant stakeholders, depending on the complexity of the monitoring required. Where monitoring programmes are required, these should be designed to be pragmatic and implementable. As far as possible, measurement parameters should be

selected which provide immediate results in order for appropriate management actions to be taken as soon as possible, in the event of an exceeding of regulated values or accepted performance levels.

The monitoring programme could comprise three main aspects:

- ***baseline measuring:*** This should occur prior to the start of the project or activity in order to determine the level and status of the environmental parameters prior to any impacts associated with the project or activity;
- ***impact (or performance) monitoring:*** This monitoring should be ongoing throughout the project life-cycle and must be implemented to ensure that environmental impacts are within the predicted levels and that specified performance targets are being achieved;
- ***compliance monitoring:*** This monitoring should be implemented to ensure that the prescribed mitigation measures are having the predicted and desired effect. This monitoring would be conducted periodically, the timing of which will vary from project to project. It must be used to check that the levels of specific environmental parameters are compliant with laws, regulations, standards or guidelines, as applicable. The programme must make provision for remedial measures to be effectively implemented in the event of non-compliance - i.e. when mitigation measures are inadequate or when impacts have been underestimated in the EIA.

The management actions and monitoring need to take into account the following three scenarios:

- normal operations;
- abnormal situations (eg. planned shutdown to service equipment);
- emergency situations (eg. unexpected oil spill).

Stabilized **Performance specifications** (eg. criteria or targets) must be provided for each management action or monitoring activity, in order to assess whether the actions have been effective. Performance specifications could be based on the level at which an environmental condition must remain (eg. habitat in a part of the site that must not be disturbed), or the level to which the environmental condition must be restored (eg. habitat rehabilitation), or legislated or agreed limits (eg. air quality standards), or the level of socio-economic benefits to be realized through the project (eg. use of local labour and enterprises). Where possible, these performance specifications should be quantitative. These specifications might be revised during the implementation of the EMP, in the spirit of promoting continuous improvement.

VI. An **implementation schedule** must be prepared showing the sequence and timing (including frequency and duration) of the management actions and monitoring activities of the EMP. Where monitoring reports are produced, the timing of such reports should be indicated. The schedule must be drawn up with the Project Proponent, to ensure necessary links are made between the implementation schedule for the EMP and the overall project schedule.

7. Cost estimates and financial resources

Provide cost estimates for expenses of EMP implementation such as:

- initial and recurring expenses;
- expenses for mitigation measures;
- expenses for enhancement actions like for selective collection increasing, training and environmental awareness requirements;
- expenses for monitoring;
- expenses for auditing and corrective actions.

Box 10 Environmental Management Plan – Landfill Site (illustrative purposes only)

All sites should be subject to a detailed Environmental Management Plan. Operators of landfills which do not have the benefit of such a document should have one developed as a matter of priority. The Plan is not only necessary for competent site management, but will provide essential information for any application for a waste license or permit.

The Environmental Management Plan can be broken down into a number of sections and associated drawings. Main contents of such a Plan for landfills should include but not be limited to:

Details of Operator

Name and Address of Operator and Site. Included should be contact names in respect of person with managerial responsibility for site operations, including the site manager, site engineer. Relevant telephone numbers should also be given.

Site Description

A description of the site should be provided which covers the following:

- boundaries and topography;
- geological and hydrological characteristics of the area;
- local meteorology.

Types of Waste Accepted

A detailed description of the procedures for acceptance and the types of waste that can be accepted on the site should be given. This should clearly state whether household, commercial and industrial wastes are to be accepted. Stabilized hazardous wastes and other difficult wastes should be listed separately and a clear indication given, where appropriate, of the maximum permissible concentration or loading thresholds for particular substances. Consideration should be given to the procedures to be employed for the acceptance of other difficult wastes such as tyres, empty drums, sewage sludge, asbestos and so on.

Quantity of Wastes Accepted

Details should be given on the annual quantity of waste taken into the site. This should be sub-divided into major types (examples would be household waste, commercial waste, industrial waste – specified by type, source etc).

Site Capacity

An estimate should be provided of the original site capacity and remaining capacity. The latter should be derived from the annual survey.

Engineering Details

Details of all significant site engineering works should be included. Where applicable the information should cover:

- site preparation and provision of services;
- containment details;
- leachate drainage, collection and treatment;
- landfill gas abatement methods (e.g. passive trenches, active extraction) collection and flaring;
- monitoring points for landfill gas, leachate, surface water, groundwater etc;
- fencing, gates and other security;
- site access roads and secondary site roads;
- offices, fuel stores etc;
- current landscaping and tree planting;
- wheel cleaning infrastructure, site weighbridge etc;
- surface water control measures, ditches, road drains, wheel wash water etc.

Operational Matters

These should include:

- description of the operations;
- phasing of filling;
- water, leachate and gas control measures;
- measures for the control of environmental nuisances;
- site opening and operating times;
- access control and waste acceptance procedures;

- equipment to be utilised;
- waste placement procedures;
- cover requirements;
- site personnel, including qualifications, duties and responsibilities;
- monitoring and maintenance procedures;
- operational and safety rules (including safety statement) and emergency procedures;
- litter abatement methods and procedures;
- noise and dust abatement;
- wheel cleaning procedures;
- measures to deal with vermin and other pests;
- assessment of settlement in filled areas;
- assessment of compacted waste density.

Operational status

In certain cases, information on older, and already filled, parts of the site may not be readily available to the operator. However, as much information as possible should be given, even where estimates have to be made. It is essential that a detailed topographical survey of each landfill site is undertaken. This should be based upon identified fixed datum points located in areas of the site which are not likely to be disturbed and which relate to ordnance datum. These will provide a benchmark for subsequent site surveys, so that surveys are comparable and the resultant plans can be used to overlay each other.

The site survey and associated void space calculation should be repeated annually, so that the rate of fill can be assessed. The up-to-date survey can be used as the basis for other plans and for developments on the site. The survey should include filled areas so that the effects of settlement can be assessed. All leachate pumping chambers and other leachate and landfill gas monitoring points should be surveyed and accurately recorded. Benchmarks on all leachate level monitoring points should be accurately surveyed so that leachate levels can be assessed in respect of the fixed reference monitoring points at the landfill periphery. The accuracy of these benchmarks should be checked during the annual survey to ensure that factors such as settlement and lateral movement within the fill are taken into account.

Closure and Aftercare

Closure and aftercare procedures should include:

- final capacity and expected operational period of the facility;
- final contours and topography of the site;
- the restoration plan;
- phases for closure and restoration of completed areas;
- aftercare monitoring and other control measures;
- maintenance programme for aftercare phase.

6 NON TECHNICAL SUMMARY

6.1 PRINCIPLE

Annex IV of the EIA Directive setting requirements for the information to be supplied to the competent authority by the project developer, mentions in its point 6 “A non-technical summary of the information provided under the above headings.” i.e. of the information contained in the EIA Report.

A NTS is required because one of the fundamental objectives of the EIA process is to ensure that the public is made aware of the environmental implications of anti-decisions about whether to allow new developments to take place.

It is often useful to prepare a NTS as a separate and self contained document, which can be widely distributed to the public who are likely to be affected by the proposed development.

6.2 STRUCTURE AND CONTENT

The NTS is laid out in a similar, but condensed, format to the main EIA Report. i.e. describing the project, existing environment, impacts (including both negative and positive) and mitigation measures. It should include a site location and site layout plan (showing context) together with easily interpreted graphical representation of the proposed development, such as a perspective drawing.

Also it may contain an overview of the approach to the assessment and some brief explanations related to the development consent process for the project and the role of EIA in this process. It is recommended to include in the NTS data about sequence of EIA procedure stages accomplished so far for the project (Screening Decisios issued and Scoping report prepared by the competent environmental protection authority, previous public consultation actions).

6.3 PURPOSE AND LANGUAGE

As stated above, the main purpose of the NTS is to communicate to the public the EIA Report findings.

To achieve this goal, it should use a language easy understandable, without a scientific and technical jargon. In this respect, the copy and paste exercise by which some entire paragraphs are transferred from the EIA Report itself into NTS, is contra-productive and should be avoided. Instead, the text needs to be rephrased and terminology explained.

The NTS length should not be a matter of concern. Examples are available of short but intelligent prepared NTS (23 pages including 6 with photos and diagrams for a 280 pages coordinated EIA Report), in comparison with a long but fluffy NTS (about 100 pages for a 300 pages coordinated EIA Report).

Recommendation is to attach the tables with Summary of Impacts, Mitigation, Residual Impacts to the NTS when made available to the public. NTS has to have key maps and data in simplified tables if necessary. Figures used in NTS should be more explained to none experts.

Annex 1

Relevant European legislation

on EIA

- Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 97/11/EC, Directive 2003/35/EC and Directive 2009/31/EC

on Nature Protection

- Directive 92/43/EEC o on the conservation of natural habitats and of wild fauna and flora

on Waste Management

- Directive 1999/31/EC of the Council on the landfill of waste
- Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives;
- Directive 2008/1/EC of the European Parliament and of the Council concerning integrated pollution prevention and control (IPPCD).
- Directive 2002/96/EC on electrical and electronic equipment waste as amended by Directive 2003/108/EC
- Directive 94/62/EC on packaging and packaging waste as amended by Directive 2004/12/EC and Directive 2005/20/EC
- Council Decision 2003/33/EC establishing criteria and procedures for acceptance of waste at landfills pursuant to Article 16 of Annex II to Directive 1999/31/EC;
- Commission Decision 2000/532/EC (as amended by Decision 2001/118/EC, Decision 2001/119/EC and Decision 2001/573/EC) replacing Decision 94/3/EC establishing a list of wastes pursuant with art. 1 letter. a) of Directive 75/442/EEC and Decision 94/904/EC establishing a list of hazardous waste in accordance with art. 1 para. (4) of Council Directive 91/689/EEC on hazardous waste

Relevant national legislation

on EIA

- Government Decision no. 445/2009 on the assessment of certain public and private projects on the environment;
- Order no. 135/2010 of the Minister of Environment and Forests to approve the application methodology of environmental impact assessment for public and private projects;
- Order 863/2002 the Minister of Water and Environment Protection for the approval the methodological guidelines that apply to different steps of the environmental assessment framework procedures.

on Nature Protection

- Government Emergency ordinance 57/2007 on the regime of protected areas, conservation of natural habitats, wild flora and fauna.

on Waste Management

- Government Decision no. 349/2005 on disposal of waste in landfills;
- Government Decision no. 856/2002 on the keeping of records related to waste management and a list of waste, including hazardous

- Government Decision no. 448/2005 on electrical and electronic equipment waste
- Government Decision no. 621/2005 on the management of packaging and packaging waste as amended by Government Decision no. 1872/2006
- Government Emergency *Ordinance* no. 152/2005 concerning integrated pollution prevention and control, amended and approved by Law 84/2006, and amended Emergency Ordinance 40 2010
- Order no. 95/2005 of MEWM establishing criteria and procedures for the acceptance of waste at landfills;
- Order no. 757/2004 of MEWM approving the Technical Norms for waste landfills;

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