Guidance Manual
Environmental Impact Assessment of Waste Landfills

Foreword

This decision support model is developed by the workgroup Milieu, Nature and Landscape (MNL), of the Faculty of Policy Science of the University of Nijmegen, ordered by the Waste discourse Organ (AOO). The AOO has the task to prepare the waste removal on a national scale. Every three years the AOO elaborates a Ten-Years-Waste-Programme (TJP.A). Besides the programming of the recycle capacity, in the TJP.A special attention is paid to the side measures (and their implementation) to guaranty proper implementation of the programming.

The TJP.A is formed within limits given by the Ministry of Environment. One of them is the space limit of the waste removal. Taking into consideration National Space Policy the AOO developed selection and weighting limits for the choice of location for the waste recycle facilities. These limits taken into TJP.A Design (January 1992) give a main direction for the choice of location for the waste recycles facilities and offers a basis for implementation of the state policy on spatial order.

1.1 waste policies

The government imposed stricter norms in connection with effects of the waste disposal places on their direct neighborhood. It was officially formulated in the IMC (Isolation, management and control) criteria:
- the spread of the soil threatening materials have to be avoided by isolation measures;
- the situation when soil threatening material is disposed must be manageable, and it must be like this in the future even if isolation measures fail;
- the situation, when soil threatening material is disposed, must be controllable, and it must stay so in the future. The regular control of the situation and effectiveness of taken measures is very essential.

1.2 The choice of location for the waste disposal place

The choice of location for the waste disposal place generally is quite difficult. There are different reasons for it.

In the first place, a good cooperation between provincial and district authorities is essential for the process of location choice.

In the second place, the synchronization of space and environmental policies is very important. While choosing the place which is less vulnerable from an environmental point of view, preventive environmental policy can be implemented with the help of a spatial order plan. According to the Law on Waste the distance from natural, geological, historical and ecological valuable places must be taken into consideration. The synchronization of the plans of the space and environmental policies has to be conducted on national, as well on provincial level. On provincial level a synchronization between provincial waste plan and district development plan is needed.

In the third place, the outcome of the location choice process - the final choice of location, must be realized by definition of the destination plan. The organization of the waste disposal place in certain districts might cause difficulties. District authorities prefer to keep the waste disposal place outside their territory, because it is not the favorable exploitation of free space. Finally, the level of resistance of community on district level can play an important role during the decision making process.

The above-mentioned aspects significantly affect the complexity of the process of location choice. Besides being very complicated, the process of location choice is often non-transparent, because many criteria must be taken into consideration. During the determination of the appropriate dumping place, besides environmental-hygienic and space criteria, landscape, financial-economical and juridical criteria must be taken into consideration. During the decision making process significance to each criterion is implicitly awarded. Due to that reason it can be unclear, why a decision was made in favor of a certain location. The decision making process is therefore vague, not only for decision makers, but for third parties as well.

1.3 The decision support model

The process of location choice is dynamic, where many people with different positions and interests are involved in. The above-mentioned problems concerning cooperation, coordination and integration can not be solved by one (static) model. That is why this decision support model does not provide ready solutions; it is more a method to make decision making process more clear and transparent for all involved persons. This model is not meant to be used as a guideline for lower authorities.

The “involved” can be divided in two groups. First group: people, professionally involved in process of the choice of location, for example government officials on the district and provincial level. Second group: so called “thirds”, for example environmental organizations, local population and other interest groups. The main objectives of the model can be summed as follows:

- to structure the process of the choice of location of garbage dump place;
- to support the decision making process;
- to enlighten the aspects, which play a role during the choice of location;
- To ensure the transparency of the decision making process, especially for the “thirds”.

In the decision support model the above mentioned objectives are organized in different ways.

1. The model includes as much as possible aspects/criteria, relevant by choice of location of garbage dump place. In this sense the model can be described as a checklist, sum of the focus points, meant as a memory support for user. In the past the decision making concerning choice of location of garbage dump place, was mainly based on a few of the above mentioned aspects. Not all relevant aspects were taken into consideration, and basis for broad evaluation of all involved aspects was missing;
2. In the model taken focus points were clarified first, by forming of the question on each focus point in order to get explicit answer and second by further illuminating each question;
3. In the model the user has an opportunity to clarify the importance given to the each criterion in the process of the choice of location. The model user can self assign the different factors to appropriate criteria according the importance he attaches to them.

1.4 Composition of the model

When the most suitable or least suitable place for waste dump must be found, the following selection procedure can be used: choose first the broader territory to look for an appropriate place. This territory, so called search space, can be an entire province or a cooperation territory of one of the waste regions. The search space later can slowly be limited according to the previously elaborated location criteria. Thanks to this model search space becomes smaller and limited.

Beside the mentioned way to use the model, it comes in practice that there are already several favorable locations known and testing of how they suit the model is needed. In this case it must be checked, which criteria are fulfilled by each chosen location. In the description of the model we assume a "Blanco situation", when there are no locations chosen yet.

The "limitation procedure" serves as a basis for the composition of the model. On page 5 there is a schematic overview of the model's composition. The decision support model consists of three stages, which have to be followed step by step. There are the following stages in the model:

1) Exemption stage; there are several places/destinations where the organization of waste disposal places are undesirable. Excluding such places considerably limits search space;

2) Restriction stage; after excluding a number of possible waste dump areas in the previous stage, this time - with less hard criteria - other areas must be evaluated for their suitability as a waste disposal place. By going through the new restriction criteria, some other areas are excluded as well, which limits the search territory even more.

3) Ranking stage; there are numerous criteria, which have to limit the remaining search space to several locations. To make it more understandable, ranking criteria are segregated in five main directions:

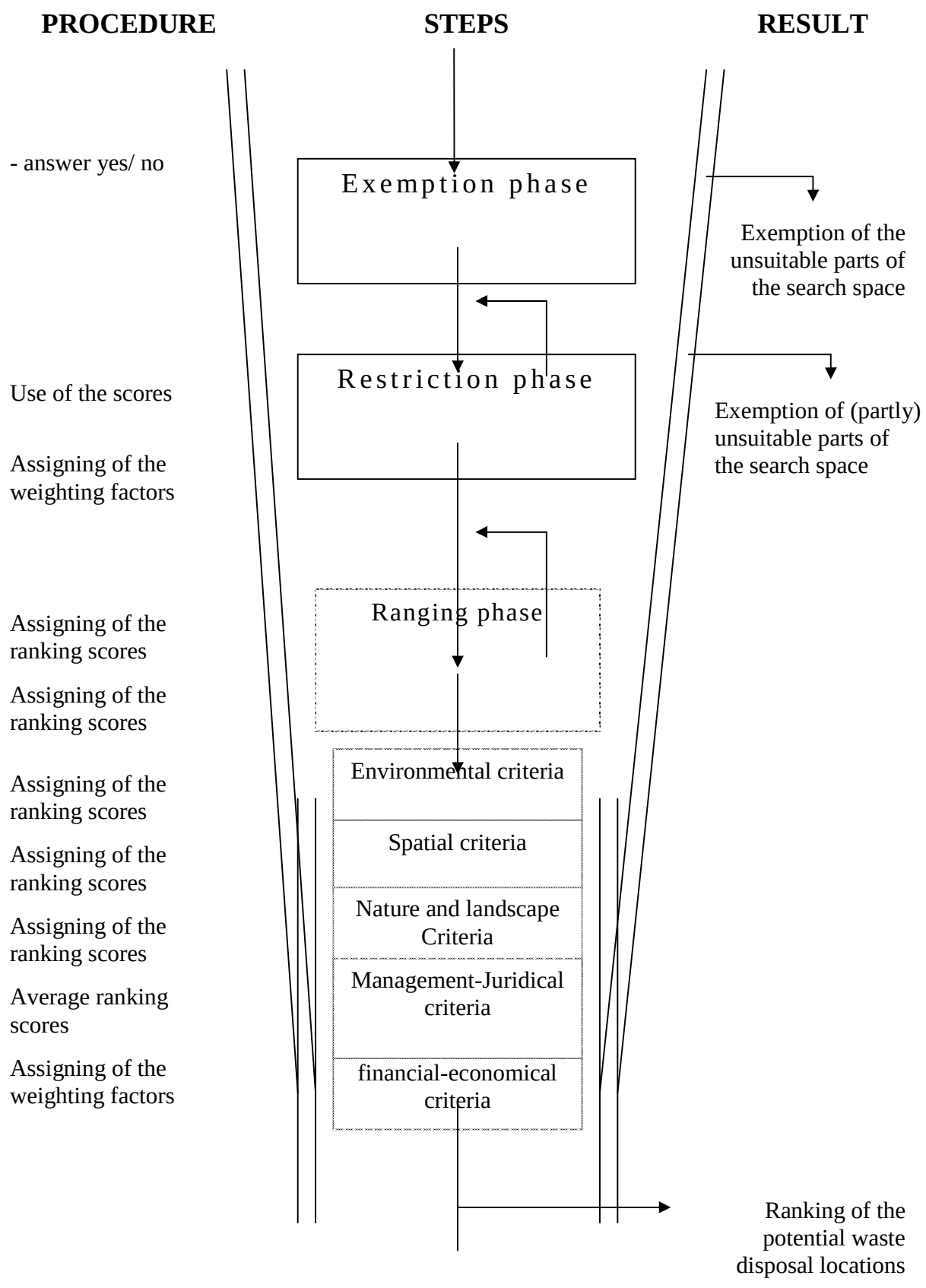
- environmental criteria;
- spatial criteria;
- nature and landscape criteria;
- juridical-management criteria;
- Financial-economical criteria.

It has to be mentioned that the environmental criteria (for example) in the ranking stage does not mean that there can not be other environmental criteria in previous stages.

From the above mentioned it is clear that the stages are ranked from hard to soft criteria. Corresponding to the increase of limitation of the search spaces, the location criteria become softer.

In the restriction stage, as well in the ranking stage, the user has an opportunity to return to the previous stage and revise part of it once more.

Schematic illustration of the model



1.5 Remarks in connection with the model

The criteria used in the model and their place in separated stages will become more obvious with the help of the overview table on page 8. In this regard the following remarks can be made.

In the first place there are just some ranking location criteria taken into account in the overview table. This is to give a better overview of the involved location criteria. The exception and restriction criteria are completely represented.

Some areas are present several times in the exemption and restriction stages in table 1. The insufficient synchronization of rules, which caused the creation of the mentioned areas, is the main reason for the existing overlapping.

Table 1. Overview of the location criteria of the waste disposal places

Criteria	Exemption stage	Restriction Stage	Ranking stage*				
			E	S	N/ L	M/ J	F/ E
Populated area	X						
Nature Area	X			X			
Ecological main structure area	X						
Soil protection area	X						
Ground water protection area	X						
Silence area	X						
Surface water	X						
Other exemption areas	X						
Distance to the water- or railways		X		X			
Located in urban area		X					
Airports (in case of organic waste)		X					
Geo-hydrological situation		X	X				
Green line area		X					
Blue line area		X					
Hindering infrastructure provision		X		X			
Recreation Area		X					
Military area		X					

Industrial area		X					
Hinder for living neighborhood			X				
Surface water (Stream speed, quality)			X				
Risk for the population			X				
Bruto-netto proportion				X			
Sun-sensitive destinations				X			
Distance from the waste collection places				X			
Industry (distance to particle sensitive industry)				X			
Later use of the space				X			
Biological value (flora, fauna, ecosystem)					X		
Value of the landscape (cultural, historical, etc)					X		
Community acceptance						X	
ownership relations						X	
Existing collection and provision contracts						X	
costs (purchase of the land, unsealing)							X
Transport costs							X
Extra milieu technical costs							X
Exploitation costs							X
Costs of follow-up care							X

* Abbreviations in the ranking stage:
- E = environmental criteria
- S = spatial criteria
- N/L = nature and landscape criteria
- M/J = management and juridical criteria
- F/E = financial and economical criteria

Several location criteria can be found in more than one category in the ranking phase. The criterion "purchase of the ground" is not only mentioned in the management-juridical, but in the financial-economical category as well.

One of the main characteristics of the model is to make it easy for the user to find its way through the model. In order to make it a more user-friendly model there is some extra information added. Hopefully, the model is not only clear and usable, but nice to work with, as well.

The model has an idealistic character. This can already be seen from the data, which is necessary to fill in the table, and the answers asked for. Unfortunately, not always comprehensive data is available. For example, some provinces do not have a complete list of the areas which need special protection (soil protection areas, silence areas and ground water protection areas). In this sense the model demands certain creativity from the user.

A last remark has to be made about the table appendix of the model, which is called "fill-in appendix". All the tables are to be filled in one by one by the model user. All these tables can be found in the main text as well. In the main text the structure and use of the model is clarified, to make it easier to fill them in the appendix.

1.6. The decision support model and m.e.r.

Milieu Effect Rapport (m.e.r) is a plan evaluation instrument which is meant to give environmental interests a proper place next to the other interests during the decision making process. Decision about the activities, which might have negative impact on the environment, can not be taken before the elaboration of the Milieu Effect Rapport. M.e.r. is helping during the formation of the decision, not replacing the decision.

Each waste disposal place with a capacity of more than 500.000 m3 and where household waste, old cars and other non-industrial waste is dumped, needs an m.e.r. It means that a Milieu Effect Rapport must be elaborated.

The m.e.r. can be used in different ways during the decision making process for the realization of the waste disposal place. In case of a waste disposal place there are three different types of Milieu Effect Rapport possible, namely a MER on policy level, MER on location level and MER on organizational level.

A MER on policy level has to be elaborated for policy plans, where the decisions, which have important consequences for the environment, are made. A provincial waste plan is an example of where a MER on policy level is essential. A MER on location level is aimed to compare several potential locations for the waste disposal place. The different locations function as alternatives which are compared according to their environmental impacts on the location and surrounding. At last the MER on organizational level describes the different organizational alternatives and compares them according to their impact on the environment. In order to realize a waste disposal place it is possible to elaborate three different Milieu Effect rapports. Due to fact that elaboration of the three Rapports can cost lots of finances and time, in most of the cases just one rapport has been elaborated linked to the most crucial decision.

The relation between this model and m.e.r. gives a broad merge of possibilities, depending on the level, the MER is elaborated on.

A MER linked to the PAP can leave many unclear issues about the impacts of the chosen waste disposal place on the environment. In such cases the model can have supplementary function, because the model can form the basis to work out the differences in impacts on the environment in the locations mentioned in the PAP.

It is clear that the model has the most similarities with the MER on location level. In cases where the MER on location level has to be elaborated, the model can fulfill important preparatory work, especially if there is no MER on policy level.

Finally, the relation between this model and the MER on organizational level is less important. The main purpose of the model is to clear and structure the process of location choice and at organizational level this process is already over.

The model can be used to conduct the preparatory work for an eventual MER on location level. The model is set up in such a way that after going through it, five locations are left ranked according to their suitability as a waste disposal place. The (eventual) MER on location level can weight up those locations and make more intense evaluation according to the impact on the environment.

What are the most important similarities and differences between the MER and the model?

One of the most important similarities between the MER and the model is that both try to evaluate the process of the choice of location in a way that environmental issues receive extra and special attention. Besides the above-mentioned, both aim to structure the process of the choice of location. Lastly, neither MER nor the model can force a certain decision, but have a clear decision support function.

The most important differences between the MER and the model are connected to the scope and offered alternatives of the MER. The scope of the MER includes the impacts of the activities on humans, plants, animals, goods, soil, water and air. At the same time the MER pays attention to the protection of the esthetical, natural and culture-historical values. Socio-economical and spatial consequences are outside of the scope of the MER. Those aspects are included in the model. Thus the model is going broader then the MER, which mainly concentrates on the environmental effects, caused by planned activities.

The second difference between the MER and the model is that in the MER besides the original initiative, also the most environment-friendly alternatives and a possible zero-alternative have to be worked out. In contrary to the MER, several locations can be chosen as alternatives in the model. The final choice of the waste dump location does not have to be the most environmental-friendly, because the other factors play an important role in the model, as well.

The supplementary or preparatory role of the model in connection to the MER will become clear in practice.

2.1 Introduction

We start the model with a blank sheet; the total space where the area for waste disposal place must be found is not limited. The whole territory is considered as a possible location for the waste disposal place. As it was said in chapter 1.4 it can be a cooperation area, an entire province or eventually on of the waste regions.
In this first phase of the model, the search space must be limited, through choosing and exemption of the areas which are unsuitable for the location of the waste disposal place. The search space left after the exemption phase will be further limited during the testing in the restriction phase.

2.2 Exemption areas

Generally, the territory is taken into the exemption phase if the area is formed on the ground of formal legislative regulation, or on other regulations or decisions which have a juridical power, which could be nota's, circulars or state council decisions, etc.
While selecting exemption areas, special importance has to be given to the Law on Waste (23 June 1977, Stb 455). According to article 40, permission to implement the Law on Waste can be refused if it does not fit into the existing provincial plan or contradicts the importance of environmental protection. The Law on Waste gives a broad explanation "of the importance of environmental protection" namely taking into consideration natural and ecological interests; importance of recreational surroundings and meaning of surrounding as a living space. Besides the Law on Waste, some other formal regulations are important as well, like the Law on Soil Protection (3 July 1986, Stb 374), the Law on Spatial Order (21 December 1985, Stb 623) and the Law on Noise Hindering (16 February 1979, Stb 99). The following territories are included in exemption areas:

1. Populated area
2. Urban area zone
3. Natural area
4. Natural area zone
5. Area of ecological importance
6. Soil protection area
7. Ground water protection area
8. Silence Area
9. Surface water protection area
10. Other areas like graveyards and airports

In chart 2 there are several questions to be answered by "yes" or "no". If one or more questions are answered with "yes", this area is unsuitable for the location of a waste disposal place. See annex for chart 2.

Chart 2: Questions about exemption areas

Is the part of the search area:	
1 within the populated area?	yes/ no
2 within a distance of 250m from a populated area?	yes/ no
3 in a natural area?	yes/ no
4 within a distance of 150m from a natural area?	yes/ no
5 in an ecological protection area?	yes/ no
6 in a soil protection area?	yes/ no
7 in a ground water protection area?	yes/ no
8 in a silence area?	yes/ no
9 in a surface water area?	yes/ no
10 within in a distance of 5,5km from an airport	yes/ no
11 within in a distance of 100m from a grave yard	yes/ no
If one or more questions are answered with "yes", this area is unsuitable for the location of a waste disposal place.	

2.3. Explanations to the exemption areas

The following paragraph is highlighting the above mentioned areas. If necessary, the legislative base and other sources are mentioned as well.

Ad 1) Populated area
A waste disposal place is not allowed to be situated within a populated area. According to the Law on Waste the permission can be refused if the surrounding is described as a populated area.

Ad 2) urban area zone
The distance between the waste disposal place and nearest populated area has to be at least 250 m. Several decisions made by State Council on this issue can be mentioned as well. Also there is an indicative norm of 300 meter between a waste disposal place and quite neighborhoods because of the smell and particles.

Ad 3) Natural zone
Waste disposal place can not be situated in the following areas:
a) The areas which are described as nature monuments or as state monuments according to the Law of the Protection of the Nature (1967) and have to be included in the district development plan.
b) The areas which are considered as valuable nature and landscape areas according the Law on Spatial Order:
- Structural schema of Nature and Landscape Protection (1986): National parks, brook walleyes, flood plains, big unit of nature, wild bird areas and geologically valuable areas.
- Structural schema of Open Air Recreation (1986): National Landscape.
c) The land property and historical places protected by the Law on Clean Nature (1928).

Ad 4) Natural area zone
According to the Crown Jurisprudence (KB 31 march 1982, number 42, Emmen) the distance norm of 150 meters between nature reservation and waste disposal place is in force.

Ad 5) Area of ecological importance
In the Nature Policy Plan within the areas of ecological importance the nature development areas and core areas are distinguished. The core areas generally coexist with policy categories mentioned in the Structural Schema of Nature and Landscape Protection. Though it does not mean that all areas of the Structural Schema of Nature and Landscape Protection are part of the areas of ecological importance, the following territories are included in the core areas according to the Nature Policy Plan: existing nature territories, valuable land, valuable agriculture landscape, brook walleyes, lakes and the costal zone of the Northern Sea. The policy intentions from the Nature Policy Plan can be implemented only after passing the certain procedure formulated in the Law on Spatial order. The spatial aspects of the decision of the government on Nature Policy plan has to be worked out in the Structural Schema Agriculture, Nature and Open Air Recreation. The exact boundaries of the areas within the ecological head structure have to be determined on provincial level.

Ad 6) Soil protection area
According to the Law on Soil Protection, the central government is obliged, in order to protect the extraordinary qualities of the soil, to elaborate special intention programs. At the same time, according to the Law on Soil Protection, the provincial government is obligated during the elaboration of the district development plan to take into consideration the above mentioned special intention programs. Further, the provincial government - according to the Law on Soil Protection - can elaborate regulations concerning the protection of characteristics of the soil, declared as a soil protection area in the district development plan. Those regulations are not applicable to the soil protection areas, which are declared as nature monuments or state nature monuments on the basis of the Law on Nature Protection (1967, Stb. 572).
On the basis of the Structural Schema Nature and Landscape the following territories are declared as soil protection areas: National parks, flood plains, big unit of nature, wild bird areas and geologically valuable areas.

Ad 7) Ground water protection area
In conformation with general guiding lines the location of the waste disposal place has to be separated from the sphere of influence of water gaining areas. The provincial government, according to the Law on Soil Protection, is obligated, in order to guaranty the quality of water, to elaborate the ground water protection plan. The ground water protection areas have to be indicated in the above-mentioned plan. The indication of the water gaining areas has to be done on the basis of the ground water protection plan and the Law on protection of the Ground Water. The provincial government on the ground of the above-mentioned law elaborates regulations for ground water protection areas, where the rules can be articulated due to the importance of the protection of ground water quality. Those rules can be also connected to the organization of the waste disposal places.

On the basis of the Ground Water Plan (1988), the following protection areas are subject to provincial regulations:
a) Existed and planned ground water gaining areas for provision of drinking water. They are included in the approved second Ten Year Plan (1984);
b) Industrial ground water gaining;
c) Other category ground water gaining.

Ad 8) Silence Area
The central government according to the Law on Noise Hindering is obligated to elaborate a special intention program. The provincial government, according to the Law on Noise Hindering, is compelled, during the elaboration of the district development plan, to take into consideration the above mentioned special intention program. According to the Law, in order to avoid or limit noise, the provincial government can elaborate regulations concerning the silence areas.
The Law on Noise Hindering mentions several areas, which must be indicated in the district development plan as a silence area:
a) Protected (state) nature monuments: Appropriate nature monuments on the ground of the Law on Noise Hinder and Law on Nature Protection are included as silence areas in the district development plan.
b) "Wetlands" according to the Ramsar Convention;
c) National parks.

Ad 9) Surface water protection area
The waste disposal place, according to the IBC criterion, is not allowed to be in direct contact with soil, ground water and surface water. It is not allowed to dump any waste in the surface water (excluding mud).

Ad 10) other areas like graveyards and airports
a) Graveyards (Law on Corpse Care, 1962).
The graveyards, as well the direct surrounding of the graveyard is not suitable for waste disposal place. The 100 meter zone has no legislative base; it has to be seen as publicly accepted guiding line.
b) Airports.
The collision of planes with birds causes real danger to the air traffic. The most recent concept concerning the Law on Air Traffic, advises the Ministry of Transport to elaborate special protection zones. It limits and in some cases forbids the use of the land around the airports. Concerning the waste disposal place, it is advised to introduce a 5.5 km free zone around the landing strip. Contrarily to the concept advice, the model distinguishes waste disposal places according to potential of attraction for birds. Due to that fact that birds are attracted to organic waste, the protection zone is only suitable for this kind of waste.

The restriction phase

3.1 Introduction

In the exemption phase search space has been limited by areas which were unsuitable for the waste disposal place. When part of the search space does not correspond to one of the demands of the exemption phase, it directly excludes this area from the search space. In chart 2 if one or more questions are answered with "yes", this area is unsuitable for the location of a waste disposal place.

The criteria of the restriction phase qua hardness can be placed between exemption and ranking phases. Certain criteria from the restriction phase are similar to the one from the exemption phase. The difference is that criteria from the exemption phase have no exceptions, unlike the criteria from the restriction phase. It can be best illustrated by the criterion "recreation territory". Generally the territory for recreational purposes is not suitable for waste disposal places; exceptions can be made for certain forms of recreation like noise sports. Moreover, the destination of the waste disposal place can be adapted to the surrounding recreation territory.

Several criteria are taken into the restriction phase from a practical point of view and not because of certain legal regulations. The criterion "hindering infrastructure" is an example of it. There are following criteria in the restriction phase:

1. Vicinity of the rail- and waterways;
2. Location in the urban area;
3. Direct surrounding of the airport;
4. Unfavorable geo-hydrological situation;
5. Location in Green area;
6. Location in Blue area;
7. Hindering infrastructure
8. Location in recreation area;
9. Location in the military area;
10. Location in the industrial area.

Due to that fact that the criteria of the restriction phase can not be called "hard", they can be applied much more flexible. The user, unlike in the exemption phase, does not have to limit the search space just on the basis of one criterion. The user has a certain free space, when he/she has the possibility to apply each criterion the way he or she prefers (stricter or more flexible). By varying the level of strictness, the user has an opportunity to manipulate the final result of the restriction phase. Exactly this is essential, because the final goal of the restriction phase is to limit the search space in such a way that there will be just five potential waste disposal places left after going through the restriction phase.

The layout of the restriction phase is as followed. In paragraph 3.2 the restriction criteria are further clarified. Paragraph 3.3 is divided in three subparagraphs. The first two are about the importance of the bandwidth and use of weights. In subparagraph 3.3.3 the way to determine geo-hydrological suitability of certain parts of the search space is a central topic. The method to compare different parts of the search space is illuminated in paragraph 3.4 with the help of a broad example.

3.2 Clarification of the restriction criteria

Ad 1) Vicinity of the rail and water roads
A waste disposal place must be easily accessible for long distance transport. In the recent Transport Structure Schema the accent is shifted from heavy vehicle transportation of goods to transportation by ship or train. The increase of share of the waste transportation by rail and water roads can dramatically decrease the impact on nature by waste transportation. From accessibility, as well as from an environmental point of view, the advantage has to be given to the location of a waste disposal place next to the rail and water roads.

Ad 2) Location in the urban area
The State Planning Service mentions in the "Spatial cadre for waste removing" several location criteria for waste recycle fabrics; whereof a location in an urban area is seen as an important factor. By situating the waste disposal places next to the population concentration areas, damage to the countryside will be limited. Besides, the organization of new locations in urban areas will limit the distances for the waste transport. The limitation of the transport distances for waste will reduce environmental effects caused by heavy vehicle movement. It leads to lower transport costs as well.

Ad 3) Airports
In addition to the information, given in exemption phase about "airports", there are some areas next to the airports, which are suitable for location of non-organic waste disposal place. The construction and demolition waste is an example of it.

Ad 4) Geo-hydrological situation
With the broad term "Geo-hydrological situation" many different geo-hydrological features are meant. These physical and geographical features can not be evaluated separately from each other, because they are related to each other in a very complex way.
In the exemption phase the most sensitive areas from a Geo-hydrological point view were excluded from the search space for possible waste dump areas, namely the soil protection areas and ground water protection areas. In this phase the user has to exclude some parts of the search space which are relatively unsuitable from a geo-hydrological point of view. It can occur that in some regions the geo-hydrological situation is practically everywhere unfavorable for the organization of the waste disposal place. But a choice has to be made and some relatively favorable places should be transferred to the ranking phase. The organization of the waste disposal place in one of the - from geo-hydrological point of view - unfavorable places brings certain pollution risks for soil, ground- and surface water.
The negative effects connected to the unfavorable geo-hydrological situation can be partly compensated by additional milieu-technical measures. Due to the required milieu-technical measures the organizational costs of the waste disposal place can get considerably higher. Besides, some of those milieu-technical measures will have permanent character.
The term "unfavorable geo-hydrological situation" has an all-inclusive and a relative meaning. In order to give the user a guideline on how to work on practice, there are several most common criteria presented underneath.
a) Setting sensitivity

In this specific case, the setting can be defined as a ground descent, caused by ground heightening or allocation of other materials on one place. The level of the setting is important for three reasons:
- If the setting becomes too big, the bottom of waste disposal place can come close to average ground water level;
- The differences in setting can lead to the cleavage of the soil sealing required by the Guiding Line Controlled Dumping (1985);
- Besides the above mentioned, the setting can damage the drainage system.
The setting map of the Netherlands, scale 1: 100.000 can be used as a source of information. This map gives information about the calculated setting information in case of an equivalent of three-meter-sand pressure. The setting is most common in clay and peat soil. Peat soil is the most setting sensitive and is the main cause for setting.
b) Permeability
Permeability is the ability of the soil to let through liquid or gas. The soil with higher permeability promotes quick accessibility of the ground water from eventual percolate water. On the basis of permeability, it is advisable to avoid the usage of coarse sand as the ground for waste disposal place. As a source of information the Soil Map of the Netherlands, scale 1: 25.000, can be used.
c) Avoiding of the impermeable layers
It is important to know the existence and size of any impermeable layers on a possible waste dump area. It is important not only deeper in the ground, but directly under the soil seal of the waste disposal place as well (the so called diffusion halting layer). The map "Deep Clay Layers", scale 1: 250.000 illustrates the place and size of poorly permeable layers in the ground.
d) Ground water level
The level of the ground water is important regarding the distance between the ground water and the bottom of the waste disposal place. According to the State regulations on waste dump, the dumping of the waste must be organized in such a way that after ground setting the waste should not come closer than 0.7 meter from average ground water level. The provincial ground water maps can be used as a source of information.
e) Avoiding of the percolating water
In the percolating water area the ground water comes to the surface under influence of heights outside the described area. In case of the realization of the waste disposal place in a percolating water area, the chance of ground water pollution considerably declines: In case of soil seal damage, the percolating water, instead of merging with deep ground water via shallow ground water, will come into circulation. Thus, the infiltration of the percolating water in the usable water will be avoided. The geo-hydrological system map of the Netherlands can be used as a source of information, scale 1: 200.000.
Ad 5) Location in Green line area
According to the State Spatial Order the countryside is divided in four different development line areas. Long-term maintaining and development of the spatial quality of country areas is the main aim of line determination. In the country areas with green line, the priority is given to the development of the ecological qualities during the spatial development. The green line areas are part of the restriction phase, because the nature areas of the green line areas are already included in the exemption phase. In the parts of the green line areas, which are outside nature areas, the

location of the waste disposal places is allowed if it does not obstruct the long-term development of the nature. Several water areas, like Wadden Sea, some parts of the Northern Sea coast, Eems-Dolard, Oosterschlde, Zoom Lake and Markizaat Lake are included in the green line area. The determination of the development lines have to be supported by the state regulations on the spatial order. Only then it will become legal ground. Due to the fact that state policy on this issue has to be worked out on provincial and district level, the exact boundaries of the Green Line are not determined yet.

Ad 6) Location in Blue Line area

In the blue line country areas the specific regional quality is decisive and theoretically new waste removal installations should not be placed there. The development of the ecological structure is very important for this area. Similar to the Green Line area the determination of the development line in the Blue Line Area has to be supported by the state regulations on the spatial order.

7. Hindering infrastructure provision

The infrastructure provision can be hindering, if the waste disposal place is situated next to the infrastructure provision facilities. Infrastructure provision facilities are located above the ground (electricity lines, ray paths), as well under ground (under ground transport lines). Depending on the situation, the presence of the Infrastructure provision facilities, like provincial and regional roads, rail and water roads can be seen as positive, as well as negative restriction conditions.

Ad 8) Recreation area

The Structural schema Open Air Recreation (1986) provides the list of those areas. Certain forms of recreation do not have to be in contradiction with waste disposal place. So called "noise sports" can be mentioned here. Besides, the waste dump location can be used in such a way that waste dump place can get recreational function.

Ad 9) Military area

The Structural schema Military areas (1985) provide the list of those areas. Some military areas, like unused barracks territories can be considered as possible waste disposal place. It means that founding of the waste disposal place in such areas can not be disqualified.

Ad 10) Industrial area

Industrial Areas do not have to be excluded from possible waste dump areas. If the functioning of the waste disposal place does not disturb existing industrial facilities (for example, particle sensitive factories, food industry) or urban construction, the waste dump area can be described as a part of the industrial area. The good infrastructural connections of industrial areas can be useful, as well.

3.3 Describing of the methodology used in the restriction phase

3.3.1 Introduction

The final purpose of the restriction phase is to limit the search space in such a way that there will be just five possible waste dump areas left. Those five possible waste dump areas later will be transferred to the ranking phase.

In paragraphs 3.1 and 3.2 ten criteria are illuminated in order to limit the search area. Those ten criteria are set in the form of questions and are presented in table 3. The questions are formulated in such a way that the answering of any question with "yes" means that a specified part of the search space is less suitable for a possible waste dump area than the rest. The procedure and working method to use table 3 is explained in following paragraphs.

Table 3. The questions from the restriction phase

Is the specified part of the search space situated:
1 outside a radius of ten kilometers from train- and/or water roads?
2 outside an urban area?
3 outside a radius of 5.5 kilometers from the airport? (Only for non-organic waste!)
4 in the area with unfavorable geo-hydrological situation?
5 in a Green Line Area?
6 in a Blue Line Area?
7 in an area with hindering infrastructure provision?
8 in a recreation area?
9 in a military area?
10 in an industrial area?

In the beginning of the restriction phase the user has to test the remaining search space to those questions and scrap the part of the search with answers "yes". The restriction phase has to be used as strict as in the exemption phase. After a strict evaluation of the restriction phase, there are three possible scenarios left:

1) The remaining search space can include approximately 5 potential waste dump locations. The user can than directly go to the ranking phase. The aim of the restriction phase is already achieved.

2) The remaining search space is too big; the search space for ranking phase includes more than five locations. Due to that fact that the restriction phase is applied as strict as possible, the remaining search space can not be limited any further. All remaining search space goes to the ranking phase.

3) The remaining search space is too small; the search space is limited in such a way that it includes just one, two or no locations at all. In this case the user has to go through the restriction phase once more, but with more flexible requirements. By making the criteria more flexible, the search area will be increased. The criteria have to be flexible in such way that there will be just 5 possible potential waste dump areas left.

It is expected that the first possible scenario occurs very seldom or practically never. In most of the cases the third scenario takes place. The following way of working is based on this scenario.

The criteria have to become more flexible in such way that remaining search space will include just 5 possible potential waste dump areas.

3.3.2 The use of weighting factors

So far, to all restriction areas the same importance was given. In practice it might happen that some criteria can be described as more important than others. Depending on the context, advantage can be given to certain criteria. Because the decision support model tries to make the process of the location choice as realistic as possible, the weighting factors are assigned to different criteria.

The assignment of the weighting factors strongly influences the weighting factors' outcome of the process of the location choice. Thus, the outcomes can be manipulated. It has not to be forgotten that one of the main aims of the decision support model is to enhance the process of the location choice. The model requires namely the making of certain decisions. These choices lead to certain results. It is exactly the meaning of the entire process to make choices more transparent and understandable. Just because of the transparent and understandable process of the location choice, the made decision has to be clearly and convincible motivated by the model user. Assigning weighting factor to different criteria must satisfactorily motivate the decision made. Decision support model is more directed on managing the process of the location choice, than on the final outcome, which partly will be based on results of the model.

To avoid significant differences between criteria, the lowest score for weight is 1 and he highest 5. A criterion can be evaluated maximally five times more importantly than any other criterion. In table 4 those weights are illustrated. The table 4 is the scale where the increasing evaluation of the certain criterion corresponds with an increasing weight of the appropriate criterion. Corresponding importance of the certain criterion given by the user, increases not only value of the criterion, but the assigned weight as well.

Table 4 Evaluation according to assigned weights

User evaluates the criterion as...	unimportant	not so important	moderately important	important	very important
Corresponding weighting factor	1	2	3	4	5

There can be numerous reasons to assign different importance to various criteria. The evaluation is different for every criterion and depends on local circumstances. The criterion "hindering infrastructure provision" will be in most of he cases not applicable and is going to receive weighting factor 1. In specific cases the above mentioned criterion can require special importance and is going to receive weighting factor 4 or 5.

Besides the above mentioned, weight of the criterion depends on the weights assigned to other criteria. It is about relations between the different criteria: the assignment of the weight illustrates the relative importance of the one criterion with regard to the other criteria.

It is advisable to take into consideration the clarifications of the restriction criteria (chapter 3.2). In most of the cases the clarification assigns the importance to the criteria in accordance to the state interests. Several criteria are evaluated essentially heavier than other criteria. If the user

decides to assign less weight to those criteria, he is going to need extra motivation for it. The following criteria are described as essentially more important:

- situation in urban area;
- distance from rail and water roads;
- unfavorable geo-hydrological situation;
- situation in Green Line Area;
- situation in Blue Line Area.

The motivation of the choice of weights is essential to encourage the transparency of the process of the location choice.
Many different factors can play a role during the assigning of the weights, which can be different for various parts of the search space. It is up to the user to clear up those reasons and explain the made decision.
The suitability of the different parts of the search space for possible waste disposal place will be evaluated by the sum of used weighting factors. The way to determine weighed sum of specific part of the search space is illustrated in paragraph 3.4.

3.3.3 The determination of the geo-hydrological suitability

In chapter 3.2 there are five criteria mentioned under the headline "geo-hydrological suitability". These geo-hydrological criteria have an extraordinary position in the restriction phase, because only they require further explanations. A preparatory stage is submitted in this chapter, because just the clarification does not give enough information for a final judgment about the geo-hydrological suitability of certain parts of the search space: on the basis of the geo-hydrological criteria there are several questions formulated, which are formalized in table 5. With the help of the table 5 the final judgment can be formed on the geo-hydrological suitability of appropriate part of the search space.
The geo-hydrological table is included as an appendix in Table B. The following paragraphs have to be read, prior to the filling of the table B.
The aim of the table 5 is the general determination of the geo-hydrological suitability of the parts of the search space for the possible waste dump area. The ranking phase, when just a few possible waste dump areas are left, will go deeper in precise geo-hydrological suitability of the location. Table 5 does not give yet the possibility to assign weights to the different criteria.
It is advisable to evaluate the parts of the search space, which answers the below mentioned questions twice with "yes", as unsuitable. It must be mentioned that the first criterion "setting sensitivity" has an exceptional position. This criterion is very important and a positive answer on the question for any part of the search space, excludes this area as possible waste dump area.

Table 5. Determination of the geo-hydrological suitability

Is a relevant part of the search space situated:	**answer**
1 in peat soil or other setting sensitive ground?	yes/no
2 in an area with non homogeneous underground?	yes/no
3 in an area where the surface is composed of coarse sand?	yes/no
4 in an area with impermeable layers in the ground?	yes/no
5 in an area where the expected distance between the average level of ground water and the bottom of the waste is less than 0.7 meter?	yes/no
6 in an infiltration area?	yes/no
Eventual addition of other specific geo-hydrological criteria?	
In case of 'yes" answer on question one or on any other two questions, this part of the search area can be described as an unfavorable destination for possible waste dump area.	

The user is free to add any other criteria, due to specific circumstances on location. Added criteria have to be mentioned and the motivation explained by the user.

3.4 Working according to the example

As it was already mentioned in paragraph 3.3.1, in this chapter we describe how to use the restriction criteria in such a way that will be just 5 potential waste disposal places left after. How to do it?
We start from the beginning: In the beginning of the restriction phase, there is no limitation to the remaining search space after the exemption phase. With the help of the questions of table 6, the parts of the search space will be excluded, which correspond to the answer 'yes". Only the parts of the search space with no "yes" go further to the ranking phase.

Table 6. The questions about the restriction phase

Is the specified part of the search space situated:	**Answer (yes/no)**
1 outside a radius of ten kilometers from rail- and water roads?	
2 outside urban area?	
3 outside a radius of 5.5 kilometers from the airport? (Only for non-organic waste!)	
4 in an area with unfavorable geo-hydrological situation?	
5 in a Green Line Area?	
6 in a Blue Line Area?	
7 in an area with hindering infrastructure provision?	
8 in a recreation area?	
9 in a military area?	
10 in an industrial area?	
All those criteria are accepted as important weight criteria.	

Let's imagine that just one part of the search area complies with the rule "not even one single yes". If the specified part of the search space is not big enough, it may only include one potential waste disposal place. The remaining search space has to be enlarged by making the restriction criteria suppler. The rule "not even one single yes" will be replaced with the rule "only one yes allowed". It can happen that even now the remaining search space is still too small to include five possible waste dump areas. What than?
The answer is simple: the rule "only one yes allowed" will be replaced with the rule "only two yes allowed". After enlarging the restriction criteria for the second time, it appeared that the remaining search space is big enough to include eight possible waste disposal places. In the example we accept that there are four parts of the search area which consists of eight possible waste disposal places. In the restriction phase we compare the different parts of the search area between each other, and not the potential locations, because choosing the real location is not an issue in the restriction phase.
To finalize this example, we should know on which questions at appropriate parts of the search space the positive answer is given. Let's see the table 7 for an example. In the first column of table 7 there are five different parts of the search space placed and several potential waste dump areas within them (column 2). Because in the example some parts of the search space are larger than other, there is a difference in quantity between the possible waste dump areas per parts of the search space.
In column three of the table 7 the appropriate parts of the search space with a positive answer on the questions from table 6 are shown. In the example it is assumed that the possible waste dump area will be used for organic waste as well. That is why the question 3 from table 6 is not relevant any more, because it was assumed that it was only for non-organic waste dumping (no attraction for the birds).
From table 7 it is clear that area E corresponds to the rule "not even one single yes" and only area C corresponds with the rule "only one yes allowed". This is because C is situated outside an urban area (see question 2 from table 6). The remaining three parts of the search space correspond with the rule "only two yes allowed".

Table 7. Determining of the weighted sum of the parts of the search space (example)

Parts of the search space	Quantity of the potential locations	the questions with "yes' answer	weight	weighed sum
Area A	2	- situation in Green Line area	4	9
		- unsuitable geo-hydrological situation	5	
Area B	1	- outside urban area	4	8
		- situation in Green Line area	4	
Area C	2	- outside urban area	4	4
Area D	2	- unsuitable geo-hydrological situation	4	6
		- situation in recreational area	2	
Area E	1	no questions with "yes"		0

In accordance with table 4, the user can assign weights to the different criteria from table 7. Every question with a "yes" answer becomes a positive score on restriction criterion connected to this question. From table 7 it is visible that some criteria occur several times. For instance, the areas A and B are both situated in the Green Line Area. Because the assigning of the weight can not be evaluated without the part of the search space connected to the above mentioned criterion, the certain criterion in one part of the search space can get a different weight than in other parts. Also because of this reason the motivation of the assigned weights is important for the transparency of the process of the choice of location. In the example the user motivated the made choices on the ground of the assigned weights:

- From Table 7 is obvious that area A, as well as area B are situated in the Green Line Area. The criterion "situation in Green Line Area" in both cases receives weight 4, because the situation in the Green Line Area is evaluated as "important" by the user. The user can explain the made choice as followed (example):
  - the criterion "situation in a Green Line Area" is included as a heavy weight criterion;

- there are several nature areas in the respective Green Line Area according to the district development plan;
- according to the recent regulation of the provincial government "Nature in our province, worth to be saved", the province intends to be more active in nature and landscape policy.

- The situating outside an urban area is assessed by the user as "important" for area B as well as for area C, which leads to the assignment of the weight 4 to the criterion "Situating outside Urban Area" to both cases. It is motivated by the user as followed:
  - the criterion "Situating Outside Urban Area" is included as a heavy weight criterion;
  - by situating the waste dump area within an urban area further damage to the nature in the countryside is limited.
- Also the criterion "geo-hydrological situation" is applicable to two parts of the search space (area A and D). Generally the location of appropriate parts of the search space in the area with unfavorable geo-hydrological situation is evaluated by the user as "important". It is motivated by the user as followed:
  - the criterion "geo-hydrological suitability" is included in heavy weight criteria;
  - after collecting information from the scientists, it became obvious that milieu-technical costs are going to rise in both parts of the search space as a result of the extra environmental provisions.

  Concerning the area A, in the past, in similar situations, the pollution on large scale took place, caused by a percolation water disposal. Due to the above mentioned fact the user decided to assign the weight score 5 to the criterion "geo-hydrological suitability" in area A, and weight score 4 in area D.
- The situating in the recreational area is experienced by the user as "not so important". That is why the part of the search area D next to the appropriate criterion weights score 2. It is motivated by the user as followed:
  - there are two more recreational areas in direct surrounding of the relevant part of the search space. They can easily deal with increasing recreational pressure.
  - the organization of the waste disposal place can be taken into consideration during the regional recreation plan which is not yet developed.

Which parts of the search space go to the ranking phase? The parts of the search area with the lowest weight sum will go to the ranking phase. It has not to be forgotten that those parts of the search space all together should include approximately five possible waste dump areas.
In table 7 the weight score is determined by the sum of the weight scores of the search space parts. It is easy to see that area E has the best result with a weight sum of 0. Area C has the next best score with a weight sum of 4. Areas E and C include 4 potential waste disposal places altogether. To come up with a result of five possible waste dump locations, area D is selected, as well. It has a lower sum of the weight scores than the remaining A and B areas.
The areas C, D and E together include five potential waste dump locations. That is why they will go to the ranking phase.
At the beginning of the ranking phase it will be explained how these parts of the search space can be transformed in possible waste dump locations.

The ranking phase

4.1 Introduction

The meaning of this phase is to arrange the remaining locations according to their suitability. Finally this will lead to the (quantitative ranking) of the locations according to their suitability for location of the waste disposal place.

Whereas in previous phases it was talked about the "parts of the search space", now this term is replaced with "locations". After going through the exemption and restriction phases there are just several possible locations left in the limited search space. Another possibility may occur that instead of the several locations just one big area is left, with few locations within it. Here the solution is quite simple: the area will be divided in several areas in such a way, that each area includes just one possible waste dump location. These locations will be compared to each other. Naturally, the same can be done if there are two bigger areas left together with small possible locations. In the ranking phase the areas are compared with just one possible waste dump location. The required minimal size of the waste disposal place determines which parts of the search area are large enough for potential waste dump location. When some areas are smaller than the required minimal size for the potential waste disposal place, they can be excluded from the search area.

As it was mentioned in chapter 3.4, the search space should be limited in such a way that it must include in ideal case maximal 5 locations. This is not always the case. What does the user need to do if there are more than 5 locations left?

1. The user decides to convey with all remaining locations to the ranking phase. The disadvantage of this method is that it is difficult to achieve a good overview while comparing and ordering for example ten possible locations. Some less important, but practical disadvantage is a larger paper work than with 5 possible waste dump locations.
2. The user decides to go through the ranking phase at least twice. For the first time this will be done generally and five best scoring locations will be selected. These five locations will be compared to each other for a second time.

The ranking phase is subdivided in five possible rubrics:

1. environmental criteria;
2. spatial criteria;
3. nature and landscape criteria;
4. juridical-management criteria;
5. Financial-economical criteria.

Generally all these criteria have the same value. At the end of this phase the user can assign different weight scores to the above-mentioned five rubrics. It can occur that the user finds the environmental criteria structurally more important than the financial-economical criteria. In this case the first criteria receive a higher weight than the second.

In the ranking phase next to the new location criteria, some old criteria are used as well, which were described earlier. In this phase we move from regional level (search space) to local level (locations); the criteria, which are going to receive attention once more, will be illustrated more specifically and precisely.

Certain overlapping of the rubrics can occur, because several criteria have to be illustrated from different points of view.

4.2 Clarification of the procedure

In this phase the used criteria per rubric are united in a chart, five in total. As finally there must be achieved just 5 locations, they are ranked according to their suitability as a potential waste disposal place and suitability of the location is expressed within the final figure. In order to accomplish this, the score must be determined for each rubric and location. After verification of the scores for each rubric, they can be easily summed up to the final figure.
How all this can be done in practice? In table 8 (example) five criteria are selected from the list of the environmental criteria. There are location criteria in the left column and locations from A to E on the right side.

Table 8 Environmental criteria (example)

Criteria	Locations				
	A	B	C	D	E
1. permeability of the ground					
2. existence of poor permeable layers in the ground					
3. Setting sensitivity of the ground					
4. Existence of sensitive objects (ground water stream direction)					
5. Ground water level under potential waste disposal place					
Total score per location (Sum)					
Average score per location					

Every location receives a score for each criterion. These are no absolute, but relative scores. These relative scores are later called ranking scores. Ranking scores illustrate the order of the locations for each criterion. The best evaluated location for a certain criterion, receives the most points and a ranking score of 5. Second best location gets the ranking score 4 etc.
There are two main reasons to use the ranking scores in this model. First, the ordering of the locations according their suitability is the most important goal of this phase. Second, methodologically it is easier to sum up the ranking scores instead of the absolute scores. The criteria are so different from each other, that from a methodological point of view it is unreasonable to summarize absolute scores. Each of the five rubrics is extensively exemplified. Each of the location criteria are illustrated separately. As an example, here is some extra information regarding the criteria from table 11:

Ad 1. The high permeability means that eventual percolation water can easily merge with the (deep) ground water. The location with the least permeability receives the highest ranking score.
Ad 2. The location with impermeable layers has better ranking score than the locations without impermeable layers. The map "deep clay soil layers", scale 1:250.000, can be used a source.

Ad 3. The level of the setting is determined with the help of the Settings map, scale 1:250.000 and the soil map of The Netherlands, scale 1:50.000. The location with the most limited setting, receives the highest ranking score.
Ad 4. The location, where there are no sensitive objects in the same direction as the ground water stream, receives a high ranking score. Examples of the sensitive objects are: water wells and nature areas depending on the ground water.
Ad 5. The location with the lowest ground water level receives the highest score. Sources: Provincial Ground Water plans and Soil Map of the Netherlands, scale 1:50.000.

The most suitable locations receive always the highest ranking scores assigned, the least suitable - the lowest ranking scores. If a location complies with the "negative criterion", it means that the location is less suitable for a possible waste disposal place and therefore receives a low ranking score. The location with a setting sensitive underground receives a lower ranking score than the location with less setting sensitive underground. In case that a location complies more with the "positive" criteria, than the location is more suitable for possible waste disposal place. For example if a location complies with spatial criterion "location next to the rail and water roads", it in suitable for founding of the waste disposal place and receives a higher ranking score assigned. By each criterion it will be shown if a location is assigned a high or low ranking score. By the criteria the following specifications can be made:

- In this example there are five possible locations to compare (A-E). In practice they can be more or less, as well. In order to assign the ranking scores, it is important to realize that the location with the lowest ranking score receives number 1 assigned. The location with the highest ranking score receives exactly the number of the quantity of the existing locations.
- It is not always easy to make a distinction between the different locations from "high to low". It can occur that from five locations three locations score so close to each other that in fact they should receive the same ranking score. In this case each of the similar location can receive one average ranking score (see table 9). In the example the locations B, D and E have a similar ranking score. The highest ranking core is assigned to location A and the lowest to the location C. If the locations B, D and E would not be treated equally, they should get the ranking score 2, 3 and 4. Because they are evaluated similarly in corresponding criterion, all locations receive the same ranking score (2+3+4:3);

Table 9. Assigning of the ranking scores of similar value (example)

Locations	A	B	C	D	E
"Score"	"good"	"average"	"bad"	"average"	"average"
Ranking score	5	3	1	3	3

- The information is not always available, to assign the ranking scores to on or more locations. In such case the can assign no ranking score to particular location. The locations with available information receive the ranking score assigned according to quantity of the location with available information.

- The several criteria can be used as location criteria only in specific cases. For example, the criterion "location next to the particle sensitive fabrics" will not be important during the process of the choice of location, if there are no particle sensitive fabrics in direct neighborhood of the all possible waste disposal places. In this case this criterion can be excluded from the research.

With the help of the received information about the criteria, the ranking scores can be determined and included in the table. In table 10 (example) the ranking scores are included in the table and total average ranking score per location and per rubric are determined.

Table 10. Determination of the average ranking scores per location (example)

Criteria	Locations				
	A	B	C	D	E
1. permeability of the ground	1	4	5	3	2
2. existence of poor permeable layers in the ground	3	?	1	4	2
3. setting sensitivity of the ground	4	3	2	1	5
4. location of sensitive objects (ground water stream direction)	2	1	3.5	3.5	5
5. ground water level under potential waste disposal place	3	2	1	5	4
Total score per location (Sum)	13	10	12.5	16.5	18
Average score per location	2.6	2.5	2.5	3.3	3.6

The total average ranking score is calculated in two steps:

1. Summing up of the filled-in ranking scores makes up the total ranking score;
2. Dividing the total ranking score by the quantity of criteria, the average ranking core is calculated per location.

To calculate the average of the total ranking scores is important because not every rubric includes the same number of criteria. A rubric with more criteria without an average score would be weighted heavier than the rubric with fewer criteria. Besides that, it might occur that there are no data available for one of the criteria and this criterion is included during the calculation of the total ranking score. Through dividing the total ranking score by the number of the used (filled in) criteria, insufficient evaluation of the entire rubric is avoided.

The user does not have possibility to assign weights to particular criteria. There are three reasons for it. At the first place, every time when a weight is assigned to the criterion, it has to be explained for the transparency of procedure, but at the same time it makes the model less practical and workable. As it was mentioned in the Introduction, at the end of the ranking phase the possibility to assign weights to the whole rubrics exists. The second reason not to assign weights to particular criteria is that assigning ranking scores to the locations provides satisfactory distinctions between them. The limited difference between the criteria qua importance is the third reason not to assign weights to particular criteria.

With the help of the table 10 the possible problems during the calculation of the average ranking score are further illustrated.
There is no information available about "poor permeability of the ground" for location B. That is why there are just 4 locations filled in for criterion 2. These locations receive maximal 4 and minimal 1 ranking score.
The locations C and D have the same core in the criterion "situating next to the sensitive objects". Because locations A and B have a lower score and location E a higher score, the average score of 3.5 was assigned to the locations C and D. The average score of 3.5 is calculated by the summing of 2 and 4 and later dividing it by two.
The average score per location is calculated by dividing the total score by the quantity of the used criteria. For the locations A, C, D and E the total score was divided by five. In the case of location B there was no data available for one criterion: that is why the total score is divided by four.
The average scores from table 10 show how suitable the locations are for the possible waste disposal place measured with the help of the used criteria. The location with the highest ranking score is, in this case, the most suitable from the environmental point of view. In this case, it is because of the following characteristics of location E:

- The underground of the location E is expected to have the smallest setting;
- There are less sensitive objects in the direction of the underground water stream in the neighborhood of the location E than in the neighborhood of the other locations;
- Location E has a low ground water level, only location D has a lower ground water level.

In contrary the location E has a low score in contrast with other locations on the criteria "permeability of the ground" and "existence of the poor permeable layers in the ground". The relatively bad ranking score in these criteria does not mean that the place is not at all suitable for the possible waste disposal place. The exclusion of the really unsuitable places from the entire search space in exemption and restriction phases has to be taken into consideration.

4. 3 Environmental criteria

The waste disposal place has an important impact on the location and the direct neighborhood of a waste disposal place from an environmental point of view. The waste disposal place can have negative effects on the soil and ground water in the area. The pollution of the soil and ground water can lead to the spread of pollution in the direct surrounding and near the surface water.
Despite the common requirements for the location of the waste disposal place according o IBC criteria, the specific circumstances play an important role: Geological and geo-hydrological situation determine to which extend the potential waste disposal place complies to the IBC criteria and to which extend the extra environmental measures are required.
Finally, the choice of location for the waste disposal place hinders functioning of the humans, plants and the animals. To avoid or minimize the impact depending on the sort of hindering and sensitivity of the situation, (indicative) distance norms are introduced. It was already mentioned in the exemption phase that the minimal distance between the nearest populated area and the waste disposal place must be at least 250 meter. Because this 250 meter zone is already included in the exemption phase, outside this 250 meter zone is an indicative distance norm. In

connection with the possible stench, some state organs are advising to keep a 300 meter distance between urban neighborhoods and waste disposal places. This issue will be further illustrated later under the rubric "spatial criteria".

T**able 11. The environmental criteria**

Environmental Criteria	Locations				
	A	B	C	D	E
1. permeability of the ground					
2. existence of poor permeable layers in the ground					
3. Setting sensitivity of the ground					
4. location of sensitive objects (ground water stream direction)					
5. speed of the ground water stream					
6. Ground water level under the potential waste disposal place					
7. surface water quality					
8. speed of the surface water stream					
9. stench annoyance for neighbors					
10. particle annoyance for neighbors					
11. traffic attraction					
12. risks for neighbors					
13. other kind of annoyance for neighbors					
Total score per location (Sum)					
Average score per location					

Explanations for environmental criteria

Ad 1. A high permeability means that eventual percolation water can easily merge with the ground water. The location with least permeability receives the highest ranking score.

Ad 2. The location with existing poor permeable layers in the ground has a better score than the location with missing poor permeable layers in the ground. As a source the map "deep clay soil layers", scale 1:250.000 can be used.

Ad 3. The level of the setting is determined with the help of the Settings map, scale 1:250.000 and the soil map of The Netherlands, scale 1:50.000. The location with the most limited setting, receives the highest ranking score.

Ad 4. The location, where no sensitive objects are in the direction of the ground water stream, receives a high ranking score. Examples of the sensitive objects are: water wells and nature areas depending on the ground water. In this case the ecosystem connected to the ground water has to be taken into consideration. The State Institute of the forest and Landscape research publicized a map in 1982, illustrating ground water dependant vegetation.

Ad 5. The fast ground water stream promotes fast spread of the percolation water under the waste disposal place. The speed of the movement of the ground water depends on the porosity of the ground and filtering speed.
Ad 6. The location with the lowest ground water level receives the highest score. Sources: Provincial Ground Water plans and Soil Map of the Netherlands, scale 1:50.000.
Ad 7. There are different quality requirements for the surface water, depending on their destination. That is why there are different requirements concerning the extent of the possible pollution of the surface water. The provincial governments have elaborated the surface water quality plans in order to protect its quality, where the various protection levels are given. With high quality surface water corresponds to a lower assigned score.
Ad 8. During the high speed of the surface water, the eventual pollution can be limited much faster. High surface water speed corresponds to high ranking score.
Ad 9. The indicative norm of 300 meters between the populated area and waste disposal place is accepted for possible stench. This indicative norm of 300 meters is more than the norm used in the exemption phase (250 meter). With longer distance between the location of the waste disposal place and populated areas corresponds higher ranking score. Beyond 500 meter this criterion is not relevant anymore. That is why the locations situating beyond 500 meter zone from populated area receive no ranking score assigned.
Ad 10. Similar to the stench, the indicative norm of the 300 meters between the populated area and the waste disposal place is accepted for possible particles. Longer distance between the location of the waste disposal place and populated area corresponds to a higher ranking score. Also similar to stench, beyond 500 meter this criterion is not relevant anymore and the locations situated beyond the 500 meter zone from a populated area receive no ranking score assigned.
Ad 11. The location of the delivery routes has to be assessed in connection with existing and planned urban construction, in order o avoid eventual traffic to the waste disposal place through populated area as much as possible. The location with the most favorable delivery routes receives the highest score assigned. The limitation of the traffic depends also on the size of the waste disposal place and on used means of transportation. The location of the waste disposal place next to rail and water ways will lead to the reduction of the hinder caused by traffic.
Ad 12. The existence of the dumped natural gas can cause an explosion or fire. The location with longest distance between the populated area and waste disposal place receives the highest ranking score. Beyond 500 meter this criterion is not relevant anymore. That is why the locations situating beyond 500 meter zone from populated area receive no ranking score assigned. There are no spatially relevant norms for the dumped natural gas.
Ad 13. Under the category "other kind of annoyance for neighbors" are, for example, vermin attracted by waste (rats, insects, gulls), spread of the waste in the air, voice hinder by activities on the territory of the waste disposal place. Similar to other, here as well, the location with the longest distance between the populated area and the waste disposal place receives the highest ranking score within maximal 500 meters.

4.4 Spatial criteria

The rubric "spatial criteria" generally can be divided into three groups: direct use of the space, indirect use of the space and spatial fitting.

The direct use of the space of the waste disposal place is very important. This is the result of the seizure of the space of the waste disposal place itself and by organized infrastructure. The direct use of the space exceeded approximately 160 hectares per year in the eighties. The central government intends to decrease the limit of direct usage of the space by the year 2000 till 40 hectares per year.

In the second place the waste disposal place needs a large indirect use of the space. The negative influence of the location on the neighborhood can be mentioned here, like voice hinder, stench, traffic etc. The indirect use of the space is much larger than the direct use of the space. By introducing environmental zones, where a certain minimal distance is determined between the hinder causing activities and sensitive destination, government tries to minimize or even avoid any inconvenience for the neighborhood.

Finally, when choosing the location for possible waste disposal place, special attention has to be paid to the extend of the spatial fitting: in which extend the waste disposal place fits into the neighborhood, taking into consideration functions and exploitation regulations, linked to the surrounding destinations.

Table 12. The spatial criteria

spatial criteria	Locations				
	A	B	C	D	E
1. Bruto-netto relations of the ground surface					
2. Infrastructural hinder					
3. distance from industrial, military or recreational area					
4. distance from the areas with essential landscape, geological, historical and ecological value					
5. location next to the rail- and waterways					
6. distance from waste central point					
7. Results for spatial structure of the country side					
8. possibility of the use of the rest energy					
9. distance from the particle-sensitive fabrics					
10. Spatial fitting in connection to the development perspective of the area					
11. possibilities of the extra destination for spatial fitting					
Total score per location (Sum)					
Average score per location					

Explanations for the spatial criteria

Ad 1. A place with of size of 80 by 75 hectares has a same surface size as a place of 150 by 40, but has better Bruto-netto relations of the ground surface. The location with better Bruto-netto relations of the ground surface receives a higher ranking score assigned.
Ad 2. The locations with least infrastructural hinder receive the highest ranking score assigned. It depends on local circumstances to which extend the local infrastructure are described as hindering.
Ad 3. On the ground of the state regulations the minimal distance norm is introduced between the waste disposal places and the populated area, including the recreation areas in order to avoid stench or other hinder. The location with the longest distance between an industrial, military or recreation area and the waste disposal place receives the highest ranking score.
Ad 4. In the exemption phase a zone of 150 meters is included as a minimal distance between the waste disposal place and nature area. The place, situated in longest distance from areas of the essential landscape, geological, historical or ecological value receives the highest ranking score assigned. The maximal distance on this criterion is 500 meters. It is advisable to examine this criterion together with the environmental criterion "location of the sensitive areas".
Ad 5. In order to avoid inconvenience caused by heavy vehicle traffic, the share of the transportation by rail- and waterways has to be increased. The locations easily reachable by rail- and waterways should get an advantageous position and a higher ranking score assigned. It has to be mentioned as well that this criterion is generally less relevant if the maintenance area of the waste disposal place is small. Where the use of the trucks is unavoidable, the advantage is given to location C. These are the most accessible locations via roads and are situated within or on the edge of the urban area.
Ad 6. The waste central point is the imaginable central point of the area where the waste is collected from. The location of the waste central point depends on the sort of the waste, form of the area, the waste is collected from, and the spread of the waste producers. With an increase of the size of the waste disposal place, the importance of the criterion "distance from the waste central point" decreases. The location of the waste disposal place next to the central waste point decreases the transportation distances and therefore reduces disturbances and transportation costs (see also the financial and economical criterion). The nearest location from the central waste point receives the highest ranking score assigned.
Ad 7. The location of the waste disposal place in an agricultural area can cause an unfavorable spatial structure. The nearest location from the central waste point receives the highest ranking score assigned. As a result, the agriculture development possibilities in the affected area could decrease. Taking into consideration the spatial structure, attention has to be paid to the direction of the water routes and the land allotment. The location which has the least unfavorable impact on the agricultural development possibilities, receives the highest ranking score assigned.
Ad 8. The gas released from the waste disposal place can be used as an energy source. The location with the most possibilities of such energy sources should receive the highest ranking score assigned.
Ad 9. Due to the fact that production processes of the high-tech companies are generally particle sensitive, it is not advisable to organize a waste disposal place in the surroundings of

high-tech companies. The locations, with particle sensitive companies in the surroundings, receive the lowest ranking score assigned.
Ad 10. The state regulations determine the frame for spatial development perspectives.
- strengthening economical and spatial aspects are important for development in connection with the conservation of environmental values,
- increasing the spatial diversity,
- using and strengthening the inherent qualities of the area,
There are certain favorable developments identified for a certain area in the district development plans. The location of the waste disposal place which decreases the development perspectives of the area receives a low ranking score assigned.
Ad. 11 The surface of the waste disposal place can be used for limited purposes only. It can become a recreational area like a golf terrain, a park, or being used for jogging. The location which has the most possibilities in this sense, receives the highest ranking score assigned.

4.5. Nature and Landscape Criteria

The waste disposal place has huge negative impacts on nature and landscape. This is not only the direct result of the functioning of the waste disposal place, but also the long-term effects, which are more difficult to identify and measure. Even when placing all the criteria under one rubric, all the location criteria are connected to various subjects.
This rubric is characterized by the diversity and comprehensiveness of the criteria. Nature and landscape are difficult to be evaluated in figures. Nevertheless, in this model the attempt is made to evaluate it in figures, even realizing that it can lead to underestimation of the nature and landscape interests.
The criteria shown in the following table are partly based on the Nature Policy Plan and other sources.

Table 13: Nature and Landscape Criteria

Nature and Landscape Criteria	Locations				
	A	B	C	D	E
1. Ecological value of the flora					
2. Ecological value of the fauna					
3. Impact on the eco-system					
4. Cultural and historical value of the landscape					
5. Possibility of visual spatial fitting in the landscape					
6. Geological and archeological value of the landscape					
7. Pleasure deriving value of the landscape					
Total ranking score per location					
Average ranking score per location					

Explanations for the Natural Landscape Criteria

Ad 1. Direct and indirect spatial use of the waste disposal place destroys the existing flora. Besides this, some unusual vegetation can occur on the waste disposal place. This is going to happen in every location where the waste disposal place is situated. The only difference between the locations is the ecological value of the existing vegetation. These are the criteria in connection with the ecological values according to the Nature Policy Plan:
- Diversity; it can be measured by the rarity and the diversity of the sorts;
- Naturality; the way the local eco-system fits into the wider intact and integral eco-system;
- Character; the way the pleasure-deriving value of the nature fits into the surrounding.

The location with the most ecologically valuable vegetation receives the lowest ranking score assigned.

Ad 2. With regards to the fauna, in the Nature Policy Plan the focus lies on mammals and birds. Here the difference can also be made between the direct and indirect impact on the fauna. Other disturbances by dumping activities can be mentioned here, as well. During the assignment of the ranking scores to the locations, the criteria (diversity, naturality, character) presented in the Natural Policy Plan can be used. The location with the highest ecological value receives the lowest ranking score assigned.

Ad 3. As it what mentioned above in the criterion "naturality", how the waste disposal place and its eco-system fits into the intact and integral greater eco-system is very important. Special attention has to be paid to the eco-systems connected to the ground water. It is about brook and river valleys, hills and springs. As it was explained by the environmental criterion "location of the sensitive objects", the connection to the ground water stream direction is of paramount importance. The location of the waste disposal place which can lead to severe endangering or even destroying of the natural diverse eco-system is going to get a lower ranking score.

Ad 4. The Nature Policy Plan with its evaluation of the landscape in cultural and historical sense stresses the (inter)national rarity and functional correlation with the landscape. Besides this mentioned criteria, there are some other cultural and historical landscape criteria used, like the level of changeability, age, and characteristic features of this region. The working group "Landscape-typology", founded in 1982, intends to elaborate a historical and landscape map of the Netherlands, scale 1:50.000. The location with the most cultural and historical value receives the lowest ranking score assigned.

Ad 5. During the organizational phase and after the end of the dumping activities the waste disposal place has to be fitted into the surrounding as much as possible in visual and spatial sense. Aspects like hill grade, the height of the waste disposal place and eventual waves of the waste, planting possibilities etc. play an important role during this phase. Some locations have more possibilities for visual and spatial design than others. In connection with visual and spatial fitting of the waste disposal place to the landscape the following landscape signs play an important role:
- Openness of the landscape; in a half-open or -closed landscape there are more vertical elements present, the waste disposal place can be connected to. With vertical elements we mean: planting, hills, buildings, installations, viaducts, etc.
- Scale of the landscape; the waste disposal place is a big scale activity which - in visual and spatial sense - fits better into a big scale landscape than in a small one.

In the Nature Policy Plan the priority is given to maintaining the areas with existing openness and to the small scale areas. The locations which offer more possibilities for the visual and spatial fitting of the waste disposal place receive the highest ranking score assigned.
Ad 6. According to the Nature Policy Plan, mostly valuable geological criteria are: substitution, (inter)national rarity and non-involvement in geological processes. The relief (relief class) and the form (form group) determine geological value of the place. The geo-morphological map of the Netherlands scale 1:50.000 can be used as a source. The workgroup "Gea" made a selection of several geologically valuable areas. The location where the geological value is evaluated as "highest" receives the lowest ranking score assigned.
Ad 7. The location of the waste disposal place has an influence on pleasure-deriving value of the landscape. The pleasure-deriving value is connected to the visual and spatial aspects of the landscape and linked to the scale and the openness of the landscape. Besides the above mentioned, some other aspects play a role during pleasure deriving from the landscape. The location with a high pleasure-deriving value receives the lowest ranking score assigned.

4.6. Management/ juridical criteria

There are some management complications explained in paragraph 1.2 caused by the process of location choice for possible waste disposal place. In order to achieve a good progress in the process of location choice and to realize the chosen location, the cooperation between different management levels and policy sectors is essential.
Adapting the plan requires cooperation from the management of the concerned districts. If the local administration is not ready to accept the waste disposal place on their territory, the perspective of wrong procedures can form an important obstacle during the process of the location choice.
Besides management acceptance of the waste disposal place, the acceptance by the local population plays an important role, as well. The interests groups with their democratic right to complain and object can delay or even stop the process of location choice. The crucial role of the lower government and civil society groups in the process of choosing the right location for the waste disposal place requires a weighted, rational and transparent process.
Along the management aspects there are some juridical criteria included in this rubric.

Table 14: Management/ juridical criteria

Management/ juridical criteria	Locations				
	A	B	C	D	E
1. Management acceptance of the concerned province					
2. Management acceptance of the concerned districts					
3. Hampering effects on other plans connected to the development of the location					
4. Social acceptance by the involved interest groups					
5. Ownership relations connected to the necessary territory					
6. Existing contracts related to waste collection					
Total ranking score per location					
Average ranking score per location					

E**xplanation to the management/ juridical criteria**

Ad 1. In certain cases it might occur that the potential waste disposal place can be situated within different provinces. The management acceptance of the waste dump location can be different as well. The extend of management acceptance has an influence on the readiness of the province to change eventual district plans and grant necessary permissions. The decrease of management cooperation generally causes a delay of the process of the location choice. The location within a province with high management acceptance receives the highest ranking score assigned.

Ad 2. Management acceptance of the concerned districts is very important during the process of location choice for all relevant factors, requiring the management cooperation. The most important factor is the readiness of the local council and administration to cooperate regarding the changes in the district development plan and possible amendments. If the concerned district administration is not willing to cooperate, it significantly delays the process of the location choice. The location with the highest local government acceptance receives the highest ranking score assigned.

Ad 3. In different policy areas like spatial order or milieu there decisions can be made which can have a delaying effect on the process of location choice. It can be seen in relation with certain decisions of the governmental bodies trying to influence or guide the process of location choice. If the decisions of the local government included in the district development plans have a delaying effect on the speed of the realization of the waste disposal place, the location receives a lower ranking score assigned.

Ad 4. The social non-acceptance of the possible waste disposal place is expressed in ever-increasing public resistance against the realization of the waste disposal place. The level of public resistance can delay or even fully block the realization of the process of location choice. The success of public interest groups depends on the degree of mistakes made during the decision-making process and how the involved public interest groups take advantage from it. There are some other actors playing a role for the success of the public interest groups like the relations with the local population and local self-governments and the access to the media etc. The expected delaying of choosing the waste disposal place location as a result of public resistance can be one to of the concrete location criterion. The location with the lowest expected public acceptance receives the lowest ranking score assigned.

Ad 5. Ownership relations connected to the necessary territory are important concerning public or private ownership of the ground where the waste disposal place could possibly be situated. It is not only the ground for the waste disposal place itself, but also eventual grounds in case of waste disposal place enlargement. If the land owners refuse to give away their land for the waste disposal place, under certain circumstances they can be forced to do so by law. Obviously, this procedure requires time. The risk for this kind of situation is increased when a vast part of the necessary land is in public ownership or owned by more than one person. The greater the risk of such kind of procedure, the lower the ranking score assigned for the concerned location is.

Ad 6. Besides existing waste collection contracts there can be certain agreements between the management of the waste disposal place and the concerned area, province or particular collection services on waste delivery. The existence of such contracts means for the realization

of the waste disposal place that it gets less waste, which will increase the costs of the waste disposal place. The location where the waste disposal place is going to suffer less from existing contracts receives the highest ranking score assigned.

4.7. Financial-economical Criteria

In the past, locating a waste disposal place in a far away corner of the district was a cheep solution to get rid of the waste. Nowadays, the organization of the waste disposal places costs a lot of money. Due to the increasing care for the milieu, the legal regulations for the arrangement of the waste disposal place became stricter. It caused the rise of the dumping and arrangement costs, as well the costs of future follow-up care.
In this rubric, only the location criteria are represented, which cause some locations to be more expensive than others.
The biggest part of the location-connected costs are transportation costs. Mainly it is determined by the distance from the waste collection center. The transportation costs in rural area are higher than in urban areas because of longer distances. With the increase of the size of the waste disposal places, the transportation costs rise. In contrarily to the transportation costs, exploitation costs decrease with enlargement of the waste disposal place.
Some locations require extra milieu technical provisions, namely in case of unfavorable geological suitability of the ground in order to comply with legal regulations. The arrangement of the extra soil layers to increase the distance between the average ground water level and the bottom of the waste disposal place is a good example of it.

Table 15. Financial-economical Criteria

Financial-economical Criteria	Locations				
	A	B	C	D	E
1. The costs of the ground purchasing					
2. the costs of the unsealing					
3. the costs of the extra milieu technical provisions					
4. the Transportation costs					
5. the Exploitation costs					
6. the costs of future follow-up care					
Total score per location (sum)					
Average ranking score per location					

Explanation to the Financial-economical Criteria

Ad 1. The costs of the ground purchasing depend on the prize of the ground which can vary for different locations. The present use of the location is also very important for the prize of the ground. This has an influence on the payments of the land compensations. The location with the lowest costs of the ground purchasing receives the highest ranking score assigned.
Ad 2. The unsealing costs depend on the location of the possible waste disposal place in connection with water roads, railways and other kind of roads. The location of the possible

waste disposal place in the neighborhood of the water roads and railways in some cases can lead to the increase of the unsealing costs, if the improvement of the communications is necessary. The location with the least unsealing costs receives the highest ranking score assigned.
Ad 3. The costs of the extra milieu technical provisions are the result of the need to avoid the pollution of the soil, ground and surface waters. The extra milieu technical provisions are mainly directed to the management of the eventual percolation water. The examples of the provisions are: arrangement of the soil seal, waste dump seal and drainage system. Also eventual connection to the canalization system can be mentioned here. The location which needs less extra milieu technical provisions, receives the highest ranking score assigned.
Ad 4. The size of the transportation costs is determined by the transportation distances and by means of the transportation and waste collection. By segregation of collection and dumping, the share of the transportation cost of a 50-60 km distance makes up to 20% of the total removal costs. The transportation costs by rail or waterways are generally lower than transportation costs by trucks. The transportation costs consist of the collection, transshipment and carrying costs. The location with the lowest expected transportation costs receives the highest score assigned.
Ad 5. For the size of the location dependant exploitation costs the following two aspects are important:
- The ground balance; necessity of weekend and final cover by necessary ground from elsewhere, leads to higher exploitation costs. (See also the spatial criterion "existence of the cover ground");
- monitoring costs during and after exploitation (see also item 6).
The location with the lowest expected exploitation costs receive the highest ranking score assigned.
Ad. 6. The costs of follow-up care are connected to the IBC criteria to be complied after the end of the dumping activities. The costs of follow-up care depend not only on done milieu technical investments, but also on the sort of the dumped material. Depended on the quantity of the dumped material, the costs of follow-up care are approximately from five to fifteen guldens per tone of waste. Because of their geo-hydrological suitability, some locations require more follow-up care than others. Besides financial, follow-up care have also technical, organizational and juridical consequences. The location with least expected costs of future follow-up care receives the highest ranking score assigned.

4.8 The determination of the final scores per location

Now, the average ranking scores are already determined for every location. They can be filled in the equivalent of table 16 in the appendix (table I). The last option to assign weights per rubric exists in table 16. This is for cases where the user thinks (example) that environmental criteria are more important than financial-economical ones and wants to use it for all locations. In that case, the user can assign to this criterion a heavier weight. The assignment of the weights is done according to the scale in table 4 (evaluation and weighting) in chapter 3. It is obvious that the made choice has to be explained by the user. In the appendix there is a separate space reserved for the motivation.
The weighed scores are determined by the average ranking scores in the left column of the table multiplied by the weights. The weighted score will be filled in the right column of the table 16.

Table 16. The assigning of the weights to the rubrics per locations

rubrics	Ranking score of the rubric per location					weight (1-5)	Weighted ranking score of the rubric per location				
	A	B	C	D	E		A	B	C	D	E
Environ-mental criteria											
Spatial criteria											
Nature and landscape criteria											
management-juridical criteria											
Financial-economical criteria											

Finally the weighed ranking scores are moved to table 17. In table 17 the final scores per location are determined by adding the scores of the rubrics to each other. The final scores illustrate which location is most suitable. The location with the highest ranking score is the most suitable for the possible waste disposal place. The location with the lowest ranking score is the least suitable for the possible waste disposal place from all location of the ranking phase. With the determination of the final scores per location the model is closed.

Table 17. The determination of the final scores per location

Rubrics	Weighted score of the rubric per location				
	A	B	C	D	E
Environmental criteria					
Spatial criteria					
Nature and landscape criteria					
management-juridical criteria					
Financial-economical criteria					
Final score					

Appendix The model of the location choice for the waste disposal place

The tables are to be filled in by the user.
In the following, all tables to be filled by the user of the model are presented. The user has a good overview to fill in the tables. Besides, the user can make copies of these tables before filling them in. All the tables from the appendix are included in the text, as well. In order to make it easier for the user to find them in the text, the reference to the page is stated on top of the each table.

Table A: Questions about exemption areas

See also page 11

Is the part of the search area:	
1 within the populated area?	yes/ no
2 within a distance of 250m from a populated area?	yes/ no
3 in a natural area?	yes/ no
4 within a distance of 150m from a natural area?	yes/ no
5 in an ecological protection area?	yes/ no
6 in a soil protection area?	yes/ no
7 in a ground water protection area?	yes/ no
8 in a silence area?	yes/ no
9 in a surface water area?	yes/ no
10 within a distance of 5,5km from an airport	yes/ no
11 within a distance of 100m from a grave yard	yes/ no
If one or more questions are answered with "yes", this area is unsuitable for the location of a waste disposal place.	

Appendix The model of the location choice for the waste disposal place

Table B. Determination of the geo-hydrological suitability

See also page 21

Is a relevant part of the search space situated:	**answer**
1 in peat soil or other setting sensitive ground?	yes/no
2 in an area with non-homogene under ground?	yes/no
3 in an area where the surface is composed from coarse sand?	yes/no
4 in an area with impermeable layers in the ground?	yes/no
5 In an area where expected distance between average level of ground water and bottom of the waste is less than 0.7 meters?	yes/no
6 in an infiltration area?	yes/no
Eventual addition of other specific geo-hydrological criteria?	
In case of 'yes" answer on question one or on any other two questions, this part of the search area can be described as unfavorable destination for possible waste dump area.	

Table C. The questions about the restriction phase

See also page 21

Is the specified part of the search space situated:	**Answer (yes/no)**
1 outside a radius of ten kilometers from train- and water roads?	
2 outside an urban area?	
3 outside a radius of 5.5 kilometers from the airport? (Only for non-organic waste!)	
4 in an area with unfavorable geo-hydrological situation?	
5 in a Green Line Area?	
6 in a Blue Line Area?	
7 in an area with hindering infrastructure provision?	
8 in a recreation area?	
9 in a military area?	
10 in an industrial area?	
All those criteria are accepted as important weight criteria.	

Appendix The model of the location choice for the waste disposal place

Table D. Determining of the weighted sum of the parts of the search space

See also page 23

Parts of the search space	Quantity of the potential locations	the questions with "yes' answer	weight	weighed sum
Area A				
Area B				
Area C				
Area D				
Area E				

Motivation for assigned weights (per weight)

Appendix The model of the location choice for the waste disposal place

Table E. The environmental criteria

See also page 30

Environmental Criteria	Locations				
	A	B	C	D	E
1. permeability of the ground					
2. existence of a poor permeable layers in the ground					
3. Setting sensitivity of the ground					
4. location of sensitive objects (ground water stream direction)					
5. speed of the ground water stream					
6. Ground water level under potential waste disposal place					
7. surface water quality					
8. speed of the surface water stream					
9. stench annoyance for neighbors					
10. Particle annoyance for neighbors					
11. Traffic attraction					
12. risks for neighbors					
13. other kind of annoyances for neighbors					
Total score per location (Sum)					
Average score per location					

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Table F. The spatial criteria

See also page 32

spatial criteria	Locations				
	A	B	C	D	E
1. Bruto-netto relations of the ground surface					
2. Infrastructural hinder					
3. distance from industrial, military or recreational areas					
4. distance from areas with essential landscape, geological, historical and ecological value					
5. location next to the rail- and waterways					
6. distance from waste central point					
7. Results for spatial structure of the country side					
8. possibility of the use of the rest energy					
9. distance from the particle sensitive fabrics					
10. Spatial fitting in connection to the development perspective of the area					
11. possibilities of the extra destination for spatial fitting					
Total score per location (Sum)					
Average score per location					

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Table G: Nature and Landscape Criteria

See also page 34

Nature and Landscape Criteria	Locations				
	A	B	C	D	E
1. Ecological value of the flora					
2. Ecological value of the fauna					
3. Impact on the eco-system					
4. Cultural and historical value of the landscape					
5. Possibility of visual spatial fitting in the landscape					
6. Geological and archeological value of the landscape					
7. Pleasure-deriving value of the landscape					
Total ranking score per location					
Average ranking score per location					

Table H: Management/ juridical criteria

See also page 36

Management/ juridical criteria	Locations				
	A	B	C	D	E
1. Management acceptance of the concerned province					
2. Management acceptance of the concerned districts					
3. Hampering effects on other plans connected to the development of the location					
4. Social acceptance by the involved interest groups					
5. Ownership relations connected to the necessary territory					
6. Existing contracts related to waste collection					
Total ranking score per location					
Average ranking score per location					

Appendix The model of the location choice for the waste disposal place

Table I. Financial-economical Criteria

See also page 38

Financial-economical Criteria	Locations				
	A	B	C	D	E
1. The costs of the ground purchasing					
2. the costs of the unsealing					
3. the costs of the extra milieu technical provisions					
4. the Transportation costs					
5. the Exploitation costs					
6. the costs of future follow-up care					
Total score per location (sum)					
Average ranking score per location					

Appendix The model of the location choice for the waste disposal place

Table J. The assigning of the weights to the rubrics per locations

See also page 39

rubrics	Ranking score of the rubric per location					weight (1-5)	Weighted ranking score of the rubric per location				
	A	B	C	D	E		A	B	C	D	E
Environ-mental criteria											
Spatial criteria											
Nature and landscape criteria											
management-juridical criteria											
Financial-economical criteria											

Rubric	Motivation for assigned weights
Environmental criteria	
Spatial criteria	
Nature and landscape criteria	
management-juridical criteria	
Financial-economical criteria	

Appendix The model of the location choice for the waste disposal place

Table K. The determination of the final scores per location

See also page 40

Rubrics	Weighted score of the rubric per location				
	A	B	C	D	E
Environmental criteria					
Spatial criteria					
Nature and landscape criteria					
management-juridical criteria					
Financial-economical criteria					
Final score					